

PD-AAI-058

532-0065 - ①

UNCLASSIFIED

UNITED STATES INTERNATIONAL DEVELOPMENT COOPERATION AGENCY
AGENCY FOR INTERNATIONAL DEVELOPMENT
Washington, D. C. 20523

JAMAICA
PROJECT PAPER

ENERGY SECTOR ASSISTANCE

AID/LAC/P-080

Loan Number: 532-W-016
Project Number: 532-0065

UNCLASSIFIED

AGENCY FOR INTERNATIONAL DEVELOPMENT
PROJECT DATA SHEET

1. TRANSACTION CODE
 A Add
 C Change
 D Delete
 Amendment Number _____

DOCUMENT CODE 3

2. COUNTRY/ENTITY
Jamaica

3. PROJECT NUMBER
532-0065

4. BUREAU/OFFICE
LAC [05] [Energy Sector Assistance]

6. PROJECT ASSISTANCE COMPLETION DATE (PACD)
MM DD YY
06 31 86

7. ESTIMATED DATE OF OBLIGATION
(Under 'B:' below, enter 1, 2, 3, or 4)
 A. Initial FY [81] B. Quarter [3] C. Final FY [81]

8. COSTS (\$000 OR EQUIVALENT \$1 =)

A. FUNDING SOURCE	FIRST FY			LIFE OF PROJECT		
	B. FX	C. L/C	D. Total	E. FX	F. L/C	G. Total
AID Appropriated Total	2669	50	2719	13,516.65	534.45	14,051.1
(Grant)	(-)	(-)	(-)	(-)	(-)	(-)
(Loan)	(2669)	(50)	(2719)	(13,516.65)	(534.45)	(14,051.1)
Other U.S. 1.						
Other U.S. 2.						
Host Country					19,374	19,374
Other Donor(s)						
TOTALS	2669	50	2719	13,516.65	19,908.45	33,425.1

9. SCHEDULE OF AID FUNDING (\$000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	C. PRIMARY TECH. CODE		D. OBLIGATIONS TO DATE		E. AMOUNT APPROVED THIS ACTION		F. LIFE OF PROJECT	
		1. Grant	2. Loan	1. Grant	2. Loan	1. Grant	2. Loan	1. Grant	2. Loan
(1) SD	744B		878		0		14,051.1		14,051.1
(2)									
(3)									
(4)									
TOTALS					0		14,051.1		14,051.1

10. SECONDARY TECHNICAL CODES (maximum 6 codes of 3 positions each)
 876 874 840 720 830 160

11. SECONDARY PURPOSE CODES
None

12. SPECIAL CONCERNS CODES (maximum 7 codes of 4 positions each)
 A. Code TECH
 B. Amount

13. PROJECT PURPOSE (maximum 480 characters)

Strengthen the GOJ's institutional capacity to plan and manage energy programs, particularly to expand and improve its energy conservation program and to institute programs in alternative energy.

14. SCHEDULED EVALUATIONS
 Interim MM YY 07 82 MM YY 07 83 Final MM YY 05 86

15. SOURCE/ORIGIN OF GOODS AND SERVICES
 000 941 Local Other (Specify)

16. AMENDMENTS/NATURE OF CHANGE PROPOSED (This is page 1 of a _____ page PP Amendment.)

17. APPROVED BY
 Signature: Glenn O. Patterson
 Title: Director, USAID/Jamaica
 Date Signed: MM DD YY 05 29 81

18. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION
 MM DD YY

UNITED STATES INTERNATIONAL DEVELOPMENT COOPERATION AGENCY
AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON D C 20523

PROJECT AUTHORIZATION
(Amendment No. 1)

Name of Country: Jamaica
Name of Project: Energy Sector Assistance
Number of Project: 532-0065
Number of Loan: 532-W-016

1. Pursuant to Section 106 of the Foreign Assistance Act of 1961, as amended, the Energy Sector Assistance project for Jamaica was authorized on August 27, 1981 (the "Authorization"). Paragraph 3.g. of the Authorization is hereby amended by deleting therefrom clause (ii) in its entirety.
2. Except as expressly modified or amended hereby, the Authorization remains in full force and effect.

15

Marshall D. Brown
Acting Assistant Administrator
Bureau for Latin America
and the Caribbean

SEP 16 1981

Date

Clearances:

GC/LAC:BVeret:BV/CI date 9/16
LAC/CAR:RDelaney: date _____
LAC/DR:ILevy: date _____

GC/LAC:GMWinter: date 9/8/81:x29182

UNITED STATES INTERNATIONAL DEVELOPMENT COOPERATION AGENCY
AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D.C. 20521

PROJECT AUTHORIZATION

Name of Country: Jamaica
Name of Project: Energy Sector Assistance
Number of Project: 532-0065
Number of Loan: 532-W-016

1. Pursuant to Section 106 of the Foreign Assistance Act of 1961, as amended, I hereby authorize the Energy Sector Assistance project for Jamaica, involving planned obligations of not to exceed Seven Million Five Hundred Thousand United States Dollars (\$7,500,000) in loan funds ("Loan") over a two-year period from the date of authorization, subject to the availability of funds in accordance with the A.I.D. OYB/allotment process, to help in financing foreign exchange and local currency costs for the project.
2. The project ("Project") consists of strengthening the institutional capacity of the Government of Jamaica ("Borrower") to plan and manage energy programs, expand and improve its energy conservation program and institute programs in alternative energy.
3. The Project Agreement, which may be negotiated and executed by the officer to whom such authority is delegated in accordance with A.I.D. regulations and Delegations of Authority, shall be subject to the following essential terms and covenants and major conditions, together with such other terms and conditions as A.I.D. may deem appropriate.

a. Interest Rate and Terms of Repayment

The Borrower shall repay the Loan to A.I.D. in U.S. Dollars within twenty (20) years from the date of first disbursement of the Loan, including a grace period of not to exceed ten (10) years. The Borrower shall pay to A.I.D. in U.S. Dollars interest from the date of first disbursement of the Loan at the rate of (i) two percent (2%) per annum during the first ten (10) years, and (ii) three percent (3%) per annum thereafter, on the outstanding disbursed balance of the Loan and on any due and unpaid interest accrued thereon.

b. Source and Origin of Goods and Services

Goods and services, except for ocean shipping, financed by A.I.D. under the Project shall have their source and origin in Jamaica or in countries included in A.I.D. Geographic Code 941, except as A.I.D. may otherwise agree in writing. Ocean shipping financed by A.I.D. under the Project shall, except as A.I.D. may otherwise agree in writing, be financed only on flag vessels of Jamaica or countries included in A.I.D. Geographic Code 941.

c. Condition Precedent to Initial Disbursement

Prior to any disbursement, or to the issuance of any commitment documents under the Project Agreement, the Borrower shall, except as A.I.D. may otherwise agree in writing, furnish to A.I.D., in form and substance satisfactory to A.I.D.,

evidence that the Project Implementation Unit has been established and that a Project Director has been appointed and is working full-time in that capacity.

d. Condition Precedent to Disbursement for Borrower Contracts

Prior to any disbursement, or to the issuance of any commitment documents under the Project Agreement, to finance each Borrower procurement of goods and services, the Borrower shall have obtained written approval from A.I.D. of the respective procurement procedures and such procurement and contracting documentation as A.I.D. may specify in implementation letters.

e. Condition Precedent to Disbursement for Public Education Program Mobile Unit

Prior to any disbursement, or to the issuance of any commitment documents under the Project Agreement, to finance the purchase of a vehicle and related equipment for the Public Education Program Mobile Unit, the Borrower shall, except as A.I.D. may otherwise agree in writing, furnish to A.I.D., in form and substance satisfactory to A.I.D., a detailed implementation plan for the utilization of the Mobile Unit, and for the preparation of energy conservation programs which will be presented by the Mobile Unit.

f. Condition Precedent to Disbursement for Public Sector Auditing and Retrofitting Program

Prior to any disbursement, or to the issuance of any commitment documents under the Project Agreement, for the public sector auditing and retrofitting program, the Borrower shall, except as A.I.D. may otherwise agree in writing, furnish to A.I.D., in form and substance satisfactory to A.I.D., a detailed implementation plan including an identification of priorities and a schedule for auditing government facilities during the five years of the Project and for retrofitting such facilities, including a statement of the responsibilities of the various Borrower organizations involved.

g. Conditions Precedent to Disbursement for Public Sector Solar Water Heating Program

Prior to any disbursement, or to the issuance of any commitment documents under the Project Agreement, for the public sector solar water heating program, the Borrower shall, except as A.I.D. may otherwise agree in writing, furnish to A.I.D., in form and substance satisfactory to A.I.D.:

(i) a detailed implementation plan and schedule for the program, including a statement of the responsibilities of the various Borrower organizations involved; and

(ii) evidence that the excise tax on solar water heaters in Jamaica has been eliminated.


h. Condition Precedent to Disbursement for CAST Solar Energy Institute

Prior to any disbursement, or to the issuance of any commitment documents under the Project Agreement, for the purchase of equipment for the CAST Solar Energy Institute, the Borrower shall, except as A.I.D. may otherwise agree in writing, furnish to A.I.D., in form and substance satisfactory to A.I.D., evidence that the building to house the Institute will be completed by the time the equipment arrives in Jamaica.

i. Covenants

The Borrower shall covenant that, unless A.I.D. otherwise agrees in writing, it will:

- (i) assign its personnel to work on a substantially full-time basis with all Loan-funded advisors;
- (ii) provide on a timely basis suitably qualified personnel for training in the United States or elsewhere in general accordance with the Project's implementation schedule; that such participants will, upon completion of training, be placed in suitable positions, relevant to the objectives of this Project, within the Government; and that its normal bonding requirements will be made available to all Jamaicans undertaking such training;
- (iii) it will inform A.I.D. of ongoing and contemplated external donor-funded activities in the energy sector by means of semi-annual letter reports and that an annual meeting of donors will be convened to review progress of and planning for such activities; and
- (iv) that energy coordination bodies, such as the National Energy Commission (NEC) and its sub-committees and the National Advisory Council on Energy shall be continued; that the NEC will periodically review the progress of this Project and that it shall use its best efforts to promise and ensure coordination and cooperation of the various Jamaica organizations involved in the implementation of this Project.



 David Lazar
 Acting Assistant Administrator
 Bureau for Latin America
 and the Caribbean



 Date

Clearances:

GC/LAC:BVeret: _____ date 8/27/81

LAC/CAR:RDclaney: _____ date _____

LAC/DR:MBrown: _____ date _____

ENERGY SECTOR ASSISTANCE

Table of Contents

- I. Summary and recommendations
 - A. Summary of problem
 - B. Summary Project rationale and description
 - C. Summary of findings
 - D. Recommendations

- II. Background
 - A. Statement of the problem
 - B. GOJ sector goal
 - C. Related AID and other donor assistance
 - D. Project development
 - E. Relationship to USAID sector goals
 - F. Beneficiaries

- III. Detailed Project Description
 - A. Goal and purpose of Project
 - B. Project components
 - 1. Program Planning and Management
 - (a) Economic Planning Branch of the Energy Division
 - (b) Energy Information Center
 - 2. Conservation
 - (a) Development of a conservation plan
 - (b) Public education program
 - (c) Auditing and retrofitting program
 - (i) Public sector
 - (ii) Private sector
 - (d) Energy conservation industry development
 - (e) Preparation of energy conservation manual for the construction industry
 - 3. Alternative Energy
 - (a) Institutional strengthening of the Alternative Energy Branch of the Energy Division
 - (b) Solar water heating program
 - (i) Public sector
 - (ii) Private sector
 - Residential
 - Industrial/Commercial
 - (c) Development of the infrastructure needed for an expanded solar water heating program
 - (i) Standards for manufacture of solar water heating systems

- (ii) Improvement of the meteorological data base
 - (iii) Expansion of the capacity of Jamaican solar equipment manufacturers
 - (iv) Training program for solar systems installers
- (d) Research and development in alternative energy resources
- (i) CAST Solar Energy Institute
 - (ii) Solar crop drying
 - (iii) Assessments of other indigenous alternative energy resources
 - (iv) Forestry resources
 - (v) Alternative Energy Demonstration Centers
- C. Summary of outputs
- D. Summary of inputs

IV. Project Analysis

- A. Economic Analysis
- B. Social Soundness Analysis
- C. Technical Feasibility
- D. Administrative Feasibility
- E. Financial Analysis
- F. Engineering Analysis

V. Implementation Plan

VI. Conditions, Covenants and Negotiating Status

VII. Annexes

- A. Job Descriptions of Long-Term Advisors
- B. List of equipment and supplies
- C. Examples of Energy Conservation Opportunities for Retrofitting
- D. Initial Environmental Examination
- E. Logical Framework
- F. PID Cable
- G. 611 (e) Certification
- H. Statutory Checklist
- I. Draft Project Authorization
- J. Request for Assistance
- K. Description of Operating Policies and Procedures for Credit Funds
- L. Cost Estimates for Solar Hot Water Systems - Hospitals

ABBREVIATIONS USED IN THIS PROJECT PAPER

AE	-	Alternative Energy
AID	-	Agency for International Development
API	-	Agency for Public Information
BOS	-	Bureau of Standards
CAST	-	College of Arts, Science and Technology
ECOs	-	Energy Conservation Opportunities
ED	-	Energy Division of the Ministry of Mining and Energy
EIC	-	Energy Information Center
ESI	-	Energy Systems International
GOJ	-	Government of Jamaica
JIDC	-	Jamaica Industrial Development Corporation
JMA	-	Jamaica Manufacturers Association
JPS	-	Jamaica Public Service Company
MME	-	Ministry of Mining and Energy
MOA	-	Ministry of Agriculture
NACEC	-	National Advisory Council on Energy Conservation
NCB	-	National Commercial Bank of Jamaica Limited
OAS	-	Organization of American States
OPEC	-	Oil Producing and Exporting Countries
OTEC	-	Ocean Thermal Energy Conversion
PCJ	-	Petroleum Corporation of Jamaica
PEP	-	Public Education Program
PIU	-	Project Implementation Unit
PSOJ	-	Private Sector Organization of Jamaica
SEI	-	Solar Energy Institute
SRC	-	Scientific Research Council
USAID	-	United States Agency for International Development
UWI	-	University of the West Indies (Kingston campus).

I. Summary and Recommendations

A. Summary of Problem

Jamaica has a critical energy problem. It is virtually 100% dependent upon imported oil for its energy requirements. The increase in oil prices over the past seven years has caused serious foreign exchange problems and has had a devastating effect on all sectors of the economy. Even though the volume of petroleum imports has steadily declined since 1973 and is now twenty percent below the level of that year, the annual oil import bill has increased almost eight-fold and now totals \$500 million. Foreign exchange, badly needed for the importation of materials and supplies and for investment in productive enterprises, is not available because it must provide for oil imports.

As difficult as the overall problem is, a more detailed examination of the structure of petroleum demand emphasizes even more the severity of the situation. Jamaica's economy can be conveniently divided into an international sector and an inland sector. The international part, comprised of the bauxite/alumina industry, aviation and shipping, consumes approximately 55% of the total petroleum imported. The inland sector consumes the remaining 45%.

By and large, the international sector can pay its own way, in particular its share of the oil bill. The domestic sector is the true problem. The export earnings from this sector totalled approximately \$270 million in 1980; the oil bill was \$225 million, a full 83% of the related export earnings. This domestic petroleum demand is divided into three parts: the national electric utility uses 37% of the inland petroleum (1979 figures), the transportation sector 34% and the other consumers 29%. Table I-1 summarizes the petroleum demand, by major consuming sectors, for 1980.

Jamaica's known energy reserves are limited. It has no known fossil fuels although a program is underway to explore for oil and gas both onshore and offshore. There are a number of indigenous alternative energy resources which could in the future provide appreciable amounts of energy, but at the present time these are only beginning to be exploited. Solar energy has the greatest potential for making an immediate impact on the energy problem and so is a particularly attractive resource.

Jamaica's industry is particularly energy inefficient, resulting from the fact that most industrial investments were made when energy was cheap and little concern was given to energy efficiency. Also a result of Jamaica's poor economic performance over the past decade, there has been little investment in the private sector; plants and machinery are old and out-dated, spare parts required for efficient operation are frequently not available and proper maintenance of equipment is not practiced.

Jamaica's human resources to deal with its energy problems are also limited. Skilled technicians and trained plant engineers are in short supply. The primary energy office in the Government of Jamaica, the Energy Division in the Ministry of Mining and Energy, has recently been expanded but remains a relatively new, small and inexperienced organization.

The Jamaican response to the energy problem has been exemplary and important steps have been taken in the last few years. The Energy Division of the Ministry of Mining and Energy was created in 1977 and charged with developing a National Energy Plan and coordinating all energy activities in the country. The initial National Energy Plan was completed in 1978. The Petroleum Corporation of Jamaica was created in 1979 to implement the Government's petroleum policy and exploration program. A National Energy Commission and a National Advisory Council for energy conservation have been established. Efforts have been made to establish a nation-wide energy conservation program and assessments have been completed of several indigenous alternative energy resources. Initial funding for a Solar Energy Institute has been provided. These and other activities indicate the great amount of attention being given to the area, yet energy remains one of the critical problems inhibiting economic recovery.

To help Jamaica mitigate its energy problems, a number of international donors have played an active part. The Venezuela/Mexico oil facilities have the capability to make credit available for financing energy projects among others. In the area of oil and gas exploration, the InterAmerican Development Bank, the UNDP and Norway have already provided assistance and negotiations with the World Bank are underway. In electricity generation and distribution (including rural electrification), assistance has been provided by the World Bank and the InterAmerican Development Bank. The United Kingdom has provided initial technical assistance in conservation. The EEC has provided some help in biogas.

The AID's prior efforts have included a critique of the draft of the National Energy Plan, training of several GOJ personnel in energy planning and alternative technology and the conduct of a set of specialized studies on coal utilization, electric utility rate structure, urban waste conversion, biogas and solar energy. Other U.S. Government efforts have looked at the potential markets for solar technologies in Jamaica and, currently underway, the possibilities of establishing manufacturing facilities for solar technologies in Jamaica.

There are several corollary issues that relate to the energy problem and the proposed USAID assistance.

Jamaica has a severe problem unemployment. Approximately 35% of the Jamaican work force is either unemployed or underemployed. The Jamaican private sector is characterized by many small industrial/commercial concerns. Under the new Seaga Administration, it is clear that significantly increased attention will be given to the private sector, including the smaller establishments. U.S. interest in private sector investment in Jamaica has increased considerably since the recent election, including interest in establishing facilities in the Kingston Free Trade Zone. Solar energy industries might find this possibility to be especially attractive.

The USAID project can have a positive impact on these issues. It stresses efforts in energy conservation and alternative energy technology that are labor-intensive; it supports the greater use of equipment that can be manufactured by the local enterprises; it encourages the use of quality control standards; and it provides training to local technicians some of whom might be expected ultimately to work for newly-established manufacturing facilities in the Free Trade Zone.

B. Summary Project Rational

USAID's analysis of Jamaica's energy problem and possible areas for AID assistance has been carried out over a period of almost three years. This long period of time has been required due to the fact that energy is not only a new area for USAID/Jamaica, but also a relatively new area for AID. The institutional knowledge in AID as to how to carry out development programs in energy is still limited although rapidly expanding. USAID/Jamaica's efforts, we believe, will assist AID's overall attempts to develop experience and expertise in this sector.

More than 25 U.S. energy experts have spent varying lengths of time in Jamaica assisting USAID and the GOJ in analyzing its energy sector and developing a strategy for AID assistance. Several virtually unanimous conclusions have been reached on which the USAID energy project is based.

- The solution to Jamaica's energy problems must be seen in terms of decades. There is no easy solution to Jamaica's dependence upon imported petroleum; no single-faceted solution exists. There is no single form of energy which can wholly substitute for petroleum. Indeed, petroleum imports to the Year 2000 probably cannot be significantly reduced. They can, however, be held to their present level (in terms of volume of oil imported) despite the requirement for additional energy arising from an expanding economy. Additional energy requirements can be met from alternative sources of energy and energy conservation.

- The options open to Jamaica, as with any country, are limited by technology, management and economics. Although dozens of possible energy sources are under study in the world today, very few are both technologically ready for widespread application and affordable to a country in Jamaica's economic situation. Solar water heating is one of the technologies ready for commercialization in Jamaica which is economically competitive with petroleum-based energy.

- Jamaica must continue to assess its energy options, particularly those alternative and renewable energy sources which appear to offer reasonable possibilities for providing Jamaica with energy in the future. A broadly based program of assessing all alternative energy possibilities in Jamaica is needed, followed by a program of prototype testing for those technologies which appear to be most attractive as energy sources.

- The most important, cost-effective, and well established technology which Jamaica can and should apply in the short term is energy

conservation. A barrel of oil saved is as good as that equivalent amount of energy produced from an alternative source, and usually less expensive. All energy experts agree that the centerpiece of any Jamaican energy policy must be increased efficiency in energy consumption.

- Jamaica must substantially improve its capacity, both institutional and human resources, (a) to carry out national energy planning and analysis and (b) to develop and manage energy projects. Jamaica's present capacity is limited and it has been relying to a considerable extent on foreign experts for much of its energy efforts, a situation which cannot be continued indefinitely.

The most recent AID energy assistance effort in Jamaica, an overview study of energy-source options available to Jamaica which was requested of AID by Prime Minister Seaga and which was carried out by an AID contract team in April 1981, concurred in the conclusions of the analysis listed above. The USAID project, described herein, is based on these conclusions. Section IV of this Project Paper, Project Analysis, particularly Section IV C, Technical Feasibility, provides a detailed discussion of the USAID analysis and the conclusions reached.

The overall goal of the Project is to reduce Jamaica's dependence upon imported petroleum. The specific Project purpose is to strengthen the GOJ's institutional capacity to plan and manage energy programs, to expand and improve the Government's energy conservation program and to institute programs in alternative energy. The Project implementation period is five years; the entire Project is loan-funded.

There are three major components of the Project:

1. Program planning and management
2. Energy conservation
3. Alternative energy

The Energy Sector Assistance project will be implemented in two phases. Phase I deals with institutional development and public sector conservation and alternative energy activities while Phase II will provide credit for undertaking a variety of private sector conservation and alternative energy investment projects plus related technical assistance and a solar crop drying program. Those activities and the amounts proposed are:

(in \$ US thousands)

Retrofitting for industrial/commercial firms	3,000
Energy Conservation industry development	653
Industrial/commercial solar water heating	1,030
Capacity expansion of solar equipment manufacturers	623
Residential solar water heating	500
Solar crop drying (loans, grants and equipment)	<u>321</u>

TOTAL - \$6,127

Before authorization of Phase II activities, USAID will submit to AID/Washington a supplement to this Project Paper which will describe the results of USAID's analysis of the credit demand of the private sector for the proposed activities. The analysis will determine the extent to which there is demand for the proposed credit funds; the appropriate rate of interest for financing private sector investments; borrower eligibility criteria and procedures for maintaining the monetary value of the revolving credit funds.

