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A Report of the

Office of Energy
Bureau for Science and Technology
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Impact Assessment of

The Low Cost Energy Technology Project (936-5701)
The Energy Technical Service Support Program (936-5702)
The Small Decentralized Hydropower Program (935-5715)

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Section 1:

I. INTRODUCTION

With the world-wide economic disruption caused by the oil embargo of late 1973, and subsequent political and economic after-shocks in the petroleum sector, energy emerged as a high-priority challenge to public policy makers in the developing countries as well as in the industrialized world. Already struggling to develop with limited natural and human resources, the Third-World countries were particularly devastated by the energy crisis. Donor organizations in the industrialized countries were quick to respond with assistance to lesser developed countries to help alleviate their energy-related problems.

Simultaneously with the energy crisis came an awareness of the rapid depletion of the known fossil fuel reserves on which most conventional energy generation depended. Concern over the pollution caused by coal combustion, and the technological and political inappropriateness of nuclear power further reduced energy resource options. Obviously, the negative economic impact of importation of costly fossil fuels and coal was contrary to the objectives of the development process. A broad surge of enthusiasm for renewable energy, especially solar, wind, and water (hydroelectric) occurred in both the industrialized and developing countries alike. Research and development in renewable energy technologies burgeoned, and donor organizations supported tests, demonstrations, and pilot projects worldwide. The recipient countries viewed renewables as especially promising, involving modern technology, stimulating donor interest, and applicable to a variety of scales and locations, while using local resources and developing indigenous skills and institutions.

As a donor agency, the Agency for International Development (A.I.D.) initiated numerous bi-lateral and centrally funded projects involving renewable energy technologies over a broad field of applications The centrally funded projects implemented by A.I.D.'s Office of Energy provided technical assistance, training, and other services to supplement and support the objectives of energy-related projects initiated by A.I.D. Regional Bureaus and Missions in a number of developing countries. Three of these projects have been selected for evaluation, and are the subject of this report.

The Low Cost Energy Technology Project (936-5701) was implemented in August 1979 under a Cooperative Agreement with Volunteers In Technical Assistance (VITA) and was designed to facilitate technology transfer, expand VITA's alternative energy network in relationship with other international appropriate technology users and suppliers, and implement a small grants fund to support indigenous groups in small-scale renewable energy development efforts. The main areas of focus were small-scale solar, wind woodfuel/charcoal, biomass/biogas, and waterpower/hydroelectric. The principal users were other private voluntary organizations, individual entrepreneurs, and LDC host government organizations. Over an eight-year period, $5.8 million was committed to project activities. The program terminated December 31, 1987.

The Small Decentralized Hydropower Project (936-5715) was a centrally-funded A.I.D Office of Energy activity implemented under a Cooperative Agreement with the National Rural Electric Cooperative Association (NRECA). Initiated in May 1980 with a planned duration of 5 years, subsequent extensions continued the project to July 31, 1987. Total costs over the project's life came to about $4.4 million. Established to provide technical assistance to USAID Missions and LDC governments in the identification of suitable

hydropower sites of one megawatt or less, and the development of programs to exploit such sites, the project underwent refinement and expansion over the years. It came to include assistance to LDC governments in establishing national hydropower goals in order to reduce dependence on energy imports; advisory services in planning, engineering, organizational, logistical, and financial aspects of small hydro projects; strengthening institutional and individual capabilities through international workshops; employing an information exchange network with other technical and financial institutions involved with small hydro; and encouraging broader private sector participation in small hydro development worldwide.

Many of the Office of Energy projects could be utilized as mechanisms to provide short-term technical consultants to USAID Missions and developing country governments in the general field of energy development. However, not all the requests for such assistance fell within the purview of active or proposed technical projects of the Office of Energy. To fill such a gap, the Energy Technical Service Support project was initiated in 1978 to provide a means of responding to a much broader range of requests for short-term professional, scientific and technical services. Most of the assignments funded under this project were implemented via inter-agency agreements between A.I.D. and the U.S. Department of Energy (D.O.E.), and were performed by personnel of D.O.E., its associated national research laboratories, and other D.O.E. contractors. Independent consultants were occasionally chosen by the Office of Energy to work directly under specified projects, as well. Through mid-1988, aggregate life-of-project costs were $1.8 million.

Relevant Project Data
($000)

Name	No.	Initial FY	Final FY	LOP Costs
Low Cost Energy Technology (VITA)	936-5701	1979	1988	$5,839
Small Decentralized Hydropower (NRECA)	936-5715	1980	1987	$4,446
Energy Technical Service Support (A.I.D/D.O.E)	936-5702	1978	1988	$1,782

Section 2:

IMPACT ASSESSMENT SCOPE OF WORK

OBJECTIVE

To assess prior applications of renewable energy technologies and to identify those renewable energy systems which offer economically viable options to meet LDC energy needs.

In meeting this purpose a combined impact assessment will be undertaken of the following three completed projects:

- Low Cost Energy Technology
- Small Decentralized Hydropower
- energy Technical Service Support

STATEMENT OF WORK

The Low Cost Energy Technology Project was implemented under a Cooperative Agreement with Volunteers In Technical Assistance (VITA), was composed essentially of three activities: technology transfer through on-site and by-mail consulting services, with alternative energy publications and training; expansion of an alternative energy network involving VITA and other international appropriate technology users and suppliers to facilitate transfer of alternative energy information; and a program implementation fund to support local (indigenous) organizations in implementing small-scale energy efforts. VITA internally denominated the project the Renewable Energy Program and saw it as a way to exploit the full potential of its volunteers in the delivery of VITA's services and to expand the demand for them, especially in low cost energy technologies based on renewable resources.

In the initial eighteen month period under the project, VITA's requests for technical information increased by almost 70% and energy-related requests over the same period increased some 117%. The five principal areas of interest in renewable energy in order were solar, wind, woodfuel/charcoal, biomass/biogas, and waterpower/hydroelectric, accounting of 80% of energy-related requests. The vast majority of requests came from other private voluntary organizations, individuals, and government organizations, comprising some 2500 of 3532 requests.

User demand defined VITA's areas of emphasis: e.g., woodstoves and cooking systems in Africa, wind energy technology in the Caribbean, technologies for tropical island application in ASIA/Pacific area. VITA continued to maintain technical competence in low-cost solar, wind, biomass, micro-hydropower, and other energy technologies to the termination of the project in 1984.

The Small Decentralized Hydropower Project was implemented under a Cooperative Agreement with the National Rural Electric Cooperative Association (NRECA) signed in May 1980, and designed to continue for five years. The purpose of the project was to strengthen the technical capacity of NRECA in the skills related to the identification of hydropower facilities up to 100 kilowatts. The intent was to make available to A.I.D. Missions and developing country governments hydropower specialists, energy economists,

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engineers and social scientists for project identification, site selection, resources surveys, project estimates, and analysis of economic, social and technical factors relevant to small hydropower systems. Associated with these activities were to be workshops, case studies, and limited training. There was an agreement with the A.I.D. Regional Bureaus that responsibility for introducing and financing hydropower pilot projects, demonstrations or adaption tests of hydropower pilot projects, demonstrations or adaption tests of the technology in developing countries would rest with these the technology in developing countries would rest with these bureaus, the field missions and developing countries themselves.

By the completion of the fourth year of project activity under the Small Decentralized Hydropower (SDH) project the NRECA program provided field assistance to 23 A.I.D. host countries. This assistance consisted of short-term field assignments by teams of up to several specialists to conduct country surveys of SDH potential, to develop country-specific site-selection methodologies, identify and rank sites based on these methodologies, and to prepare preliminary designs and cost estimates for representative projects. In some instances, this assistance was specifically tailored to address problems with on-going projects and programs; in others it involved assistance in developing A.I.D. Project Papers. In most cases, the team studied not only technical aspects, but also institutional and energy-planning concerns in support of efforts to organize A.I.D. host countries to carry out systematic programs of SDH development.

To tap the wealth of experience existing worldwide on small hydropower technology, NRECA devoted significant resources to publication of case studies, methodologies, directories and source books to add to a growing data base. Case studies included those related to Pakistan village micro-hydropower schemes, and Nepal's private sector approach to micro-hydropower. Methodologies developed were related to: country assessment of mini-hydropower potential; prefeasibility studies of candidate mini-hydropower sites; hydrologic estimates for small hydroelectric projects; and environment assessments of small hydropower projects. Special studies were done on problem areas in small hydropower projects, including management, site evaluation, and private sector development.

Over the same period regional workshops on an annual basis were held in Latin America, Asia and South Pacific, West and Central Africa, and East Africa. Some 400 participants from 60 developing countries were registered and contributed to the overview of hydropower design, technology, implementation techniques and assessment methods. Other activities by NRECA in the U.S. offered occasional seminars and study tours for selected LDC delegations and training short-courses at a U.S. university.

The Energy Technical Service Support Project was initiated in 1978 concurrently with the establishment of the Office of Energy to provide a method for responding to a broad range of requests by USAID Missions and governments of developing countries for short-term professional, scientific and technical services in the energy sector. Often involving a single consultant but occasionally a team of persons with a mix of skills, the assignments were primarily undertaken by personnel of the U.S. Department of Energy (DOE), the national laboratories associated with DOE or other DOE contractors. In addition, the project funded independent expert consultants chosen directly by A.I.D.'s Office of Energy. A.I.D. provided the scope of work and the allocation of funds and DOE selected the personnel.

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Examples of activities under this project include:

- a preliminary assessment by Lawrence-Berkeley Laboratories (LBL) of energy efficiency programs in ASEAN countries;

- a demonstration plan for use of renewable energy systems for water pumping, also by LBL;

- a comprehensive system for measuring solar insolation and wind velocities in Morocco by the Solar Energy Research Institute (SERI) and Battelle Laboratory personnel;

- a survey of energy consumption by Oak Ridge National Laboratory (ORNL) in the transportation sector in Tunisia to facilitate conservation; and

- a survey of geothermal energy potentials in the Caribbean area by Los Alamos personnel.

OBJECTIVE OF THE IMPACT ASSESSMENT

The three cited projects were designed for and were implemented to address LDC energy needs in a wide variety of economic development activities through the application of a broad spectrum of renewable energy technologies. The principal considerations to be addressed for selected technologies in this assessment are:

- was the energy application appropriate to the selected development need;

- is the energy application economically viable on a sustained basis;

- how effective was the program in addressing the needs of the LDC; and

- did the project accomplish its purpose as set out in the Project Paper, etc?

The selection of the individual technology and the instance of its application will be at the option of the assessment team. Sources of information may include the range of project and evaluation documentation, as well as former project managers, back-stop officers, and contractor personnel.

REPORTS

The contractor will provide the Office of Energy with three copies of the draft impact assessment no later than 35 days from signing of the Contract. The Office of Energy will review the assessment and return it to the Contractor with comments five working days after receipt. Twenty copies of the Final assessment are to be submitted to the Office of Energy 10 days after receiving comments.

In addition to copies all reports submitted to Project Officer and A.I.D. Library, one copy is to be submitted to S&T/EY, Attn. Shirley Toth.

Section 3:

Impact Assessment of

The Low Cost Energy Technology (LCET) Project

(Project No. 936-5701)

Implemented by Volunteers in Technical Assistance (VITA)

(1979-1987)

by

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1.0 INTRODUCTION

1.1 The Low Cost Energy Technologies (LCET) Project Phase I: 1979 - 1984

In 1979, VITA (Volunteers in Technical Assistance), a non-profit organization, submitted an unsolicited proposal to A.I.D.'s Bureau of Development Support, Office of Energy (DS/EY) for assistance in implementing a five-year alternative energy program. The proposal stated the aim of "developing, transferring, and diffusing low cost alternative energy technologies for rural areas of the third world." VITA was seeking to strengthen its institutional base by using outreach mechanisms to assist the rural poor. These objectives were to be accomplished through the expansion of VITA's existing technical assistance programs, promotion of a global alternative energy network, and support to local organizations in carrying out energy efforts. While A.I.D. documents would refer to this as the Low Cost Energy Technologies Project (LCET), VITA came to use its own name for the program: the Renewable Energy Program (REP).

The proposal represented a major policy decision by VITA to attempt to deliver alternative energy services to the rural poor. It was a recognition of the acute need for access to low cost energy technologies. VITA observed that the lack of energy frequently serves as a roadblock to development in all sectors of rural life, hence contributing to increasing migration into the cities. VITA recognized that the issue which the proposed program must face was the extent to which low cost energy technologies could provide viable alternatives and have positive impacts on the energy problem and on the lives of people in the rural areas.

The proposal was submitted to DS/EY on February 7, 1979. The Project Authorization was signed by Sander Levin, Assistant Administrator of the Bureau for Development Support on June 21, 1979. First year funding of $914,000 was approved for the program. Total life of project costs were anticipated at just under $10 million.

On August 31, 1979, A.I.D. signed a Cooperative Agreement with VITA which covered the five year period ending August 30, 1984. Subsequent amendments continued the agreement through December 31, 1987. Initial discussions between VITA and A.I.D. had contemplated a smaller grant to expand the organization's technical response capability. However, it was eventually agreed that the proposal would be for a considerably wider range of activities, including a small grants component for local organizations.

By the time of the first evaluation in December 1981, A.I.D. was planning to reduce the funding for the project as part of the Agency's overall reduction in assistance levels. Nevertheless, with the new Cooperative Agreement in place, A.I.D. still accounted for fully 60 percent of VITA's total funding. By the end of project life, the total funds actually obligated to the project amounted to $5,839,201, a reduction of some 40 percent over initial projections. This figure includes funds obligated to VITA for the second phase of the project (1985-87), the period referred to by VITA as REP II.

In the FY 1985 Congressional Presentation the Low Cost Energy Technology Project was shown as having had the following estimated life-of-project inputs and outputs:

Major Outputs	All Years
Technical Workshops	8
Publications prepared	80
Grants awarded	60
On-site consultants provided	70
Information requests answered	800

A.I.D. Financed Inputs	Life of Project ($ thousands)
Technical workshops	$ 1,200
Personnel (240 person months)	3,100
Travel	500
Small grants	600
Network and research services	1,400
Total	$ 6,800

1.2 Phase II: 1985-1987

In 1985, a second phase of the Low Cost Energy Technologies (LCET) Project was negotiated as a follow-on to the original project. S&T/EY submitted the justification for a non-competitive procurement as a continuation of the project. It was based on the experience of five years in which VITA had developed a comprehensive computerized renewable energy database. The specific need identified in the contract's work statement was a program designed to assist development planners, research institutions, small entrepreneurs, and project implementers in their efforts to develop and disseminate small-scale renewable energy technologies.

The scope of work called for the implementation of the three activities described below.

Renewable Energy Database

Working with the A.I.D. Development Information Unit library staff, VITA was to expand its existing data base to include ongoing and recently terminated renewable energy projects by country, Mission, Bureau, technology and user. This database was to facilitate VITA's response to requests for information from A.I.D. Missions and others. It was anticipated that VITA Volunteers in all fields of renewable energy would "back-stop" the effort by providing technical information and advice.

Technology Application Assessments

This would entail the compilation of appropriate renewable technology assessments on topics selected by S&T/EY, including A.I.D. Bureaus and Missions. Selected assessments were to be conducted on photovoltaics (for water lifting) and household fuels.

Design and Implementation of Woodstove Network

This component was to develop a strategy and work plan for woodstove technology assessment, research and development, as well as dissemination and marketing. This effort was to be conducted in collaboration with the Dutch Foreign Ministry.

1.3 Organizational Profile of VITA

Incorporated as a private, nonprofit, international development organization in 1960, VITA specializes in providing responses to requests for technical and development assistance from governments, local non-governmental organizations, cooperatives, small businesses, farmers, and others. VITA seeks to foster self-sufficiency in developing countries by providing such services as needs assessment and program development; mail and on-site consulting services; information systems training; and management of long-term field projects. VITA activities are facilitated by the involvement of VITA Volunteer technical experts from around the world, and by its documentation center consisting of specialized technical materials.

VITA places particular emphasis on the areas of agriculture and food processing, water supply and sanitation, housing and construction, and small business development, as well as renewable energy. VITA cooperates closely with a wide range of organizations and agencies such as PACT (a consortium of PVOs), Peace Corps, Church World Service, the World Bank, and A.I.D. as well as predecessor agencies under both contractual and grant basis. A.I.D. began grant assistance to VITA in 1968. Other income is derived from government, foundation, and corporate contracts and grants as well as fees for services and personal contributions.

VITA claims to be a leader in the search for and development of alternative energy sources in developing countries. By the time of the proposal, VITA had responded to over 2,000 requests for information and assistance on low cost energy problems. These included a broad range of topics, from solar cookers to water turbines, bio-gas generators, and windmills. The 2,000 requests for technical information on energy constituted a growing portion of the total, accounting for 19 percent in 1978. By 1988, VITA had trained people from nearly 150 organizations in 40 countries to set up their own information centers and to access and disseminate information. It maintained a roster of 5,000 volunteers available to help put technologies to work.