Under Phase I, the following activities will be carried out.

Program Planning and Management. The Project will focus on improving the capacity of the Energy Division of the Ministry of Mining and Energy. Technical assistance through long-term advisors and short-term consultants, training of Jamaican personnel both in the U.S. and in Jamaica, provision of commodities, technical material, calculators and computer equipment will be financed under the Project.

Three long-term advisors will be provided to work in the Energy Division, two for the life of the Project and one for three years. Several short-term consultants will be provided to assist in the implementation of Project activities. Through technical assistance and training, the capacity of the entire Division to carry out its responsibilities will be improved. An Energy Information Center will be established to provide information on energy matters to the Jamaican organizations, public and private, working in the energy area. The Economics Branch in the Energy Division will be increased in size and technical competence; limited commodity assistance and training will be provided to improve its capacity to carry out the economic analysis and planning required for the Government in the energy sector.

At the end of the Project, the Energy Division should be fully staffed with qualified energy planners and technicians. A fully equipped and operational Energy Information Center will have been established. A National Energy Accounting System will have been instituted and a National Energy model prepared.

This component of the Project will require \$1,363,000 from AID and will be matched by \$114,000 from Jamaica.

Energy conservation. The Project will finance the development of a national energy conservation plan and a public education program on energy conservation, the auditing and retrofitting of a public facilities in order to conserve energy, and the development of appropriate energy standards and their incorporation into national building and manufacturing codes.

Technical assistance through a long-term advisor and short-term consultants, training of Jamaican personnel, commodities, equipment and instruments needed to conduct energy audits and retrofits, and various other commodities and material will be provided.

A major public sector auditing and retrofitting program will be carried out to improve the energy efficiency of all government facilities. Using GOJ energy auditors and technical assistance provided by USAID, all government facilities will be audited and retrofitting programs carried out to improve their energy efficiency. These retrofitting programs will result in a reduction in the amount of energy used by the public sector. A major public education program will be carried out involving both a broad-scale effort to sensitize the public to the importance of energy conservation as well as a special focus on significant energy consumers (motorists, industry, etc.) by providing them with energy conservation advice and recommendations. A Mobile Unit will be established to carry the energy conservation message to the rural areas.

Appropriate standards will be established for energy consuming products and processes and for the manufacture of energy equipment and devices. Energy standards for the construction industry will be developed and incorporated into the national building codes. Approaches to energy-conserving building design and construction will be developed and promulgated through written material and instructional seminars.

This component of the Project will require \$1,843,000 in U.S. funds and will be matched by \$3,653,000 GOJ counterpart.

Alternative energy. The Project will emphasize the immediate utilization of cost-effective alternative energy technology (vis solar water heating) and the establishment of a coordinated network of institutions to undertake the further development and utilization of alternative energy resources.

Technical assistance, training of Jamaican personnel, provision of test and monitoring equipment, materials and commodities, support for construction of solar water heaters for public buildings will be financed under the Project.

A major solar water heating program will be initiated in the public sector. In the public sector, solar water heating units will be installed in Government-owned hospitals and hotels. Standards for the solar water heating industry will be developed by the Bureau of Standards.

The Meteorological Office will establish a series of 10 climatic stations to improve its meteorological data base, needed for the development of solar energy programs.

A Solar Energy Institute will be established at the College of Arts, Science and Technology, Jamaica's primary technical-level college. The Institute will provide training in solar energy and will carry out practical research into solar technologies.

Assessments will be carried out on all indigenous alternative energy resources in Jamaica. When these assessments show that a particular

resource has the potential to provide a significant amount of energy at reasonable competitive costs, a prototype testing program will be carried out to develop the technology needed. An assessment of Jamaica's forestry resources will be carried out to determine the energy potential of that resource. A research effort to determine fast growing species of trees will be supported under this Project.

Finally, alternative energy demonstration centers will be established in rural areas to encourage the acceptance of alternative energy technologies among the rural population.

This component of the Project will require \$3,806,000 in U.S. funds and will be matched by \$2,474,000 as GOJ counterpart.

C. FINANCIAL SUMMARY

	PHASE I		PHASE II	
	<u>FX</u>	<u>LC</u>	<u>FX</u>	<u>LC</u>
<u>PROGRAM PLANNING</u>	1363	114	-	-
TA-long term	560	-		
Training	281	60		
Energy Info. Center	451	54		
Econ. Planning	71	-		
<u>CONSERVATION</u>	1788	55	3653	-
TA-long term & short	347	-		
PEP	211	20		
Mobile Unit	23	2		
Pub. Sec. Aud + Retrofitting	1061	33		
Priv. Sec. Aud +Retrofitting	72	-	3000	-
Energy Conser. Ind. Dev.	33	-	653	-
Energy Conser. Manual	41	-	-	-
<u>ALTERNATIVE ENERGY</u>	3686	120	2254	220
TA-long-term - Trg. Veh.	995	60		
Pub. Sec. Solar Wtr Htg Prog.	1530	-		
Pr. Sec. Solar Wtr. Pg.	-	-	1530	-
Standards: Solar Wtr. Ind.	91	-	-	-
Meteorological Data	90	-	-	-
Expansion of Solar Ind.	-	-	623	-
Training Installers	41	-	-	-
Res. + Dev.	879	60	101	220
CAST	(370)	-	-	-
Solar Crop Drying	-	-	(101)	(220)
Assess. of Alt. Energy Res.	(199)	(60)	-	-
Forestry Resources	(310)	-	-	-
Alt. Energy Demo Centers	60	-	-	-
<u>TOTAL PROJECT</u>	6837	289	5907	220
<u>TOTAL PHASE</u>	\$7.126 million		\$6.127 million	
<u>CONTINGENCY</u>	.374		.273	
<u>GRAND TOTAL</u>	\$7.500		\$6.400	
GOJ Contribution*	\$3.874		\$15.500	
	\$11,374		\$21,900	

*See Annex E for detailed discussion of GOJ contribution.

D. Summary of Findings

It has been concluded from the analyses herein that:

1. Jamaica is faced with a major energy problem. The GOJ requires assistance in its efforts to deal with that problem.
2. With the USAID assistance provided, the GOJ will be capable of managing the Project, achieving the Project purpose and reducing its dependence upon imported petroleum.
3. The technical design and cost estimates of the Project components are reasonable and adequately planned in accordance with FAA Section 611 and other applicable provisions.
4. The Project is consistent with AID policy and program objectives and meets the design criteria outlined in the PID and the subsequent PID review.
5. The Project is fully consistent with Jamaica's overall development objectives and priorities.

II. Background

A. Statement of the problem

Jamaica has a critical energy problem. It is among the LDCs most severely affected by the OPEC price increases. Key to Jamaica's ability to bring about economic recovery and growth and reverse an eight-year history of negative economic growth is the Government's plan to reduce the oil import bill thus freeing foreign exchange for vitally needed imported goods (equipment, raw materials, spare parts, etc.). Jamaica is one of the most intensive energy users in the developing world and is more than 99% dependent on imported petroleum for its commercial energy. Since the OPEC price increases began in 1973, Jamaica's annual import bill has increased almost eight-fold, from \$65 million in 1973 to approximately \$500 million in 1980, while the total volume of oil imports has decreased by 20%. The escalating cost of energy imports has already severely inhibited economic growth. Energy imports and debt service combined now preempt more than two-thirds of Jamaica's total foreign exchange earnings, leaving precious little foreign exchange for needed import items essential for economic growth.

Jamaica's prospects for improving its energy situation in the short to medium term are not good. Hopes are high that the new administration headed by Prime Minister Seaga will be able to stimulate investment in the private sector and improve Jamaica's foreign exchange situation over the next several years. This would, of course, improve Jamaica's ability to finance its oil imports, but would not reduce Jamaica's dependence upon imported energy sources.

Jamaica has underway an active oil and gas exploration program. Drilling, both on-shore and off-shore, is expected to begin in 1981. The prospect of finding oil or gas is always problematical, and even if Jamaica is successful, it will take five years before the oil or gas can be developed to the point where it will provide energy to Jamaica. Even then the supplies will be finite and at some point will themselves be used up.

Like all countries, Jamaica was not well prepared to meet the energy crisis precipitated by the OPEC price increases. Since 1973, it has taken a number of steps to improve its capability to deal with the situation. An Energy Division in the Ministry of Mining and Energy was established to serve as the Government's focal point for energy policy and programs. However, as late as 1979 the Division was staffed with as few as 4 professionals, three of them non-Jamaican. Since 1979, the Division has been increased to 23 professionals, and a number of programs, both in energy conservation and in the development of alternative energy, have been started. A Five-Year Energy Plan has been developed and several donors have provided assistance in a variety of areas, mostly in the conventional energy sector of electricity generation. However, these efforts, significant as they are, are only a modest start in dealing with the critical energy situation. The Energy Division (ED) needs strengthening; its staff is relatively young and inexperienced in carrying out energy programs. The ED staff needs to be increased in size and the present staff needs to have its skills in energy upgraded. The energy conservation program in public education has gotten off to a reasonably good start, but it needs major strengthening and expansion. The same can be said for the Government's public sector auditing and retrofitting program designed to improve the energy efficiency of the public sector facilities. A similar program for the private sector, a far larger user of energy, has not even been initiated. A variety of projects has been launched in the area of

alternative energy resource development, but much more needs to be done in the way of assessing Jamaica's indigenous alternative energy resources and in developing plans and programs to exploit those resources which seem most promising. The trained manpower available to Jamaica to carry out these assessments and to develop these programs is limited.

For all these reasons Jamaica has requested USAID assistance to improve its capacity to deal with its energy problem and specifically to assist it in carrying out energy conservation and alternative energy programs.

B. GOJ sector goal

As indicated above, Jamaica has developed a Five-Year National Energy Plan with the assistance of a UNDP energy economics advisor. Its main objectives are:

- (a) Reduction in the dependence on imported energy and diversification of the present energy supply mix of the Jamaican energy system away from imported petroleum.
- (b) Accelerated exploration for and development of indigenous energy supply sources.
- (c) Reduction of the energy intensity of the economy while seeking to sustain economic growth especially non-energy intensive exported-oriented growth.
- (d) Cushioning the impact of continually increasing energy prices on the low income groups of the society while adopting pricing policies appropriate to the promotion of objectives (a) to (c) above.

The USAID Project will provide assistance directly to the Government in meeting objectives (a) - (c) above, and indirectly in meeting objective (d).

The energy plan of Jamaica, which is based on the Five-Year National Energy plan prepared in 1978, is fully consistent in USAID's judgement, with the conclusions cited above. That Plan emphasizes energy conservation, the exploitation of indigenous energy resources (including both exploration for oil and gas and the development of alternative renewable energy technologies), policies designed to reduce the energy intensity of the economy and development of the institutional capacity of the GOJ to deal with its energy problems. All of this is directed at reducing Jamaica's almost 100% dependence upon imported petroleum.

USAID has been instrumental in assisting the GOJ to develop its present strategy to carry out its Five Year Plan by providing a variety of consultants over the past three years who have carried out short-term studies in several key areas of the energy sector. As USAID has assisted the GOJ in developing its overall strategy, we have identified a number of ways in which AID, within its policy and budgetary constraints, can provide important assistance to Jamaica in the energy field. This project is a result of the analysis carried out by our consultants and our own judgement as to how USAID can best assist.

The current GOJ energy strategy is based on the following conclusions which resulted from a recent AID study of the energy sector.

- Unless concerted action is taken, renewed economic growth in Jamaica implies significant increases in oil imports. If the economy grows as envisioned, oil demand and thus imports could increase by 60% in the next 10 years. Such implied imports, in an era of rising world oil prices, could make the economic growth targets established by the GOJ unattainable.
- It is, however, possible to maintain or reduce oil imports from current levels over the next 5-10 years, despite a rapidly growing economy. Despite an anticipated growth of energy demand of around 50% by 1990, a combined alternative energy and energy rationalization strategy could reduce oil as a fraction of total energy consumption from its current level of almost 100% to 64% by 1990 and to 50% by the year 2000.
- In the short term, the most effective measures in reducing oil imports are: (a) implementation of the slow speed diesel option in the JPS system, (b) industrial and transportation energy conservation, and (c) conversion of JPS from oil to coal. (USAID's project will assist with energy conservation and, in cooperation with the U.S. Trade and Development Program, we are assisting the GOJ in analyzing the feasibility of coal conversion.) Other options that could be significant in the next 5 years are: more efficient use of bagasse by the sugar industry, solar water heaters for domestic and commercial use and medium scale hydropower. (USAID's project will assist with solar water heaters and possibly with studies of the sugar industry. Other donors are helping with medium scale hydro power.)

- In the intermediate term, the most beneficial strategies relative to oil imports remain the use of coal (with peat used for electricity generation an additional possibility) and energy conservation. In addition, other options such as the following could be important: ocean thermal energy conversion, large scale hydropower, urban waste for power generation and wood and charcoal. (GOJ's requirements for its large scale hydropower projects are for capital financing which AID could not meet. The USAID project can assist the GOJ to assess the potential of the other options.)

- Over the longer term (to the year 2000) a number of other options could play a significant role. Many of these, however, are at the present time very uncertain regarding technical performance, economic viability, environmental implications and social acceptability. USAID's project can assist the GOJ to assess these technologies, e.g., solar ponds, liquid fuels, concentrating solar collections, etc.

- Energy conservation measures are the principal sources of oil replacement in the near term. Indeed, unless vigorous conservation actions are pursued, oil demand may grow to unacceptable levels over the next several years. (The USAID project stresses conservation.)

- An improved and tightly coordinated national energy planning and analysis capability which extends to project planning, investment analysis and implementation is greatly needed. (The USAID project will assist in improving this institutional capability in the GOJ.)

In summary, USAID has not only thoroughly analyzed the overall Jamaican energy sector, but we have assisted the GOJ in developing its national plan and strategies for solving its energy problem. The proposed USAID project focuses on those important data gaps and opportunities in the energy sector in which AID can make a contribution.

C. Related AID and other donor assistance

The Project is the only bilateral USAID energy activity in Jamaica. Several elements of the Project involve the rural sector, especially the prototype testing of solar crop drying technologies, and will, therefore, complement the USAID agricultural projects.

The AID Caribbean regional project, funded by RDO/C in Barbados and being implemented by the Caribbean Development Bank and CARICOM, involves Jamaica to a limited extent, and it has been taken into account in designing this Project. The regional project provides assistance primarily to the eastern Caribbean islands. Jamaica has received some training in energy auditing under the regional project, but the amount of assistance expected to be received by Jamaica is relatively small and will complement the assistance provided under this Project.

A number of other donors have provided assistance to Jamaica in the energy sector and the USAID project has been developed with full knowledge of the other donors activities and in close cooperation with them so that our activities complement each other and are not duplicative.

Peace Corps

The Peace Corps has provided two volunteers in energy, one of whom is working in the energy conservation program in the ED and the other at CAST. USAID has discussed this proposed Project with the Peace Corps and has identified two Project activities on which we intend to cooperate closely. The Peace Corps has agreed to attempt to provide volunteers to help staff the Alternative Energy Demonstration Center and to assist in carrying out the forestry research project designed to identify fast growing species of trees. Other ways in which USAID and the Peace Corps can collaborate on this Project may unfold as the Project is implemented and we will be alert to identifying additional areas for cooperation.

IBRD

The World Bank has an active lending program in the conventional energy sector, primarily electricity generation from petroleum. A \$20 million loan approved in 1978 to expand the distribution system of the Jamaica Public Service Co. is now being implemented.

The Bank is now negotiating another \$25-30 million loan to JPS which will be for expansion of the distribution system but will also focus on improving the energy efficiency of JPS by assisting in the rehabilitation of existing plants and by reducing the energy losses which occur in the distribution system. The goal is to reduce those losses from 19 to 12%. Technical assistance will also be provided to improve the management capability of JPS. In discussions with both the IBRD and JPS, USAID has determined that the Bank is adequately meeting the foreign assistance needs of the JPS and that major USAID assistance under this loan is not required. Limited USAID assistance under this loan may be provided in the form of short-term training or consultants to meet JPS needs in the future which can be covered by the IBRD loan.

An IBRD team has visited Jamaica to discuss possible assistance to the oil and gas exploration effort and negotiations are underway on that project possibility. USAID and IBRD representatives have exchanged views and information several times during the design of the USAID Project. At the present time, the IBRD plans to continue its lending to Jamaica in the conventional energy sector and does not plan to lend in the areas in which the USAID Project is designed to assist.

InterAmerican Development Bank

The IDB has provided \$20.9 million for a rural electrification program which is now being implemented. It has also recently provided a loan of \$25 million for Jamaica's oil and gas exploration program. The IDB has shown some interest in alternative energy and USAID has discussed our Project with IDB officials on several occasions. The Bank is familiar with the USAID Project and any activities which it might undertake in alternative energy development will be coordinated with USAID.

Canada

CIDA has been approached by the Energy Division of the MME to provide assistance in energy conservation. Following discussions with USAID, CIDA has decided that since USAID is undertaking a major effort in energy conservation, it will not provide assistance to the GOJ in this area at the present time and has referred the GOJ to USAID for assistance in energy conservation. CIDA is providing assistance in the development of Jamaica's mini-hydro potential.

UK

The UK has funded several short-term consultants in energy conservation to the GOJ who provided valuable assistance to the Government in developing the conservation program to the point where it now stands. The UK does not plan to follow through with any large scale assistance in energy conservation (e.g., a credit program for retrofitting). Therefore, USAID has decided to include energy conservation as a major Project element. The UK has been fully briefed on the USAID Project.

Norway

Norway provided important assistance to the GOJ in the early stages of its oil and gas exploration effort. Norway has no plans to provide assistance in the areas which are covered by the USAID Project.

EEC

The EEC has provided some assistance in the GOJ's biogas program and is expected to continue with this. Such assistance is not included in the USAID Project and would be completely consistent with it.

UNDP

A 5-year technical assistance project in energy will be drawing to an end in 1981. Under that project, the UNDP provided a long-term energy economist to assist the ED and the Petroleum Corporation of Jamaica, several short term consultants and some equipment. UNDP assistance in energy after 1981 is uncertain and the UNDP will coordinate its future assistance with the USAID Project.

A variety of other donors have provided small amounts of assistance in the energy sector -- OAS, OLADE, Germany, etc. None of these donors has had major energy assistance efforts, nor do they anticipate major energy assistance programs to Jamaica in the future.

USAID is the only donor which, at the present time, is planning a major assistance effort in the energy conservation and solar energy areas. Since an increasing number of countries are showing interest in assisting Jamaica and since energy is such an important problem sector for Jamaica, USAID expects that other donors will be considering energy projects in the future. The coordinating mechanism for such assistance must, of course, ultimately be the Government of Jamaica itself. However, USAID will continue its close dialogue with other donors and will be alert to possible areas of duplication as this Project is implemented.

D. Project Development

The GOJ first expressed an interest in receiving USAID assistance in the energy sector in 1978. The Government's preliminary request was for a team to review its just-completed Five-Year Energy Plan. A two-person USAID contract team spent approximately two weeks in Jamaica reviewing that plan and developing recommendations for USAID and the GOJ. Those recommendations involved, essentially, suggestions that a variety of short-term studies be undertaken in the energy sector to more precisely define the next steps which the GOJ should take in exploiting its indigenous alternative energy resources.

Based on those recommendations, the USAID and the GOJ agreed on a series of short-term studies which were then carried out by a USAID-funded contract team (ESI) in August-November 1979. The studies were carried out on urban waste,

solar energy, biogas and coal, which seemed to be among the most promising alternative energy possibilities at the time, and on revising the electric utilities rate structure of JPS. Those studies recommended that the GOJ should undertake major programs in both solar energy (primarily hot water heating) and biogas.

Based on those studies and intensive discussions with the GOJ, the USAID developed a PID in December 1979. The PID included solar energy and biogas as major project elements, added institutional strengthening of the Energy Division and included energy conservation as a third priority area. The PID was reviewed and approved by the Energy Division and forwarded to AID/W in January 1981 where it was reviewed by the DAEC. The results of the DAEC meeting are provided in the PID Cable, Annex F. Essentially, AID/W gave its approval to proceed with the development of the Project.

Further discussions with the GOJ confirmed its interest in the Project as outlined in the PID, with the exception that biogas was to be dropped out as another donor had expressed an interest in this technology and the GOJ/MME/ED decided that the USAID should focus its assistance in alternative energy on solar.

USAID then contracted with the Georgia Institute of Technology to assist in designing the Project. A team of energy experts from that Institute spent September-December 1980 in Jamaica and basically provided the technical input into the Project Paper.

Based on the work of the two energy teams, ESI and Georgia Tech, and in close consultations with the GOJ, the Project Paper was prepared by USAID, primarily the General Development Officer (USAID Energy Officer), and submitted to AID/W in May 1981.

In April 1981, Prime Minister and Minister of Mining and Energy Seaga asked for USAID assistance to undertake an overview study of the energy situation in Jamaica focusing on the energy sources which Jamaica should concentrate in the near and medium term. This study was undertaken in three weeks time by a team of AID contract consultants. The team considered all energy options available to Jamaica, including conversion of JPS from oil to coal, major hydroelectric schemes, etc. The study team confirmed USAID's analysis that the three most important areas which AID can and should help with in the energy sector are conservation, solar water heating and institutional strengthening.

AID/W provided valuable assistance in conceptualizing the project and in providing technical backstopping. Dr. Jerome Bosken, DS/EY, visited USAID on three occasions to assist in the Project design effort and Carl Duisberg, LAC energy officer, visited once. The economic analysis was carried out by Robert Burke, LAC/DR, and the USAID/Haiti engineer, Tibor Nagy, prepared the engineering analysis.

E. Relationship to USAID sector goals

Assistance to the GOJ energy sector has been highlighted as a major USAID priority in all of our CDSS's including the most recent one submitted in January 1981. USAID sees assistance to the energy sector as a key element of our production/employment strategy. Our assistance is aimed at assisting Jamaica decrease its dependence upon imported petroleum, thereby reducing its import bill and freeing up foreign exchange which can be used to purchase vitally needed equipment, spare parts and other items essential to increase production.

F. Beneficiaries

The Project is addressed primarily to reducing Jamaica's dependence upon imported energy. The USAID's analysis and that of the GOJ has led us to develop a Project which focuses on institutional strengthening of the GOJ's Energy Division, improving the energy efficiency of the Jamaican economy (energy conservation) and developing alternative energy technologies. USAID believes these are the most important ways in which USAID can be of assistance to the GOJ in the energy sector at this time.

It follows from this that the primary beneficiary of this Project will be the economy as a whole, an economy whose energy dependence on imported petroleum is reduced and which is therefore a stronger and more viable economy as a result. Other beneficiaries will, of course, be those Jamaicans or Jamaican institutions who receive direct assistance under the Project - the GOJ officials who receive training, the public sector institutions and private sector firms and residential home owners who receive technical and capital assistance to reduce their energy costs and become more energy efficient.

A part of the Project is designed to provide assistance to the rural poor, although they are not primary beneficiaries under the Project. The solar crop drying program and the alternative energy demonstration centers are Project elements which will impact directly upon the rural poor and are attempts to provide them with alternative sources of energy which are cheaper than petroleum. The Forestry resources activity will eventually help to provide cheaper sources of energy to the rural poor.

III. Detailed Project Description*

A. Goal and Purpose of the Project

The goal of this five-year Project is to reduce Jamaica's dependency upon imported petroleum. The Project purpose is to:

- (a) strengthen the GOJ's institutional capacity to plan and manage energy programs;
- (b) expand and improve the GOJ's energy conservation program; and
- (c) institute programs in alternative energy.

The Project is designed to create a solid base for Jamaica to deal with its energy problems in the coming decade.

B. Project Components and Phases

The Project has three major components, each of which is divided into a number of related activities. The components are:

1. Program planning and management
2. Energy conservation
3. Alternative energy

The Project is divided into two phases, Phase I and Phase II. Phase I, financed by this project deals with institutional development and public sector conservation and alternative energy activities, while Phase II, which will be financed by a separate project, will provide credit funds for a variety of private sector conservation and alternative energy investment projects.

Phase I

1. Program Planning and Management

One of the principal objectives of the GOJ's National Energy Plan is to strengthen existing energy institutions so they will be able to effectively carry out their responsibilities for program planning and management. The purpose of this Project component is to support this GOJ objective by strengthening the planning and management function of the Energy Division (ED) of the Ministry of Mining and Energy. This strengthening will be carried out through increasing the size of the staff, training of staff (both long term and short term), development of an Energy Information Center, the provision of technical assistance consultants in a variety of fields and limited commodity support.

The ED is the primary GOJ organization responsible for program planning and management in the energy sector and is divided into three branches, Economic Planning, Conservation and Alternative Energy.

Descriptions of the Program Planning and Management elements of the ED's Conservation and Alternative Energy Branches are found under the Conservation and Alternative Energy sections of the Project Paper. This component of the Project describes the function of the Economic Planning Branch and the Energy Information Center.

* This detailed Project Description is based on the best judgement of USAID and the GOJ at the present time. Because of the dynamic nature of the energy sector, it is expected that over the five-year life of the Project, some revisions may be necessary in the Project activities to correspond to changing circumstances. These changes will be made as they are mutually agreed to by USAID and the GOJ and in accordance with AID and GOJ regulations.

The responsibilities of the ED are to plan and develop the energy strategy for the country, to determine priorities and resource allocations, to organize and coordinate activities and to monitor and evaluate all energy activities. It is the central planning office for energy (with the exception of the oil exploration efforts which come under the responsibility of the Petroleum Corporation of Jamaica), and the focal point of the Government's efforts to deal with the energy problem.

The ED will have primary and overall responsibility for implementing this Project for the GOJ. Several other Jamaican institutions will be involved in implementation of the Project (National Commercial Bank, College of Arts, Science and Technology, Bureau of Standards, Meteorological Office, Jamaica Public Service, Agency for Public Information, and others) but USAID will look to the ED to be responsible for the entire Project.

The ED has been in operation since 1973, although as recently as 1978 it was staffed with only six professionals, three of whom were non-Jamaicans. As evidence of the Government's increasing concern with the energy problem and the high priority assigned to energy, the ED has now been increased to a total of 23 professionals, with a Jamaican PhD scientist as Director. The ED will still require a further increase of 9 professionals over the five-year life of the Project to be fully staffed to carry out its responsibilities, 2 in the Economic Planning Branch, 3 in the Conservation Branch, 2 in the Energy Information Center and 2 in the Alternative Energy Branch.

Several of the staff of the ED have some training in energy, some of which has been provided by USAID. However, the staff is still relatively inexperienced in energy matters and most require additional training. Training will be provided through three modes: on-the-job training provided by long and short term loan-funded advisors, short-term courses offered either in Jamaica, the U.S. or a third country, and long-term academic training.

On-the-job training - Three long-term loan-funded advisors will be provided under the Project: (1) an energy generalist who will be responsible for coordinating all AID inputs into the Project and who will serve as an advisor to the Director of the ED for the life of the Project, (2) an energy conservation specialist and (3) an alternative energy specialist. (See Annex A for job descriptions of these three advisors).

One of the primary functions of these long-term advisors will be to provide on-the-job training to the ED staff in their subject matter specialties. This long-term exposure to energy experts will facilitate the transfer of energy information and technology to the ED staff. In addition to the long-term advisors, all of the short-term loan-funded consultants will be tasked not only with carrying out the responsibilities assigned to them in the implementation of the Project but also with transferring their expertise to Jamaican counterparts.

Short courses - A variety of short courses (including observation trips) will be held either in the U.S. or Jamaica for ED staff and selected participants from other Jamaican organizations such as UWI, CAST, PCJ, JPS, SRC and the private sector. These courses will be in energy management, project design, conservation (including energy auditing and public education), alternative energy and energy information.

Long-term post graduate training - While the focus of the training provided under the Project will be on short courses and on-the-job training, a total of 12 Jamaicans will be chosen for longer term post graduate training. Three participants will be sent to the U.S. to study energy economics, 3 to study energy conservation (2 in auditing and 1 in public education), and 6 to study in alternative energy. These participants will either be staff members of ED or will become staff members after their training. In either case, the participants will be required to return to work in the ED in accordance with GOJ regulations and will assume key roles in the ED after their training.

(a) Economic Planning Branch of the Energy Division

The primary functions of the Economic Planning Branch are to:

- monitor the Jamaican petroleum sector and determine the prices of petroleum products in Jamaica;
- collect economic intelligence on world-wide energy developments and determine their implications for local energy policy;
- develop an efficient system for data collection, storage and retrieval for energy related data;
- provide support services to other branches of the ED by producing project feasibility studies and other relevant data and by carrying out economic analyses of proposed projects;
- revise, when needed, the National Energy Plan; and
- develop a National Energy Accounting system to identify sectoral energy flows and ultimately develop a national macro-economic input-output energy model.

In order to adequately carry out these responsibilities, the Branch needs to increase its professional staff from eight to ten. The GOJ will provide the two additional positions within the first two years of the project.

The long-term energy generalist will provide assistance to this Branch in a variety of tasks. Six person-months of loan-funded consultants will provide assistance in economic planning and analysis during the life of the Project, primarily related to updating the National Energy Plan.

During 1981, the Branch will complete six sectoral energy surveys (agriculture, household, industry, tourism, commerce and transportation) designed to determine energy consumption and sources in those sectors and provide the data needed to establish a National Energy Accounting system. These surveys will yield valuable data which the GOJ can use in planning its energy activities and determining priorities.

Loan funds will finance \$3,000 of needed equipment for the Branch (primarily calculators). Another donor is providing a mini-computer system to the Branch which will meet the data processing needs of the ED as a whole.

Several staff members will receive short-term training and three persons will be sent to the U.S. for post graduate training in energy economics and will return to work in the Branch.

(b) Energy Information Center

The small library of the MME (which is primarily an energy library) will be expanded into an Energy Information Center (EIC) by considerably increasing its library holdings, establishing a computer facility to permit information retrieval from data banks in the U.S., increasing the size of the staff to handle these new functions and providing selected equipment, supplies and materials. The energy libraries in SRC, UWI and CAST will also be supplemented.

At the present time, no one institution in Jamaica has a specific mandate to operate an energy information system for all persons and institutions working in the energy sector. Several organizations have libraries which contain books on energy, but the number of books available on energy is extremely limited. Periodicals in the energy field are almost non-existent in Jamaica. Neither is there any coordinated system for knowing what information is actually available on any particular subject in energy in Jamaica. In order to improve its capacity to plan and manage energy projects, Jamaica must greatly increase the information on energy which can be quickly and easily made available to the individuals and organizations working in the energy sector. This can most readily be done by establishing an EIC, providing it with the required books and periodicals and computer facility so that it can have access to energy data banks in the U.S. and developing a coordinated system of information on energy involving all the major institutions working in the energy field.

The objective of the EIC will be to collect, collate, classify, store and disseminate information on energy to the individuals, organizations (private or public) and researchers involved in energy and related work in Jamaica. The EIC will be the center of a network of energy information which will include SRC, UWI, CAST and perhaps other organizations.

Specifically, the EIC will:

- strengthen existing book and periodical collections at MME, SRC and UWI and establish a new collection at CAST's Solar Energy Institute.
- produce a national energy bibliography with networking and updating capabilities.
- establish a computer-based system to provide access to local and international energy bibliographies and data bases.
- establish an information delivery system to provide energy information in printed or microfilm forms.
- establish special capabilities to identify, acquire and deliver information on solar energy and other alternative energy developments.

The GOJ will hire two additional personnel to work with the librarian of MME to establish the EIC. All 3 librarians will receive one month of training in the U.S. in information systems related to energy and computer based data systems. The computer facility and a 5-year search contractor with a data center will be loan-funded, and a three-months loan-funded consultant will train the Jamaicans in the use of the computer and the external data bases and will assist with the establishment of the EIC. The consultant will provide an additional 3 months of technical assistance to the EIC over the life of the Project. Books, subscriptions to journals and microfiche material up to \$300,000 will be provided under the loan. Computer time and the telephone charges will be loan-funded to encourage the use of the computer facility. Equipment, supplies and materials (\$45,000) for the EIC will be provided by the loan (bookshelves, microfiche readers, coding equipment, reproduction equipment, etc.). Linkages will be developed with the National Technical Information Service in the U.S. Department of Commerce.

2. Conservation

The GOJ initiated energy conservation efforts in 1975 on a limited scale. During 1980 these efforts were increased considerably. A National Advisory Council on Energy Conservation has been established to advise the GOJ and has made a number of recommendations which the Government is now considering. A Conservation Branch has been established in the ED staffed with 17 professionals and supporting staff. A start has been made in carrying out energy audits of public sector institutions as well as few industrial firms to identify ways to improve the energy efficiency of those facilities. A public education program has been initiated involving newspaper advertisements, government statements, seminars, spot announcements on radio and the production of pamphlets, posters and brochures. This Project will build on the start the Government has made in energy conservation and will help the GOJ to expand and improve its efforts.

(a) Development of a conservation plan

Although several efforts are underway in the conservation field, the GOJ still requires a comprehensively defined energy conservation plan in order to identify and prioritize public sector interventions which affect energy usage. This plan will identify costs and benefits of various potential energy conservation measures, identify resource requirements, establish priorities and set forth a detailed implementation schedule. One long-term, loan-funded energy conservation specialist will be provided to assist the Conservation Branch in preparing this conservation plan within the first year of the Project. (This conservation specialist will have other duties as well. See Annex A for his/her job description). The plan will focus on what the GOJ should do in energy conservation, e.g., public education programs, changes in government policy, conservation programs for public sector enterprises, etc. However, private sector organizations will be involved in discussions leading up to the preparation of the conservation plan and the plan will include measures which need to be taken by the private sector as well. For example, the plan will include an energy auditing and retrofitting program (described below) which will assist private sector firms in identifying energy measures and in financing the retrofitting required to carry out the recommendations of the energy audits. Fiscal and other energy conservation incentives will be identified. Six months of loan-funded short-term consultants in specialized areas will be provided to assist the GOJ carry out studies or prepare detailed implementation plans related to the conservation plan.

(b) Public Education Program

Since 1979, the ED has been operating a small Public Education Program (PEP) designed to provide information to the public on energy matters. The PEP has attempted to sensitize the public to the energy problems of Jamaica and the need to conserve energy and inform them of efforts underway to identify and develop Jamaica's indigenous alternative energy resources.

In order to meet the goals of this program, the PEP will be considerably expanded under this Project.

The goals of the PEP are to:

- create public awareness of the world energy crisis and its effect on the Jamaican economy.
- inform the public on what the GOJ is doing about the energy problem.
- motivate and educate the nation to conserve energy and manage the available supply.
- motivate and educate the nation to adopt the use of new alternative sources of energy.

In carrying out the program, the ED will utilize booklets, posters, leaflets, brochures, billboards, films and other audiovisual techniques, radio and TV programs, newspaper advertisements, conferences, seminars and talks. Public service announcements on radio will encourage conservation, and special programs will be produced such as interviews with energy conservation specialists who will describe measures the consumer can take to reduce energy consumption. A video program will be prepared as a full-length (one-hour) TV special showing conservation potential and some initial efforts being made in Jamaica. Training materials will be developed for use in the public schools and guest lectures will be provided for schools and industries. Already available appropriate material from the U.S. or other English-speaking countries will be utilized.

The informational materials will concentrate on describing energy consumption requirements for certain activities and specific conservation opportunities for these activities. In particular, conservation ideas in cooking, motoring, air conditioning, heating of water, transportation and lighting will be emphasized. Industrial and commercial awareness programs will receive major attention. Workers will be encouraged to discover energy conservation opportunities in their jobs and to report these to management. In turn, management will be encouraged to reward good suggestions which are implemented, either financially or with fringe benefits, such as paid days off.

The program will serve to develop a greater awareness of energy consuming activities and the methods by which energy can be saved in these activities. This program will reach out to the people, using all forms of media, to make them better able to recognize energy waste or inefficiency and motivate them to reduce their waste. The ED will strengthen and expand the existing efforts to provide technical information to various groups (householders, motorists, government organizations, industry and commerce, etc.) on what specific steps they can take to conserve energy.

The program of energy coordinators initiated by the GOJ in 1980 (in which each firm and government office is asked to appoint someone to be responsible for the energy conservation program in that unit) will be strengthened by providing educational material to the coordinators and by holding a series of seminars to train them to carry out their responsibilities.

All government organizations and business firms will be encouraged to start programs of energy conservation. Assistance will be provided on an "as requested" basis to help develop their conservation programs. The civic clubs in Jamaica will be encouraged to take an active part in this public education program.

The PEP will be directed by the Public Education Unit of the Conservation Branch of the ED. Production of most of the informational material will be done by the Agency for Public Information (API), the GOJ office responsible for disseminating information on Government programs. The API is adequately staffed and equipped to carry out this work.

The materials to be produced and the programs to be carried out under the Project include the following:

- A one hour video special for national TV showing energy consuming activities, quantifying the consumption and its cost, and demonstrating ways to reduce consumption, thereby saving costs.
- 10 short public service TV spot announcements to be used as commercial or filler announcements, each concentrating on one specific energy consuming activity.
- A series of short films and slide presentations to be used on TV, in the cinema, and for loan to various public, private and civic organizations.
- 30 radio spot announcements focusing on a variety of energy conservation measures.
- 10 billboards to be erected in strategic spots around the country urging the public to conserve energy.
- A wide variety and assortment of leaflet materials, posters and brochures describing a variety of energy conservation opportunities in the residential, transportation and industrial sectors.
- Various educational materials for the public schools including slide shows and lecture texts. A program of visiting lecturers will be developed.
- A program of industrial and commercial energy conservation awareness among workers centering on traveling lecturers who will visit industrial and commercial installations.
- Musical materials in the form of songs by local musicians encouraging conservation and alternative energy utilization for use as public service announcements on radio and TV.

A mobile unit will be used to bring the material generated by the PEP to local neighborhoods, particularly those in the rural areas. This mobile unit will include a four-wheel drive vehicle with a station wagon body and will be equipped with a 16 mm film projector and screen, a television receiver, video tape equipment, a slide projector, a portable public address system, a tape recorder and related equipment, material and supplies all to be loan funded.

The mobile unit will be operated by the PEP and at least five programs for the public will be given each month for a total of 300 for the 5-year life of the Project. Additional loan funded video equipment, supplies and film, totalling \$45,000 will be provided to the ED to assist in preparing informational material for the energy conservation program.

The PEP office, presently consisting of three persons, will be expanded by 3 other personnel, a media specialist, a general information specialist and a graphics specialist, all to be hired during the first year of the Project. A special three months training program in the U.S. will be developed for the Director of the PEP during the first year of the Project. Two other staff members will spend one month each in the U.S. on observation/field trip training programs during the first year of the Project, one in production techniques for the media and the other in the preparation of written material for public education emphasizing conservation themes. In the second and third years of the Project, \$70,000 in training funds will be reserved to meet specific, individualized training needs that are identified during the first year of the Project. One person will receive post graduate training in public information in the U.S.

The loan-funded long-term energy conservation advisor will assist in all aspects of the conservation program. He/She will focus primarily on the auditing and retrofitting program (described below), but approximately one-third of his/her time will be devoted to the PEP and he/she will provide on-the-job training to the ED staff. The long term advisor will be provided for the first three years of the Project, after which time the need for the continuation of the position will be evaluated. A three-months loan-funded consultant will assist the PEP to develop a detailed implementation plan for the Project, select equipment and provide training in the use of the equipment. The consultant will return for one month during each of the second and third years of the Project to review the progress of the program and provide technical assistance in its implementation.

In addition to providing the six person staff to manage the PEP and the services of API to produce media and informational materials, the GOJ will provide funding for all of the time-purchases required for the television, radio and newspaper advertisements and will fund the construction of the billboards. The GOJ will also fund the local printing contracts, supplies, materials and paper required.

At the end of the five year program, the PEP will have achieved the following goals:

- A smoothly working organization with six people trained in the operation of the Public Education Program.
- A well equipped organization structure capable of preparing and delivering a full range of media presentations.
- A selection of documentary films concerning energy in Jamaica.
- A well informed citizenry resulting from the work of the mobile unit and the wide-spread energy conservation public education program.
- A large selection of printed material dealing with energy topics.
- A fully self-sufficient PEP which will continue to operate with appropriate modification and without major outside assistance.

(c) Auditing and Retrofitting Program

Given the publicity program as a seed to foster an attitude of awareness and energy thrift, another Project component will assist in transplanting energy conservation technology in Jamaica. This program will lead to the installation of energy conservation retrofitting equipment through an orderly sequence of steps.

First an energy audit will be performed on the energy consuming facility in question (firm, school, hotel, Government building, etc.). This audit will quantify the amount of energy used and identify the energy using devices and their respective contributions to total consumption. Operations and maintenance energy conservation opportunities (ECOs) will first be identified. Many of these operations and maintenance ECOs can be carried out with little or no investment of funds. The audit can be performed by qualified engineering technicians, such as CAST graduates. Following the energy audit, the next step is known as technical assistance and is carried out by a qualified engineer. The technical assistance activity serves to identify additional operations and maintenance ECOs, but, more importantly, capital improvement ECOs. The ECOs identified are then evaluated. Potential hardware devices are located, the project budget is estimated and the energy cost savings which will result from the installation are determined. This information serves as the basis of an economic analysis to determine the project's payback period (or net present value, life cycle cost, etc.).

Although the techniques of auditing and retrofitting are the same whether the facility in question is in the private or public sector, the management and implementation of the program will be different, depending upon which sector the facility is in. Therefore, the Project provides for separate programs for the two sectors.

(i) Public sector auditing and retrofitting program

The GOJ's auditing and retrofitting program will serve as a demonstration program and model for the rest of the country and will be designed so that its effective implementation will encourage the private sector to undertake similar programs. Government buildings, military installations, airports, schools, hospitals, and government owned hotels as well as selected government owned productive enterprises will be the focus of this initial demonstration program. The ED has already hired a staff of 12 auditors, 9 of whom are CAST graduates and the others university graduate engineers. These auditors have received some training in auditing under the AID/Caribbean regional energy project and the public sector auditing program has already been initiated. The long-term loan-funded conservation specialist will work closely with the ED auditors and will spend about half his/her time assisting in the auditing program and providing on-the-job training.

The ED auditors will make the initial energy audits of the facilities and recommend changes in operations and maintenance procedures. The advisor will provide the auditing technical assistance that is required to identify more sophisticated retrofitting needs usually involving some capital improvements in the facility. By working alongside the advisor, the ED auditors will learn-by-doing and after the first year of the Project should be able to carry out the more sophisticated audits themselves. The advisor will provide this advisory service and on-the-job training for three years, after which time the need for his/her continued services will be evaluated. Loan funded short courses will be held to upgrade the skills of the ED auditors.

Loan funds will provide \$850,000 for the foreign exchange costs of retrofitting programs during the first three years of the Project, after which time the capital improvements will be fully funded by the GOJ or from other sources. Approximately 40% of the costs of the retrofitting program will involve foreign exchange costs and the remainder local costs which the GOJ will provide from its capital budget. The GOJ will contribute the Jamaican dollar equivalent of \$1.4 million for the retrofitting capital improvements program and will fund all the engineering investigations and designs needed to prepare the individual retrofitting projects. Two loan-funded vehicles will be provided for transportation for the auditors.

The ED will develop an implementation plan for the public sector auditing and retrofitting program which will determine which facilities will receive priority treatment. A funding review committee will be established, composed of representatives from ED and other GOJ institutions, to review all proposals for retrofitting and determine priorities.

The implementation of the retrofitting program will be carried out by the National Development Agency (NDA) under contract with the MME/ED and will be closely coordinated with the individual Ministries and government offices concerned. Follow-up analysis of the resulting cost and energy savings will be made by the ED.

Systems to be investigated for possible ECOs include air conditioning and ventilating equipment, lighting, heating of water, refrigeration, boilers, steam systems, motor and compressed air (see Annex C for an illustrative list of ECOs).

(d) Energy conservation industry development

For an ongoing program in energy conservation, hardware items to be used in retrofitting applications will be needed on a continuous basis. These devices may be purchased with foreign exchange or made locally. For a nation such as Jamaica with a shortage of foreign exchange together with a high unemployment rate, it is desirable to develop local sources of these products. Therefore, an important part of the energy conservation plan for Jamaica will be the development of a local industry producing manufactured products for the energy conservation market. This industrial development will serve as a bridge to future energy conservation installations in the country by making products and marketing infrastructure available. The development will also impact on two of Jamaica's most critical problems, foreign exchange and unemployment. Products manufactured on the island will replace foreign imports and may even represent exportable goods. In addition, jobs will be created by the industrial growth.

The types of energy conservation products which could be manufactured or assembled in Jamaica can be divided into two groups, high and low technology devices. The fabrication of low technology products is quite feasible in Jamaica. Many of these products have a high labor component, and, with the relatively low cost of labor in Jamaica, these items could be produced at lower cost on the island than if imported. These may also be exportable products which would provide additional foreign exchange. Examples of low technology products are window screens, window louvers and awnings, air conditioner filters, timers, switches and insulation. Development of these industries can proceed with relatively little capital investment. The high technology products have, in contrast, a significant capital investment required in product design, production, machine and tooling design, production tooling and raw materials. The industries which might produce these products will require capital loans in order to begin operations. Examples of the types of products with high technology components are heat recovery devices such as heat exchangers, heat pipes, heat

wheels, and heat pumps, energy efficient electric motors and efficient lighting systems such as 35W fluorescent lamps.