1.4 VITA's Approach to Energy Development

The VITA proposal identified the rising cost of conventional energy as one of the most disturbing trends in the world. The rapid growth in demand for energy was already straining existing supplies, leading to sharp increases in prices. Alternative energy technologies such as sun, wind, bio-mass, and water were becoming ever more important. The need for low cost energy alternatives was seen as especially critical in the rural areas of the developing world. There were numerous factors such as shortage of skilled technicians and low incomes that restricted the introduction of conventional energy technologies. VITA sought to address the need to look for low cost energy alternatives based on renewable sources.

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VITA's response to this perceived need was presented in the proposal under three broad program objectives:

- Provide access to proven transfer mechanisms through which technical information can be collected and disseminated.
- Seek out worldwide network of alternative energy technology, from research and development to commercial enterprise. Provide outreach to government agencies, local institutions, small businesses, and other groups.
- Support the ability of these groups to overcome constraints through selected grants.

VITA viewed these goals as being grounded in its philosophy of Appropriate Development, a term derived from Appropriate Technology. Appropriate Development was defined as change occurring as a result of needs and actions generated from within a group, village, or society made possible through the use of technologies which enhance change. These technologies are developed by or in concert with the various groups in the community. They promote job creation through the introduction of labor-intensive equipment and approaches. Self-reliance is emphasized through the use of local resources, materials, and expertise. Members of the community should be able to afford the new technologies and also be encouraged to expand their own capabilities and skills.

The VITA proposal recognized the pitfalls of alternative energy projects that focused only on the technology hardware without regard for other aspects of development. This lack of development perspective had accounted for the failure of many technically sound projects. No technology, be it high- or low cost, can be successfully applied without considering the social and economic systems in which it operates. For example, if introducing a windmill makes it possible to grow more crops, will most of the increase be lost due to lack of storage facilities?

The VITA proposal concluded that "in order to provide a structure in which alternative energy technologies can have most potential for impact, there is need for a program or framework which has mechanisms to respond to the system of constraints which is now limiting transfer of technology and technical information...." Such a framework was put forward in a VITA Energy Program which spelled out several specific objectives. The proposal indicated that the Renewable Energy Program would be administered as a separate program within VITA, drawing upon the core VITA program and lending support to it. The Cooperative Agreement that eventually became the basic project operating document incorporated the main elements of the VITA proposal.

2.0 SCOPE OF THE COOPERATIVE AGREEMENT: PHASE I

A.I.D. was receptive to the unsolicited proposal, mainly because VITA was perceived to have unique capabilities in drawing upon a volunteer assistance pool in the United States. In August 1979, A.I.D. signed a Cooperative Agreement with VITA to implement a project entitled Low Cost Energy Technologies for Rural and Urban Poor. The purpose of the agreement was stated as making effective use of VITA experience in the field of alternative

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energy technologies by enhancing its abilities to provide resources to develop low cost technologies based on renewable energies. VITA was charged with undertaking the three basic activities described in the sections below:

2.1 Technology Transfer Services

Expand and develop VITA's existing technical assistance mechanisms to include outreach capability in several areas:

- the provision of on-site consultations by VITA volunteers and staff;
- technical information on alternative energy technologies to developing countries;
- by-mail technical and consulting services to enable volunteer and staff expertise to address energy problems;
- alternative energy publications such as technical manuals and resource directories; and
- education and training in alternative energy technologies through use of in-country training.

2.2 International Alternative Energy Network

Establish an alternative energy network to solve rural energy problems and to serve as a mechanism facilitating the transfer of the technologies mentioned above. Activities would include:

- establishment of a global energy information network to provide local institutions with access to current renewable energy programs;
- development of information base and research capabilities of local institutions;
- access to VITA's computerized documentation center and volunteer expert capabilities; and
- development of regional energy technology transfer and diffusion centers.

2.3 Program Implementation Fund

Establish a program implementation fund to support the ability of local implementing organizations to carry out activities in selected areas of low cost energy technology:

- demonstration of alternative energy technologies to illustrate their effectiveness to a wide audience;
- training of extension agents in low cost technologies; and
- support of applied research to produce alternative energy technology equipment and processes.

There were to be three types of sub-grants - travel/training, equipment, and project - aimed at assisting PVOs and individuals known to VITA to be capable. Individual project funding was not to exceed $10,000. Projects selected for funding by VITA were to be described in the quarterly reports according to the format agreed to by the parties. Projects were to conform to certain criteria, such as being consistent with A.I.D. energy strategies for the proposed country.

The Cooperative Agreement specified that A.I.D. and VITA would undertake an intensive evaluation of the project 18 months after the signing of the agreement. There was no provision for an end-of-project evaluation in the agreement, and in fact the 1981 evaluation was the only one conducted.

3.0 SUMMARY OF 1981 EVALUATION

The only evaluation of the VITA project was conducted in 1981. It was a collaborative effort between A.I.D. and VITA begun in May and written up in final form in December of 1981. It reviewed the first 18 months of project operations, beginning in October 1979 and running through March 31, 1981. Stephen Klein of AA/PPC/EY chaired the evaluation team, which consisted of eight persons representing the A.I.D. Science and Technology Bureau and the three Regional Bureaus. The prospective reduction in A.I.D. funding levels provided an important frame of reference for the evaluation. Although it was conducted to determine how VITA had performed, both VITA and A.I.D. agreed that the evaluation would anticipate alternative scenarios based on likely funding cuts.

The evaluation team concluded that VITA had generally done a good job in managing the program. VITA had addressed a broad range of renewable energy technologies: biomass, solar, wind, and micro-hydro. During the first phase of the project VITA developed special capabilities in two program areas: technologies for food processing and cooking - especially fuelwood-efficient woodstoves - and for tropical coastlines. In general, however, the evaluation team found that VITA's expertise in renewable energy technologies did not appear to be particularly unique. It proposed that a greater concentration of VITA's efforts would be desirable in light of the likely budget reductions.

The evaluation assessment was complicated by VITA's decision to integrate the entire renewable energy program into its overall operations. However, the evaluation team did not suggest any fundamental revisions in the internal organization of VITA to create a separate effort. It was recommended simply that VITA and S&T/EY agree on the focus and concentration of the Cooperative Agreement resources areas in which VITA had a special capability (presumably woodstoves and tropical coastlines).

3.1 Operational Areas

The evaluation report first focused on the operational areas, followed by VITA's management and staff, financing levels, and then views by USAID Missions.

Technology Transfer Services

VITA maintained that as a matter of policy it had responded to every technical inquiry it received. The expanded staff capacity (an additional 23 full time employees, of whom 10 were professionals) allowed VITA to reduce its response time from 11 weeks to only two. However, the evaluation team questioned why there appeared to have been no substantial

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increase in volunteer consultancies. In its response to the initial evaluation draft, VITA took issue with this observation. VITA reported that the number of consultancies increased from only 13 in the year before to 84 during the first six months of 1981.

The evaluation team found that VITA had been able to upgrade both the quality and quantity of its publication efforts, adding a special energy supplement to **VITA NEWS** and a range of other materials. The team concluded that the woodstove project in Upper Volta (now Burkina Faso) appeared to have achieved remarkable success in promoting an extensive flow of information in technology transfer.

The evaluation team concluded that there appeared to be less emphasis on having the volunteer network respond directly and more on having staff from the VITA home office to respond to requests. VITA had found it difficult to hire technical specialists of a sufficiently high level. Therefore, people with field experience were hired for the home office and VITA Volunteers were relied upon for technical expertise.

The evaluation team recommended that S&T/EY press VITA to increase the allocation of resources for direct participation and consultancies by the volunteer network.

International Alternative Energy Network

The project paper suggested that a separate network be created within VITA to facilitate the transfer of alternative energy information. However, VITA informed the evaluation team that this plan had been revised and that the project had been integrated into already existing networks. Although the evaluation team concluded that VITA's approach to the networking represented a departure from that implied in its original proposal, it found that the approach being used was generally sound. And while the team acknowledged that this posed a problem in assessing the project, it did not recommend that the network be changed. Rather, it recommended that that the Cooperative Agreement be amended by deleting the requirement for specific alternative networking activities.

VITA Responses to A.I.D. Mission Requests

The evaluation identified a difference in interpretation of the obligation of VITA to respond to Mission requests. VITA contended that it was never the intent of the Cooperative Agreement to make technical resources of VITA available to USAID Missions, while S&T/EY maintained that this type of assistance was implicit. It was VITA's view that its assistance should be directed toward those outside the normal foreign assistance channels. When VITA did respond, however, USAID Missions were generally pleased with the results. VITA asked that additional funds be made available to cover consultative costs incurred in responding to Mission requests.

The evaluation team concluded that VITA should have separate line item funding to support direct USAID Mission requests for VITA assistance. It was thus recommended that the agreement be amended to include a specific task of VITA consultancy support for USAID Missions requests, stipulating that any activities in excess of $25,000 for this purpose be Mission funded.

Project Implementation Fund (Small Grants Program)

The VITA project included an implementation fund which provided small grants of money for local initiatives. Through March 1981, the project had made 42 grants totalling $282,490. The average grant size was $7,000 with the largest being $21,000. The evaluation report concluded that VITA had established effective procedures for the review of the small grants program and that it was operating smoothly.

However, when VITA received word of the likely reduction in funding it decided to restrict new grant approvals, pending clarification of the budget levels. The evaluation team expressed the belief that the small grants program was providing an effective wholesaling mechanism for responding to project requests at the grass roots level. In fact, it was argued that with funding uncertainties removed as a result of the evaluation, the embargo on grants could be expected to be lifted. This element of the Cooperative Agreement was expected to account for 20 to 25 percent of VITA's total effort.

3.2 Management and Staffing

The evaluation team observed that as a result of VITA's having established the renewable energy program as an integral part of its overall activities, its other program capabilities such as publications and equipment had been strengthened. The director of VITA's energy program was serving as Deputy Executive Director of VITA, another measure of the full integration of the energy program.

The Cooperative Agreement had enabled VITA to expand its staff, accounting for an additional 23 full time staff. As of June 30, 1981, VITA employed 61 staff, 47 of them full time. The decision by VITA to integrate the new energy capability into the existing structure of the organization made it impossible to determine whether a given input would result in a specified increase in an energy related activity. The evaluation team stressed the need for both VITA and A.I.D. to be able to quantify and evaluate investments in relation to achievements. Nevertheless, the team did not recommend a reorganization of VITA to clarify the energy involvement in terms of staff and costs. It did, however, argue for a detailed study of VITA's budget in relation to the level of its energy initiatives.

The evaluation team found the VITA staff to be well suited to the coordinating function. While the general VITA staff did not have extensive technical expertise, it was felt that the VITA Volunteers could provide such expertise when needed. VITA had originally contemplated the assignment of field representatives. A woodstove specialist was employed in Ouagadougou and another advisor stationed in Bangkok. The woodstove activity received positive Regional Bureau and field endorsement, suggesting that the assignment of field representatives ought to be specialists in a given technology rather than generalists. The team recommended that, as a rule, general VITA representatives not be assigned to field positions but that specialists such as the woodstove expert in Ouagadougou could be justified.

3.3 Funding Levels

At the time of the evaluation VITA had provided A.I.D. with three alternative funding levels and a projection of the type of activities it would pursue under each funding level. The evaluation team noted that the VITA project would require resources of nearly $2 million a year to sustain the level of operation it established when the Cooperative

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Agreement went into effect. However, actual obligations made by S&T/EY through FY 1982 would have averaged just over $1 million per year for FY 1979-82. In early 1981 VITA began cutting back on its operations following notification of reduced funding.

Given the likelihood of continued budgetary constraints, the evaluation team recommended that VITA plan for an operating budget of approximately $1 million per year. It further recommended that VITA reinstate the small grants program, targeting 20 to 25 percent of its total program to selected small grant funded efforts. It was also recommended that the Cooperative Agreement include funds for VITA consultancies. VITA would be free to undertake specific technical consultancies requested by A.I.D. Bureaus and Missions under the Cooperative Agreement, subject to funding being provided on a case by case basis by the requesting organization.

3.4 VITA's Perspective on the Evaluation

VITA was pleased to remind A.I.D. at the time of the evaluation that the renewable energy project fell squarely within one of the three Agency priorities as stated in the 1982 Congressional Presentation: agriculture, family planning/primary health care, and energy. The purpose of the project was to strengthen VITA's capabilities in the field of renewable energy so that it could have a greater impact in overcoming the constraints identified in the original proposal. An internal memorandum in preparation for the evaluation stated that "it must be clear to every one that the primary purpose of the REP was to provide the resources for a major expansion of the services VITA has traditionally provided." What was new in the project was the unprecedented scope of the services and the innovative means of bringing them to the users, that is to say the small grants recipients.

VITA feared that A.I.D. had lost sight of the original purpose to which they had agreed. Under normal circumstances, VITA would have expected the evaluation to show that all the stated indicators anticipated had been achieved. However, so much had changed, in particular a reduction in resources, that VITA realized it would be necessary to demonstrate not only that it had achieved expected outputs, but that it was being responsive to current A.I.D. priorities.

VITA's approach was to emphasize that its activities were demand driven. Through its information service it was seeking to identify technologies of interest to developing countries. By responding to requests for information, VITA was building up appropriate resources. VITA also touted its ability to generate demand by providing consultancies. However, in light of the budgetary uncertainties, VITA made the decision to suspend those services which it felt could be reinstated quickly, such as small grants and periodical publications. The internal memorandum stated that "these actions should not be interpreted as a judgement on priorities but only as an expedient to maintain our momentum while trying to avoid irrevocable actions during this period of uncertainties."

In another memorandum dated May 1, 1981, Henry Norman addressed potential A.I.D. concerns regarding the project. He noted that the demand for all of VITA's services had increased dramatically among a varied constituency. There could be no question, he argued, but that the resources made available through the project had enabled VITA to generate widespread demand and to respond effectively with improved services. With respect to the feat that a program as large as the REP would jeopardize VITA's independence as a private voluntary organization, Norman pointed out that VITA's Board of Directors had directed the staff to pursue funding alternatives to A.I.D. He cited service

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agreements with UNESCO, ILO, and UNHCR as well as other contracts and sub-contracts as evidence that this directive was being carried out. Norman predicted that by the third year of the REP project, the Cooperative Agreement would make up between 40 and 60 percent of VITA's budget, but that proportion would decline thereafter.

Despite the uncertain budget picture of the REP, Norman asserted that it was VITA's intention to do everything possible to sustain the project as its present level, with the exception of the small grants. He proposed several changes. USAID Missions should have access to VITA consultants through a separate fund or Indefinite Quantity Contract. Demand from the Missions had been so great that it threatened to crowd out those for which the program was originally intended. He argued for expanding the networking goal of the project and for the addition of technical staff in such fields as woodstoves and water resources.

4.0 ACHIEVEMENTS OF THE LCET PROJECT

4.1 Phase I (1979-1984) Project Outputs

By the end of the first phase of the project in 1984, VITA could point to several tangible achievements, although it was difficult to determine how much was directly attributable to the project. These were outlined in the justification for a noncompetitive procurement as a continuation of the ongoing effort:

Renewable Energy Database

The computerized database contained approximately 5,000 documents on various aspects of renewable energy technologies. This capability was augmented by information exchange agreements with 250 institutions in the developing world and frequent contacts with and support of renewable energy projects of USAID Missions.

Information Services

VITA provided customized technology searches and technical assistance in response to approximately 2,500 developing country requests, including 34 from USAID Missions and from Washington Bureaus.

Training

VITA trained 60 librarians from 24 countries during the first phase of the project, including instruction in the use of microcomputers in information systems managements.

Publications

VITA published a number of renewable energy-related books and manuals as well as its quarterly magazine, **VITA News** which featured a special renewable energy section.

Technical Assistance

In 1984, VITA provided 51 short term technical consultancies, including 31 in the renewable energy area, and 40 of them to USAID Missions. VITA was implementing bilaterally-funded small-scale renewable energy projects in ten countries around the world. VITA consultants had also prepared surveys of wind energy activities; performed national

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energy assessments in Bolivia, Guinea, Ethiopia, and Djibouti; and developed microcomputer programs to assist project designers with feasibility studies in wind and solar energy.

International Conferences

VITA organized or assisted in the organization of several seminars and conferences on water pumping using wind energy for water-pumping.

Woodstove Technology

VITA was actively involved in the development of an international woodstove network, maintaining a mailing list of over 70 organizations and disseminating materials. VITA representatives attended various donor meetings on woodstove technology. In October 1983, VITA contributed $10,000 of REP funds for an International Workshop on Woodstove Dissemination held in Wolfheze, the Netherlands. There were 22 participants from 17 countries in attendance, including VITA Volunteer Dr. Timothy Wood. Papers delivered at the workshop were published by IT Publications in 1984.