A three-month loan-funded consultant will carry out a survey to determine those products which are needed to implement ECOs in Jamaica. Those which can be manufactured or assembled on the island will be identified. Contacts will be made with local companies having the potential skills and equipment to produce these products. When an interested company is identified, a design for the product will be formulated, tooling to produce the product will be designed and technical assistance, if required, will be provided through loan-funded consultants to assist the company in drawing up a proposal. These proposals will include the estimated costs to tool up for production, the estimated demand for the product, the estimated price of the product made in Jamaica relative to a similar product which is imported, the export potential for the product and the number and type of jobs to be created in the industry. The proposals will be submitted to the National Commercial Bank which will review and evaluate the proposals. The ED will be consulted on the proposals. Loan funds (\$500,000) will be provided to establish this credit fund and the GOJ will contribute the Jamaican dollar equivalent of \$500,000 to the fund.

The result of this effort will be the development of an energy conservation industry in Jamaica. The presence of such an industry will be extremely valuable in effecting future energy conservation measures.

(e) Preparation of energy conservation manual for the construction industry

Building practices in Jamaica often follow those of England or North America and do not take into account the tropical environment. Air conditioning and ventilation systems could be improved by sun load reduction, variable air volume, economizer cycles and the use of windows with screens for natural ventilations. Domestic hot water systems are often specified as electric, whereas solar heaters can pay back their additional cost in 2-4 years. Lighting designs are often inefficient in terms of types of luminaries specified, use of natural sun lights or sky lights, positioning of luminaries and availability of switching controls.

In order to identify ways in which the construction industry can utilize more energy efficient building techniques, a three months loan-funded consultant will observe the building practices in Jamaica, focusing on the architectural designs, construction materials and construction techniques used. Working closely with the building trades, the Bureau of Standards and the ED, the consultant will prepare a manual to be entitled "Designing and Constructing Energy Conserving Buildings in Jamaica." This manual will identify opportunities for energy conservation in all areas of the building trade. The manual will estimate additional costs for including these new designs in construction and develop cost data and energy savings estimates.

The manual will also include recommendations for revising the Jamaican building codes in such a way as to encourage energy conservation. Five hundred copies of the manual will be produced by the GOJ and provided free to construction companies, architects and interested parties. A series of four workshops will be held to present the manual and discuss the energy saving technologies recommended. The consultant will return for another month to participate in these seminars.

3. Alternative Energy

The purpose of this Project component is to provide assistance in support of Jamaica's efforts to develop its alternative sources of energy.

Jamaica has considerable potential in the form of indigenous renewable energy resources. During the last few years the GOJ, assisted by USAID and other donors, has begun to assess the potential of these resources. This assessment is, however, a continuing process and much remains to be done. A recent survey undertaken by a former Director of the ED reveals a number of possible alternative sources of energy available in Jamaica.* However, few of these resources have been developed to the point where a technology is ready for dissemination. The only one which is ready for wide-spread dissemination is solar water heating. Therefore, this Project component includes a program to disseminate this technology and to assist Jamaica in further assessing and developing its other alternative energy possibilities. A number of other donors are also assisting Jamaica in this field, and the USAID assistance has been closely coordinated with those donors to avoid duplication.

(a) Institutional strengthening of the Alternative Energy Branch of the ED

The Five-Year Energy Plan identifies the development of Jamaica's renewable alternative energy resources as a priority and a number of activities have been initiated by the GOJ to assess and develop these resources. The Alternative Energy Branch of the ED has the primary responsibility for encouraging and promoting research, development, demonstration and implementation of alternative energy technologies appropriate for Jamaica. The Branch is staffed with 6 professional engineers and is attempting to develop, implement and monitor projects in a number of areas. Some of the activities are directly under the responsibility of the Alternative Energy Branch. Projects involving other indigenous energy resources (such as peat, biogas, wood and charcoal) are being carried out by other GOJ organizations.

A long-term, loan funded alternative energy specialist will be provided for the life of the Project to assist the Alternative Energy Branch with its overall responsibilities for developing Jamaica's alternative energy resources. His/her responsibilities are spelled out in the job description in Annex A. The loan-funded specialist will provide on-the-job training to the staff of the Branch, assist in developing and reviewing project proposals, assist in the implementation and monitoring of the on-going activities of the Branch, assist in identifying training needs and in developing training programs to meet those needs and in developing a system for the continual revision and updating of the alternative energy strategy and implementation plan of the ED.

During the first year of the Project, the ED's Alternative Energy Branch, assisted by the long-term advisor, will develop, in coordination with other GOJ institutions working in the energy sector, a long-term strategy for the development of Jamaica's indigenous alternative energy resources including the establishment of priorities and an implementation schedule. This planning exercise will help the GOJ in the preparation of its budget needs and development plans.

* This report, entitled Survey of Alternative Energy Possibilities in Jamaica, was prepared by Roddy Ashby and has previously been provided to AID/W.

In order to carry out its increased responsibilities resulting from this Project, as well as other projects which the Alternative Energy Branch will be undertaking in the future, the staff will be increased by two professional engineers during the first two years of the Project. One loan-funded vehicle will be provided to provide transportation for the staff.

Long-term post graduate training will be provided to six persons in various areas of alternative energy. Short-term training will be provided following a training program to be prepared by the long-term advisor during the first six months of the Project.

At the end of this five year Project, the Alternative Energy Branch will be fully staffed by well-trained alternative energy specialists and will be better able to carry out its responsibilities for overseeing the development of Jamaica's alternative energy resources.

A fully developed strategy for developing these resources as well as action programs to exploit these resources will be in place. During the Project, all alternative energy possibilities will have been assessed and, if they appear feasible, prototype-testing programs will have been developed to exploit their energy potential. Finally, a coordinated network of institutions will have been established involving the ED, UWI, CAST, PCJ, SRC and other institutions which will be responsible for carrying out the development of Jamaica's alternative energy resources.

(b) Solar water heating program

The alternative energy technology which is most advanced in Jamaica and ready for wide-spread dissemination is solar water heating. Although water heating accounts for only a small fraction of Jamaica's oil consumption (about 190,000 barrels per year of the imported total of 8 million barrels - excluding the bauxite sector - or about 2.5%), it represents an opportunity to apply a well tested alternative energy technology in the near term. This technology is not new to Jamaica. For a number of years solar water heaters have been used and several small companies manufacture and distribute them on the island. The purpose of this Project component is to undertake a major demonstration program, in both the domestic and industrial/commercial sectors, as well as in the public sector, by installing a number of solar water heating systems in a relatively short time. While this effort will help to reduce Jamaica's use of petroleum, its main attempt is to serve as a catalyst and demonstrate that alternative energy technologies can and do work, thus preparing the way and convincing larger segments of the society to accept and utilize these technologies. It is expected that as a result of this demonstration effort, there will be a major shift on the part of home-owners as well as industries and commercial enterprises to solar water heating during the life of the Project.

The solar water heating program will be divided into separate programs for the public and private sectors.

(1) Public sector solar water heating program

The GOJ operates 27 hospitals within the country which house 90% of the hospital beds in Jamaica, owns or partially owns 15 hotels and owns a number of productive enterprises such as the sugar industry, cement plant, a large textile plant, etc. All of these establishments use hot water for their operations and virtually all now obtain this hot water by electricity. Studies have shown that it is economically sound to convert these electricity-fueled water heating systems to solar systems (payback periods are estimated at 2-3 years). A major effort will be undertaken under this Project to bring about this conversion. A fund of \$1.5 million will be established, to be complemented by a GOJ contribution of the Jamaican dollar equivalent of \$2.3 million to carry out this program.

The first step is to identify those public sector facilities which will be converted to solar and develop engineering plans. The GOJ has assigned highest priority to the hospitals, second priority to the government-owned hotels and third to a selected number of productive enterprises. A loan-funded consultant will be engaged for three months to work with the ED in identifying which facilities should be converted and in preparing detailed engineering designs and equipment specifications. In some cases the structure of the facility may require additional support before it can hold the weight of a solar water system. The GOJ will provide funds for these structural improvements.

The ED, in cooperation with the National Development Agency and the Ministry of Health will supervise this program. Contracts will be let to Jamaican firms to manufacture and install the systems. The loan funding provided will be adequate to finance 15 to 20 institutional solar water heating systems (hotels and hospitals) and 5 public sector productive enterprises under the Project. This investment will result in a substantial annual savings of petroleum and will demonstrate the feasibility of large scale solar water heating to the entire country.

(c) Development of the infrastructure needed for an expanded solar water heating program

The basic infrastructure needed for the solar water heating program proposed under this Project exists in rudimentary form in Jamaica. There is a limited capacity in Jamaican industry to manufacture and install solar water heating systems. The data base required to determine that solar water heating systems will work and to what specifications the systems should be designed exists, at least partially. However, in order to expand the solar water heating program and to more firmly establish the industry in Jamaica, at least four steps need to be taken:

- (1) standards for manufacture of solar water heating systems need to be developed;
- (2) the meteorological data base needs to be improved to allow for improved design of systems;
- (3) the capacity of the Jamaican solar equipment industry needs to be expanded; and
- (4) additional personnel need to be trained in solar systems installation.

(i) Standards for manufacture of solar water heating systems

Standards are needed for the protection of the consumer and in order to insure high quality in the manufacture and installation of solar water heating units. At the present time, solar collector performance data does not exist, nor does Jamaica have an established standard certification program for solar systems. In order to provide consumer protection and to encourage the purchase of solar water heating units, such a program will be developed. Under this Project, the Jamaican Bureau of Standards (BOS) will test locally produced solar equipment, conduct evaluations of the minimal standards required and establish government standards for the industry. Loan-funded equipment and supplies (\$70,000) will be provided to permit BOS to carry out the studies and evaluations required. The BOS will provide all the necessary personnel to conduct the studies and will hire an additional person to conduct this work. Short-term training programs in the U.S. will be provided to 3 BOS personnel to permit them to learn the latest techniques in conducting these tests and evaluations.

(ii) Improvement of the meteorological data base

The measurement of meteorological information over an extended period of time is needed for the design and evaluation of alternative energy systems such as solar thermal, wind energy and photovoltaics. It is likewise desirable to acquire meteorological information at a reasonably large number of sites representing locations where solar, wind or photovoltaic systems might be constructed. At the present time, island-wide solar and climatic measurement capability does not exist. The Jamaica Meteorological Office has only one reasonably satisfactory station, located at the Norman Manley Airport in Kingston. Without accurate solar radiation data, solar system performance cannot be accurately determined, nor can the required size and quality of solar collectors be determined with precision.

PREVIOUS PAGE BLANK

ED has determined that a network of ten additional climatic stations is needed to produce the required meteorological data. The stations will be managed by the Meteorological Office. Loan funds will finance the purchase of \$60,000 of equipment needed to establish the stations. The ED and the Meteorological Office will determine the installation sites. A three-months loan-funded consultant will be provided to assist in site selection and installation of the equipment and will provide training in the operation of the equipment.

(iii) Expansion of the capacity of Jamaican solar equipment manufacturers

Jamaica at present has a limited capacity to manufacture solar equipment. Several small firms manufacture solar water heating systems and a number of backyard fabricators are also in the business. With the increased demand for solar water heating systems which will be stimulated by this Project, these firms will need to expand production, and other firms are expected to enter the market. A loan fund of \$500,000 will be established to be supplemented by a GOJ contribution of the Jamaican dollar equivalent of \$500,000 to provide loans to those firms or individuals who wish to expand production or enter the industry. Loans will be made available to qualified Jamaican manufacturers of solar equipment through the National Commercial Bank for capital improvement loans to be used for purchase and construction of tooling and production facilities. NCB will require credible business plans from applicants and adequate demonstration of an applicant's ability to produce high quality products which will be competitive in the Jamaican market. Loan-funded consultants will be provided to assist those firms interested in expanding.

The following beneficial results are expected from this program:

- Jamaican manufacturers of solar devices will be strengthened and enabled to compete in export markets.
- The production capacity for solar energy systems will be increased and product quality improved.
- Competition among manufacturers will be increased, to the overall benefit of the consumer.

(iv) Training program for solar systems installers

With the increased demand for solar water heating systems resulting from this Project, additional trained systems installers will be needed. With the assistance of a three-months loan-funded consultant, CAST will establish an in-depth, hands-on training course for solar water system installers. These installers are needed to assure that the systems are properly installed and function properly and that trained personnel are available to service the systems when maintenance problems arise. The consultant will develop the curriculum and course material and work closely with CAST faculty members in providing the training needed. Approximately 20 persons will be trained during each of the two sessions to be held during the second month. During the final month, CAST faculty members will conduct the training, while the consultant will be available to assist and advise. Also during the third month, the course will be evaluated and revisions made as necessary. By the end of three months, CAST will have the capacity to carry out the training without outside assistance,

and approximately 80 systems installers will have been trained. CAST will continue to offer the course once each semester (or more often if the demand exists) and will be available to provide advice and assistance to those installers already trained.

CAST will charge its usual fees for this short course and will provide the classroom space and training staff. The loan will finance the purchase of course materials, including instruction booklets and solar water heating units for classroom or field drill.

(d) Research and development in alternative energy resources

The purpose of this Project component is to support Jamaica's search for indigenous alternative energy resources which might be profitably exploited.

The Project will assist the GOJ to assess those indigenous alternative energy resources which appear to have a reasonable possibility of providing significant amounts of energy and which are not already being assessed with the assistance of other donors. The Project will concentrate principally, although not exclusively, upon solar technologies. One principal element of this Project component will be assistance to the Solar Energy Institute at CAST, which is now in its inception stage. Other assistance will be provided in assessing the feasibility of programs in solar crop drying, photovoltaics, solar ponds, solar cooling, ocean thermal energy conversion, wood and charcoal and refuse. Loan funds will also be provided for prototype testing of technologies in the experimental stage, when the initial assessments indicate such testing is justified.

(i) CAST Solar Energy Institute

CAST is establishing on its campus a Solar Energy Institute (SEI). The Petroleum Corporation of Jamaica (PCJ) has made a grant of approximately \$150,000 for the construction of a new building to house the Institute. The remaining funds required to construct the building (approximately \$130,000) will be either raised by PCJ or provided directly by that organization. The Institute is expected to become a center of excellence for training and practical research and development on operational solar programs which can be implemented in the relatively near term. While a limited amount of basic research will be done, the emphasis of the Institute will be on training of personnel and research directed at making technology available to consumers in as short a time frame as possible.

The Institute will be headed by a full-time professional Jamaican and will be staffed with other faculty members from CAST, some of whom will be newly hired for the Institute. CAST will also provide supporting staff and general operating costs for the Institute. The loan will fund 12 person months of solar energy specialists who will help to advise on the program content as well as carrying out the work of the Institute. The loan will also fund specialized equipment, one vehicle and will provide short-term training to a number of faculty members.

SEI will work on a wide range of solar energy matters. Initial efforts will be on proven technologies, such as testing and adaption of solar water heating systems to improve those available on the Jamaican market. CAST, as described elsewhere, will establish a training course for system installers to assure an adequate number of well-trained installers to install and maintain the solar units.

The Institute will also conduct a small program of experimentation with photovoltaics and will become the organization in Jamaica responsible for keeping up on current developments in this fast-evolving new technology.

Loan funds will also be provided under the EIC program (described above) to purchase the required solar energy library for SEI.

(ii) Solar crop drying

Solar drying of agricultural commodities already is practiced in Jamaica in the barbecue method, wherein products are spread on an open hard surface, such as concrete, and exposed to direct sunlight. This method is very suitable for reducing moisture content down to approximately 20%, but drying below this level is slow and the products are exposed to the risk of rewetting by rain showers. A modification of this method in common use is drying in transparent buildings, where the roof and walls of a drying building are enclosed with a transparent cover. Products are spread on the floor, as with the barbecue, and air circulates within the enclosure by free or forced convection. The rate of drying and energy efficiency are lower than in the barbecue method but the crops are protected from rain.

Although these solar drying methods are widely used in Jamaica and are to be encouraged, they are not very effective in reducing moisture content of the products down to 10-15% which is required for long term storage without deterioration or spoilage.

After initial drying to around 20% moisture content, some products are finish dried in beds or rotating draws using forced air heated by diesel fuel or liquified petroleum gas. However, many commodities must be sold at very low prices during harvest season because facilities do not exist to preserve them by drying, and some are merely allowed to spoil, thereby creating shortages after the harvest season has passed.

Jamaica's agricultural performance has deteriorated by an estimated 30% between 1966 and 1975. Production did not keep up with demand, and consequently food imports rose as a percentage of consumption from 16% in 1950 to 26% in 1974-1975. Studies show that the agricultural sector has the best possibilities for expanding national output and foreign exchange earnings in the coming years, and this growth could be given substantial assistance by introduction of new solar drying technology.

While liquid solar collectors are used for water heating, air type solar collectors are generally more suitable for crop drying because warm air is the drying medium desired. A feature of air type collectors is that they can, because of their design simplicity, be constructed more cheaply and be assembled at the construction site, if desired. Technically, the development of solar air heaters is still in its infancy. Although the designs are relatively straightforward, the selection and optimization of materials is a very significant problem area and the most efficient configurations for solar collector, heat storage and product-supporting components have yet to be determined.

Many ingenious schemes have been proposed for collecting solar heat to dry many different products. Work in this area is underway throughout the world, and a natural result of this diversified situation is that the dryers employ configurations, materials, and working strategies which are adapted to their respective geographical areas. For example, latitude and local materials strongly influence dryer designs. Therefore the first step in establishing solar crop drying program is to undertake research to develop data and information to advance the technology of solar crop drying with specific emphasis on the commodities and climate in Jamaica and make this information available to interested parties and organizations throughout the nation. Three specific tasks are needed of which two are presently being carried out to some degree by MME assisted by a commercial firm (Appliance Traders) and the Jamaica Industrial Development Corporation (JIDC).

Review of equipment, technology and designs

A thorough review of solar dryer technology throughout the world will be conducted by the ED with assistance from the long-term alternative energy advisor. Data will be gathered and organized by type of product dried, such as grain, coffee, cocoa, cassava, tamarin, peanuts, peas, peppers, lumber, fish, etc. The ED has initiated this task and the existing base information will be incorporated into the present findings. Loan funds (\$2,000) will be used to purchase publications and literature needed for this work.

Materials and solar air heater development

Candidate glazing and absorber materials will be subjected to long term weathering tests in the environment of Jamaica for the purpose of identifying those materials and structural combinations which can give adequate performance and operating life. Tests will be carefully designed to provide air cooling which simulates normal use and to provide periods of no air flow which simulate exposure to stagnation operating conditions. Test modules of solar air heaters will be constructed and evaluated with respect to efficiency of energy capture and

conversion. The solar air heater designs tested will include systems suitable for application in farm and industrial dryers, using both free and forced air flow.

The ED will contract this testing activity to Appliance Traders, JIDC, SRC, or other suitable organizations that have the facilities to carry out the implementation as designed. Loan funds (\$45,000) will be provided to purchase material needed for testing.

Small drying unit development

At present, ED, assisted by Appliance Traders and JIDC, are developing prototypes of small drying units suitable for use on farms and in homes. These systems are designed to handle product charges of about 50 to 200 pounds and are being constructed from readily available materials. Successful designs will be made widely available to the public through the PEP, using brochures, pamphlets and newspaper articles. This activity is presently on-going, but the alternative energy advisor will provide guidance to the staff implementing this. Loan funds (\$24,000) will be provided to purchase the materials needed for prototype building and construction.

Industrial solar drying of agricultural products

The purpose of this activity is to motivate industrial food processors in Jamaica to purchase materials and supplies for solar drying experiments on their respective commodities. It is anticipated that this incentive will encourage industries and agricultural organizations to undertake solar drying development.

The industries and agricultural organizations are best qualified to develop drying technology for their own products because they understand the properties of their products, the ways in which they could implement solar drying in their operations and the economics of their markets. The Project will provide low-interest loans to a few industrial organizations to implement solar drying technology on a commercial scale after they have completed satisfactory demonstrations.

The organizations which will be involved in this activity are the Agricultural Marketing Corporation, MFV Limited, Grace Kennedy Ltd, Tanners Ltd., National Institute of Crafts and Coffee Industry Board. Two tasks have been designed to be implemented by the ED using loan funds.

Industrial solar drying development grants

Approximately six grants will be made to agricultural industries or organizations in Jamaica. The grants are to be used for purchase of materials, supplies and equipment to construct and test solar drying hardware capable of drying about one-half to one ton per day of an agricultural commodity or other commodities such as lumber, leather, fish or meat. The grants will be awarded on the basis of written proposals and will not exceed \$20,000 to any organization. Recipients will supply the labor required to carry out their projects. The alternative energy advisor will assist ED in preparing the request for proposals and in determining the selection criteria and formal selection. A total of \$120,000 in loan funds will be provided for this activity.

USAID ended its assistance to a major forestry project in 1978, but the present Forestry Department is understaffed as a result of a reorganization which took most of the staff from that Department and transferred them to FIDCO, a Government-owned commercial firm responsible for developing commercial (but non energy) uses of forestry products. The Forestry Department has been unable to give major attention to the potential energy uses of forestry resources.

A three-months loan-funded consultant will be provided to undertake a complete assessment of forestry resources for energy uses. The consultant will ascertain the present market and consumption of charcoal and firewood, evaluate the cost and pricing structure of those fuels and indicate those economic factors which are likely to effect the development of wood fuel for rural and urban consumption. The consultant will recommend what steps the GOJ should take to develop its forestry resources for energy uses.

Assistance will also be provided to a GOJ experimental program to determine the feasibility of planting and harvesting fast-growing tree species. The research program will establish 40 hectares of trials over a two-year period and test a variety of species to determine those tree species which are suitable as an efficient source of fuelwood and determine the technical base for growing selected species. An advisor provided by the United Kingdom is responsible for the overall research effort of the Forestry Department but is not able to spend the time required to manage an experimental program to ascertain the feasibility of fast-growing tree species. USAID will provide a loan funded forestry research specialist for a two-year period to direct this experimental program which will include a review of the potential for using indigenous varieties. He/she will work with a Jamaican counterpart and a Peace Corps Volunteer in the implementation of the program. Short-term training in the U.S. will be provided to the Jamaican counterpart. In addition, loan funds will finance two 4-wheel drive diesel vehicles and trailers and related equipment and spare parts which will be used to provide transportation to the project sites, which are often located in remote areas. Once the research program has identified the fast growing tree species, the GOJ will establish fuelwood plantations which will provide fuelwood for a variety of energy users.

(iii) Assessments of other indigenous alternative energy resources

As Jamaica develops its alternative energy program over the next five years, the GOJ will need to evaluate the potential of various alternative energy resources and decide which should be seriously pursued and given priority.

Loan funds will be provided to fund 12 person months of short-term consultants to assist the ED assess a variety of indigenous alternative energy resources such as photovoltaics, biomass, solar ponds, solar thermal, solar cooling, ocean thermal energy conversion, refuse and others. (Funds for an assessment of Jamaica's forestry resources are provided elsewhere). The ED, with the assistance of the loan-funded consultants, will prepare detailed scopes of work for the assessments and will have overall responsibility for carrying them out.

In addition to the short-term consultants, \$120,000 in loan funds is provided for purchases of equipment and supplies needed to carry out testing of prototype technologies which may result from the assessments. The Project will not fund replication of these technologies. Should an assessment and/or pilot activity involving prototype testing demonstrate that a particular technology merits replication, the GOJ will seek additional funding from other sources. AID may consider a follow-on loan to fund replication of selected and proven alternative energy technologies.