4.2 Phase II Project Outputs

As noted above, the second phase of the VITA project consisted of three components: development of a computerized renewable energy database describing A.I.D.-funded projects, undertaking of technology application assessments, and development of an international woodstove strategy.

Renewable Energy Data Base

In September 1987, VITA completed production of the A.I.D. Renewable Energy Database which consisted of a looseleaf notebook which allows the user to incorporate additional pages. The initial database consisted of 80 projects and sub-projects implemented since 1975. For each project the database contained such information as the project number and title, country, years of operation, status, length of funding, and descriptions of technical applications. Data were gathered from projects documents available in the A.I.D. central document depository and reports provided by contractors. The notebook corresponds to an online file linked to the A.I.D. Development Information System (DIS) Projects Database.

Technology Application Assessments

VITA consultants conducted an energy assessment in Morocco employing life-cycle cost analysis. The study compared unit water costs for water pumped at various levels by photovoltaic, wind, and diesel water pumps. The comparison was based on costs of pumps currently in Morocco and included projected costs of "improved" windmills and photovoltaic pumps. The assessment results were reported in a document of August 1986 entitled "Water Pumping with Wind Energy in Morocco."

A second publication produced under this component of the project was a review of A.I.D. project evaluations and audits to ascertain which renewable energy technologies were most cost-effective, easily replicable, and capable of making the best contribution to the development of private enterprise. (Ramsay and Zink, 1987).

Design and Implementation of Woodstove Network

VITA has been actively involved in the development of an international woodstove network. For the last five years it has developed and maintained an international woodstoves mailing list of over seventy organizations active in woodstove development. VITA has both conducted and participated in numerous seminars and conferences, and served as the motivating force behind development of international standards for woodstove testing; and routinely response to requests for information on woodstoves.

5.0 EVALUATION OF THE LCET PROJECT

In this section we will examine the outputs of the VITA project in the light of stated objectives and attempt to determine the extent to which expected impacts were attained.

5.1 Technology Transfer Services

The first years of the VITA project saw the rapid expansion of VITA's own human resource base. During the period after the evaluation VITA began providing technical assistance in earnest. VITA studied numerous technologies but eventually identified serious problems with some of them. For example, family-scale biogas digesters proved uneconomic. Solar cooking devices were found difficult to promote. Two technologies, however, appeared to have achieved a measure of success: wind power and woodstoves.

Wind Power

According to VITA's own assessment, the one technology that did emerge with particular promise during the project was wind power. In fact, by focusing its resources on this technology, VITA came to be recognized in development circles as a leading proponent of small-scale wind energy. By 1984, VITA had undertaken demonstration projects in 15 countries involving wind energy systems producing water or power, allegedly on a financially competitive basis. There are many arguments in favor of wind power. Windmills are a stationary power source that have been used since pre-industrial times for pumping water and grinding grain. They also power sawmills, paper mills, and oil presses. Thousands of windmills are in use in countries as diverse as Australia, Argentina, Crete, Thailand, and Colombia.

Most windmills are not easy for laymen to build, however, since they may require welding, carpentry, and design skills. And many of those being constructed in developing countries required up to date knowledge of aerodynamics and engineering. The cost of windmill power is usually less than hooking into a central electric grid, but they are still not cheap. Small windmills being built in Asia and Latin America in the late 1970s cost $500 to $1,000. More efficient, larger designs cost even more.

Some wind energy demonstration efforts assisted under the VITA project achieved a fairly high degree of success:

• *Honduras: Wind Power on Roatan Island*

Roatan is the largest of the Bay Islands of Honduras, with a hot tropical climate and economy based on seafood and shipping. The town of Gravel Bay, with a population of 200, managed to install a windpump system, one of the first of its kind in the region, that

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carried water to individual homes. The story of how this came about involved VITA technical assistance.

The Roatan Development Committee - composed of business, church, and community leaders - began to help install diesel-powered pumping systems in three towns in 1980. The committee soon realized that it would be too expensive to provide similar systems for the remaining island communities. A local well-driller suggested that they try windpumps instead, connecting them to central storage tanks and piping the water to individual homes. A plan to do this was developed.

VITA technical adviser Alan Wyatt visited Roatan in April 1981. He conducted a feasibility study and concluded that the idea would work. Roatan residents bought and installed a ready-made windpump with high reliability and low maintenance. VITA met with the local development committee and promised to help obtain the funds and technical resources needed to get additional windpumps running. The town of Gravel Bay formed a water board, most of whose members were women, to coordinate volunteer labor to build and manage its system. The board was responsible for collecting monthly fees from users, monitoring use of the water to avoid abuses, and appointing maintenance personnel. It was this community-based participation that proved to be the key to the success of the windpump project.

In November 1981, VITA shipped Gravel Bay a Dempster windmill, a type requiring little maintenance. Three months later the system was installed and fully operational. The windmill pumps water from a deep well cased with polyvinyl chloride (PVC) pipe. The well is 6 inches in diameter and 210 feet deep. The windmill itself is a multiblade geared design made in the United States, with a 14 foot diameter rotor and 18 sheet metal blades. The technical problems, such as cracked pipe couplings and a loose pump arm base, were easily resolved. The more serious problems concerned matters of maintenance, lack of payment of water bills, and whether to use group funds to expand the system. In other words, the technology itself was seen as successful; it was the human problems that demanded attention.

The perceived success of the Gravel Bay effort generated enthusiasm in other communities. Three of them formed water boards and began planning water systems. The critical question regarding the lasting impact of the Roatan Island initiative was whether Roatan and other island communities would be willing and able to afford such activities without outside assistance. Even though the residents of Gravel Bay paid a fair amount of the costs of their windpump project, they were helped in large part by several development organizations in addition to VITA (PACT, the Public Welfare Foundation, and A.I.D.). This is the issue of sustainability, which in turn is linked to the question of commercial viability of technologies. There is no information available to determine whether the windpumps on Roatan have become commercially viable, however.

Woodstoves

Another technology in which VITA was able to achieve a measure of success was woodstoves. VITA assumed a role in the worldwide effort to develop more efficient wood-burning cookstoves, using the resources of its A.I.D.-funded Renewable Energy Program. By 1983, VITA estimated that it had helped bring better stoves to over 100,000 people in 40 countries. In the 1970s, woodstoves were still being developed on the periphery of forestry programs. VITA claimed to further the development of scientific technology

necessary to effectively evaluate woodstove materials and designs. VITA staff maintained that well designed woodstoves could help reduce deforestation, relieve family budgets, and improve nutrition. From demonstration projects, VITA began to move toward efforts at dissemination of successful woodstove models.

More than half the world's kitchens use simple wood-burning stoves for cooking. Ninety percent of the population in developing countries relies upon wood for fuel, especially for boiling water and cooking.

Population growth has increased the demand for firewood with disastrous consequences. The picture in some countries such as Burkina Faso, Nepal, and Haiti is grim: shrinking forests, higher fuel prices, and eventually malnutrition owing to a lack of cooked food.

Most stoves used for cooking are little more than clustered rocks used to balance pots, covered buckets, or scooped-out clay forms. But they are not generally very efficient and therefore use up the fuel supply. In fact, the cooking efficiency of most of these stoves is less than ten percent. Improved stove models are seen as an important way to help preserve forests. Women in these areas are often interested in new models that will reduce smoke, reduce the potential for injury, and making cooking easier and faster. Models that use local materials typically claim to double or triple efficiency.

Improved woodstove designs vary widely. There are large sand/clay Lorena stoves in Guatemala, sheet metal models in Zimbabwe, and Thai charcoal bucket stoves covered with flattened Coca-Cola cans. Most of them share basic features. They are made from local materials and are inexpensive to manufacture. Those promoting the new models found that the design was the easy part; convincing women to use them was harder. The challenge was to develop culturally acceptable stoves that would also improve efficiency. Testing procedures had to be systematized, extension services developed, and entrepreneurs encouraged to market new products. Through the REP, VITA began to explore new, efficient stove models that burned biomass fuels, and to promote their use. According to a VITA memorandum of January 1983, the stoves had been built and tested in 17 countries on three continents (see Appendix, Table 1.0).

- *Upper Volta (Burkina Faso): Woodstove Projects*

One country in which VITA mounted a concerted effort in the development of woodstoves was Upper Volta. In 1980, the Interstate Committee Against the Sahel Drought (CILSS), headquartered in the capital city of Ouagadougou, undertook a long term strategy to develop and encourage the use of domestic fuel wood conserving technologies. Funded jointly by VITA and the United Nations Fund for the Decade of Women, a two-member regional team was formed to coordinate the initial phases of the program. Dr. Timothy Wood was named the CILSS Regional Technical Coordinator for fuel-conserving technologies. He contributed technical articles and project reports on woodstoves, as well as managing the VITA office. Wood began organizing national projects and developing fired clay stoves. He was succeeded by Dr. Sam Baldwin as VITA West Africa Representative and CILSS Woodstove Coordinator.

In November 1983, VITA and S&T/EY agreed to concentrate the activities of the REP program on cooking technologies and wind energy. VITA also received a seed grant from IBM to help launch the cookstove initiative in the Sahel. Wood and Baldwin provided the technical basis for evaluating stoves conducted evaluations, and developed alternative

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designs and production techniques. The designs were mainly massive multipot stoves of banco, clay and sand, or cement with a chimney. The results of this research were published by VITA in a monograph entitled **Biomass Stoves** (1986).

The basic element of the regional CILSS team was effective communication with the coordinating units of member states. One means of communicating was the publication of a quarterly newsletter, written in French, containing up-to-date news of woodstove activities throughout the Sahel as well as profiles of stove projects.and a technical page for stove masons

VITA also funded projects in Upper Volta under the small grants program. One of these was the Kaya woodstove dissemination project. The grantee was a private businessman who received $7,000 in October 1980 for equipment, materials, training, and technical assistance to work on improved stove efficiency over traditional cooking methods. A Peace Corps Volunteer helped develop a prefab stove and two masons were trained in stove construction. Women were taught how to conserve wood when cooking. Four stove models were designed and tested by the company, and about 1000 stoves were built over a two year period. However, a VITA evaluation of the Kaya project in 1983 indicated that the stove company had yet to prove itself a viable enterprise sustainable from revenues received from stove sales.

A second small grant in Upper Volta was to the Tenkodogo woodstove project. Two Peace Corps Volunteers working in collaboration with the Tenkodogo Government personnel proposed the project. The $1,522 grant went for materials and equipment for the construction and testing of 140 cement, Lorena, and banco stoves. A cookstove center was established to promote the stoves. Visual aid presentations were made and construction workshops held. The final report of the project (October 1982) indicated that 85 percent of the stoves built were still in use.

Other Technologies: Dug-well Handpumps and Rice Husk Extruders

- *Thailand: Appropriate Technology Project*

In 1979 an environmental study in Thailand found that most of the country's dug wells supplied water to villages containing fresh fecal matter, making it unsafe for drinking. The Thai Department of Health undertook an experimental program to provide safe drinking water which entailed field testing a simple suction type handpump made of polyvinyl chloride (PVC) plastic. The pump selected for the project was designed by VITA Volunteer Charles Spangler and described in the VITA publication "Handbook for Village Wells." The VITA pump design met all of the criteria established by the program: a PVC body, components that could be made from locally available material, and a design simple enough for a villager to understand, build, and maintain.

The pumps were constructed of local materials that the villagers could afford. The shallow wells cost $25.00 while the force-lift pumps cost $38.00. A year after the project began in 1980, there were 271 protected dug wells with pumps inspected. Most of the pumps remained in operation over the next two years. VITA concluded that the pumps promised to be reliable and easy to repair, as well as inexpensive. The design was so simple that any machine shop in the country could fabricate the entire pump or its components. Like the Honduras project, the success of the pump project in Thailand could be attributed in large part to the participation of the villagers in the implementation of the project using technology they could manage themselves.

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VITA maintained an office in Bangkok that worked on a wide variety of renewable energy efforts. In 1981, VITA was involved with other private organizations in setting up the Appropriate Technology Alliance of Thailand to coordinate renewable energy activities. It also published a newsletter on technology developments in Thailand. These activities helped assure that the VITA project's impact would be well disseminated. Once again, however, there is no information available to indicate the extent to which the project became commercially viable when funding ceased.

5.2 International Alternative Energy Network

Publications are the hub of VITA's international alternative energy network. All phases of VITA's operations contribute to publications, and vice versa. **VITA News** began publication under a different title in 1961, during the very early days of VITA's existence. **The Village Technology Handbook**, for a long time VITA's best-known title, was first published in 1963. By 1981 over 2,000 copies per year were being distributed. When the renewable energy project began in 1979, VITA had published over 100 different titles in several languages. By the time of the evaluation in 1981, VITA claimed to have met or exceeded all the original benchmarks set forth for the project: numbers and types of periodicals as well as numbers and types of case studies. (See Table 2.0, Energy Program Indicators in Publications in the Appendix.)

The technical staff provides in-house expertise for technical review. The Information Services - with its network of requestors from all over the world - functions as an ongoing "marketing survey." This is the way in which the VITA publications staff come to learn what the constituents want. Volunteer responses to specific requestors are published as **Technical Bulletins** for a general audience. Volunteers play a role in writing, translating, illustrating, and technical review. Publications, in turn, publicize VITA's efforts and those of other development groups.

The renewable energy project provided valuable support to ths effort. For the first time VITA was able to hire a technical translator, typesetters, and layout specialists. The project allowed VITA to add vital equipment, including a word processor. In support of other renewable energy project activities, VITA developed several publications to keep readers informed of energy developments around the world. In addition to the **Technical Bulletins** and **VITA News**, VITA published manuals, bibliographies, and directories. By 1982 VITA had also produced filmstrips, slide shows, and blueprints on woodstoves, biogas digesters, and windmills. The foreign language staff of the publications department produced materials in such languages as French and Spanish. (See the list of VITA publications for 1982 in the Appendix.)

VITA's primary objective has been to make its publications as useful as possible to the "end user" and those working directly with end users. Technical manuals were written for use by extension agents on their training missions. Slide shows and film strips illustrated the manual in nonformal education or community groups settings. The visual aids were intended to be culture specific. In Guatemala, for example, filmstrips and pamphlets were developed in simple Spanish language by the Choqui Station to illustrate the steps involved in building a Lorena stove. VITA claimed that virtually every development agency in the world was on its mailing list. The government of Guinea (Conakry) requested 300 copies of the **Village Technology Handbook** in French so that all its appropriate technology

centers could have at least one copy. In the first 18 months of the renewable energy project VITA reported having distributed nearly 20,000 energy-related books and bulletins.

5.3 Program Implementation Fund (Small Grants)

The first quarterly report of the VITA project (January 1980) indicated that an investment strategy had been developed to guide the selection of small projects for funding. The effort to elaborate such a strategy involved a panel of VITA Volunteers from VITRO laboratories specializing in energy technology as well as Drs. Robert Nathans and Romir Chatterjee of the State University of New York at Stoneybrook. The strategy VITA proposed drew upon information in two reports produced by Brookhaven National Laboratory.

The basic premise of the VITA approach was the recognition of the need to shift away from an overwhelming reliance upon oil as a power source. Hence, assistance under the small projects fund would emphasize activities which fall within the context of the local economy and environment. Priority was to be given to seeking less energy-intensive strategies of growth which could generate employment and higher income among beneficiaries living at the subsistence level. Potential projects were reviewed with the following considerations in mind:

- degree to which it was relevant to the problem of rural energy development;
- relative importance of the project to the overall development goals of the country;
- possibility that it would provide new and unique solutions to particular problems; and
- potential for developing an institution or improving local capacity to manage energy support systems.

Several criteria were established for funding selection:

- energy impact - the amount of energy projected to be conserved or produced;
- affordability - ability of beneficiaries to sustain the recurrent cost of the energy technology;
- development impact - extent to which energy production and distribution systems contribute to the achievement of social goals;
- implementability - extent to which cultural, managerial, and financial factors are likely to inhibit project success; and
- replicability - degree to which the project results could be replicated in other countries.

By the seventh quarterly report (June 1981) VITA reported that 30 proposals had been received in that quarter. A total of $47,997 had been disbursed in grants to twelve projects, for which funds had been mostly obligated during preceding quarters. In Bolivia, an award of $14,500 was made to SEMTA, a non-governmental organization in La Paz, for a range

of activities including a literature search, workshops, and construction of full-scale prototypes of solar water heaters. In Zimbabwe, a grant of $16,500 went through Silveria House, a Jesuit-associated self-help training and technical assistance group, to local groups to test and disseminate solar cookers, mudstoves, and biogas digesters. A grant of $2,450 went to a Thai entrepreneur to help finish developing and testing a rice husk fuel log extrusion machine.