(iv) Forestry resources

Jamaica's forests are one of its potentially most significant alternative energy resources. Jamaica has been fortunate to have avoided so far the kind of deforestation found in many Africa countries and in neighboring Haiti. However, with the increasing price of petroleum making kerosene and butane (used by approximately 50% of the rural population for fuel) too expensive for the poor, Jamaica will have to turn more to its indigenous forestry resources in the future, with its resulting implications for deforestation.

(v) Alternative Energy Demonstration Centers

Increasingly, rural people are having difficulty obtaining energy at affordable prices. For example, about half of the rural people use wood or charcoal for cooking, the other half use kerosene or a similar petroleum product. These fuel sources will be in increasingly short supply in the future due to increased demand for them and escalating prices. Alternative energy technologies, as they are developed in Jamaica, can provide important sources of energy for the rural areas. In order to assure that rural people learn of these technologies and their potential, the GOJ plans to establish a series of Alternative Energy Demonstration Centers in rural areas where alternative energy technologies will be demonstrated and programs developed for their dissemination. These centers will prove the value of alternative energy technologies to rural consumers by providing hands-on experience, showing rural residents that these technologies work and can improve the quality of their lives.

One Center will be established as a pilot project in a carefully selected village or town. The Center will be attached to an existing agency in the identified community, a Ministry of Agriculture extension office, an agricultural school, 4-H club or similar organization. The Center will be staffed by a full-time Jamaican technician who will receive special training in alternative energy technology and demonstration techniques. A Peace Corp Volunteer (perhaps two) will also be assigned to the Center. The Center will have sufficient space to demonstrate various technologies. The Center's staff will demonstrate the alternative technologies both at the Center itself and in various places around the community.

A number of Jamaican organizations are involved in developing low-cost alternative energy technologies - the SRC, CAST, UWI, Forestry Department, as well as private sector businesses. Technologies which are available at the present time for demonstration include solar water heaters, experimental solar crop dryers, improved charcoal kilns and biogas generators. During the life of the Project, other alternative energy technologies (e.g. wind mills for pumping water, improved charcoal cookstoves, solar ovens, etc.) are expected to come on stream and be ready for demonstration at these Centers.

The Center will keep their devices operating continually, providing a model for people to see. Once the rural people see the successful operation of the models, they will want to take advantage of the product, especially if it is affordable or financing can be arranged. Thus, the demonstration strategy will lead to a generation of demand for these alternative energy technologies, especially when combined with commercial advertising and media publicity. The Center will provide an excellent opportunity for the agencies developing prototype alternative energy technologies to see if their design will be accepted by consumers or what type modifications need to be made in order to achieve this acceptance. Linkages with these agencies will be coordinated through the ED.

With demand generated, the Center will become a focal point for dissemination efforts. The Center staff will coordinate a program of hands-on workshops where interested persons will receive training in how to construct, operate and maintain these products. Two streams for this dissemination are planned: some sessions will be directed at residents who want to install the product for their personal use; others will be focused on village-level entrepreneurs who want to develop a business centered on these technologies.

Various kind of printed material will be prepared for the rural audience to explain the functioning of these alternative energy technologies.

Loan funds will finance a three-months consultant to help establish the first pilot Center and another consultant for 2 months to provide assistance in developing the seminars and printed material. A loan-funded vehicle will also be provided. The GOJ will provide the full-time staff person, space for the Center and demonstration models of the alternative energy technologies to be demonstrated. An evaluation of the Center will be held after six months of operation. If it appears that this demonstration technique is effective, six other Centers will be established in rural areas and the GOJ will establish a credit fund of the Jamaican dollar equivalent of \$250,000 to provide low-interest loans to persons wishing to purchase the technologies.

USAID assistance under this loan will be limited to assisting the GOJ to establish the first pilot center by providing TA and a vehicle, and in the evaluation of the center after the first year of operation.

Phase II

Private sector auditing and retrofitting program

The technical aspects of the private sector auditing and retrofitting program will be the same as the public sector program. The audits and preparation of proposals will, however, be carried out by private engineering consulting firms and funding for the retrofitting will be provided through a credit fund to be established in the National Commercial Bank (NCB). (Details of the policies and procedures of the credit fund are provided in Annex K.) The auditors employed by the private sector engineering consulting firms will be trained in several short courses to be developed at CAST with the assistance of a one-month loan-funded consultant. Private sector firms will directly engage the services of engineering consulting firms to provide the auditing and technical assistance required to develop a proposal for retrofitting. That proposal will then be submitted to the NCB for funding.

Energy consumption records before and after the retrofitting will be obtained and the project will be monitored by the ED for at least one year. This will enable the true savings to be determined in order to better refine future ECO evaluations and also to serve as information for publicity and public education programs for energy conservation.

This credit program will serve as a demonstration program for the rest of the private sector. The Project will demonstrate energy conservation opportunities, and, as it is carried out, it is expected that other industries will implement similar retrofit programs. Since the Project will also foster development of conservation equipment industries in Jamaica (see next section), it is expected that the percentage of Jamaican materials used in the retrofits will gradually be increased from 20% to 30% over the Project. The result of the Project will be significant reductions in the energy consumption of the Jamaican industrial and commercial sector.

Loan funds (\$3 million) will be provided to establish the credit fund and will be used largely for foreign exchange costs of the retrofitting. The GOJ will provide the Jamaican dollar equivalent of \$4.2 million for the local costs of the retrofitting.

During the design of this Project, careful attention was given to the question of whether private sector firms would be willing to borrow money to carry out energy retrofitting programs. During the economic decline of the past several years, Jamaican firms have invested little in their own improvement and expansion. Interviews were held with a number of representative firms, with all Jamaican private sector business organization (PSOJ, Jamaica Manufacturers Association, Jamaica Exporters Association, etc.) and with a number of key business leaders. The opinion was virtually unanimous that Jamaican firms, partly due to the improved investment climate resulting from the October 1980 election results, could be motivated to borrow money to undertake energy retrofitting programs if they could be shown that it was in their own best interest. The USAID's judgement is that a major public education effort combined with a subsidized interest rate will be sufficient to assure that the credit fund is utilized.

Low interest loans for commercial solar drying

Low interest loans will be made available through the NCB to two or three agricultural organizations or industries in Jamaica for construction of commercial solar drying equipment. The projects may be outgrowth of the solar drying development grant program described above or may be independently developed. They may include any commercial system using solar heated air such as solar pre-heating of combustion air or solar heating of makeup air for transparent building dryers. The loans will not exceed \$30,000 to any single organization. A total fund of \$200,000 will be allocated to this activity, \$100,000 from the AID loan and \$100,000 from the GOJ. The ED in consultation with NCB will develop the terms for the loan fund.

The research and materials testing activities will be conducted during the first two years of the Project since two harvests will be necessary to construct and evaluate the solar agricultural drying system. The grant and loan programs will be carried out during the second through the fourth years of the Project.

Industrial/commercial solar water heating program

The industrial sector uses large amounts of hot water in the form of process heat, cleaning and other uses, much of which is generated by electricity. The commercial sector also uses substantial amounts of hot water, principally in the hotel industry. At least one hotel has installed a solar hot water system to serve its laundry facilities, but no industrial solar hot water system is known to exist in Jamaica at this time. Economic studies have shown that solar water heating in industrial and commercial firms which use electricity (or LPG) for heating their water is feasible.

A loan-funded consultant will be provided for three months to evaluate several privately owned industrial plants and commercial buildings to identify those sites where installation of solar water heating appears feasible. The consultant will work closely with a private consulting engineering firm and provide on-the-job training to engineers from that firm. The evaluations will include inspections of the physical arrangements and structural characteristics of the buildings, hot water requirements, present water heating equipment and fuel used and the economics of a solar unit to supplement or replace the existing system. The results of these evaluations will be provided to the plant or building owners who will be encouraged to have a system design performed by a commercial architect/engineering firm and to apply for a low-interest construction loan when these evaluations indicate high feasibility.

A credit fund of \$1 million from loan funds will be established in the National Commercial Bank to provide loans to those industrial and commercial firms which elect to install solar water heating systems. The GOJ will provide the Jamaican dollar equivalent of \$1.3 million to the loan fund for the local costs of the projects.

Completion of this project will result in the installation of at least 15 commercial or industrial solar water heating systems in Jamaica. This will result in another large scale demonstration of solar water heating technology.

Private sector solar water heating program

This program is divided into two: residential and industrial/commercial.

Residential solar water heating program

An estimated 30,000 residential water heaters exist in Jamaica today, about two-thirds of which are electric. In 1980, the electric utilities company, Jamaica Public Service Co. (JPS), surveyed 10,000 of its customers to determine how many would be interested in converting their water heating systems from electric to solar and over 600 responded positively.

Under the Project, \$500,000 in loan funds will be provided to the National Commercial Bank to be supplemented by a GOJ contribution of the Jamaican dollar equivalent of \$900,000 to establish a low-interest credit fund from which homeowners can borrow money to install solar water heating systems. Each system will cost approximately \$2,000 and the loans will be paid back in 3-5 years, thus establishing a revolving credit fund. Local firms will manufacture and install the systems. (See Annex K for details of the credit program). This program will provide for the installation of approximately 700 solar water heating units and will be carried out during the first three years of the Project.

It is expected that this program is large enough to serve as a demonstration project and that it will stimulate local industry to invest the capital and personnel resources necessary to build a viable industry and to convince the public that solar water heating is more than a technical novelty.

A major publicity campaign, to be jointly carried out by ED, JPS and the National Commercial Bank, will support this effort and make the results of the program widely known to the public.

Successful implementation of this program will have the following beneficial results:

- develop public acceptance of residential solar water heating.
- stimulate manufacturers to create a viable industry for manufacturing solar water heating systems in Jamaica with possibilities for export to other Western Hemisphere countries.
- install 700 solar water heating systems in Jamaica with subsequent savings of imported petroleum.

C. Summary of outputs

At the completion of the five-year Project, the following outputs will have been achieved:

- An Energy Division which is fully staffed, trained and capable of planning and directing a nation-wide energy program with a minimum of outside technical assistance.
- A revised National Energy Plan.
- A National Energy Accounting system based on sectoral energy surveys.
- A fully staffed and operational Energy Information Center providing necessary energy information to GOJ organizations and private sector individuals and firms.
- A comprehensive energy conservation plan.
- A fully staffed and operational Public Education Program providing energy information to consumers and all energy users.
- All Government facilities (with the exception of the public transportation sector) audited and retrofitting programs carried out. Public sector will be a model of energy efficiency with savings of over 15% in energy usages realized over the five-year life of the Project.
- Energy auditing and retrofitting firmly established in the private sector as routine and necessary investments.
- Energy consumption reduced in those firms which were retrofitted by a minimum of 15%.
- The retrofitting credit fund operating effectively with the entire USAID and GOJ contributions to the fund disbursed, with loans being repaid, and the revolving fund firmly established.
- An energy conservation manual for the construction industry prepared and its findings disseminated in a series of seminars. The construction industry will have initiated programs in energy conservation based on the recommendations in this manual.
- A GOJ long-term strategy for the development of its indigenous alternative energy resources in place, with clear indication of priorities.
- Solar water heating firmly established as a viable alternative energy technology and a national-wide demand for solar water heating systems created.
- Solar water heating systems installed in 10 Government-owned hospitals, 5 government-owned hotels and 5 public sector enterprises.
- Solar water heating units installed in 700 residential homes.
- Solar water heating systems installed in 15 industrial/commercial firms.
- Jamaican standards for solar water heating developed.
- A system for collecting meteorological data for solar energy programs established, based on 10 climatic stations located around the island.

- All indigenous alternative energy resources assessed and prototype testing programs started for those technologies which appear promising as significant sources of alternative energy.
- The Solar Energy Institute at CAST firmly established, fully staffed and equipped and operating effectively.
- The solar crop drying program producing products for commercial use.
- One alternative energy demonstration center established and operating effectively, demonstrating alternative energy technologies in the rural areas.

FINANCIAL SUMMARY

	PHASE I		PHASE II	
	<u>FX</u>	<u>IC</u>	<u>FX</u>	<u>IC</u>
<u>PROGRAM PLANNING</u>	1363	114	-	
TA-long term	560	-		
Training	281	60		
Energy Info. Center	451	54		
Econ. Planning	71	-		
<u>CONSERVATION</u>	1788	55	3653	-
TA-long term & short	347	-		
PEP	211	20		
Mobile Unit	23	2		
Pub. Sec. Aud + Retrofitting	1061	33		
Priv. Sec. Aud +Retrofitting	72	-	3000	-
Energy Conser. Ind. Dev.	33	-	653	-
Energy Conser. Manual	41	-	-	-
<u>ALTERNATIVE ENERGY</u>	3686	120	2254	220
TA-long-term - Trg. Veh.	995	60		
Pub. Sec. Solar Wtr Htg Prog.	1530	-		
Pr. Sec. Solar Wtr. Pg.	-	-	1530	-
Standards: Solar Wtr. Ind.	91	-	-	-
Meteorological Data	90	-	-	-
Expansion of Solar Ind.	-	-	623	-
Training Installers	41	-	-	-
Res. + Dev.	879	60	101	220
CAST	(370)	-	-	-
Solar Crop Drying	-	-	(101)	(220)
Assess. of Alt. Energy Res.	(199)	(60)	-	-
Forestry Resources	(310)	-	-	-
Alt. Energy Demo Centers	60*	-	-	-
<u>TOTAL PROJECT</u>	6837	289	5907	220
<u>TOTAL PHASE</u>	\$7.126 million		\$6.127 million	
<u>CONTINGENCY</u>	.374		.273	
<u>GRAND TOTAL</u>	\$7.500		\$6.400	

IV. A. Economic Analysis

Introduction

In order to demonstrate that the activities to be undertaken in this project are economically feasible, it is necessary to demonstrate, first, that they are privately feasible, that is, that the economic actors involved have an incentive to do the things the project expects them to do, given the private costs they face, the private valuation of the benefits they receive, and the value of discount they apply to future benefits and costs. As a second step, we will attempt to demonstrate social feasibility. Given that individuals will undertake the activities promoted by the project, we will attempt to show that they ought to do so, that the activity is worthwhile given the pattern of social costs and benefits faced by Jamaican society. Finally, we will examine the sub-projects (promotion of residential solar hot water, for example) as projects, taking into account management overhead, dissemination and evaluation costs. Even if solar hot water installation is privately and socially worthwhile as an activity, it does not immediately follow that every project designed to promote it is necessarily worthwhile. Finally at each stage of the analysis we will attempt to show that the conclusions about the feasibility of the activity are robust with respect to key assumptions about unknown and unknowable future developments.

I. Solar Hot Water Installation

1. Private Feasibility of Residential Solar Water Heating

In many ways, residential solar hot water is the simplest aspect of this project. Solar water heaters are available in Jamaica at the present time and their costs and general characteristics are known. Some uncertainty may exist with respect to future real prices of solar units as longer production runs may make possible lower unit costs. For purposes of this analysis, however, we have assumed that prices of solar units will remain constant in real terms.

At present, there are 20,000 household electric water heaters in Jamaica consuming an average of 2,783.3 kwh per year. The user cost of electricity in Jamaica, as elsewhere, is determined by a complex tariff schedule which relates the charge to the level of usage and type of customers. As part of its Preliminary Energy Sector Assessments of Jamaica, Energy Systems International (ESI) carried out an analysis of electricity tariffs and prepared recommendations for a marginal cost pricing system. According to the present tariff schedule, residential usage of 101 to 300 kwh per month is charged a marginal rate of J\$.1101 per kwh plus a fuel adjustment charge which varies month by month. For March 1981, it was 14.46¢ per kwh. Usage from 301 to 500 kwh was charged J\$.07 plus the fuel adjustment and over 500 kwh was charged J\$.0625 per kwh plus fuel adjustment. Converting to a US dollar numeraire gives a start-of-project charge for electricity of US\$.1455, US\$.1226, or US\$.1183, depending on the level of electricity usage.

The purchase price of a solar hot water heater, of course, varies with its size. At present, Jamaica Appliance Traders Ltd. quotes an installed price for a 40 (imperial) gallon system of J\$1870, including all taxes, for a 60 gallon system the price is J\$2435; 80 gallon, J\$3320; and 120 gallon, J\$4169. It is anticipated that the systems financed under the project will be a mixture of 40, 60 and 80 gallons systems. In the computations that follow, a 60 gallon is taken as representative.

There is, at present, a 37½ percent tax on water heaters in Jamaica in addition to the sales tax. There is a strong indication that the GOJ will remove the water heater tax on solar water heaters. We will examine the private feasibility of solar installation with and without the tax.

To some extent, the private attractiveness of a solar system depends on whether the solar system is used in addition to, or as a replacement for, an existing electric system. A solar-only system avoids the cost of maintaining and ultimately replacing an electrical backup system. This saving is achieved, however, at the cost of a degradation of service after a succession of heavily overcast days or when heavy demands are placed on the system. Hence it will be assumed that an electric system is maintained as a backup and that it is used some of the time. It will be assumed that these additional costs approximate as well the implicit cost to the user of service degradation in the absence of a backup system.

To recapitulate, we will examine private feasibility of a 60 gallon system with and without remission of the 37½% tax at each of the three electricity tariff levels on the assumption that a saving equivalent to 85% of electricity usage will be realized. We will also assume a 15 year useful life for the system, at the conclusion of which it has no scrap value.

TABLE I.1

Private Rates of Return to Residential Solar Water Heating

	Annual Electricity Savings	Private Internal Rate of Return
60 gallon system including tax US\$1,391		
Marginal Electricity Rate: US\$.1455	344	.237
.1226	290	.194
.1183	280	.186
60 gallon system without tax US\$861		
Marginal Electricity Rate: US\$.1455	344	.397
.1226	290	.332
.1183	280	.320

The results of this examination are summarized in Table I.1. It is clear from the table that even if the tax on water heaters continues to be applied to solar heaters, the private rate of return on an investment in a solar water heater shows very attractive rates of return of 18.6% to 23.7%. If the tax were to be removed, the rate of return would then be an extremely attractive 32.0% to 39.7%.

TABLE 2

Sensitivity of Private Feasibility to
Decline in Real Electricity Prices

	Electricity Savings	Private Internal Rate of Return
60 gallon system including tax at constant marginal electricity rate of: US\$.1455	US\$ 344	.237
.1226	390	.194
.1183	280	.186
60 gallon system including tax at electri- city rates - 10% lower in real terms than at present	Initial Savings	Rate of Return
US\$.1323	313	.212
.1115	264	.172
.1075	255	.165
60 gallon system including tax with rates 20% lower in real terms than at present	Initial Savings	Rate of Return
US\$.1213	287	.191
.1022	242	.154
.0986	233	.146

TABLE 3

Sensitivity to Lower than Expected System Performance

	Percent Electricity Savings	Annual Electricity Savings	Internal Rate of Return
60 gallon system including tax at marginal electricity rates of US\$.1183	85%	US\$ 280	.186
	75%	247	.158
	50%	165	.082

Sensitivity to Alternative Assumptions

In addition to uncertainty about the continued application of the water heater tax, there are a few elements of uncertainty about the residential hot water system which the buyer must face. Chief among those will be the future real price of electricity, presumably because of variations in the real price of imported petroleum. Some may take it as given that real petroleum prices will continue to rise steadily in the face of exhaustion of finite oil deposits. It has been argued by others that, while perhaps rising over the long term, short-term world price movements in this century have been characterized by short periods of rapid upward movements followed by long periods of slow decline. Table 2 illustrates the effect on the private attractiveness of the solar heater in the with-tax case if electricity prices should prove to be 10% and 20% lower than those at present. Here it can clearly be seen that the solar heater continues to show an attractive real private return of 14.6% even with a continuation of the water heater tax, at the lowest marginal residential electricity rates and with a 20% decline in real electricity rates.

The final area of uncertainty to be examined relates to the performance characteristics of the system in actual installation and usage. It is presumably because of uncertainty on this score that we have this sub-project at all. On paper the residential water heater appears to be a very attractive investment even with a continuation of the water heater tax, and in the presence of marginal electricity rates which are significantly below the marginal cost of providing service (estimated by EST of J\$.1167 plus the fuel adjustment or, currently J\$.2613 or US\$.1493). Nonetheless, despite the fact that, for the moment, loans are available at interest rates below the anticipated rate of inflation, demand for solar water heaters has been less than overwhelming. Presumably, potential buyers suspect that performance on their roof tops will be less than that projected, because of defects either in manufacturing or installation.

Although in a sense, the entire purpose of this sub-project is to convince purchasers that such fears are exaggerated, it must be candidly admitted that there may be some validity to them. In Table 3, estimates of the private rate of return are presented for the case in which, with a continued application of the water heater tax and of the lowest current electricity rate for the cases of saving only 50% and only 75% of present water heated electricity. It is clear that the private rate of return, while still positive and therefore greater than present interest rates on loans is much less attractive. If there is a significant risk to the success of the project in promoting this solar technology, it would appear to be here, in the area of quality control.

2. Social Feasibility

Determining the social feasibility of a project is essentially a process of replacing market prices with prices reflecting true social scarcities where the two are believed to diverge. In Jamaica, there are a number of likely candidates for such replacement. These include unskilled labor, which is clearly in excess supply, foreign exchange, whose allocation is tightly controlled by an administrative process, electricity rates, which do not coincide with the marginal cost of producing electricity, and finally the discount rate itself where for a variety of reasons, the social opportunity cost of capital diverges both from the market rate of interest and the anticipated private rate of return on investment projects.

a. Shadow Prices

(1) Foreign Exchange - At present, foreign exchange in Jamaica is rationed through a tight exchange licensing system, clear evidence that there is a social premium on foreign exchange. At the same time, there exists a relatively thin black market on which the US dollar is reported to command a premium which varies throughout the year but which averages about 30%.

On the other hand, Jamaican authorities firmly assert (and apparently the IMF agrees) that, in the long run, the Jamaican dollar is appropriately valued in terms of its purchasing power parity. To shadow price foreign exchange at a rate different from its market rate, therefore, it would be necessary to specify both the level of the premium to be attached to foreign exchange and the pace of which it is to be eliminated. Specifications of either element would be quite arbitrary. At the same time, approximately 18% of the social cost of solar water heating is foreign exchange cost while considerably more than half of the savings in electricity costs represent foreign exchange savings. Thus, a failure to shadow price foreign exchange in the early years of the project tends to understate project net benefits in the first years of the project. We have chosen here to go with this understatement rather than attempt to specify a year by year shadow price and risk overstating the project's net benefits.

(2) Unskilled Labor - Unskilled labor is clearly in excess supply in Jamaica while a lack of skilled and professional workers of various kinds has been an obstacle to economic recovery. In fact, very little unskilled labor is involved in the production of solar water heaters and no correction is being applied. In the cases where the unskilled labor component is significant, following the practice of recent IBRD and IDB projects, a 50% discount would be appropriate for the unskilled labor component.

(3) Electricity Costs - While petroleum product prices in Jamaica (exclusive of tax) closely follow world-market prices, electricity tariffs continue to apply a "declining block" prices structure which applies below marginal cost prices to high rate of usage. However, ESI, as part of its study recommended a conversion to a marginal cost pricing system. ESI computed the marginal cost of delivering electricity to residential customers at J\$.11669 kwh plus the value of the fuel adjustment, which in March 1981 was J\$.1446 combining these two costs and converting to US dollars gives a cost per kwh of US\$.1493 per kwh.

(4) Social Discount Rate - For reasons which are not entirely clear, the multilateral development banks have diverged in projects in recent years in their estimate of the Jamaica discount rate. The IBRD has used 11% while the IDB has used 12%. We have chosen to follow the IBRD's lead.

b. Social Feasibility of Residential Water Heaters

The installation cost of the 60 gallon water heater, net of tax, is US\$783. If there is a net saving (including maintenance costs) equivalent to 85% of the average electricity cost, and usage of electricity for hot water averages 2783.3 kwh per year, this gives an annual social savings of US\$353 per year. Again assuming a 15 year useful life, and no scrap value, this investment has an internal rate of returns of .449. Even if cost savings should be as low as the equivalent of 50% of electricity costs, the social rate of returns to this investment is still .257. Rates of return, of course, are similarly robust with respect to variation in real energy prices.

Finally, for purposes of determining overall project feasibility, it is necessary to compile the net present value per water heater of an investment in residential solar water heating. At an 11% social discount rate, this is US\$1755 per water heater, for a benefit of \$2438 per water heater.

II. Social and Private Feasibility of Industrial, Commercial and Public Sector Solar Water Heating Applications

While the structure of the project distinguishes between private and public sector solar applications, there is little reason to distinguish them analytically except insofar as private industrial and commercial applications require that we demonstrate that, at market prices, private firms will have sufficient incentive to adopt these specific technologies.

A. Private Feasibility

Table II-1 summarizes the results of eight feasibility studies for the application of solar water heating technologies to hotels, hospitals and industrial establishments. These are private feasibility estimates based on market prices. The first four columns of the table refer to the costs and returns of a complete replacement of fossil fuel heating by solar heating. The last four columns refer to the characteristics of a minimum cost (or maximum rate of return) system that replaces some fossil fuel heating. Because beyond some point, the cost of a solar system rises more rapidly than its output, the higher rate of return system is smaller, frequently much smaller, than the full replacement system.

It may be useful to point out here that a rational businessman or public sector decision maker will seek to maximize total profit, not rate of return. Indeed, this is almost a textbook example of a case in which rate of return maximization is not consistent with profit maximization because we are considering mutually exclusive projects of different magnitude. Carrying out the smaller rate-of-return project precludes carrying out the larger project (there is only one rooftop). The size installation which maximizes profits is that with the largest net present value (if borrowed funds are freely available), or the largest net present value per unit of investment funds if there is a credit constraint.

Returning to Table II-1, it appears that the rate of return from replacing electricity and LPG heated water with solar heating have a very high private rate of return and in general the 100% replacement will be financially attractive. The case of diesel fuel water heating is more marginal although, at current interest rates, entrepreneurs may find it attractive to do so. Given the rate of return of alternative investments, implicit in the social discount rate, it is less clear that they should replace it but this point will be discussed further below.

The replacement of water heating by bunker C oil has a very low rate of return although, at negative real interest rates, entrepreneur might find it attractive to do so.

TABLE II-1

SUMMARY OF SELECTED SOLAR HOT WATER FEASIBILITY STUDIES

Location*	100% Replacement by Solar Collector to Fossil Fuel System			Internal Rate of Return (if 15 yr. useful life)	Minimum Cost per Unit Output Solar System			Internal Rate of Return (if 15 yr. useful life)
	Collector Area (ft ²)	System Cost J.\$.	Pay Back (years)		Collector Area(ft ²)	System Cost J.\$.	Pay Back (years)	
Negril Beach Village (D)	3,570	80,400	6.7	.123	2,000	41,000	6.0	.145
Montego Bay Club (E)	2,100	58,260	2.6	.382	2,100	58,260	2.6	.382
Coconut Cove Hotel (D)	900	18,000	6.1	.141	900	18,000	6.1	.141
Trelawny Beach Club (L)	4,300	96,750	3.1	.317	2,000	41,000	2.7	.367
Intercontinental Hotel Ocho Rios(B)	3,555	78,210	17.0	neg	2,000	41,000	15.0	0
Bustamante Hospital for Children (E)	318	7,000	2.5	.397	318	7,000	2.5	.397
Cornwall Regional Hospital (E)	6,350	158,750	2.3	.433	2,000	41,000	1.9	.525
Desnoes and Geddes Bottling Co. (B)	12,700	334,000	21.0	neg	2,000	41,000	15.4	neg

*Existing fuel or energy utilized

- (B) Bunker C Oil
- (D) Diesel Oil
- (E) Electricity
- (L) LPG

B. Social Feasibility

The elements of adjustment needed to correct private rate of return estimates are similar in this case to that of the residential water heaters discussed previously. The institutional heaters differ primarily in being essentially custom made for each application as well as in requiring a substantial amount of structural reinforcement to permit their use. These additional structural costs were taken into account in estimating the case and return streams of Table II-2.

It is likely that the unskilled labor component of the institutional water heater activities will be somewhat larger than that of the residential activities because of the structural repairs which will be required. However, it remains a very small part of total costs and no shadow pricing of the unskilled labor component has been included here.*

Similarly, for reasons explained in the previous section on residential heaters, no shadow price has been applied to foreign exchange although a case could be made for one in the early years of the project.

In the case of electricity rates, the situation is similar to, but far more complex than that of residential electricity rates. The present pattern of electricity rates does not appear to be either systematically higher or systematically lower than the marginal cost of supplying that service (estimated by ESI at approximately 6.11¢ per kwh plus the fuel adjustment or, at the rate of the March 1981 fuel adjustment US\$.118 per kwh). However, the marginal rate applicable to an individual customer appears to bear very little relation at present to marginal costs. Thus, while there is no reason to adjust the overall benefit estimates reflected in Table II-1, the choice of projects during project execution will require some consideration of this divergence between electricity rates and marginal costs.

To deal with this last problem, it is intended that feasibility studies for individual installations will include a computation of internal rates of return at market utility rates and at the estimated marginal cost of supplying services. This requires only a minor modification of the current general practice of computing payback periods. The only additional data required are an estimate of the installation's useful life and scrap value if any. Care must be taken that the computation be done in terms of a constant price level but this is the usual practice. The additional computation involved in computing the social and private internal rates of return in addition to the payback period requires, at most, 10-15 minutes additional with the aid of a moderately sophisticated pocket calculator (TI-55 or similar).

With these social rates of return (that is, the internal rate of return computed using the marginal cost of electricity) projects can be roughly prioritized and those with the highest rate of return will, in general, be done first. In the case of replacement of LPG or diesel oil heaters, private and social rates of return coincide since world prices for these fuels are passed through directly to the domestic market. In no case will an installation be financially viable whose social internal rate of return is less than 11 percent.

* For example, structural repairs have been estimated by MME to make up 17.4% of the cost of installing water heating units in 24 selected hospitals. Further, in general 34% of construction costs are labor costs (and not all labor costs are unskilled). The resulting change in project costs were judged insignificant in comparison with other uncertainties about the project.

C. Sensitivity to Alternative Assumptions

In addition to possible variations in real energy prices considered in the case of residential water heating, the custom-built character of institutional systems leads to some uncertainties about construction and installation costs as well. We would consider a one-third increase and a one-third decrease to be the limits of uncertainty about the costs of these solar installations.

Table II-2 summarizes the effects of increased or decreased system costs on the attractiveness of institutional solar water heating. Similarly, the second set of figures show the effects of 20% and 40% lower system benefit, either because of lower real fuel costs, lower than anticipated system performance, or some combination of those. It can be seen that the rate of return is quite robust to those alternative assumptions.

The final line of the Table shows the effects of a "worst case" outcome where system costs are increased by one-third and system benefits are 40% lower than anticipated. Even in this case, institutional solar water shows an unspectacular but respectable .157 rate of return.

For purposes of later computations, we will be assuming a typical institutional installation costing \$80,190 and returning \$30,360 per year. Such a system has a net present value (at an 11% discount rate) of \$138,125 at the time of its installation.

III. Installation of Solar Hot Water Production Capacity

Although there is currently production of solar water heating units by the private sector in Jamaica, presently installed capacity would not be sufficient to undertake the major expansion of this sector which this project contemplates. While it may be that the additional demand produced by project activities will be sufficient to bring about increases in installed capacity or that imports can bill some or all of the gap, some portion of the project funds will be used to finance loans for the construction of such capacity. The rationale for this is that, just as homeowners and entrepreneurs are reluctant to install solar technology because they regard its benefits as unproven, so investors and bankers are reluctant to provide funds for what is perceived to be a risky technology. At the same time, imports are an important substitute for domestic capacity, particularly in the case of institutional water heating systems.

The precise economic evaluation of these loans is unknown at this time and will be developed along with the feasibility studies of the individual projects. Loans for this purpose will carry normal commercial rates (although interest rates on such loans are, at present negative in real terms and are likely to be so for some time to come). However, loans will not be approved unless their feasibility study demonstrate that they will produce a real internal rate of return of at least 11% when: (a) output is valued at the lower of the price at which it can be sold in Jamaica or the price at which a suitable substitute can be imported, and (b) unskilled labor is valued at 50% of its market wage rate.

For purposes of further analysis of the project, it will be assumed that sub-projects under this heading have an internal rate of return of 11% and therefore that the net present value of these activities is precisely zero.

TABLE II-2

Sensitivity of Solar Installation Rate of Return to
Alternative Assumptions

	Electric and LPG		
	Cost	Annual Benefits	Internal Rate of Return
Estimated System Cost	80,190	31,360	.388
Cost if 1/3 higher	106,652	31,360	.287
Cost if 1/3 lower	53,727	31,360	.583
Annual Level of Benefits	80,190	31,360	.388
20% lower	80,190	25,088	.307
40% lower	80,190	18,816	.214
System cost 1/3 higher and 40% lower benefits	106,652	18,816	.157

IV. Summary of Social Costs and Benefits of Solar Components

The overall feasibility of the solar water heating sub-project depends both on the rate of implementation and on the level of overall project cost for management, evaluation, etc. In this case, these include the cost of developing standards for solar industry, meteorological data gathering, and training solar installers.

In the case of public sector installations, the computation of project benefits is quite straightforward based on the earlier-computed ratio of benefits to costs per installation and the projected rate of disbursements. These are summarized in the third portion of Table IV-1.

In the remaining three solar components, the case is complicated by reflows and by National Commercial Bank's cost of administering the loans. Reflows have been computed on the assumption that commercial loans have a five year repayment period beginning one year after the investment and consist of five equal principal repayments. Similarly, for residential loans, a three year term has been assumed. Reflows will be reduced in real terms by the rate of inflation which is assumed to be 32.5% in year 1, 30% in year 2, 25% in year 3, 22.5% in year 4, and 20% thereafter. NCB's estimated "spread" of 4 percent is assumed to consist of 2 percentage points cost of administering the loan (a true social cost) and 2 percentage points risk premium (a transfer payment). The pace of implementation and resulting costs and benefits are detailed in Table IV-1 and summarized in Table IV-2. The net present value of Solar Sub-projects is \$14.508 million.

V. Energy Conservation Retrofitting Program

The term retrofitting, as used in this Project, covers a wide variety of activities which have as their common characteristics the fact that they achieve a saving in energy usage in return, usually for some increase in recurring expenditure (for example, by increased monitoring of air conditioning usage) or some investment. In addition, the investment may either be embodied in a piece of equipment, in which case its useful life ends with the equipments or it may be disembodied for example, an investment in personal training or procedures. Even in the latter case, however, the investment will usually be specific to a particular technology or productive process so that a change in productive techniques will render the investment obsolete.

Despite the fact that retrofitting investment typically has a limited useful life, available evidence from Jamaica and elsewhere strongly suggests that the returns on this investment are typically quite high. The Hale Report*, for example, suggests that 15% of energy usage could typically be saved by the application of measures having an average payback period of 1.5 years. While no clear indication is given in the Hale Report of the useful life of such investments, a period of seven years appears reasonable for the sort of investments mentioned.

A final point to be made is that, whether or not the recipients of energy audits and technical assistance pay for these services, these activities have a social cost which must be included as the social benefit-cost analysis. The planned approach of this project will have firms pay the cost of audit and technical assistance but to subsidize these activities, at least initially, by low interest loans.

* D. K. Hale, Energy Conservation Scheme for Industry and Commerce in Jamaica, Kingston, July 1979.

There is no rigid distinction in the project between loans to finance audit and technical assistance and loans to implement the recommendations of these activities. It is judged likely that 15% of project funds will be used to fund audit and technical assistance activities and that 85% will be used to implement recommendations.

A. Private Feasibility

Based on the diverse nature of retrofiting activities it is not possible to say precisely what activities will be financed or what their rate of return will be. Nonetheless, it is clear from the Hale Report and elsewhere the sorts of costs and benefits that can be expected. The social and private feasibility of specific activities will be developed as part of the audit process itself. If retrofiting activities have an average payback period of 1.5 years, if the audit process itself costs 15 cents for each 85 cents ultimately invested in retrofitting, and if the resulting investments have a useful life of 7 years, the internal rate of return for such activities would be .539. If the payback should be twice as long, either because equipment is less efficient than expected to because of declining real energy prices (three years under the same assumptions), the rate of return will be a still respectable .208.

All of these results indicate a very high private rate of return to retrofiting activities. This raises the obvious question, why, if retrofiting activities are so profitable they are not being undertaken already by profit seeking firms? The simplest response is that entrepreneurs are unaware of the benefits from these activities and from energy conservation in general. But this explanation is rather too simple. The idea of energy audits and technical assistance is a new one in Jamaica (and elsewhere) and the credibility of individuals and firms has not been established. While it may be well known and generally accepted that energy conservation is a "good idea", it does not necessarily follow that an energy audit by a specific group or firm will yield benefits. The establishment of the capabilities of individual firms at the present time may require an investment of management time so large as to reduce the expected benefits of searching out energy conservation activities below the expected costs.

A further reason for entrepreneurs reluctance until very recently may have been a combination of political uncertainty and the generally depressed state of the Jamaican economy. Even investments with very short payback periods will be unprofitable if the expected useful life is sufficiently short. Two factors which will affect useful life are political uncertainty (the entrepreneur may feel he may have to abandon his business and flee the country) and a shut down of operations due to lack of business. The outcome of the recent elections, combined with a spreading optimism about the recovery of the economy, may increase businessmen's willingness now to undertake conservation measures.

B. Social Feasibility

For the most part, social rate of return of energy conservation investments will be no less than and may be somewhat more than the private rate of return. This will occur, either because the projects save foreign exchange in the first years of the project, when foreign exchange is at a premium, or because the activities employ unskilled labor whose social opportunity cost is less than their wage rate. In general, the latter factor does not appear to make a major difference because only a portion of retrofiting investments will be labor costs (perhaps one-third)

and much of this will be skilled labor. The foreign exchange premium could make a substantial difference since the overwhelming majority of benefits result from savings of imported hydrocarbon, and early year benefits carry the greatest weight, particularly at very high internal rates of return.

The principal exception to the rule that social benefits to energy conservation retrofiting will exceed private benefits, will be the cases where marginal electricity rates are greater than the marginal costs of producing electricity. Although this is likely to be a fairly unusual case, the sub-project review process will include guidelines to prevent loans from being approved or public sector projects undertaken for activities whose feasibility would arise only from mis-priced electricity.

C. Installation of Energy Conservation Capacity

The valuation of that part of the project which will provide loans for the domestic production of energy conservation equipment is virtually identical to, and poses the same problems as the one discussed previously for the installation of domestic solar hot water heater production capacity. Here again, there is concern that lack of domestic capacity for the production of conservation equipment may prove to be a bottleneck to the dissemination of conservation technologies. Again, it is impossible to say at this stage, what the economic rate of return will be on the investment. The loans will carry an interest rate equal to the commercial rate of interest on similar loans. The loan review process will similarly assure that projects will carry an economic rate of return of at least 11 percent, at a constant price level for the life of the loan and measuring the value of output at the lower of the domestic price or the import price of the imported commodity.

For purposes of further computation, as in the previous case, loans for these activities will be assumed to have a net present value of zero, measured at an 11% discount rate.

D. Feasibility of the Energy Conservation Sub-project as a Project

Based on the payback period and useful life estimated above, an investment of one dollar in retrofiting will produce, on average, a stream of benefits having a present value, at the time of initiating the activity, of \$2.67. Direct project costs are set forth in detail in the "constant dollar" budget at the end of this annex. In the case of public sector conservation activities, total costs are project costs. The stream of project costs and benefits for public sector conservation retrofiting are summarized in Table D-1. Line one shows the disbursements from the capital fund, first in constant 1981 U.S. dollars and the discount at 11%. Line 2 shows other project costs including receiving costs in year 6 to year 20 which are shown at their discounted present value in year 6 then further discounted to the beginning of the project. Line 3 summarizes the stream of project benefits. Benefits are shown at their discounted present value at the time the activity is undertaken. It will be clear from the table that all project benefits shown are attributable to the investments made in the first three years. The category at "other public sector costs" incurred in years 4 through 20 are intended to give rise to further public sector retrofiting activities in subsequent years. Therefore the net present value of this sub-project (\$2,202 million) is somewhat understated. The amounts involved are relatively small, however.

TABLE D-1

Project Feasibility of Public Sector Retrofitting

	Present Value at Beginning of Project	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6-20
Capital Fund Dis-							
bursements							
1. Real	-	450	900	900	-	-	-
Present value	1,793	405	730	658	-	-	-
2. Other Public Sector Costs	-	212	170	117	69	69	496
Present value	795	191	138	86	45	41	294
3. Benefits*	-	1,202	2,403	2,403	-	-	-
Present value	4,790	1,083	1,950	1,757	-	-	-

Net Present Value of Sub-project = 4,790 - 795 - 1,793

* Benefits are shown as the discounted present value (at 11%) of the stream of benefits from an investment in year n as measured in year n. These were computed as \$2.670 per dollar invested in year n.

TABLE D-2

ENERGY RETROFITTING IN THE PRIVATE SECTOR

(000 US\$)

	<u>Years</u>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Disbursements and Reflows		720	1148	1152	2209	2821	978	919	834	722	582	409	341	280	226	179	142	114	91	75	60	
Present value of Disbursements and Reflows <u>\$7,832</u>		649	932	842	1455	1674	523	443	362	282	205	130	97	72	52	37	27	19	14	10	7	
Administrative Expenses of NCB <u>\$ 503</u>																						
Training Costs for auditors, etc.)	)	100	145	40	40	40															
Consultants )	)	90	118	29	26	24															
Energy Conservation Manual))																					
Present value <u>\$ 287</u>																						
Benefits attributed as the Present value (at 11%) in the year incurred																						
In constant 1981 US dollars		1922	3065	4411	5898	7532	2611	2454	2227	1928	1554	1052	910	748	603	478	379	304	243	200	160	
Discounted to beginning of the Project <u>\$21,892</u>		1732	2488	3225	3885	4470	1396	1182	966	754	547	346	260	193	140	100	71	52	37	28	20	
Benefits - Costs	=	\$21,892 - 7,832 - 503 - 287																				
	=	\$13,270																				

TABLE D-3

COSTS AND BENEFITS OF CONSERVATION INDUSTRY DEVELOPMENT FUND

	<u>Years</u>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Conservation Industry Development Funds			200	428	485	141	136	136	115	92	63	54	49	36	29	23	20	15	11	10	9
Present Value of Disbursements (including Reflows) <u>\$1,183</u>			162	313	319	84	73	63	50	36	22	17	13	9	7	5	4	3	2	1	1
NCB's Administrative Costs <u>\$73</u>																					
Other Project Costs <u>\$116</u>			70	30	30	30															
Present Value of Bene- fits* <u>\$1,183</u>			57	22	20	18															
Net Present Value of Sub-project	=		\$1,183	- 1,183	- 73	- 116															

-189

* Assumed equal to discounted costs as explained in texts. This value is a minimum and could be considerably higher.

The case of the private sector retrofitting fund and associated costs is a good deal more complicated. First, the fund involves loans, the amortization payments from which serve to (partially) replenish the fund. It might seem, at first consideration, that these reflows should not be counted as an additional project cost. It is clear, however, that they are. Essentially, reflows to the loan fund permit the project to recapture a portion of the stream of benefits for further reinvestment. However, if this captured portion is to be considered a part of the benefits to be attributed to the project (as it is), its reinvestment must be considered an additional project cost.

An additional project cost which must be considered are the costs incurred by National Commercial Bank in administering the loan funds. Here again, the fact that the costs are financed by capturing a portion of the benefit stream rather than through an allocation of project funds makes them no less genuine costs. According to the planned financial arrangements set out in Annex K, NCB's loan spread is 4 percent of the outstanding balance on each loan. This spread, as with any commercial bank "spread" between deposit and loan interest rates, covers the banks costs of administering the loans and a premium to cover defaults. The former is clearly a real cost while the latter is, in effect, a transfer payment from the bank to the defaulter. In the absence of more specific information, we have assumed that 2 percentage points of the spread are a compensation for administration of the loans and 2 percentage points are a risk premium.

The timing of benefits and costs for this sub-project are set out in Table D-2 and the net present value of this activity is computed as \$12,904 million. In estimating the value of reflows, inflation rates of 32.5% in year 1, 30% in year 2, 25% in year 3, 22.5% in year 4 and 20 % thereafter, have been assumed.

The final sub-project under the heading of energy conservation is the energy conservation industry development component. As explained elsewhere, this component is intended to assure that project implementation is not obstructed by bottlenecks or that profitable export activities are not foregone by lack of financing and technical assistance. While this may be extremely important to the ultimate success of the project, it would be heroic indeed to attempt to estimate at this point just how socially profitable it will be. In the loan approval process, there will be a requirement that a real rate of return of 11 percent will be demonstrated and that minimum has been assumed here.

To recapitulate then, the public sector retrofitting activities have an estimated net present value of \$2.202 million, the private sector retrofitting activities have an estimated net present value of \$12.904 million, and the conservation industry development activities have a value of \$.189 million, for an overall net present value of \$14.917 million.

VI. Program Planning, Research, Management, Public Information and Evaluation Activities

Although it is impossible to assign specific benefit streams to the activities which comprise this section, they are by no means less important than the conservation or solar technology dissemination activities with which the rest of the project is concerned. It may well be that the rate of return to energy research, or to the public information campaign will be equal to or greater than that in the other activities. What we will attempt to show in this section is ,

TABLE III-1

Present Value of Major Project Activities

	Discounted Present Value	<u>Year</u>					6-20 (present value in year 6)
		1	2	3	4	5	
Program	<u>959</u>	113	187	187	187	187	626
Training	<u>569</u>	133	175	202	122	114	22
Energy Information Center	<u>673</u>	179	132	127	102	69	381
Economic Planning	<u>300</u>	93	140	140			
Public Education							
Program (including Mobile Unit)	<u>4,468</u>	720	661	653	645	688	3,689
Research Development	<u>2,960</u>	906	687	679	375	342	1,308
<u>Total</u>	\$9,929						

that a relatively modest saving in energy usage would be more than sufficient to produce our minimum rate of return and that quite reasonable level of savings would be sufficient to produce rates of return comparable to that of the other two major components of the project.