By August 1982, VITA had funded 34 small grants in Latin America and Asia, totaling $268,094 (See Table 3.0, Small Grants Funded Under Renewable Energy Program, August 1982). Nearly one-third of these grants went to wind energy projects, including windmill and waterpump construction and consultancies. Other activities funded were biogas and biomass projects, as well as a rice husk fuel extruder and a prototype fluid gasifier. Five projects concerned solar energy and only three involved woodstoves or charcoal. Three grants were for information systems training at VITA.

The first two and a half years of the project enabled VITA to reach tentative conclusions on what constitutes a successful small grant project. According to an internal memorandum of August 1982, 20 were in the Africa region: woodstoves (8), information resources (6), solar cooker ovens (2), biogas (1), windmills (1), waterwheels (1), and solar-electric cattle fences (1). The primary effort had been in woodstoves. By VITA's own reckoning, the other technologies were judged to have been ineffective. Solar cooker ovens had not been accepted in Lesotho or Zimbabwe. The solar fence project in Mali had not yet started and the windmill project there was still dependent upon expatriate assistance. In Latin America and Asia there had been a predominance of wind energy grants, followed by biogas and solar projects (see Appendix, Table 1.0).

The memorandum suggested the need for VITA to restructure its approach to ensure that small grants have a greater likelihood of achieving long range impact. To the extent possible, it was felt that "off the shelf" technology should be used to ensure the probability of immediate success. Grants for the development of new prototype equipment were to be severely limited; emphasis was to be placed on readily available technology. It was thought that VITA should move beyond demonstration projects to a more active mechanism for the introduction and dissemination of technologies by providing grants to small businesses, cooperatives, and parastatal organizations. Demonstration projects remained as one-shot efforts either because the technology was not workable or acceptable, or because too few resources were available to promote its widespread use. It was thought that wind and photovoltaic technologies had proved to be the most workable in the sense that they were not as socially or culturally impacting as were, for example, village-level, community-managed biogas systems.

Another memorandum of October 1982 drew some tentative conclusions about the small grants program. It was proposed that VITA should concentrate on a few technologies, attempting to achieve their widespread use. These might include wind for water and irrigation and photovoltaics for drinking water. A geographic focus on the Caribbean, Honduras and Thailand was suggested. It was also suggested that grants be larger and that staff become more operationally involved in the field. Small businesses were to be targeted and U.S.-made technologies emphasized. A primary consideration after the initial phase of small grants activity was to exploit the potential for leveraging funding from other sources over the long range. A VITA small grant for a windmill project in Somalia, for example, might lead to a more comprehensive wind energy program in that country.

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In mid-1982, VITA designed a questionnaire for evaluating the small grants program. The results were disappointing. The questionnaire was sent to 17 grantees, of whom only six responded. Only three actually completed the self-evaluation, while another grantee was interviewed at VITA. While most of the grantees had been submitting progress reports, few wrote final reports. There was very little substantive review of such issues as technology development and prospects for dissemination. This was due to a lack of emphasis on the importance of information gathering and evaluation. Project implementation was frequently delayed and key personnel often changed during the life time of the project.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The Low Cost Energy Technology Project described in these pages clearly had a profound and positive effect on VITA. It allowed VITA to expand its capabilities in renewable energy and take its place among the leading organizations in this field. In this concluding section we will attempt to distill some of the key findings that emerge from this assessment and make some recommendations.

Sources of Information for this Assessment

Neither S&T/EY nor VITA has been very assiduous in maintaining files on the renewable energy project. This assessment has been hampered by the lack of access to a full set of quarterly reports, not to mention a final project report. VITA files provide an abundance of information on individual projects, in particular the small grants program . But cumulative lists seem to leave out important regions such as Africa. In general, there has been little attempt to document the actual outputs of the project as originally identified in the logical framework. Many of the outputs anticipated at the outset became unrealistic with the reduction in the project budget. The assessment team was given liberal access to VITA files and home office staff. Several brief discussions were held with Henry Norman, Executive Director during the lifetime of the project. Steve Hirsch, who had served as the REP project manager, had just returned from an overseas assignment when the assessment began. He was helpful in procuring those project files which he could locate. Jack Downey, also formerly manager of the REP project, met with the team and shared his observations on the project. Margaret Crouch, executive editor of **VITA News**, was gracious in providing copies of VITA publications.

International Economic Development Environment

During the life of the VITA renewable energy project there were quite significant developments in the world economy. Although oil prices fell in the 1980s, an energy crisis still persisted. The sudden energy price rises in the 1970s had forced many poorer countries to face staggering increases in their oil bills. Many attempted to develop domestic sources of energy, including renewable fuels, with only modest results in most cases. By the mid-1980s, the loans that these countries had taken out to stay afloat were coming due. They faced the threat of either defaulting or negotiating moratoria on payments. In the development of renewable fuels there have been numerous disappointments. Costs of renewable fuels such as wind, geothermal, and biogas were higher than the first optimistic estimates. The practical problems in implementing projects were underestimated. The drop in oil prices has not prevented many countries from having serious foreign exchange problems. Lower prices also had the unfortunate effect of discouraging further development of new and renewable energy schemes.

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Meanwhile, the international banking community has floundered in the search for ways to deal with the huge debts accumulated by developing countries. The emphasis on renewable energy has actually given way to a renewed interest in finding domestic oil, coal and gas in developing countries. Several of the key assumptions of the project were thus undermined. For example, it was assumed that the cost of fossil fuels would continue to rise and consume foreign exchange earnings, making alternative energy technologies cost-effective investments for governments. Oil prices have remained relatively low during the 1980s, however, and the cost-effectiveness of most alternative energy technologies has not been proven beyond question. In spite of these discouraging developments in the global environment, VITA has continued to carry the torch for renewable energy programs. As recently as April 1988, VITA News dedicated an entire issue to renewable energy issues.

Internal Transformation of VITA Organization

By all accounts, the REP project had a profound positive impact on VITA as a development agency. The transformation of VITA from a "flower power" group of hang-loose volunteers during the 1970s into the full-fledged professional development organization it is today is due in large part to the infusion of centrally-funded A.I.D. resources. Symbolic of that transformation was the transfer of the VITA home office in the summer of 1981 from modest facilities in suburban Mt. Ranier to downtown Rosslyn in a modern office suite adjacent to the A.I.D. Science and Technology Bureau. REP project funds allowed VITA to begin hiring people with field experience as professionals capable of providing technical assistance. Ironically, while VITA was accorded the Cooperative Agreement mainly predicated on its volunteer expertise, it was actually the professional home office and field staff that often carried out technical consultancies. Today VITA is considered one of the leading private voluntary organizations involved in renewable energy programs. And VITA leadership is persuaded that there is certain to be a renewal of interest in alternative energy technologies. VITA expects to be in the forefront of that revival.

Renewable Energy Technologies

The project promoted experimentation in several renewable energy technologies with varying degrees of success. William Ramsay has summarized the results of the experimentation in renewable energy by VITA and others in a review of A.I.D. project evaluations. His review covered several technologies considered to have some promise: photovoltaic systems, wind machines, solar hot water heating, biogas, small hydropower, gasification, stoves, and fuelwood. Ramsay concludes that, in terms of cost effectiveness, development agencies should support smaller "user-friendly" technologies such as stoves and solar water heaters. The technologies in which the REP project had the greatest impact included woodstoves and wind power, an indication that the project made a contribution to assessing which approaches would be the most cost-effective.

Diversification of Sources of Revenue

Some of the consequences of the VITA renewable energy project have been positive but unintended. Because of its recognized resources in renewable energy which were expanded during the project, VITA is in a better position to diversify its sources of revenue and funding. VITA, like many U.S.-based private voluntary organizations involved in international development, has traditionally been overwhelmingly dependent upon A.I.D. for grants and contracts (see Table 3.0). In fact, A.I.D. has accounted for 65 to 80 percent of all revenues since 1981.

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Now, however, there is a real possibility of VITA's obtaining a sizeable contract with the United Nations Development Program to help promote the role of women in renewable energy programs in West Africa. Since women are the chief collectors, managers, and users of household energy, the purpose of the project is to involve them more effectively in the design, planning, implementation, and management of energy sector programs. The U.N.D.P. project will seek to stimulate the revision and adoption of policies to improve women's condition in relation to energy use. It will establish cadres of trainers and develop practical mechanisms for achieving the participation of women in energy projects. VITA has been asked to coordinate the sub-project activities in the Francophone West African region. A VITA consultant will be based in the Mali-Burkina Faso area and oversee the two national programs. It is not coincidental that it was in this region that VITA demonstrated a strong field presence during the REP project. During the UNDP project design, six countries were visited: Cameroon, Ghana, Guinea, Malawi, Mali and Zambia. All were found to have favorable policy environments for the implementation of project objectives. The first selection for the VITA sub-project area was made of Guinea and Mali. Later Burkina Faso was substituted for Mali. VITA staff will also cooperate with sub-projects in Anglophone countries.

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_____. "Wind Power for Roatan Island: Pumping Water in Honduras," October 1982.

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Appendices

Table 1.0 Stoves Built and Tested by VITA by Country (as of January 1983)

Region	Number of Stoves by Project		Date Reported
Africa			
Burundi	40	(AIDR)	11/82
Gambia	180	(Forestry Dept., Peace Corps)	3/82
Kenya	2000	(clay stove group)	5/82
Mali	50	(Min. Indus. Devel, CILSS)	5/82
Mauritania	18	(CILSS)	5/82
Niger	372	(CWS)	6/82
Senegal	4500	(CERER)	4/82
Somalia	2400	(VITA, ICR)	11/82
Upper Volta	2000	(Germany, AIDR)	5/82
Zimbabwe	55	(Silveria House)	8/82
Asia			
India	500	(Indo-German Dhauladhar)	5/82
Sri Lanka	6500	(CISIR, Sarvodaya)	1/82
Thailand	600	(Royal Forestry Dept.)	1/83
Latin America/Caribbean			
Ecuador	200	(Peace Corps)	11/82
Guyana	10	designs	1/83
Jamaica	10	designs	1/83
Monserrat	5	designs	1/83
Total	19,400		

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Table 2.0 Energy Program Indicators in Publications (as of April 15, 1981)

Type of Publication	Benchmarked	Produced
Energy Bulletins (E, F, S)	7	5 *
Special Issue of VITA News	1	1
Enrgy Fact Sheet (E, F, S)	13	12 **
Case Studies of Energy Projects	4	14
Technical Manuals (E, F, S, A)	3	1 ***
Case Studies of Diffusion	5	8
Audio Visual Contacts	13	26

*Reformated as insert into VITA News
**Production suspended pending budget settlement
***Three other titles currently in production

E = English F = French S = Spanish A = Arabic

Publications Produced but not Benchmarked:

Existing energy manuals revised and reformatted	7
Existing Technical Bulletins translated into French	25
Existing Technical Bulletins translated into Spanish	12

Translating and typesetting support for two major energy program reports.

Translating and typesetting support to information resources seminar (handbooks and workbooks).

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Table 3.0 Small Grants Funded Under Renewable Energy Program in Latin America, the Caribbean, and Asia, as of August 19, 1982

Technology	Country	Activity	$Amount
Wind/biogas	Nicaragua	Construction/demonstration	15,000
Wind energy	Turks/Caicos	Demonstration low voltage	9,794
Wind energy	Fanning Is.	Windmill construction	10,000
Wind energy	Antigua	Construction/demonstration	8,000
Wind energy	Christmas Is.	Equipment purchase	800
Wind energy	Honduras	Windmill construction	2,700
Wind energy	Honduras	Water pump construction	19,200
Wind energy	Thailand	Consultancy	5,000
Wind energy	India	Consultancy	3,600
Wind energy	India	Consultancy/water pump	2,000
Biogas	Guatemala	Prototype construction	10,000
Biogas	Guatemala	Symposium	7,000
Biogas	Ecuador	Demonstration/dissemination	16,000
Biogas	India	Construction/dissemination	6,070
Biogas	Thailand	Dissemination/evaluation	11,076
Biomass	Costa Rica	Conference	20,000
Producer gas	New Hebrides	Prototype demonstration	10,000
Fluid gasifier	Honduras	Prototype construction	9,800
Fuel extruder	Thailand	Rice husk fuel extruder	2,450
Solar energy	Bolivia	Construction of showers	14,500
Solar energy	Bolivia	SEMTA workshop	4,660
Solar energy	Guatemala	Solar water heater	1,267
Solar energy	Guatemala	Solar water heater eval.	600
Solar energy	Tobago	Solar pump construction	8,880
Lorena stoves	Guatemala	Learning materials	5,335
Woodstoves	Sri Lanka	Design/dissemination	5,000
Charcoal	Costa Rica	Construction/charcoal maker	2,500
Info systems	Ecuador	Training at VITA	1,774
Info systems	India	Training at VITA	58
A.T. Center	Barbados	Information dissemination	21,000
Housing	Nicaragua	Low cost housing	15,000
Hybrid sailboat	Dominica	Construction/dissemination	11,300
Evaluation	Central Am.	Consultancy/evaluation	1,330
Total small grants funded: 34			$268,094

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Table 4.0 VITA Sources of Revenue (1981-87)

Source	*1987	1986	**1981
A.I.D. Contracts and Grants	$4,393,691	$3,072,705	$1,987,904
Renewable Energy Program			1,707,904
Core Grant			280,000
Other organizations	647,586	773,126	238,270
Volunteer services	333,826	310,835	
Sales of Publications	107,142	103,422	225,800
Contributions	82,717	148,329	80,000
Consultancies, conferences, etc.	37,986	53,322	35,850
Total Revenue	$5,602,948	$4,461,739	$2,567,824

*VITA 1987 Annual Report
**1981 Projected Budget

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VITA publications

1982

Books, Bulletins, Etc.

Volunteers in Technical Assistance (VITA)
1815 North Lynn Street, Suite 200
Arlington, Virginia 22209 USA

Phone: (703) 276-1800 Cable: VITANIC
Telex: 440192 VITAU1

Books . . .

ASSESSING RURAL NEEDS: A MANUAL FOR PRACTITIONERS
by Jeffrey Ashe
This illustrated book is designed to provide a mechanism for villagers and small farmers to voice needs and to enable more successful programming. Popular participation and employment generation are emphasized.
11058-BK - English $5.95 127 pages
18058-BK - Spanish $4.95

THE ARUSHA WINDMILL: A CONSTRUCTION MANUAL
by Dick Stanley
Water pumping windmill developed in Tanzania by the author, backed up by VITA technical experts. Complete step-by-step construction details. Fully illustrated. Volunteers in Asia/VITA.
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by E. Christopher Cone
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Informative guide to caring for bees, building hives, improving honey production. Originally written for use in Bangladesh, principles can be adapted anywhere. Fully illustrated.
11068-BK - English $4.95 45 pages

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Thoughtful economic and social assessment of selected Indian biogas systems. Comments on potential as fuel and fertilizer sources and on cultural and economic impact. Appendixes include detailed resource analysis and computer simulation. Available in July 1982.
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This valuable teaching aid presents environmental concepts as tools for planning agricultural projects. Enables people to make sound cost/benefit analyses of projected programs. Fully illustrated. Mohonk Trust/Codel/VITA.
11059-BK - English $5.95 103 pages
19059-BK - French $4.95
18059-BK - Spanish $4.95

ENVIRONMENTALLY SOUND SMALL-SCALE WATER PROJECTS: GUIDELINES FOR PLANNING
by Dr. Gus Tillman
Second in the CODEL/VITA planning guideline series, this is for people involved in small-scale water development. A useful primer for individuals with only limited experience in this field.
11066-BK - English $5.50 142 pages

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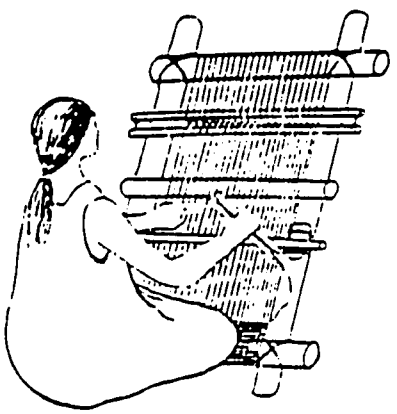
41007-AV - 20-ft windmill $8.95
Save on sets! Buy manual and either set of blueprints for $12.95



HANDLOOM CONSTRUCTION: A PRACTICAL GUIDE FOR THE NON-EXPERT
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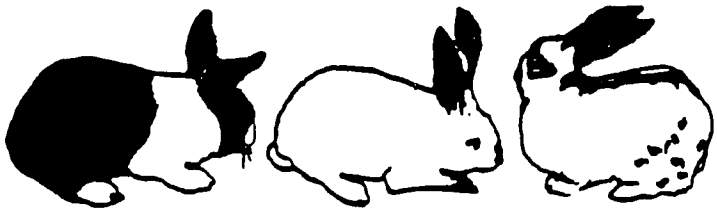

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Presents the basic technology of horticulture and vegetable growing, mainly as it applies to family gardens. Emphasizes nutritional factors, describes agricultural extension work as it relates to gardening and food production that mostly involves women.
91008-BK - English $4.50 64 pages

Bulletins . . .

VITA Technical Bulletins are the direct result of VITA's experiences in international development efforts. Some bulletins feature VITA Volunteer designs prepared in response to specific inquiries from developing areas. Others were submitted to VITA as examples of designs that worked in a particular field situation. All have been evaluated by VITA Volunteers before being published. Technological premises are sound, and testing results are provided if available. VITA makes this material available to generate ideas among as wide an audience as possible. Readers and users are urged to write to VITA about their experiences with the designs--good or bad. Please send us test results, suggestions, and other comments.

All Bulletins, $2.00 each. Available in English, French, or Spanish, as indicated. Please specify TB number and language (E, F, S).

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51063-TB - E 4 pages

SOLAR OVEN
Insulated top fits on base of gypsumboard and plywood.
51006-TB - E, F 7 pages

SOLAR OVEN FOR VILLAGE BAKERIES
Large size solar oven is spacious enough for a small business enterprise.
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Developed in Tanzania. Unique way to mix and burn oil and water.
51064-TB - E 11 pages

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Etc. . . .

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VITA
VOLUNTEERS IN TECHNICAL ASSISTANCE

1815 North Lynn Street, Suite 200
Arlington, Virginia 22209 USA

LOGICAL FRAMEWORK

VITA RENEWABLE ENERGY PROGRAM

GOAL: To develop an increased capability to utilize renewable energy sources as alternatives to imported fossil fuels in developing countries with a particular focus on the rural and urban poor.	MEASURES OF GOAL ACHIEVEMENT: Introduction and adoption of renewable energy technologies such as more efficient woodstoves, windmills solar devices by low income individuals/groups in home and work resulting in decreased energy costs and/or higher disposable incomes for rural and urban poor and reduction in future use of fossil fuels.
PURPOSE: To improve the capabilities of VITA and of developing country individuals and groups to develop, transfer, and disseminate renewable energy technologies, including strengthening traditional VITA technical assistance mechanisms, supporting information and other resource sharing systems, and establishing a small grants project implementation fund.	END OF PROJECT STATUS: 1) VITA core activities--volunteer resources, inquiry service, documentation center, and publications--will have developed stronger capabilities enabling VITA to provide more effective technical assistance in the renewable energy area. 2) Information and other resource sharing, among individuals and groups promoting use of renewable energy technologies by low income groups, will be increased. 3) A small grants project implementation fund will have been disbursed in support of projects developing, transfering, and disseminating renewable energy technologies benefiting low income groups.

MEANS OF VERFICATION:

1. Project evaluation reports.
2. World Bank Country Reports.
3. Country Energy Assessments.
4. Energy Consumption and demand surveys.
5. Program area evaluations.

IMPORTANT ASSUMPTIONS:

1. The cost of fossil fuel imports will continue to rise and consume foreign exchange earnings, making alternative energy technologies cost-effective investments for governments and individuals in developing countries.

2. Renewable energy technologies will permit energy usage in remote villages and household which could not efficiently be served by the traditional fossil fuel system.

3. Renewable energy technologies as components of local development projects will meet felt needs of local individuals and groups.

MEANS OF VERFICATION::

1. Program evaluation in final year.
2. VITA records and reports.
3. Regional and international organizations' reports.
4. Quarterly reports, interim evaluations, technical panel meetings.
5. Feedback from requestors and small grant recipients.
6. Site visits by REP personnel.

IMPORTANT ASSUMPTIONS:

1. Appropriate grassroots institutions seeking to assist low income groups exist and will seek VITA's assistance.

2. Resources for project development and implementation are lacking at the local level.

OUTPUTS:	FY 79/80	81	82	83	84
1. Core Technical Assistance activities in renewable energy.					
A. Volunteers recruited.	237	100	100	100	100
B. Requests for technical information/assistance answered, including documentation searches and by mail assistance by volunteers.	76	1000	1150	1325	1525
C. Number of publications, including special issues of VITA News, Energy Bulletins, Technical Bulletins, Fact Sheets, and manuals.	1200	2000	2000	2000	2000
D. Documents acquired and classified.	2	6	9	12	12
E. Consultancies arranged, training programs assisted.					
2. "Networking" and information system activities.					
A. Number of networking activities assisted, including information centers, skills banks, and mini-grants programs	2	5	10	10	10
B. Accessing of data bases, computerized and non-computerized.	0	25	17	10	10
3. Project implementation fund:					
A. Projects approved					
Number	14	50	85	85	85
Amount	43,000	35,000	600,000	700,000	700,00
B. Projects disbursed					
Number	8	50	85	85	85
Amount		400,000	700,000	700,000	700,00
C. Average speed of response (average no. of weeks of initial review to internal VITA approval	3	2	1	1	1

INPUTS:	($ millions)				
	79/80	81	82	83	84
AID Cooperative Agreement Funding	$.821	2.0			

Section 4:

Impact Assessment of

The Energy Technical Service Support Project

(Project. No. 936-5702)

Implemented Under Resources Support Service Agreement Between AID and the U.S. Department of Energy

(1978-1988)

by

Ray Roan

In Consultation with
TEM Associates, Inc.
Emeryville, California

Under Contract with

Office of Energy, Bureau for Science & Technology
The Agency for International Development

November, 1988

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1.0 Introduction

Between 1976 and 1978, A.I.D. and the U.S. Department of Energy (DOE) cooperated in several small renewable energy initiatives. The two agencies conducted joint efforts in renewable energy research, development, and demonstration.under a Memorandum of Understanding (November 1976) and a General Agreement (September 1977). Additionally, A.I.D. had used the professional assistance and facilities of Brookhaven National Laboratory (a DOE-funded lab) in several projects. This cooperation expanded into the Energy Technical Service Support Project which was implemented through the Resources Support Service Agreement (RSSA) between A.I.D. and D.O.E. initiated in September 1978.

Under Section 119 of the Foreign Assistance Act of 1961, as amended in 1977, A.I.D. and DOE were required to review options for the response of the U.S. Government to the energy needs of poor countries, particularly for renewable and unconventional sources of energy. The National Academy of Public Administration, under contract to A.I.D., conducted the principal study of organizational options, including that of an International Energy Institute. Representatives of A.I.D., DOE, and other agencies made written and oral recommendations, and reviewed the final report. A.I.D. and DOE also gave careful consideration to private sector participation in the planning and implementation of subsequent energy programs.

The final recommendation was for A.I.D. to become the lead agency in cooperating with developing countries in energy production and conservation, with DOE as the principal supporting agency, especially in the provision of technical and scientific services. Overall foreign policy guidance was to remain with the Department of State. A.I.D., as the lead agency, would take advantage of its body of experience with technology diffusion and its capacity to work closely with institutions and government agencies of the lesser developed countries (LDC's). A.I.D. was also expected to stimulate LDC capacities to assess and develop energy resources and technology applications suited to local environments. One of A.I.D.'s early tools in the effort to assist LDC's in the energy sector was the Energy Technical Service Support Project.

Organizationally, A.I.D. was to assemble a small core of professionals in the energy field, who would in turn utilize recognized personnel and service resources from DOE, the national labs, and the U.S. private sector. A.I.D. was also to assure that energy programs would be effectively integrated with other aspects of development cooperation. DOE was to make appropriate organizational arrangements, with due attention to funding and staffing support, to provide services to A.I.D. for LDC energy development. These services were to include energy planning assistance, technical project design, technical and scientific advice, assistance in program implementation, direct participation in A.I.D.'s overseas operations and program evaluations, as requested.

In addition to direct access to DOE employees, A.I.D. would have access to personnel and facilities of the following energy technology laboratories which operated under the auspices of DOE:

Ames Laboratory
Argonne National Laboratory
Brookhaven National Laboratory
Grand Forks Energy Research Center
Hanford Engineering Development Laboratory
Idaho National Engineering Laboratory (including ICPP)
Laramie Energy Research Center
Lawrence Berkeley Laboratory
Lawrence Livermore Laboratory
Los Alamos Scientific Laboratory
Morgantown Energy Research Center
Oak Ridge National Laboratory
Pacific Northwest Laboratory
Pittsburgh Energy Research Center
Sandia Laboratory
Savannah River Laboratory
Solar Energy Research Institute

When A.I.D. began its response to the new policy with its declared emphasis on energy, the agency was basically guided by the so-called "basic human needs" legislation. These broad development programs were activities in support of LDC strategies designed to meet basic human needs, and to simultaneously achieve self-sustaining economic growth characterized by a certain degree of equity. The basic human needs strategy incorporated three main elements: (1) increasing incomes of the poor by raising their productivity through improved access to land, water, seed, and fertilizer, and opportunities for employment; (2) increased availability of food, shelter, health services, and education; and (3) improved levels of participation in decisions affecting their lives.

These rather diverse policy considerations guided the implementation efforts of A.I.D.'s energy program, including the Energy Technical Service Support project, onto two principal tracks: the first in non-conventional renewable energy mainly dedicated to rural development, and the second in more traditional energy forms (i.e., derived from fossil fuels) associated with urban and industrial development. This distinction continues to the present day in A.I.D.'s energy program.

2.0 The Period of Growth

Activity within the Energy Technical Service Support project quickly rose from a mere two requests valued at $10,000 in 1978, to six requests at $163,000 in 1979, to a total of 15 work requests valued at some $942,000 in 1980-1981. The life-of-project peak activity for a single year occurred in 1982 with 9 work requests valued at an estimated $792,000. That level of effort within the Technical Service Project (as indicated by project resources from Development Assistance Accounts) closely paralleled A.I.D.'s overall level of project funds devoted to programs related to energy in 1982 (see Energy Program Levels table, 1978-1988).

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Agency for International Development
Energy Program Levels*
($ millions)

FY	$ DA (est.)	$ ESF (est.)	$ Total (est.)
1978	18.3	—	18.3
1979	50.0	—	50.0
1980	55.0	—	55.0
1981	48.0	—	48.0
1982	117.0	54.6	171.6
1983	74.8	—	74.8
1984	47.8	—	47.8
1985	75.0	90.0	165.0
1986	41.3	125.8	167.1
1987	53.9	124.1	178.0
1988	53.0	97.0	150.0

*excludes power generation and distribution

DA - Development Assistance Accounts
ESF - Economic Support Fund Account

Source: Annual Congressional Presentations

A.I.D.'s Energy program activity peaked in 1982, when judged by Development Assistance (DA) resources committed. (See comparative graphs in Appendix).

The following six-year period, through 1988, saw energy activity level off at an average of some $57 million on an annual basis. Development Assistance Accounts, notably Section 103 and 106 funds, had from the beginning provided the resources for the various energy projects, Section 103 in the agriculture and rural development sector and Section 106 for selected development activity, e.g. energy. In 1982 Economic Support Funds (ESF) were applied to an energy project in Egypt and produced an even higher peak in agency-wide energy activity level (see table); this proved to be a harbinger of things to come. Though as already mentioned, DA-financed energy activities plateaued in the six-year period after 1982. ESF-financed projects, re-started in 1985, provided levels of activity equivalent to and exceeding the high year of 1982 throughout the four-year period ending in 1988.

The types of technical assistance requested by A.I.D. of DOE under the Technical Service project were, in the earlier years (1978-1981), significantly weighted toward renewable energy solutions which were expected to have long-term potential for lifting the energy limitations on rural development. Solar energy and wind power were promoted for use in rural settings to provide electricity for a variety of applications. The project also supported LDC energy institutions to help plan, develop, and research technology applications for village energy requirements, especially those addressing fuelwood deficiencies. A.I.D.'s renewable energy programs supported U.S. development policies, and also U.S. nuclear non-proliferation objectives by developing alternative energy sources.

3.0 The Turning Point

The trend toward renewable energy options in the Technical Service Project peaked in 1982, but continued to be significant through the later years of the project. During the project's implementation period, renewable energy technology development was to gain a two-to-one spending ratio over activities related to conventional energy, the latter intended for LDC's interested in fossil fuel generation of electric power, conservation of energy in the commercial, transportation and industrial sectors, and the exploitation of local oil, gas, and coal energy resources.

As the project progressed into the mid-1980's, DA funding and activity levels declined. The value and number of renewable energy technical work requests in 1985 were scarcely more than in 1978; two requests totaling just $40,000.

In 1986 the levels increased slightly to three requests (not all were funded) valued at $136,000 but were still below 1979 levels. The project was terminated in 1988 after two years of non-use.

As is frequently the case in governmental organizations, policy emphasis can be affected by those persons who staff the organization. Management and staff changes in DOE in the mid-1980's effectively minimized the priority earlier placed by DOE on cooperation with A.I.D. In all fairness, staff changes in A.I.D., as well, did little to sustain the high level of cooperation achieved in the inter-agency agreement in the late 70's and early 80's. Other policy changes and political decisions by A.I.D. also influenced the energy sector development efforts.

As seen, earlier energy activities were primarily funded by Development Assistance (DA) funds, but from 1985 onward the proportion of funding from Economic Support Funds (ESF) increased substantially, and in 1988 was expected to amount to some 65% of total outlays for energy. Because of this shift, energy activities have become increasingly concentrated in countries with particular security and political importance to the United States, i.e., those in Central America, the Caribbean, and Asia/Near East regions. A.I.D. obviously attaches high priority to energy sector assistance in these countries but the shift also reflects the ability of A.I.D. to employ ESF funds to stimulate investments for capital-intensive projects which are needed to develop electricity generating capacity and to exploit fossil fuel resources in LDC's. Activities funded by DA accounts, on the other hand, are more limited in scale, continue to emphasize long-term institution building efforts, train energy professional cadres, and stimulate public energy policy reform. Latter-stage project activities tend to be restricted to production of fuelwood and other biomass resources (in coordination with A.I.D. efforts to reduce deforestation) and support renewable energy systems which have been proven to be technically viable and economically competitive with diesel and fossil fuels.

4.0 Today

A.I.D.'s current energy program focuses on three areas: enhancement and efficiency improvement in electricity generating systems with a growing role for the private sector, energy conservation in the commercial and industrial sectors, and increasing supplies of energy for rural development. Activities being financed are designed to address the most critical energy problems now facing the LDC's: the "power crisis" and the rising costs (and increasingly limited supplies) of fuels traditionally used for domestic purposes.

The energy program has evolved over the past few years in response to several factors: (1) the changing energy environment brought about to a great extent by significantly lower

fossil fuel prices; (2) a better understanding of the role that donor assistance plays in policy change and the encouragement of private sector investments in energy; (3) the application of "lessons learned" from past project activities; and (4) efforts to capitalize on unique technical and scientific skills available in the U.S. energy industry.

A.I.D.'s Energy Technical Service Support Project, with the cooperation from DOE, clearly played a significant role in launching the agency's energy program. However, external policy changes and internal organizational shifts so altered the "rules of the game" that, as a project, it lost its viability and became a bureaucratic barnacle. Its termination in 1988, almost by default, was an understandable decision.

5.0 Observations

There is a truism within the bureaucracy that resources tend to follow policy. The current fad or fashion in policy concerns attracts funding, human resources, and executive attention. A certain critical mass is attained, momentum is achieved, results are obtained. That truism appears to have applied to the Energy Technical Service Support project. That the project was a reasonable success is not difficult to accept:

- technical and scientific personnel from DOE assisted in a variety of ways A.I.D. and A.I.D. Missions here and abroad, as well as LDC governments;
- critical skill personnel were seconded to A.I.D. for long-term assignment;
- joint participation in multi-lateral activities was facilitated;
- evaluation of energy sector activities was accomplished leading to corrective policy changes; and
- an experienced body of energy sector professionals was developed who manage A.I.D.'s energy portfolio to the present.

Having accepted a reasonable degree of success for the Energy Technical Service Support Project in the undergirding it provided A.I.D.'s energy program in the formative years, certain problems did come to light in the impact assessment — not unexpectedly:

- inter-agency cooperation so evident in the early years tended to diminish over time;
- personnel shifts in both A.I.D. and DOE produced gaps in project management;
- documentation of technical analyses, studies performed or projects designed was frequently not placed in agency files;
- fiscal management was almost completely deficient; and
- policy determinations within both agencies tended to undercut the project.

On balance, however, over the life-of-the-project, agency-wide efforts in the energy sector would have been significantly more difficult and less productive without the Energy Technical Support project.