The costs of these activities are summarized in Table III-1, including the discounted present value of project benefits in years 6-20. The total discounted present value of the costs of these activities is \$9.929 million.

In 1981 Jamaica is projected to import 9 million barrels of oil for non-bauxite consumption. At an estimated market price of \$35.50 per barrel, petroleum imports alone will amount to \$319.5 million. Ignoring the domestic variable costs of energy production and assuming that energy production in the absence of the project would remain constant, which seems unlikely, a one percent reduction in energy usage would represent an annual savings of \$3.2 million per year. A reduction of one percent appears to be a quite reasonable return to expect from the project's public education and research activities. Over 20 years, this one percent reduction would show an internal rate of return of .321. This is comparable to the rates of return in other project segments. Even if energy savings of only one-half of one percent were realized, and again assuming no increase in real energy prices, and ignoring domestic variable costs in addition to imported petroleum, the education, research and management activities would show an internal rate of return of .151.

At a social discount rate of 11%, a one percent reduction in energy usage would show a discounted present value of \$15.514 million.

VII. Summary

The preceding three sections have demonstrated the feasibility of the individual project activities both to the individual decision makers who must undertake them and from the point of view of Jamaican society. The individual activities show high internal rates of return, in the range of 30-40%, and the rates of return appear to be comparable in individual activities, suggesting a project which is well balanced among its individual components. Possible exceptions to this last point are the two production capacity building activities. However, the primary rationale for these activities is the prevention of bottlenecks in the other activities rather than being undertaken for their own sake.

Rates of return for all activities are quite robust with respect to differing assumptions. In addition, no shadow price adjustment has been made for either foreign exchange or unskilled labor, because of the uncertainty of the one and the small size of the other. Both these adjustments would, if included, lead to small further upward adjustments in the internal rates of return as calculated.

Regarding the project as a whole, we may summarize the costs and benefits as follows:

<u>Activity</u>	<u>Present Costs</u>	<u>Value of Benefits</u>	<u>Net Present Value</u>	<u>Benefit Cost Ratio</u>
Solar: Residential	2830	7860	5030	2.777
Industrial	2843	7439	4596	2.617
Public Sector	3057	8520	5463	2.787
Expansion of Solar Indus- try	1452	1300	NA	NA
Other Solar Activities	<u>429</u>	<u>-</u>	<u>NA</u>	<u>NA</u>
Overall Solar Activities	10611	25119	14508	2.367
Conservation:				
Industrial & Commercial	8988	21,822	12,904	2.436
Public Sector	2588	4,790	2,202	1.851
Expansion of Conserva- tion Capacity	<u>1372</u>	<u>1,183</u>	<u>NA</u>	<u>NA</u>
Overall Conservation	12948	27,865	14,917	2.152
Management, Public Info. and Research:	9929	25,443	15,514	2.562
Total Project	33488	78,427	44,939	2.342

TABLE IV-1

INCIDENCE OF COSTS AND BENEFITS - - SOLAR HOT WATER

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Residential Credit Fund in real terms including reflows	560	749	672	449	369	287	233	185	149	119	96	76	61	48	39	31	24	20	16	12
Present value (11%) <u>\$2667</u>	505	608	491	296	219	153	112	80	58	42	30	22	16	11	8	6	4	3	2	1
NCB's Cost of Administering Loan <u>\$ 163</u>																				
Benefits (present value) <u>\$7,860</u>																				
Industrial Credit Fund	230	376	535	710	906	317	297	272	233	187	133	110	91	73	58	45	35	30	24	20
Present Value (11%) <u>\$2,645</u>	207	305	391	468	538	169	143	118	91	66	42	31	23	17	12	8	6	5	3	2
NCB's Cost of Administering Loan <u>162</u>																				
Costs & Benefits Present value <u>\$7,439</u>																				
Public Sector																				
Capital Assistance Fund	760	1520	1520																	
Present value <u>3030</u>	685	1234	1111																	
Cons'tant	30																			
Present value	27																			
Benefits (present value) <u>8520</u>	1926	3470	3124																	
Fund Disbursement & Reflows	0	220	471	534	156	149	143	128	106	69	59	47	39	31	25	20	15	14	10	10
Present value (11%) <u>1300</u>	179	344	352	93	80		69	56	39	24	19	13	10	7	5	4	3	2	1	1
NCB's Administrative Costs <u>80</u>																				
Consultants Present value <u>72</u>																				
Presumed Benefits (present value) <u>1300</u>																				

TABLE IV-2

Summary of Solar Water Costs and Benefits

<u>Costs</u>	<u>Years</u>						6-20
	1	2	3	4	5		
Overall Solar Activities							
Standards for Solar Industry	177	24	24	24	24		
Present value	<u>227</u>	159	19	18	16	14	
Meteorological Data	102	10	10	10	10	10	72
Present value	<u>158</u>	92	8	7	7	6	38
Training Solar Unit Installers	40	10					
Present value	<u>44</u>	36	8				
Industrial Solar Costs	2,843						
Public Sector Costs	3,057						
Residential Solar Costs	2,830						
Expansion of Solar Industry Costs	1,452						
<u>Benefits</u>							
Industrial Solar	7,439						
Public Sector	8,520						
Residential Solar	7,860						
Expansion of Solar Industry	1,300						
Net Present Value of Solar Subprojects = \$14.508 million							

IV. B. Social soundness analysis

USAID's analysis of the social soundness of the Project has concluded the following:

1. The Project is fully compatible with the Jamaican social context within which it will operate -- both the official Government, private business sector and general public contexts.
2. Several elements of the Project are specifically designed as demonstration efforts and there are reasonable expectations that these demonstrations will be successful and the Project's spread effect will be significant. Two Project activities, the Public Education Program and the Alternative Energy Demonstration Centers are specifically designed to encourage this spread effect.
3. The social consequences and benefit incidence of the Project relate mostly to macro-economic, macro-social and institutional changes which will be effected. Initial beneficiaries will include the GOJ Institutions which are strengthened, individuals who are trained, and private sector firms and public sector facilities which will improve their energy efficiencies and expand their productive capacities. A second order impact will be increased employment opportunities resulting from the Project's activities as well as from the foreign exchange saved in the energy conservation activities which can be used to expand private sector activity. The poor will benefit indirectly as a result of the Project, and at least two Project activities, solar crop drying and the Alternative Energy Demonstration Centers, will provide benefits directly to the rural poor. The Project has no specific women in development element, although women are expected to benefit equally from the Project's activities.

Social compatibility

The basic goal and purpose of the Project are very much in accord with Jamaica's development goals as spelled out in its current National Development Plan and more specifically in the GOJ's National Energy Plan.

The National Energy Plan was, in fact, explicitly followed in designing the Project, and the MME Energy Division, charged with executing the Energy Plan, played an active role in designing the Project.

The overall objectives of the Energy Plan are:

- (i) reduction in the dependence on imported energy and diversification of the present energy supply mix of the Jamaican energy system away from imported petroleum;
- (ii) accelerated exploration for, and development of indigenous energy supply sources;
- (iii) reduction of the energy intensity of the economy while seeking to sustain economic growth especially non-energy intensive export-oriented growth;

- (iv) cushioning the impact of continually increasing energy prices on the low income groups of the society, while adopting pricing policies appropriate to the promotion of plan objectives.

The plan is divided into short, medium and long term objectives as follows:

- (a) Short term -- energy conservation measures based on fiscal policies and direct energy conservation systems;
- (b) Medium term -- diversification of the present energy supply mix and the development of non-conventional energy sources;
- (c) Long term -- accelerated oil and gas exploration and in general the development of conventional renewable and non-renewable indigenous sources of energy.

The Project contributes directly to the energy conservation and alternative energy goals of the Government's energy program.

The energy program of the present government, elected in October 1980, is essentially congruent with that of the Plan and, to that extent, is receptive to the Project. The Project's emphasis on the private sector is highly compatible with the policy of the new government.

At the more informal level of public attitudes and sentiments, basic support exists for the Project. Jamaicans are quite conscious of the foreign trade crisis (or of its effect) and are increasingly energy conscious. Radio, newspapers and daily conversations are filled with reference to the cost of energy and to the role of energy imports in the country's economy. Jamaicans are also increasingly conservation conscious and are beginning to put their new awareness into practice. The ED's Public Education Program begun in 1979, has been shown to be quite successful in influencing attitudes and behavior of those contacted based on a recent evaluation of that program.

The people of Jamaica are disposed to the aims of the energy program, despite the fact that they, like people everywhere, continue to act and think on the basis of habits acquired when oil was cheap and plentiful. Moreover, the idea of energy independence is one that has good potential for attracting the imagination and enthusiasm of Jamaicans. It can be viewed as part of the independence struggle and search for roots that began for Jamaica - as for other third world countries - during the colonial era. It is an idea with great political and economic significance and, as a social movement, it can help to shape a better future for the country.

The Project in no way conflicts with commonly-held Jamaican values, beliefs or religious views and is fully compatible with Jamaican social structure and organization. There are no known social or cultural obstacles to Project implementation.

Finally, Jamaican society is a relatively sophisticated and technologically oriented one and there are few social or cultural barriers to the acceptance of new technology in the form of alternative energy (solar water heating, solar crop drying, etc.) which will be disseminated or developed under this Project.

Spread effects

Several of the Project activities are specifically designed as demonstration activities and the Project includes an effort to assure that the technologies introduced are accepted not only by those participating in the Project, but that there will be a spread effect which will bring the benefits of the Project to others and which will continue after the five-year Project has ended. Those demonstration activities include the retrofitting programs to bring about energy efficiency in the public and private sectors, the solar water heating program in both public, residential and industrial/commercial sectors and the solar crop drying program.

All these Project activities are designed to demonstrate various energy technologies. It is expected that as a result of the successful demonstration of these technologies, other individuals, organizations and firms will wish to adopt the technologies. Indeed, if the Project benefits accrue only to those who receive the technologies as a direct result of this Project, the Project will not have been successful. It is imperative that the technologies be widely accepted in Jamaican society before a significant impact can be made upon the energy problem of the country.

The Project is therefore initially focusing on the dissemination of only one alternative energy technology - solar water heating - because this is the only proven alternative energy technology available in Jamaica today.

Two of the Project activities will contribute directly to assuring that there is an adequate spread effect of the Project's benefits - the Public Education Program (PEP) and the Alternative Energy Demonstration Centers. The PEP is a major GOJ effort to encourage energy conservation and the adoption of alternative energy technologies. Its program will be developed to publicize the other Project activities and assure their spread. The Demonstration Centers will concentrate on the rural sector and develop programs to encourage the dissemination of alternative energies there.

Social consequences and benefit incidence

The initial benefits of the Project will accrue to the following:

- The GOJ institutions and public sector employees who receive assistance and training to upgrade their capacities to carry out their respective responsibilities.
- All those who need current energy information to carry out their responsibilities.
- The public sector facilities, private sector firms and individual home-owners who receive solar water heating units to permit them to reduce their energy costs.
- The public sector facilities and private sector firms which undertake retrofitting programs to improve their energy efficiency and reduce energy costs.
- The private firms and organizations which are involved in the solar crop drying program.
- The economy in general as a result of reduced dependency upon imported petroleum.

Second order impacts of the Project will include the following:

- The foreign exchange saved as a result of Jamaica's reduced dependency upon imported petroleum will be available to support the Government's economic recovery program and can be used for importation of food, medical supplies and raw materials. The food and medical supplies will directly benefit the poor in Jamaica, and to the extent that the raw materials result in increased economic activity and more jobs, the unemployed will benefit.
- The Project will result in increased employment directly as a result of the retrofitting programs carried out in the public and private sectors, in the manufacture and installation of solar water heaters in the private and public sectors and in the expansion of the solar energy and energy conservation industries in Jamaica.
- Increased energy savings resulting from the retrofitting carried out by private sector firms will permit these firms the opportunity of expanding production, thus paving the way for more jobs.
- The solar crop drying program will lead to the introduction of this technology to Jamaica which will assist small (as well as larger) farmers to market their products so as to increase their income. Secondly, the program will result in reduced crop spoilage which will accrue to the benefit of the entire country which is a net-importer of food at the present time.
- Alternative energy technologies, as they are developed and made ready for dissemination, will be made available to the rural poor through the Alternative Energy Demonstration Center and the low-interest loan fund which will be established to complement the Center's activities.
- As a result of the improved capability of the GOJ, specifically the ED, but also CAST, SRC, the Met Office, to plan and execute energy projects, the entire nation should benefit. Also, through the training to be offered by the Project, Jamaica will have a fairly good cadre of trained energy specialists and technicians by the end of the Project.
- The PEP will result in an energy public which is sensitized to the energy problem, aware of the importance of energy conservation and actually implementing energy conservation measures. This will contribute to decreasing Jamaica's dependency upon imported petroleum and will have the concomitant effect of providing increased amounts of foreign exchange for needed imports essential for economic recovery and development.
- As a result of the development of an expanded solar water heating industry and the establishment of Jamaican standards for the industry, the possibility of Jamaica's exporting this technology to other countries will be opened up. This will be another positive step in making additional foreign exchange available for the economy.
- The forestry assessment and the research project involving fast growing species of trees will have laid the basis for an expanded program of using wood and charcoal, in an ecologically acceptable fashion, as less expensive and more reliable forms of energy for the rural poor.

Finally, the Project will not involve nor benefit women in any special way, although it is expected that women will be involved in the implementation of the Project as they play an active role in all of Jamaican society, and that the benefits will accrue to them in a relatively equitable manner. As the Project is implemented, special attention will be given to assuring that women play an equal role in the Project and to finding additional ways in which they can be involved. The AID/W WID office reviewed the Project with USAID during the design stage and provided some helpful suggestions, but no special particular WID elements were identified which could be built into the Project.

IV. C. Technical Analysis

Over the past three years USAID has analyzed the Jamaican energy problem with the assistance of a number of US energy specialists. The result of this analysis is the USAID conclusion that Jamaica must do three things to solve its energy problem:

- use the energy currently available to it (in the form of petroleum imports) more efficiently, i.e., carry out energy conservation programs
- seek and find new sources of energy other than petroleum, and
- improve its institutional capacity to deal with an uncertain energy future.

The proposed USAID energy Project addresses itself to these three requirements. Our analysis has suggested how USAID, within our policy limitations and financial constraints, can best assist in these three areas.

The technical issues to be resolved in designing this Project involves two kinds: (a) what should the focus and priority be for energy conservation programs, and (b) what alternative sources of energy should be exploited.

Energy conservation

Jamaica is among the most intensive users of energy in the developing world and energy conservation programs can bring about significant cost savings in energy usage. In other countries with less of an industrial base, where little petroleum is used and most energy comes from charcoal or wood or animal power, the possibility of conserving energy is much reduced. However, Jamaica has developed so that its entire economy is dependent upon large volumes of imported petroleum. Without petroleum, its industrial sector would grind to a halt, its transportation system would be totally disrupted, and even its rural poor, heavily dependent upon kerosene, will be forced to find alternative energy supplies. There is no possibility for Jamaica switching from petroleum to another single form of energy within the foreseeable future. There is no single form of energy which can wholly substitute for petroleum. At best, alternative forms of energy such as solar, biogas, wood and charcoal and peat, can only provide a small percentage of Jamaica's energy requirements during the next two decades. Jamaica will continue to be largely dependent upon petroleum. Therefore it is essential that the use of energy derived from petroleum be used as efficiently as possible. Estimates have been made that with a vigorous conservation program, Jamaica could reduce its petroleum import bill over the next five years by 10-20% (all other things staying the same) without reducing its productive capabilities. For this reason, the GOJ assigns highest priority to expanding and strengthening its energy conservation program. USAID agrees with this assessment.

The state of the art in energy conservation technology has become fairly well established in recent years, resulting largely from the necessity imposed upon energy users to reduce energy consumption due to the increase in petroleum-based energy costs. With the end of the era of cheap energy, a search was begun for ways in which to improve energy efficiency, to reduce the amount of energy used, in short -- energy conservation. As a result of this rather intensive search, a number of technologies have been developed, both analytical and technical, which are widely used in the United States and other developed countries. The concept of

energy auditing, relatively unknown a few years ago in the US, is now widely and commonly practiced as a means of identifying energy waste in the industrial and commercial sector. The techniques of energy auditing are well established and may be applied to any country. Annex C provides a list of examples of the kinds of Energy Conservation Opportunities (ECOs) which may be uncovered as a result of energy audits. Not only is the analytical tool of energy auditing available, but the technology needed for taking advantage of most of these opportunities is readily available. Experience in the US and in other countries has revealed numerous cost-efficient ways of improving energy efficiency. The literature on energy conservation is replete with examples of households, firms, public sector facilities, even entire cities which have reduced their energy consumption significantly as a result of a concentrated effort and the application of readily available technology.

Energy conservation is, of course, much more than turning off lights when they aren't needed, although the importance of such simple energy conservation steps must not be overlooked. More importantly, however, the major reductions in energy usage will come in the industrial sector through installing more energy efficient production processes, e.g. more energy efficient motors, improved boilers, re-wiring the electrical system, or any one of a multitude of ECOs. Many of these ECOs will be obvious to any reasonably alert person seeking ways to reduce energy usage. Other ECOs, however, require a trained observer to identify. These trained observers, usually engineers, are the ones who carry out the energy audits.

In terms of the balance of foreign exchange payments, a barrel of oil saved is as valuable as one produced in Jamaica. Therefore, energy conservation projects can be looked upon as the equivalent of energy production. Because many energy conservation projects have low, or no, cost associated with them, they become particularly attractive. Even those projects having high capital costs are usually more cost-effective than energy production projects in terms of payback period. Conservation projects can also be selected to fit any available sum of money. An energy production facility may have a total capacity below which such plans are not produced or not cost-effective. In contrast, a portfolio of various energy conservation projects of both small and large cost can be selected from among the ECOs identified to suit the funding allocated. Even if a small sum is allocated, at least some low-cost conservation projects can be implemented.

Labor requirements for energy conservation projects are particularly well suited to Jamaica. The labor component for installation of conservation equipment is relatively high, running 40-60% of costs for typical projects. The labor required must be skilled, but the skills are readily available in Jamaica. Plumbers, welders, sheet-metal workers, insulators, electricians, mechanics and laborers are needed and are present in the workforce. In contrast, energy production facilities, whether nuclear power plants, coal-fired plants, oil wells or solar installations, require more specialized skills, many of which would have to be imported. With a national unemployment rate of over 30% in Jamaica, energy conservation projects represent welcomed jobs. Hardware required for the energy conservation retrofits in many cases has a significant labor component in its manufacture. Given the cost and availability of labor in Jamaica, it appears that the development of an energy conservation industry is feasible. Many items for use in Jamaica can be manufactured locally, including window screens, louvers, air conditioning filters, timers, switches and relays for controls and insulation. In addition, higher technology items can also be produced for use on the island and for export including heat wheels, heat pipes, heat exchangers, air pre-heaters, and heat pump systems. Companies are already in operation in Jamaica performing such services as sheet metal working, casting, pump and valve manufacturing and rebuilding, motor and generator winding, electronics assembly, mechanical assembly, tool and die work, welding and

boiler work. With engineering assistance, a design could be developed and manufacturing operations could be set up with a consortium of these shops.

The primary sources of energy conservation potential in Jamaica are the industrial, commercial, governmental, tourism and residential sectors. The reasons for the potential savings, the types of programs or equipment retrofits that are applicable, and the quantity of savings possible varies with each sector.

The industrial sector appears to offer the greatest potential for savings; therefore, the USAID Project focuses especially on this sector. Capital improvements to physical plant equipment for the purpose of increasing energy efficiency appear to offer great promise and to be particularly appropriate for the Jamaican situation. Commercial and industrial facilities in Jamaica are quite advanced, in comparison to most LDCs. This is due, for the most part, to significant foreign investment. British colonial investments, prior to 1962, and American and British investments from 1962 to about 1972 have fostered well-developed manufacturing and commercial enterprises. Most industrial operations in Jamaica use equipment that may be 10-80 years old. This equipment was designed in an era when fuel costs were low and the price of fuel made up a small percentage of the cost of manufacturing. Hence, the equipment was not designed with fuel efficiency as a primary consideration. Furthermore, as this machinery has aged and become worn, its fuel efficiency has deteriorated. Foreign exchange problems have made it difficult for Jamaica to obtain spare parts for the equipment already installed. As a result, the machines in operation, already energy-inefficient by design, have been worn and have deteriorated to an even lower efficiency. No capital improvements have been made to upgrade the design efficiency. The net result is an industrial sector that is using a greater quantity of energy than the world average to produce basic products such as cement, steel, bread, sugar and manufactured goods. Because of this basic inefficiency, the Jamaican industrial sector is ripe for conservation retrofitting. Both operations and maintenance considerations (concerning spare parts, scheduling, and the like) and capital improvements (retrofitting of conservation devices) are very attractive alternatives toward reducing imported petroleum demand in Jamaica. This sector is also the most likely to benefit from the mix of energy conservation products which are currently available in the market place. The total quantity of savings achievable from this sector is greater than all other sectors combined.

Investments in energy conservation equipment for retrofitting are sound investments. The hardware to be installed is off-the-shelf technology, readily available. An energy conservation investment will provide even greater returns as fuel prices rise and will continue to provide cost savings long after the initial capital cost has been recovered. The investment has little or no risk as the investor can lose only if fuel prices decline, an extremely unlikely circumstance.

The forms of energy consumption in the commercial, tourism and government sectors are lighting, air conditioning, cooking, hot water (including kitchens and laundries), and the forms of energy consumption found on the few military installations. Judging from the level of energy consumption and the retrofitting potential, in terms of equipment in operation and conservation product availability, potential savings of about 10% seem feasible. Because of the value of the government's setting an energy conservation example, including the resulting publicity and the indication to the general public that it is "practicing what it preaches", a significant retrofit program in the government sector is needed. The program will be a concentrated effort of short duration. The retrofitting installations will be accomplished early in the Project so that other operations can profit quickly from the example.

The residential sector in Jamaica is, by and large, already relatively energy efficient, due primarily to economic constraints, as much of the population cannot afford such major energy consuming devices as automobiles, water heaters, refrigerators or stoves. This level of effort for basic necessities has nurtured an attitude of thrift in the average Jamaican, and this is applied to energy usage.