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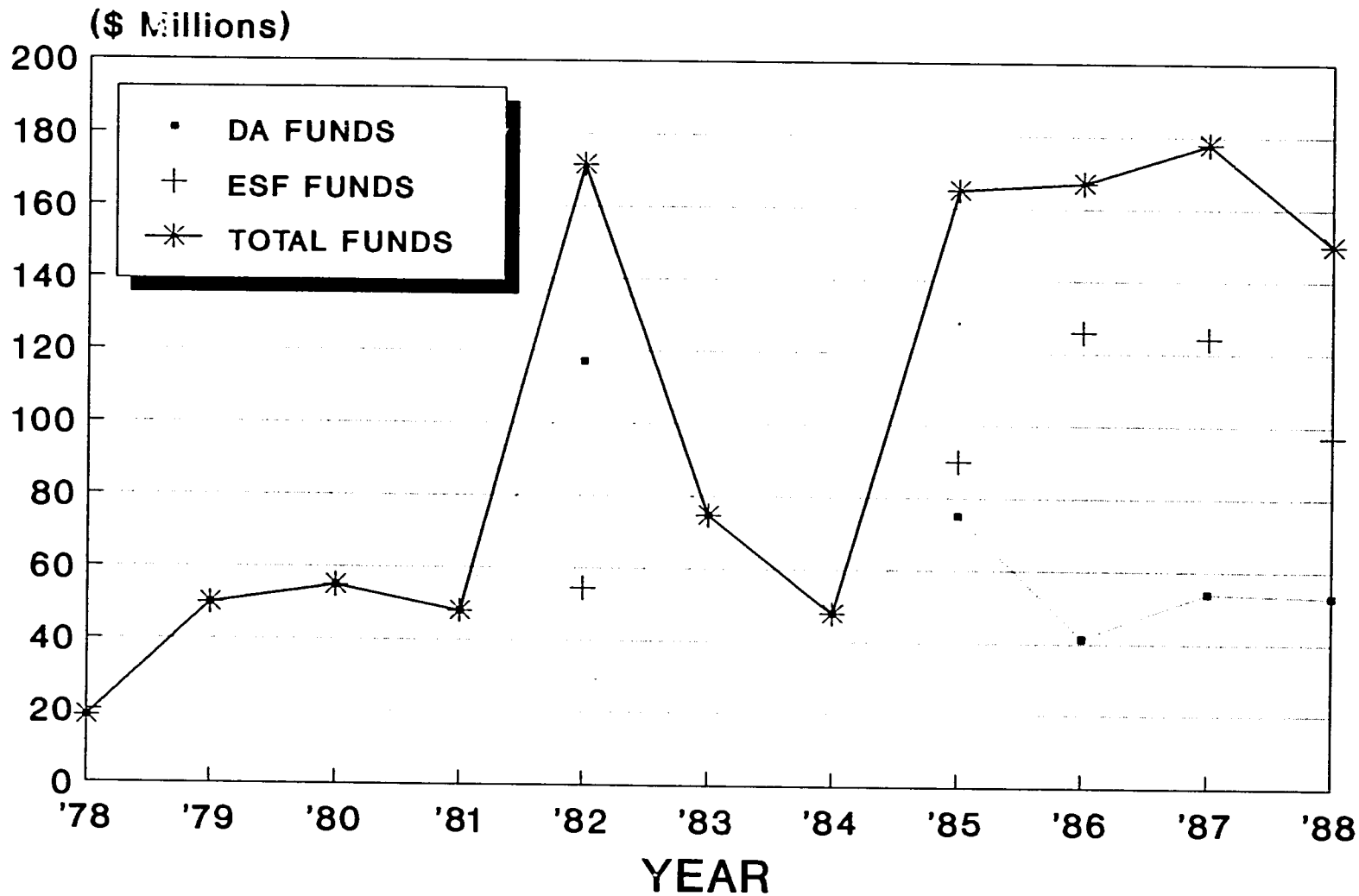
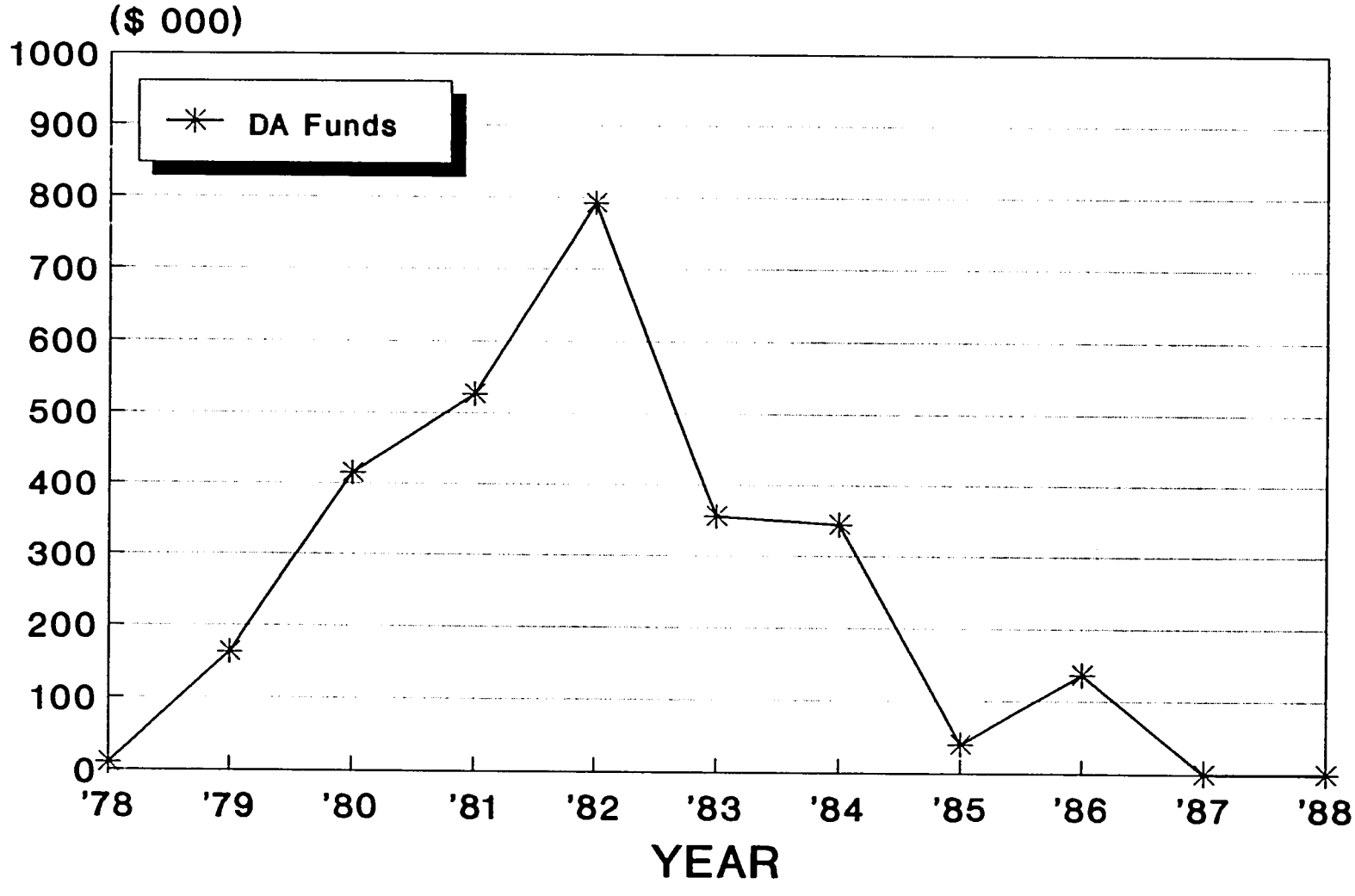
Appendices

A.I.D. ENERGY PROGRAM



excludes power generation & distribution

ENERGY TECHNICAL SERVICE SUPPORT PROJECT
Estimated Value of Work Requests to DOE



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Section 5:

Impact Assessment of

The Small Decentralized Hydropower Program

(Project No. 936-5715)

Implemented Under a Cooperative Agreement Between A.I.D. and the National Rural Electric Cooperative Association (NRECA)

(1979-1987)

by

Peter Borgo

Consultant to TEM Associates, Inc.

Under Contract with

Office of Energy, Bureau for Science & Technology
The Agency for International Development

November, 1988

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The initial program was to be in five major phases. The tasks associated with each phase are outlined below.

Phase I - Resource Assessment

Examine flowing water bodies suitable for SDH development which are untapped and near existing load centers. Determine the role of SDH in the country's rural electrification plan and overall energy strategy. Assemble a complete data base for candidate countries to include hydrologic information; planned and existing electrical loads; capabilities for providing equipment locally; and available skills for construction, operation and maintenance of the SDH system.

Phase II - Planning

Analyze data, select final site, and determine specific implementation procedures. Focus on areas where no alternate electricity supply exists or where diesel generators are the sole source of power. Emphasize coordination with rural electrification; irrigation and water resources projects; and rural development projects. Conduct site visits as necessary and identify one site in each geographic region if possible.

Phase III - System Development

Design prototype projects from initial concept to detailed engineering. Develop skills of local technicians in planning, design and engineering of an SDH plant. Determine equipment specifications and any special modifications required for specific applications. Projects should be reproducible demonstrations in terms of technology and management. Lay groundwork to create the social, political, and institutional structures required to implement and maintain an SDH program.

Phase IV - System Implementation

Complete site preparation, fabricate SDH components, and install and test the system. Stress participation by local institutions. All aspects of the implementation should be designed to remain intact after technical assistance is withdrawn.

Phase V - Technology Transfer

Disseminate information gained during the first four phases of the SDH program. Assess system performance, evaluate the success of the planning and engineering effort, identify needs for staff training and additional support, determine strength of institutional infrastructure. Evaluate social, political, and economic changes consequent to system implementation. Train host country nationals to develop a capability to continue SDH development.

1.2 Organizational Profile of NRECA

The National Rural Electric Cooperative Association (NRECA) is a Washington, D.C.-based service organization that represents rural electric systems serving 25 million people in 46 U.S. states. Since its founding in 1942, NRECA has grown to an organization of nearly 400 employees with more than 1,000 cooperative members. To accomplish tasks mandated by the membership, the NRECA is organized into five departments: Energy and Environmental Policy; Government Relations; Management Services; Public and Association Affairs; and Retirement, Safety, and Insurance. More than 20 divisions within

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1.0 INTRODUCTION

1.1 The Small Decentralized Hydropower (SDH) Program

The Small Decentralized Hydropower (SDH) Program was authorized by the United States Agency for International Development (A.I.D.) in August 1979. Program activity was initiated through a Cooperative Agreement signed with the National Rural Electric Cooperative Association (NRECA) in May 1980. The initial agreement was for a period of two years with a first year expenditure of $500,000. This agreement was periodically amended to extend the program life and to authorize the expenditure of additional funds. At one time the program was envisioned to be funded at $9.5 million from FY79 through FY83. The NRECA, through the SDH Program, actually spent $4.4 million between May 1980 and July 1987.

A non-competitive procurement was justified with the NRECA for contract assistance to carry out activities in the SDH program. The NRECA was determined to have the necessary combination of technical skills and development expertise required to carry out a major SDH program in LDCs. These qualifications were acquired from many years of programs in rural electrification work, from the existence of cooperating organizations in a number of countries, and SDH experience in the United States.

According to the USAID Project Paper, the primary purpose of the SDH Program was to develop a methodology for implementation of small hydroelectric systems to provide electrical power in rural areas. Specific program objectives included:

- Define specific energy needs in less developed countries (LDC) that can be met through SDH development;
- Identify and demonstrate cost effective applications of SDH systems in LDC's;
- Develop a coherent, well structured SDH skills resource composed of institutions and individuals that can provide short and long term expertise to Bureaus, Missions and LDC governments;
- Provide a training program in SDH for LDC technicians;
- Coordinate SDH development with other appropriate technologies to facilitate cost effective and long term solutions;
- Develop standard designs for a multiplicity of applications; and
- Implement SDH to maximize acceptance and local participation of labor and materials suppliers.

- Construction of a hydro system as a supplement to planned or existing remote diesel generation;
- Construction of some other type of renewable energy generation facility as a sole or supplementary source of power; and
- Construction of nothing at all until grid power has been extended.

2.3 Project Paper Preparation

Develop specifications and preliminary feasibility studies leading to Project Papers after appropriate site visits. Feasibility studies must include determination of the SDH potential, a load demand forecast, a preliminary design, an investment cost estimate, an operating cost estimate, determination of technical soundness, a financial and economic analysis, a sociological inquiry, an environmental analysis, and an implementation plan.

2.4 Information Transfer

Survey SDH facilities in both developed and underdeveloped countries to determine the state-of-the-art technologies. Develop an organized information base of hydro resources, available technology, and available skills resources. Prepare manuals, bulletins, and resource directories in appropriate languages. Hold regional workshops to discuss SDH systems.

2.5 Training

Develop a training program to provide SDH training for graduated engineers at university centers and government institutions. Also, provide both academic and hands-on training.

3.0 SUMMARY OF PREVIOUS PROGRAM REVIEWS AND EVALUATIONS

There have been two management reviews and two evaluations of the SDH program. Management reviews were conducted in August 1981 and in March 1983. Program evaluations were completed in May 1982 and July 1984. In addition, in January 1986, NRECA (with the editorial assistance of Hagler, Bailly & Company) completed a reassessment of the decentralized hydropower energy option in response to a November 1984 request by the A.I.D. Administrator to reassess all renewable energy technologies that were the subject of Agency programs.

The following paragraphs present a chronology of the SDH program and its accomplishments by summarizing the various reviews, evaluations and assessments. In December 1987, a fire occurred in the NRECA facility which destroyed much of the detailed historic records of the SDH program. Thus, the level of detail for accomplishments after those summarized in the January 1986 reassessment of decentralized hydropower is significantly less than that in previous documentation. Wherever possible in this current evaluation, the history of accomplishments has been pieced together by probing the "corporate memory" through interviews with SDH program contractor personnel.

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the departments provide such services as legislative representation before the Congress and the Executive Branch; monitoring regulatory activities affecting electric service and the environment; education and consulting assistance for cooperative directors and employees; publications, public relations, advertising and other communication services; and a wide range of insurance and employee benefit packages. The NRECA division directly involved with the SDH program is the International Programs Division.

NRECA's International Programs Division had been providing management consulting services and technical assistance to governmental agencies and other organizations concerned with the planning and development of feasible electric distribution systems around the world since 1961. As of August 1979 when the decision to select NRECA was made, management and technical assistance had been provided to countries in Asia, Africa, and Latin America. More than 150 rural electrification specialists had helped develop over 194 rural electric systems overseas. More than 250 representatives from 36 countries had received training to meet their power generation needs. Over 4.6 million electric meters were connected overseas that served 32.5 million rural people.

Although the NRECA experience in LDC electric generation systems was reasonably extensive, the Association did not possess extensive skills in small hydropower systems. In fact, there were very few organizations in the U.S. with experience in hydropower, much less with small systems as proposed for this program. The fact that the NRECA was involved with feasibility studies at 300 U.S. sites for the Department of Energy's small hydro program and that they could access the many hundreds of engineers within one administrative structure in their member cooperatives was sufficient justification to proceed to negotiate with them for the required services under the SDH program.

2.0 SCOPE OF THE COOPERATIVE AGREEMENT

The purpose of the Cooperative Agreement was to strengthen NRECA's capability in the implementation of hydroelectric facilities to meet rural electrical energy needs in the LDC's. The Agreement was for systems of one megawatt or less, with special attention to facilities of 1 to 100 kilowatts. This was to be accomplished by acquiring a group of SDH specialists (engineers, energy economists, and social scientists) to provide technical support and training services to the Missions, to assess hydropower potential in host countries, and to plan projects.

The following sections describe the main activities to be carried out.

2.1 Administration

Conclude contractual arrangements with SDH specialty individuals and organizations for short- and long- term assignments in LDC's.

2.2 Project Identification

Collaborate with Missions and Bureaus to identify potential hydropower sites in LDC's. Conduct country surveys to identify projects to test remote, renewable energy resources and corollary equipment in LDC's. Site specific recommendations should include:

- Construction of a hydro generation system as the sole source of electric power;

Effectiveness of Workshops

Since development of small hydro may occur several years after a workshop, it was not possible to evaluate the effectiveness of the workshops. The team believed that workshops were a very useful method of promoting interest in hydropower development. They commended NRECA on the quality of the workshops and suggested that a program be developed for LDC managers and policymakers.

Development of Resource Materials

NRECA has prepared several documents on the methodology of specific assessments which are weak in some areas. Environmental issues and prefeasibility studies are lacking in specific "how to" guides and are not specific to LDC issues and SDH.

Magnitude of Potential Power Sites

NRECA should limit its activity to sites of under 1 megawatt potential. Consideration of larger sizes should only be in country-wide assessments to help identify the most economical size powerplants.

Training

The team believed that training should be one of the more important objectives to the NRECA SDH program. Intensive courses should be developed which are oriented toward the practical side of SDH. NRECA had developed a proposal for intensive training of LDC engineers at an appropriate U.S. university. However, the team felt that the training should combine a program in the U.S. with additional time in a country with an on-going hydropower program. More specific training should be centrally held for a regional group of potential host LDC's.

Funding

The review team believed that the existing budget was adequate and that the future budget, although adequate to proceed with the program, should be increased somewhat to accommodate increased training. Additional funding may be worthwhile to continue or expand the workshops, since the team believed that the workshops were the most valuable method of providing for SDH technology transfer.

Accomplishments

The following activities were cited as accomplishments of the program as of May 1982:

Assistance to USAID and LDC's: Eight country assessments completed with eleven additional assessments planned.

Project Identification: At least three country specific projects were recommended.

Site Selection and Project Design: Six countries (Morocco, Thailand, Zaire, Rwanda, Dominica, Liberia) have had, or were in the process of having, specific projects designed.

3.1 Summary of 1982 Evaluation Findings and Recommendations

The evaluation team convened on April 6, 1982. The evaluation was carried out by a four-person team of three independent consultants (a hydrologic engineer, a civil engineer, and a mechanical engineer) and an analyst from A.I.D./S&T. The team reviewed the scope-of-work, met with cognizant NRECA personnel, and met with staff from A.I.D. Regional Bureaus and planning organizations. The evaluation task, as described in the scope-of-work was to see "how well the project is meeting its stated purpose and is thereby assisting developing countries in efforts to identify and develop decentralized waterpower resources as alternatives to imported fossil fuels, contribute to a meaningful increase in indigenous energy supplies, and extend electric power to rural areas."

In general, the evaluation team felt that the NRECA had made significant accomplishments and that "the overall thrust of their program has been good. Their staff is enthusiastic and articulate, but lacks expertise and actual experience in the design of hydropower systems and in economic analysis and social evaluation"; the Cooperative Agreement expressly requires NRECA to strengthen its expertise. The team strongly recommended that the program be continued under the management of the NRECA with at least the initial level of funding.

Problem Areas

Certain problems and issues were raised across eight specific areas:

Appropriateness of Project Activities to the Project Purpose

NRECA project activities were generally good and met an LDC need. For projects with a larger potential than 1 megawatt, NRECA should offer advice on how to get assistance from experienced U.S. agencies and private firms.

Workshops on small hydro were appropriate. The fact that NRECA has received many requests for technical assistance from A.I.D. missions was judged as clear proof that the program was meeting a need.

Effectiveness of Technical Assistance

Generally, the program has been of value and is providing needed assistance. The fact that 12 of the countries visited by NRECA teams have continuing programs is a real credit to the program. However, technical assistance has not always been effective and some of the economic analysis demonstrates a lack of expertise. Reports have not always contained sufficient information and data necessary to determine the need for a specific project. Reports for site identification and prefeasibility lack adequate project definition and conceptual design. Skilled and experienced evaluation techniques are noticeably lacking in the NRECA reports. However, recent reports are showing improvement.

Performance of the NRECA Team

NRECA has responded quickly and well. However, teams have not always been supplied with the necessary resources for a field investigation. An experienced hydro engineer and an experienced economist have not always been team members. The lack of technical education and experience in hydropower on the NRECA staff limits their ability to produce a higher quality product and their ability to judge the capability of consultants assisting in the program.

Development of SDH Data Base: Several works were published: a directory of equipment manufacturers; one case study (Pakistan) with a second in progress (Nepal); four methodology studies; three special studies on management, site evaluation and economic planning. Also, 2000 slides were accumulated which illustrate actual small hydro plants in various areas of the world.

Training: Developed a proposal for a 6-week multi-disciplinary program for university training (University of Minnesota's St. Anthony Falls Hydraulics Laboratory), conducted 3 regional workshops (Quito, Bangkok, and Abidjan), developed a "talent bank" of resumes for 100 people who have a particular expertise in small hydro.

Summary of Findings

In general, the team believed that the program purpose was not established to facilitate measurement of accomplishments and that the purpose stated in the Project Paper is somewhat different from that in the Cooperative Agreement. Although lacking in quantifiable indicators, the NRECA was said to have produced significant progress in the relatively short time span of two years.

3.3 Summary of March 1983 Management Review

As part of the March 1983 management review, NRECA developed a "working paper" which in essence was a document that reviewed the status of projects undertaken within the terms of the cooperative agreement to that date, i.e., approximately the scheduled midpoint of the SDH program. The document was divided into two sections - a discussion of activities completed or underway directly under the terms of the cooperative agreement and an "implementation" section in which the progress of USAID Mission-funded programs of assistance in SDH were reviewed. A final section on lessons learned/recommendations and future directions for the SDH program was also included to possible solutions to some constraints which NRECA felt were hindering a more effective implementation of the SDH program. The paragraphs below summarize these activities.

Findings

The review of the activities carried out during the first 2-1/2 years of the SDH program were grouped according to the requirements of the cooperative agreement - Administration, Resource Identification, Site Selection and Project Design, SDH Data Base, and Training.

Administration

Three workshops were held and one was in the planning stages. The "talent bank" consisted of 150 specialists and 60 hydroelectric equipment firms. Workshops by region included:

Latin America and the Caribbean: 118 attendees from thirteen countries, August 1980. Proceedings, in English and Spanish, distributed to over 1100 persons in more than 70 countries.

Asia and the South Pacific: Over 100 attendees from fifteen countries, June 1981. 2000 copies of the proceedings were distributed.

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West Africa: Over 90 attendees from 22 countries, March 1982. 2000 copies of the proceedings, in French and English, were distributed.

East Africa: A combined training session and workshop was planned for approximately 80 participants from fifteen countries, June 20-24, 1983.

Resource Identification

Resource assessments were completed for 14 countries for both site development and project development. Recommendations were made to the respective USAID Mission in each case. The matrix below shows country specific work completed.

COUNTRY	PRELIM	COUNTRY -WIDE	PREFEAS.	FEAS.	PROJECT DESIGN	INSTITU. ANALYSIS
Peru				•	•	
Pakistan					•	•
Panama		•			•	
Dominican Rep.		•		•	•	•
Honduras		•			•	
Burundi		•				•
Togo		•				
Ghana		•				•
Indonesia						
Bangladesh		•	•			
Sudan	•					
Tunisia	•					
Lesotho	•	•				
Sierra Leone	•					

Site Selection and Project Design

A range of in-country services was provided to six countries as follows:

COUNTRY	SITE SEL. ANALYSIS	DESIGN LAY-OUT	EQUIP. MANUF.	PROJECT DESIGN	PREFEAS. STUDIES	"TROUBLE SHOOT"
Morocco	•	•				•
Thailand	•		•		•	
Zaire				•	•	
Rwanda	•	•			•	
Dominica	•				•	
Liberia						•

Twenty countries have received some sort of assistance; 29 technical assistance teams of one to five persons have been assembled and managed by the SDH Program.

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SDH Data Base

Library holdings total 3,000 items. The slide bank contains over 1,500 slides. The SDH Program has published 45 documents and filled over 2,800 publication requests. (This "working paper" presents a detailed listing of country reports, workshop and seminar proceedings, case studies, sourcebooks, handbooks, directories, methodological guidelines, special studies, conference papers, and journal articles that have been generated by the SDH Program).

Training

Under the A.I.D. contract in September 1982, the SDH Program developed a 180 page training proposal entitled "Decentralized Hydropower Training for Developing Countries-A Proposal". NRECA has conducted tours of 9 manufacturing plants and 16 hydroelectric laboratories and hydro-system operating sites for visiting LDC engineers. A one-day seminar on financing SDH development was held in 1981. In July 1982, NRECA hosted a 2-day seminar in Washington, DC on private sector participation in SDH development overseas.

Combined efforts in the above areas had spawned many USAID Mission-funded SDH projects in seven countries. Two sites had power on-line, five were under construction, and thirty-five were either in the planning stages or proposed. The following table provides an estimate of power to be generated at the 42 sites under consideration.

Country	Sites	KW Capacity	Total KW
Panama	6	77	460
Thailand	12	250 (avg)	3000
Dominican Republic	4	400	1600
Morocco	3	163	490
Liberia	1	30	30
Peru	15	500	7500
Dominica	1	30	30
Totals:	42	1,450	13,110

NRECA's Perspective on the Evaluation

The NRECA enumerated several "lessons learned" from the first 2 1/2 years of the SDH project. NRECA believed that they had a wealth of knowledge and experience to share in overcoming problems of ineffective project management, inadequate understanding and participation by the local community, poor planning, inferior or ill-adapted technical designs, improper equipment design, inefficient use of power once the plant is built, and faulty operation and maintenance procedures. Some of the major lessons were:

- Centralized management of SDH development becomes less viable as plant capacity decreases;
- Central technical support services must be available;

- Feasibility studies must determine that adequate load is present or capable of being developed; and

- Adapting locally appropriate approaches can significantly reduce small hydro costs.

The NRECA felt that the SDH Program could operate more smoothly and effectively if NRECA and A.I.D. could resolve several areas of uncertainty as follows:

- Provide a clearer definition of how the specific internal, procedural, and authoritative responsibilities of ST/EY, Regional Bureaus, and Missions differ, and how they fit together to help NRECA manage this centrally-funded program;

- Develop a clear definition of the scale of project the SDH program implements and provide program materials to LDCs interested in projects so program goals are not misinterpreted; and

- Provide means for NRECA to supply information on other bilateral funding for a project if the Mission budget cannot fund a project beyond the preliminary survey stage. NRECA could provide information in this regard through in-country training for Mission energy officers.

Finally, the NRECA made recommendations on future directions for project implementation. They strongly supported continuation of the present activities. They suggested that they actively follow-up SDH project development and implementation in targeted countries through the following methods:

- Packaging - assistance in finding sources of financing and planning for the end use of the power;

- Training - implementation of the training proposal; broadening of client-base for training;

- Planning and Evaluation - selection of additional countries with resource potential;

- Integrated Rural Development and Power Supply - continue efforts in both types of development with design and completion of model projects; and

- Management - build in-country self-sufficiency in long-term management goals, foster institution building for overseas national programs in SDH.

3.5 Summary of 1984 Evaluation Findings and Recommendations

This report covered the period from June 1982 through May 1984 and was a prerequisite for the obligation of further A.I.D. funding for the SDH Program. In August 1983, and apparently (at least in part) due to the NRECA "lessons learned" and recommendations

mentioned in the March 1983 "working paper", there was an amendment to the SDH/NRECA program objectives. This amendment was in effect at the time of the May 1984 evaluation. The amended objectives are listed below:

- Place major emphasis on assisting LDC governments to understand the potential of decentralized hydropower in the context of national energy needs. Assistance will focus on the LDCs with the greatest resource potential.
- Provide technical advisory services for planning, engineering, financial, logistical and organizational requirements for decentralized hydropower.
- Strengthen LDC institutional and individual capacity to undertake decentralized hydropower development.
- Establish information networks on decentralized hydropower development.
- Encourage host country private sector role in decentralized hydropower.

The evaluation team assembled in Washington D.C. on June 18, 1984 to review the scope-of-work and to receive various briefings and interviews. The team also attended an all-day presentation and question-and-answer session at the offices of the NRECA. The evaluation team consisted of one member each from the Midwest Research Institute, the Organization of American States, and the Idaho National Engineering Laboratory.

In general, the evaluation team felt that the NRECA had responded well on the tasks assigned to them. They had been responsive to the Mission requirements and their performance on front-end planning and resource assessment activities had been good. Between June 1982 and May 1984, the NRECA had provided technical assistance to approximately 15 countries, conducted a workshop in Swaziland (June 1983), conducted two study tours in the U.S., and conducted a 2-day seminar on private sector participation. The NRECA had also initiated work on a Micro-Hydropower Sourcebook and an SDH Economics Handbook. The SDH data base was judged as an excellent one for identifying worldwide projects and key individuals.

The evaluation team identified several weaknesses in the NRECA efforts to date. The NRECA was slow to respond to the requirement to prepare certain critical documents, such as the Micro-Hydropower Source Handbook. They also had not displayed much creativity in anticipating future needs. In general, the team felt that the NRECA had tended to guide the SDH program toward their own capabilities, i.e. resource assessments, planning and training. The evaluation team would have preferred more focus on involving good engineering and/or private A&E firms in the program and toward seeking private sector participation.

Observations and Recommendations

The following sections summarize the major programmatic concerns and some operational recommendations of the evaluation team based on the data and information collected during the evaluation.

Program Objectives

There is a need to clarify SDH Program goals with respect to energy development. The basic question which must be answered is, are SDH projects tied to rural development or broader national energy objectives? This has great institutional implications in a LDC.

Communication

It is apparent that a communication problem exists between the various offices of A.I.D. regarding the SDH Program. Likewise, communication could be improved between NRECA, the Bureaus, and the Missions. NRECA could use this link to promote innovative approaches and ideas and gain some visibility for the SDH Program.

Program Direction

The SDH Program should not limit itself to paper studies. Implementation aspects of projects must be emphasized. There is a critical need to introduce engineering firms or A&E organizations with proven credentials into SDH programs.

Program Management

S&T/EY needs an SDH manager to direct and monitor the program, to provide support to NRECA, and to facilitate communication among the A.I.D. entities.

The NRECA noted that as a result of the 1982 evaluation, the current Cooperative Agreement had been expanded to include the development of SDH systems from under 1 megawatt to 15 megawatts. The NRECA also listed a number of self-imposed goals for the fourth year of the program and some future long-term objectives.

The goals were as follows:

- Assist in initiating the development of comprehensive small hydro programs in at least three countries; to include energy planning and resource identification, technical and institutional assistance, assistance toward the long-term capital financing of projects, training and the promotion of private-sector involvement (as appropriate).

- Develop and conduct a major in-country training program in collaboration with the ASEAN Mini-Hydro Information Exchange Network (MHINEX) Working Group.

- Complete and distribute the Micro-Hydropower Sourcebook and the SDH Economics Handbook.

- Assist in the development of a small-hydro private- sector initiative to establish commercial linkages between the U.S. and local and private concerns in target LDCs.

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- Assist in the implementation of at least one identified site serving remote rural populations or specific rural enterprises.

Three long-term program objectives were identified as follows:

- Broadened Support Base - obtain financial support for program services outside of the cooperative agreement;

- Application of Cooperatives - identify candidate sites and consumers and then design, organize, and implement appropriate elements of an electric cooperative to the small isolated service area; and

- Continued Support to USAID-Funded Projects - provide continued support to projects funded by Missions.

3.6 Summary of the January 1986 Reassessment of the Decentralized Hydropower Option

This reassessment of the decentralized hydropower option, as part of an effort initiated by the A.I.D. Administrator, provides some insight into the changing philosophy and direction that A.I.D. was infusing into the SDH program at this time. S&T/EY detailed a twofold strategy for the full realization of decentralized hydropower's potential in LDCs.

First, S&T/EY will leverage limited funding by serving as a catalyst to SDH development by conducting preliminary reconnaissance and prefeasibility analyses to identify potential sites for cost-effective applications. It will then "broker" these sites by bringing together potential developers and financiers, both U.S. and international. These entities will then assume the primary responsibility for detailed planning, financing, constructing, and operating the sites, with only minor additional assistance from A.I.D..

Second, S&T/EY will include decentralized hydropower as a key energy option in other A.I.D. renewable energy programs. Competing options will include conventional power sources and other renewables. Thus S&T/EY will ensure that SDH will be evaluated wherever it can meet a need for power, and that those applications will be identified where it is the best power generation option.

To implement this strategy, S&T/EY will focus on the following initiatives for FY86:

- Identify two A.I.D.-assisted countries that appear to have significant SDH potential;

- Conduct reconnaissance and prefeasibility studies using U.S. and, if available, host-country experts in the two target countries;

- Prepare a portfolio of "bankable" projects suitable for implementation based on the above studies;

- Identify government impediments to cost-effective SDH development and work with the host country energy planners to reduce or eliminate them;

- Broker development of attractive sites by bringing together potential site developers with potential lenders; and

- Provide training when necessary to host-country personnel in areas related to SDH development.

In addition, S&T/EY would focus its effort on two highly promising countries: Madagascar and one other to be selected by the end of April 1986.

Madagascar was selected for three reasons. First, the World Bank indicated that it was very interested in funding cost-effective power sector studies in that country. Second, the A.I.D. Mission had significant PL 480 funds available (approximately $25 million) for investments. Third, the Government of Madagascar indicated it was interested in exploring an enhanced private sector role in the energy sector, possibly beginning with decentralized hydropower projects.

NRECA, under its commitment to the Cooperative Agreement, would provide an in-kind contribution of over $2,000 per month for the SDH Program activities. In addition, NRECA would supplement the Madagascar team salaries from its own overhead funds to ensure adequate preparation for the Madagascar effort.

Findings

Annex A of the reassessment document provides a summary of A.I.D.'s decentralized hydropower experience with NRECA since 1980. As such, it is the last known summarization of the activities performed under the SDH/NRECA program. In view of the fire at NRECA in December 1987, the summary is perhaps the last written word that documents NRECA accomplishments under the program. Major points in the summary are as follows:

Seminars and Training

During the past 5 years a substantial amount of knowledge and experience were gained and many services were provided to encourage the cost-effective development of decentralized hydropower in A.I.D.-assisted countries. As part of the SDH program, four technical workshops were held worldwide - Quito, Ecuador in 1980; Bangkok, Thailand in 1981; Abidjan, Ivory Coast in 1982; and Mbabane, Swaziland in 1983. Over 400 developing country engineers, planners, and project managers attended.

Two important seminars were conducted in Washington, D.C.. The March 1981 seminar focused on the issues and opportunities to finance SDH in LDCs. The July 1982 seminar brought together developers and manufacturers from the U.S. private sector to discuss problems and opportunities for SDH in A.I.D.-assisted countries.

Training assistance was provided in three ways; technology transfer, several week-long study tours of U.S. hydropower manufacturing and site facilities, and development and presentation of a rigorous two-week course in hydrology in Manila.

Documentation

Documentation of the SDH/NRECA Program has taken many forms:

- Case studies on various approaches to implementing SDH in Pakistan, Nepal, and Zaire;
- Prefeasibility and feasibility methodologies and guidelines for evaluation, environmental assessment, and hydro analysis;
- Special Studies - a study on decentralized versus centralized management, an economics handbook, a directory of manufacturers, and a micro-hydropower sourcebook;
- Workshop proceedings from Ecuador, Thailand, Ivory Coast, and Swaziland;
- Technical articles - economically productive uses of energy, introduction to state-of-the-art electrogenerating equipment, and approaches to rural development;
- Country Reports - documentation of the team technical assistance services and attendant recommendations;
- A Library - holdings of nearly 4,000 books, reports, newspaper and journal articles, and periodicals on all aspects of SDH, rural electrification, economic analysis of development projects, and other energy technologies;
- Slides - over 2,000 slides documenting the design, implementation, and operation of SDH around the world; and
- An Information Network - a network of research organizations, universities, government agencies, development organizations, manufacturers, and individuals involved in SDH; a talent bank of over 200 specialists in engineering, economics, sociology, and other fields with appropriate language and experience.

Countries Served

In response to USAID Mission requests, the SDH Program has provided short-term assistance to the 21 countries listed below.

Bangladesh	Ghana	Madagascar	Rwanda
Burundi	Guinea	Morocco	Sudan
Cape Verde	Honduras	Nepal	Thailand
Dominica	Indonesia	Pakistan	Togo
Dominican Republic	Lesotho	Panama	Tunisia
	Liberia	Peru	Zaire

4.0 SDH PROGRAM ACTIVITY SINCE THE MAY 1984 EVALUATION

The last formal evaluation of the SDH Program was completed in May 1984. That evaluation amended the program objectives as previously stated. The major thrust of the amendments was directed to:

- Assist LDC governments to understand the role for SDH in their overall future energy planning;
- Strengthen the LDC's capability for in-country, local development of SDH installations; and
- Encourage the host country private sector to take a role in SDH financing and development.

The NRECA established some self-imposed, long-term program objectives after the May 1984 evaluation. These were to broaden their financial support base outside of the A.I.D. Cooperative Agreement, to bring the concept of electric cooperatives to small, isolated, LDC service areas, and to provide continued support to USAID Mission-funded projects.

The May 1984 evaluation was followed by a late-1985 "program review," published in January 1986, that was precipitated by an A.I.D. directive to reassess renewable energy options across all A.I.D. programs. The subsequent A.I.D. realignment of the decentralized hydropower option reflected the changing objectives in the May 1984 evaluation and, more importantly, resulted in a significant reduction in the SDH program funding. This reduction in funding was actualized by a decision not to fund the project to the previously approved limit. This final level of funding was approximately $1 million less than the approved project funding level.

Although the SDH Program was officially completed on July 31, 1987, in reality funding was depleted about one year earlier, in the second quarter of 1986. Major activities completed from November 1985 to the expiration of funds included:

- Completion of the Micro-Hydropower Sourcebook;
- Completion of a preliminary survey of decentralized hydropower investment opportunities in Madagascar;
- Support of, and inclusion in, a World Bank Mission to assess and develop the hydropower potential in Madagascar;
- Support of A.I.D./Washington in the development and preparation of various Project Papers, concept papers, and Terms of Reference dealing with the small decentralized hydropower option in a number of renewable energy applications; and
- Follow-up to regional assessments and other initiatives in Central America.

5.0 RESULTS OF THE IMPACT ASSESSMENT OF THE SMALL DECENTRALIZED HYDROPOWER (SDH) PROGRAM

The SDH Program was initiated in May 1980 and was terminated in July 1987 (funding expired about the middle of 1986). The program spent $4.4 million over that 6-year period, or an average spending rate of about $750,000 per year. However, the SDH Program was heavily front-loaded; about $3.8 million, or 86 percent of the final funding amount, was spent by September 1984.

Program activity over this period (May 1980 to September 1984) was evaluated twice to justify continued funding for the program. Generally, the following questions were answered:

- Was the SDH Program soundly conceived?
- Was the allocation of money by NRECA good or not?
- Was the quantity and quality of work completed by NRECA acceptable or not?
- Was the contractual structure of the SDH Program good or bad?
- Was there sufficient replicability and sustainability of projects initiated by the NRECA under the SDH Program?

The above questions were generally answered in the affirmative and the program was continued. In any program of this magnitude and diversity, there are specific activities that did not realize their intended objectives. There were undoubtedly also activities that went far beyond all expectations of success. The SDH Program adjusted its objectives and goals as the program progressed through the 6 years to reflect the policies of different federal administrations and the preferences of different program managers. The intent of this impact assessment is not to strictly determine the cost-effectiveness of every dollar spent on every activity, but to consolidate the sum of the worth of the SDH Program, evaluate that worth, and identify any "lessons-learned" that may help to structure similar A.I.D. renewable energy assistance programs in the future.

The results of the previous two SDH Program evaluations, and the reassessment of the program in January 1986, have been summarized in some detail in this impact assessment. There is no question that the SDH Program under the management of NRECA provided important and significant support and assistance to LDC's in the identification and development of the small decentralized hydropower potential in their countries. As part of the SDH Program, four international conferences were held that were attended by over 400 LDC engineers, planners and project managers; 2 seminars were held in Washington, D.C. on the issues and opportunities to finance SDH in LDC's; over 20 countries received some sort of assistance; over 30 technical assistance teams were assembled and sent to LDC's; a library of over 4,000 references and 2,000 slides of operating installations worldwide was assembled; and a talent bank of over 200 specialists knowledgeable in the engineering, economics and social aspects of SDH development was established.

The true worth of the SDH Program and generally of any program designed to assist LDCs, is the level to which it was able to develop a capability in the LDCs to sustain systems that were installed and to replicate, through indigenous activity, the successful

systems throughout the country. In the final analysis, the SDH Program should be judged on how well it accomplished the key objective of the Cooperative Agreement: to strengthen NRECA's capability in the implementation of hydroelectric facilities to meet rural electrical energy needs in the LDCs by acquiring a group of SDH specialists to provide technical support and training services to USAID Missions, to assess hydropower potential in host LDCs, and to plan projects.

5.1 A Sampling of Success Stories of the SDH Program

Madagascar

The hydropower potential in Madagascar was assessed by NRECA in late 1985. Since that time, follow-up activity by the World Bank has involved the NRECA specialists. The U.S. Trade and Development Program funded a feasibility study in mid-1987, based on an earlier Definitional Mission, to implement a 13 Megawatt hydroelectric facility at Ambodiroka, Madagascar. This project will most likely be funded by the World Bank. It will result in a significant advancement to meet the energy demand in the region, as well as result in over $40 million of sales for U.S. industry should they win the competition for the design and installation of the plant.

Thailand

Site selections and hydropower prefeasibility studies were completed by NRECA in the early 1980's. The USAID Mission has since funded further development of at least 6 sites. At the request of the USAID Mission in Thailand, Hagler, Bailly & Company completed an evaluation of this Micro/Mini Hydroelectric Project (No. 493-0324) over a five-week period during May-June 1987. The evaluation found that the project has:

- Provided a broad institutional setting for the development of hydro in Thailand;
- Encouraged the private sector to refine their ability to select and assess mini-hydro sites;
- Allowed the private sector to develop capabilities for engineering design of hydropower facilities in the 0.5 to 1.5 megawatt size range;
- Provided the Thai fabrication and manufacturing sector with a limited market for hydroelectric equipment; and
- Resulted in the construction of six mini-hydro facilities in the rural areas of Thailand, with planning underway for an additional two sites.

The sustainability of the mini-hydro development in Thailand is currently unclear because of existing government priorities in the energy sector, the preference for large scale central plants and because no regular source of funding for further facilities has been established.

The exact causal relationship between the early NRECA efforts under the SDH Program and the eventual construction of the six mini-hydro sites can never be clearly drawn. Yet, it is clear that local hydro turbine manufacturers have been established in Thailand and the NRECA has been instrumental in the establishment of rural electric cooperatives.

NRECA International Foundation

The expertise in SDH developed at the NRECA as a result of the SDH Program has significantly contributed to the formation of the NRECA International Foundation. This private, non-profit organization was established in 1985 to help low-income people in rural areas of developing countries achieve self-sufficiency and improve their standard of living by making electricity accessible and by promoting "productive" uses of electricity. Recognizing the potential impact that micro-hydropower schemes can have on the lives of rural dwellers, the Foundation supported the development of the Micro-Hydropower Sourcebook that was initiated by the A.I.D./SDH Program.

Recently, the Foundation cosponsored, with a cooperative relief and rural development agency of the Mennonite Church in Laos, the construction of two micro-hydropower projects in the small villages of Ban Tha Paen and Houei Nam Sai. The construction engineer on both of these projects was Alan Inversin, an engineering member of the team that the SDH Program established at the NRECA.

NRECA Involvement in the UNDP/World Bank Energy Sector Management Assistance Program (ESMAP)

As a follow-up to the redirection of the A.I.D./SDH Program to encourage private sector involvement, the NRECA recently negotiated an agreement with the UNDP/World Bank ESMAP activity whereby the NRECA will develop and promote an investment framework for private sector participation in small-scale renewable energy generation for rural and marginal-urban areas in developing counties. The energy generation will be suited to the natural resource endowment, in-country capabilities, as well as local investor financing in selected developing countries. The ESMAP activity will be initiated by focussing on small-scale hydropower and specifically on promoting the development of sites in the mini and micro hydropower range, i.e. 500 kilowatts and below.

NRECA/A.I.D. Cooperative Agreement No. DHR-5730-A-00-8040-00

As a clear indication that the NRECA has developed a capability to address energy issues in LDCs, A.I.D. recently provided the NRECA with $100,000 in partial support of a program to investigate ways in which A.I.D. can better develop its own strategy and program to address the shortage of adequate, reliable and affordable energy supplies in developing countries. The Cooperative Agreement for this program provides for funding of $400,000 over the next four years.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Project Economics

Models for the basic economics of micro-hydro, isolated mini-hydro and grid-connected mini-hydro as applied to rural electrification should be established. Further, methods for quantifying the benefits of these facilities should also be developed and agreed upon. Both of these issues must take into account the existing government regulations and procedures and those likely to be encountered over the construction life of the facility. Often these facility development projects take so long that the initial economic conditions have changed and the economic projections never materialized. The project that was economically feasible at the start is no longer economic when the plant comes on-line.

The economic assessments under the SDH Program were criticized in earlier evaluations. One of the SDH Program goals after the 1984 evaluation was for NRECA to complete the SDH Economics Handbook. Funding was depleted before this could be done. The economic evaluation issue continues to plague the rural small decentralized hydroelectric community.

Leveraging Funds

A.I.D. needs to be more aware of similar projects by other donor agencies in a LDC and the potential for private sector involvement in the design, financing and implementation of SDH facilities. In this manner, the effect of an historic precedent of funding levels that never fully reach initial program authorization can be minimized by leveraging the available funds. Toward the end of the SDH Program, A.I.D. realized that funding levels were minimal to complete the program. A focused approach was taken to address clearly attractive countries that other development and/or lending institutions showed a clear interest in. A.I.D. also attempted to build on the interest of private sector organizations and to enlist their help to complete the program. This type of approach should be continued and steps taken to ensure that it be used from the very beginning of a program.

The NRECA has endorsed this approach as evidenced by their initiative with the UNDP/World Bank ESMAP to encourage private sector investment in the development of global mini-hydro facilities. A.I.D. has also continued this type of approach in the recent Cooperative Agreement with the NRECA which specifies tasks for innovative financing, and maintaining and exploiting a private sector power network.

Program Management

A series of program management issues surfaced during the course of the SDH Program that should be re-evaluated for future programs. These issues included change of program management personnel, differing objectives among various A.I.D. organizations, and continuity of program funding sources.

It is always difficult to ensure that a single person will remain as Program Manager throughout the duration of a 6-year program. The SDH Program had 3 or 4 separate Program Managers. The changing personalities and preferences of these different personnel caused some lack of continuity of purpose and objectives in the SDH Program. This resulted in occasional fragmentation of effort, some confusion at times, and misunderstandings of required products. A more concerted effort should be made to adhere to the original intent of a program vis-a-vis the personal preferences of any particular individual. Generally, this must be done from the top echelons which usually remain more stable, at least in purpose, if not in specific personnel.

There should be a more defined agreement among S&T/EY, USAID Missions, and A.I.D. Regional Bureaus at the start of a large program such as the SDH Program on the assistance to be provided the NRECA (in this instance) on specific country activities and the services required of the NRECA during these activities. At times during the SDH Program, the NRECA was placed in the middle of various controversies concerning, for example, whether engineering services were to be provided or management assistance was all that was required, and whether or not the project was a part of rural electrification needs or had to be weighted in light of the National Energy Plan.

On occasion, Mission needs dictated a request for a specific local rural energy activity, but A.I.D./Washington would not provide funds because the activity did not fit within their purview of national energy planning, for example. Centrally-funded programs, such as the SDH Program, should make provisions for varying objectives between Missions and A.I.D./Washington which have eventual funding implications. A commitment should be made at the initiation of any activity to complete the process given that technical and economic benefits remain attractive. An activity should not be stopped because funding is not available due to different priorities of the funding organization which gave the initial approval.

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Section 6:

SUMMARY

While an evaluation or an impact assessment of three such disparate technical assistance projects is not completely unknown, it is not the most common approach in A.I.D. evaluation practice. Some differences among the three projects included: dissimilarity in types of renewable energy technologies; two different forms of implementing agreements; two different approaches to life-of-project (discrete and continuing); and a wide disparity in the degree of technology transfer or diffusion ranging through academic training; hands-on experience; project design; research, development, and pilot efforts; and on-site replication of operating facilities.

Despite the obvious dissimilarities among the technologies in the projects and in the methods of implementation among them, there were also striking parallels in the evaluation conclusions, especially in two of the three projects.

Cooperative Agreements, used as implementing documents in the VITA and the NRECA projects, were judged to be notably successful for their respective projects. A.I.D. in seeking to mount two activities for the diffusion of technology, chose two private, non-profit organizations which had experience in the diffusion and management of technologies. A.I.D. was using the two private organizations as extensions of its own organization and purpose, and under the terms of both Cooperative Agreements A.I.D. was willing to provide the necessary resources for the enhancement and strengthening of their respective institutional capabilities during the period of cooperation. In each case the enhanced capability to perform as a private organization was a residual legacy to both VITA and NRECA. Both organizations continue to function in bi-lateral and multi-lateral energy activities, advocating the more mature technology of hydropower and enhancing the body of experience in applying other renewable energy technologies to rural development.

As known from a variety of projects implemented in the field — as well as from earlier, and much more intensive evaluations — renewable energy resources, including hydro, solar, wind and some biomass can now be used effectively through technologies that perform well in daily application. But equally well known is that only those competing in the market place in terms of cost, efficiency, and reliability will succeed in the long term.

Difficulties in project management, in both low cost energy project and the small hydro project, made communications erratic and contributed to confusion and occasional lack of understanding as to project goals, purposes, and division or responsibility both within A.I.D. and between A.I.D. and the contractors. Both projects suffered some loss of momentum early years due to unexpected reductions of planned fiscal resources, but both were adjusted accordingly without a serious loss of overall effectiveness.

Conducting an impact assessment such as this one forces the evaluator to rely almost solely on secondary sources. In this instance, sources were not without gaps for a variety of reasons, including a fire (at NRECA). The contractors and A.I.D. lacked complete project documentation in their files, and the assessors were fortunate in being able to interview some current and former A.I.D. and contractor personnel, contract officers, and project managers. Access to all previously conducted evaluations was possible, and contributed significantly to the success in following the paper trail and in obtaining as complete an understanding of project implementation as was possible. Much credit and appreciation is due to the staffs of VITA and NRECA for their cooperation.