The affluent sector (monthly income of \$475 or more) uses nearly 90% of its energy in the form of electricity. There would appear to be significant savings available to this sector, however, this amounts to only 1.3% of the Jamaican households. Therefore the best approach to energy conservation in the residential sector is a public education and motivation program, which would encourage people to know how energy is used, in what amounts and how to make better use of the energy. Public announcements might vary from hints on how to cut out water (which would apply more to the affluent sectors) to ideas on how to schedule activities, such as cooking, for maximum fuel efficiency (which might be directed to users of charcoal or kerosene stoves). This campaign could make a significant impact in the national energy consumption record, providing it is properly perceived and has the support of the people. If the people join in the cause and constantly strive to conserve energy, the savings in the residential sector could amount to 1%, or more, of national consumption.

It should be noted, of course, that the aluminium-bauxite sector uses over 50% of the petroleum imported by Jamaica and, on the surface, might appear to be a primary target for energy conservation. However, based on discussions with the GOJ, the USAID has decided it would not be appropriate to include energy conservation efforts in the aluminium-bauxite sector as part of this Project. The aluminium-bauxite sector is an enclave industry, largely owned and managed by multi-national companies. The sector imports its own oil and generates its own electricity. Efforts to improve the energy efficiency of this sector are therefore not included in this Project.

Alternative Energy

Even with major efforts to conserve energy, Jamaica, like all other countries, must eventually find and develop sources of energy alternative to petroleum. The supply of petroleum in the world is finite. The price is expected to continue to increase causing further disruptions and economic dislocations to those countries which are totally dependent upon it. As a result of the OPEC price increases and the resulting energy crisis, the need for countries to develop their own indigenous energy resources is now widely accepted and needs little justification.

To assist the GOJ in defining appropriate actions to deal with Jamaica's energy problem USAID sponsored a study by a U.S. contractor (ESI) which explored various alternative energy resource possibilities. The study showed, as might be expected, that no single straightforward solution exists. What is needed is a broadly-based program of assessing all alternate energy possibilities in Jamaica, developing prototype testing programs for those which appear to have reasonable success of providing important sources of energy and then developing demonstration and dissemination programs for those which are ready for mass replication. Therefore, USAID has included activities in the Project aimed at assessing Jamaica's alternative energy resources.

There are a variety of alternative sources of energy in Jamaica. However, all of these sources have problems associated with them either because of low energy flux levels, insufficient development of the technology needed to exploit the resource, large capital expenditures required to install new infrastructures, pre-

sent economic infeasibility of certain sources and alternative uses for the sources which may be more profitable than energy production. Because of these problems, it appears that for the near term energy improvements in Jamaica must begin with well-developed, cost-effective alternatives such as solar water heaters and crop dryers and conservation retrofitting, using what is essentially off-the-shelf technology. The alternative sources of energy for Jamaica include peat, hydroelectric, solar thermal, wood and charcoal, biogas, alcohol, refuse, wind, photovoltaics, ocean geothermal and solar energy plantations (biomass). Preliminary studies of these alternatives have been carried out by MME, in conjunction with foreign consultants. A report by W.R. Ashby, a former Director of Energy in Jamaica, prepared under a consultancy with the Petroleum Corporation of Jamaica, entitled "A Survey of Alternative Energy Possibilities in Jamaica" (July 1980) examines the current status of these technologies and identifies those which have promising near-term potential. The ESI and Ashby reports were reviewed by the energy team from Georgia Institute of Technology and are considered by USAID to be competent assessments of the current situation in Jamaica with respect to alternative energy possibilities and near-term opportunities. The results of these studies are summarized below:

Peat

Significant deposits of peat exist in Jamaica. This peat can be burned directly to fire steam boilers for electric power generation or the peat can be gassified for a variety of uses. It has been estimated that Jamaican peat reserves represent 8 million long tons, a quantity sufficient to generate about 80MW capacity for 30 years. There are potential ecological impacts associated with the exploitation of this resource, including the possibility of ruining the beach at Negril. This beach is one of the newest and most popular resorts on the island, and draining of the peat bogs could result in mud being washed back up on to the white sandy beach. This could then destroy the primary source of foreign exchange, not to mention the local village infrastructure which supports the tourist trade. In addition, massive capital equipment is required to mill and extract the peat and new boilers would have to be installed to burn solid fuel. Peat must be regarded as a long-term, capital-intensive energy source for Jamaica which cannot impact the immediate situation.

Hydroelectric

Hydroelectric power stations, on the order of about 16MW, are already installed and in operation in Jamaica. These represent the major exploitable resources in this area. In addition, there are mini- and micro-installations which may be feasible. These potential installations do have associated problems, however, including low power generating potential, high capital cost especially for dam-works and other civil engineering tasks, highly variable stream flows, and the possibility of destroying tourist attractions, such as waterfalls. Again, these potentials are being investigated by MME with support from the Swedish government. A study by SWECO of Sweden examined the potential of the Blue Mountain region to supply both hydro-power and potable water for the Kingston metropolitan area. Initial installed capacity could amount to about 22.5 MW but could not come on line before 1989. Studies by Motor Columbus, Inc., in 1978 identified another 11.2 MW of small capacity plants. Jamaica is proceeding with studies of these projects, but hydroelectric does not appear to offer a near term energy solution.

Coal

ESI conducted a coal pre-feasibility study under the USAID program. The problems with the use of coal in Jamaica result from the fact that a complete system would have to be developed to unload the coal, transport it to power plants, and build new power stations capable of burning solid fuel. This would be a highly capital-intensive project, but it is one that could offer foreign exchange savings as coal is expected to continue to be a lower cost energy source than oil, on a cost per BTU basis.

Ocean

A variety of uses of ocean power appear to be attractive alternatives for Jamaica, as it is surrounded by the Caribbean Sea. All of these alternatives are now only in the prototype stage, however, and do not represent well developed technologies applicable to the near term. Ocean sources such as ocean thermal stratification, ocean-river interface temperature differentials, ocean wave, ocean current, and algae or seaweed cultures all represent good potential energy sources for this island economy. However, Jamaica does not have the resources, in terms of funding or manpower, to conduct programs of research and systems development in these areas and must, therefore, rely on the more industrialized countries to take the lead. For example, Jamaica is currently a candidate site for the installation of a 10 MW pilot plant, using ocean thermal energy conservation (OTEC), to be constructed by a consortium of Swedish companies. Commercialization of OTEC plants is not expected before the mid-1990's, however, assuming successful pilot plant development.

Geothermal

Warm spring areas exist in Jamaica, and the island does have a volcanic geological foundation. However, no recent volcanic activity has taken place and it is not known to what extent the geo-thermal resource exists or how readily it may be tapped. Jamaica is proposing to work with the Latin American Energy Organization to investigate the potential. Again, this energy source represents only a long-term solution, assuming there are sufficient reserves to be developed.

Solar Thermal

Because of the high level of incident solar radiation available in Jamaica (450-500 langleys per day), solar energy must be regarded as a source with strong potential. Solar thermal plants, using concentrating collectors (either central receiver-power towers, or distributed-dish or trough systems) offer a means of providing shaft power for electric generation, air conditioning compressor drives, or irrigation water pumping. Again, Jamaica does not have the resources to develop systems to exploit this energy form, and therefore must depend on imported technology. There are several companies in operation which have developed such systems, and these may be assembled and installed in Jamaica. At present, concentrating collector costs average about \$30 (US) per square foot, with balance of system (piping, heat engine, generator, condenser, installation, etc.) costs running an additional \$20-30 per square foot. Therefore total system costs would run at least \$50 (US) per square foot, and energy production would likely average 250-300,000 BTU per sq. ft. per year. Replacing imported oil at \$36 (US) per barrel, or \$6 per million BTU, such a site would save about \$1.80 per square foot per year, assuming equal engine, generation and distribution efficiencies for the oil and solar plants. Such an installation therefore has a payback period on the order of 28 years, which is probably in excess of the useful life of such a plant without significant deterioration. Rising oil prices and reductions in solar power plant prices will improve the feasibility of such an installation, but it is apparent that solar thermal is still a developing technology and may be far more attractive as an investment in the future.

Solar ponds are a derivative of solar thermal technology that appears attractive in salty desert regions such as the Dead Sea in the Middle East. These systems rely on layers of salt concentration to result in layers of heat stratification, this temperature differential is the used to drive a heat engine (similar to OTEC in principle). Such systems are characterized by low efficiency, which is a direct result of the small temperature difference available. The Yallahs ponds in St. Thomas, Jamaica, have been suggested as potential solar pond sites. These sites

require further study, however it appears that dilution of the brine solutions is likely from rain water from the surrounding hills, infiltration of sea water through the shore sand bar, and osmosis from the underlying water table. Such mixing would destroy the salt concentration layers in the pond, which need to be carefully maintained to ensure the already small thermal gradient is not further reduced. MME will continue study of this potential site, but again there is a lack of developed technology to be applied in the short term.

Photovoltaics

The generation of electricity by means of solar cells, or photovoltaic devices, is an attractive alternate energy source. But, it is one to be contemplated only for the long term, as the economics of photovoltaic systems are even more unfavorable than other less technical power systems at present. Although the cell cost may be reduced by as much as 90% over the next decade, the balance of system costs will remain at their present level in real terms. Present costs of electricity delivered by photovoltaic systems run as high as \$1.50 (US) per kWh, whereas JPS power currently costs about \$0.10-\$0.15 (US) per kWh. There would need to be significant developments in the field of photovoltaic system production before such systems can be cost effective in Jamaica.

Refuse

ESI conducted a study of electric power generated from municipal waste. Electric power on the order of 20MW could be generated, but first an adequate garbage collection system would have to be installed and maintained. The present system collects only about 130 tons of the estimated 700-1000 tons per day of municipal waste generated in the Kingston-St. Andrew region. To attribute the development cost of refuse collection systems to the project makes it economically unfeasible as there are insufficient energy savings to pay for the total program. If the refuse collection system could be justified on other terms, such as for safety and health reasons, the energy savings could possibly payback the incineration plant capital costs. As with other alternatives, the refuse power generating plant requires additional research and consideration.

Wood and Charcoal

The use of wood and charcoal for cooking fuel is already widespread, particularly in the rural areas. One resource that could be developed are the millions of dead coconut trees which have been afflicted with lethal yellowing disease as well as those damaged in September, 1980 by Hurricane Allen. These can be converted to charcoal, but an infrastructure must be developed for the logging and transport of these trees. Trucks and heavy logging equipment, not present on the island, would have to be imported and charcoal production facilities would need to be expanded. A charcoal development program has been drawn up by MME and the Forestry Department, but funding has not yet been approved. This is one source that may be a relatively near term prospect, however.

Biogas

The production of low BTU gas from animal waste was one topic considered in the ESI report. Pay back periods of 4-7 years were estimated for systems based on the Chinese model, assuming local construction. MME is proceeding in this area and has submitted a proposal, for \$3.8 million (J), to build 2000 household units and 100 medium-sized plants. The proposal has been submitted to the European Development Fund for consideration.

Wind

Preliminary studies indicate that relatively little wind energy potential exists in Jamaica, as wind velocities average only about 7 mph, whereas average speeds of 10-14 mph are usually considered for favorable sites. There have been windmill installations on the island however. The base structure for one unit, built around 1930 or earlier, still stands in Portland on the northeast coast near Port Antonio. A wind machine for water pumping has recently been put into operation in St. Elizabeth on the south coast at an elevation of 800 feet. MME has followed up this successful project with a proposal to the European Development Fund for a 5-year program costing \$2.8 million to erect some 500 windmills for water pumping.

Alcohol

Both sugar and cassava are crops that can readily be converted to alcohol for fuel use, and both are widely grown in Jamaica. However, a study performed in 1977 by the Organization of American States reported unfavorably on alcohol production from sugar at that time, showing \$3 lost in foreign exchange earnings (which would have been sugar sales) for \$1 saved in foreign exchange expenditures (for petroleum). A recent (1980) update using current fuel and sugar prices shows that the ratio has now dropped to 2:1. With a growing foreign exchange problem, however, Jamaica cannot now afford such a loss in revenues. Cassava farming productivity in Jamaica is low, with production rates of 5 tons per acre compared with 15 tons per acre elsewhere in the world. In addition, alcohol production from cassava requires the use of fuel (whereas bagasse is available as fuel in sugar distilleries) and may be a net energy using process.

It is possible that solar energy plantations (SEP), may one day be effective in Jamaica. Such a plantation would grow sugar cane for alcohol production. It is possible that some lands, such as along the north coast, where sugar production is becoming uneconomic due to transportation costs, could serve as the basis for SEP. Close monitoring of petroleum and sugar prices, together with the design and construction of plants sized to fit the local cane availability, would be required to determine the point at which such an operation might become cost-effective. This may be a viable long-term remedy to some portion of the transportation sector's energy problem.

Solar Water Heating

Direct solar conversion is the most feasible alternative energy source for Jamaica. Due to its geographical location, almost even number of hours of daylight, and large areas with high degree of solar radiation, Jamaica will eventually come to depend on solar energy to a much greater degree than at present.

Although water heating accounts for only a small fraction of Jamaica's oil consumption (about 190,000 barrels per year of a total of 16 million barrels per year imported, or 1.2%), it represents an opportunity where alternative energy technology can be applied in the near term. Solar water heating is applicable in Jamaica for several reasons:

- Hot water is needed on a year-round basis, so that the investment in equipment has high utilization,
- Jamaica has high average insolation (about 450 langleys per day), so that well-built equipment should capture a relative large quantity of energy per unit of aperture,

- Jamaica's warm ambient temperature eliminates any requirement for freeze protection of solar collectors containing water, thus simplifying system design and reducing costs,
- Jamaica's warm ground water temperature (typically about 24°C or 75°F) reduces the thermal load which must be met to supply satisfactory hot water temperatures, thus tending to reduce system size and cost.
- The solar hot water application can be met with flat plate solar collectors, which represent mature technology and are already being produced in the country.

While solar water heating will not make a substantial change in Jamaica's foreign exchange situation, it is a step in the right direction and it will bring many associated benefits, such as development of trained personnel and enhancement of the country's capacity for manufacturing and exporting consumer goods. Therefore this Project contains a major solar water heating program since it is the only proven and readily available alternative energy technology available in Jamaica today.

Solar crop drying

The development of effective food and agricultural products solar drying technology will benefit everyone--including the poorest of the poor--in Jamaica by providing a better supply of food products throughout the year. It is a well known fact that the wide fluctuation in the price of a food product (as is the case in Jamaica) is an indicator that more of that product needs to be preserved for use after peak harvest season. This is being done to some degree by farmers using solar barbecue methods and by farming organizations using forced hot air drying technology.

In 1979, according to the Ministry of Agriculture, Jamaica produced 1,474,000 kilos of unroasted coffee, 1,792 tons of cocoa beans, 1,249 tons of pimento, 680 short tons of ginger, 2,944 tons of legumes, and 1,708 tons of cereals. These products all need drying to some degree and most farmers today dry their crops using the traditional barbecue method. From data generated by the ESI report, it appears that the number of farms producing five or more tons of products are as follows:

Red Peas	-	290 farms
Gungo Peas	-	59 farms
Cow Peas	-	61 farms
Peanuts	-	85 farms
Corn	-	549 farms

Disregarding all other production, the above 1,044 farms could profitably use a one to two ton capacity solar grain dryer. According to the Ministry of Agriculture there is a need for drying at least 25% of the legumes and cereals produced (4,652 tons in 1979). The most desirable storage moisture content for corn and peas is about 60% relative humidity for 12% moisture content. The crop off the field is usually at about 18% moisture content so drying is needed to avoid degradation.

The National Energy Plan also recognized the need to displace some of the present oil usage for crop drying by using solar dryers and designed into the plan four actions which are:

- a. To carry out laboratory and field tests to determine the solar drying conditions for a wide variety of local products.
- b. To introduce the use of solar drying at the farm level on as wide a scale as may be feasible.
- c. To carry out feasibility studies of solar drying methods at commercial levels for products such as: salted fish, bananas, cassava, and lumber.
- d. To implement as many as such projects as are found to be feasible.

Many direct solar applications are being used today in agricultural food drying in Jamaica. Nevertheless, a significant amount of fossil fuel continues to be used in low temperature heating and drying operations, in agricultural food drying because of a) traditional convenience, b) dependability of fuel fired equipment and c) availability of fuel fired equipment.

The drying of food products using direct or indirect solar energy is a known technology and a fairly simple one. What is needed in Jamaica is R&D to determine the type of device most appropriate for a) the products to be dried b) the local environment and c) the local tradition. The project will attempt to provide the appropriate solutions.

Although solar water heating and crop drying will have only minor impact on Jamaica's oil import problem, they represent steps which should be helpful to the country in the longer term.

IV. D. ADMINISTRATIVE FEASIBILITY

Energy Division of the Ministry of Mining and Energy

The Energy Division (ED) in the Ministry of Mining and Energy will be the primary implementing agency for this Project and will be responsible for overall policy and administrative direction. The Division was established in 1973 but as recently as 1978 was staffed with only 6 professionals. With the increasing GOJ emphasis being given to energy, the ED has been increased to 23 professionals. However, it is still a relatively small and inexperienced Division and will require considerable strengthening. One of the primary purposes of this Project is to provide the assistance required to improve the capability of the ED to carry out its responsibilities. The loan will provide three full-time energy specialists (two for life of the Project and one for three years) who will work within the ED as advisors and who will have major responsibility for assisting in the implementation of the Project. In addition, a total of 38 person-months of short-term consultants will be provided to assist the ED in Project implementation and monitoring.

Within the ED, a Project Implementation Unit will be established to have overall responsibility for the implementation of the Project. The Unit will be headed by a senior GOJ energy specialist who will report to the Director of the ED. Two full-time engineers, a financial officer and appropriate support personnel will be provided to the Unit.

The Project Implementation Unit will relate directly to the several other GOJ organizations which have responsibilities for implementing various activities under the Project. Those other organizations will keep the Unit informed of Project progress and problems in both formal (through periodic reports) and informal means. The Unit, in turn, will be responsible for the preparation of quarterly reports which the GOJ will submit to the USAID to keep AID informed of Project progress and problems. The Unit will be responsible, in cooperation with USAID, for carrying out the annual evaluations of the Project.

National Commercial Bank

Second to the ED, the National Commercial Bank will be the most important GOJ organization involved in implementing the Project.

Now owned by the GOJ, National Commercial Bank Jamaica Limited (NCB) is the largest commercial bank in Jamaica in terms of assets and loans, having recently overtaken Bank of Nova Scotia Jamaica Limited, which had been the leader for some 50 years. NCB has been operating in Jamaica for 15 years as Barclays Bank of Jamaica, until its purchase by GOJ in 1977.

NCB conducts a general commercial banking business with a staff of approximately 1,000 and 40 branches throughout Jamaica. As of September 30, 1980, NCB has total assets of J\$621.2* million and total loans after provision for losses of J\$328.9 million, up from a figure of J\$261.1 million in the previous year.

As of the year ended September 30, 1978 (its first year of operations as a Government-owned bank), NCB's pre-tax profit and accumulated deficit was J\$0.6 million and J\$4.2 million, respectively. As of 30th September 1980, two years later, NCB has a pre-tax profit of J\$9.7 million and had wiped out the accumulated deficit completely, with accumulated retained earnings of J\$.4 million. Even more impressive was the fact that this was accomplished during a period of economic downturn.

* J\$1.00 = US\$.56

Most of NCB's lending operations are on terms of three years or less except for some rather large agricultural project loans which would extend to five years and, exceptionally, seven years. While this concentration on shorter-term consumer-industrial lending is a drawback as far as certain segments of the energy program are concerned, nevertheless, NCB's lending record indicates a solid base for medium-term credit analysis. Two months of technical assistance will be required by the bank staff concerning proper analytical and administrative procedures in connection with medium term credits and this will be provided under the loan.

NCB's branch management has lending authority on a secured basis ranging from J\$15,000 to J\$100,000, depending on the branch and the Senior Supervisor involved. The average Senior Supervisor in the branches has at least five to ten years experience with the bank as most of NCB's employees are former Barclay's Bank staff. Loans in amounts above the branch authority up to J\$2 million are sent to the Main Office for vetting and loan requests over J\$2 million are sent to the Board which meets monthly. Within branch authority, answers can be given in two days, from one to three weeks at the Main Office, with a maximum of one month for Board level loans, as the Board meets monthly. All of these time elements are for completed applications. NCB has fourteen lending officers at the Main Office who would be handling the credit activities of the Project.

NCB's operations are fully computerized and all accounting, record-keeping and billing is up to date. NCB will give a full status report on the program quarterly as would be required by the fund's Advisory Board, or monthly if necessary. The Bank has 280,000 depositors' accounts and 40,000 checking accounts, so that up to date computerized operations are imperative.

The limited experience of NCB in medium term lending operations is the one negative factor in utilizing it as the financial intermediary. However, the USAID feels that, with the short-term technical assistance mentioned earlier, this limitation can be easily overcome. Moreover, the positive aspects of NCB--speed of decision-making, experience of staff, good loan administration and collection procedures, geographical coverage and numbers of clients, up-to-date data processing, etc. - more than compensate for the existing limitation.

Other Government of Jamaica Agencies

The GOJ Meteorological Office will be responsible for implementing the establishment of climatic stations and the collection and interpretation of meteorological data. The Met Office will hire one additional clerical person to carry out this task and, with this additional staff, is fully capable of implementing this Project activity.

The Bureau of Standards (BOS) will be responsible for implementing the Project activity involving the establishment of standards for the solar water heating industry. The BOS will hire two additional persons to carry out this work. The BOS is fully competent to carry out its Project responsibilities.

The College of Arts, Science and Technology (CAST) is Jamaica's main technical-level college, offering diplomas in a variety of technical fields following 2-4 year study programs. The establishment of the Solar Energy Institute as a new function of CAST will require careful planning and loan funds will provide six-person months of short-term consultants to assist CAST in planning this effort.

The Ministry of Finance will play an important role in providing the necessary counterpart financing for the Project and the National Development Agency will provide essential engineering and construction management services as required.

Several other GOJ organizations will be involved in various ways in the implementation of the Project - the Scientific Research Council, Forestry Department, Petroleum Corporation of Jamaica, Ministry of Agriculture, Jamaica Public Service Company, as well as the private sector which will be the recipient of credit funds under the Project.

Need for Coordination

Project coordination and cooperation among these organizations will be crucial. The Energy Division and Project Implementation Unit will have primary responsibility for insuring this coordination and cooperation. In addition, the National Energy Commission, a high-level GOJ advisory body which provides advice to the Minister of Mining and Energy, will be continued and will meet on a regular basis to review the progress of the Project and to help assure the necessary coordination and cooperation among the various organizations.

AID organizational responsibility

The primary responsibility for monitoring the Project within AID will be with the General Development Office of USAID/Jamaica. The General Development Office will work closely with the Project Implementation Unit and especially the three long-term loan funded advisors to monitor Project progress and identify implementation problems before they become major bottlenecks. The General Development Office will look to AID/W for technical backstopping as required. AID/W services are expected to include those of LAC as well as of DSB. Recognizing the breadth of the activities to be undertaken in this Project, support would be anticipated from AID/W offices responsible for energy, engineering and small industry development.

IV. F. Engineering Analysis

1. General Scope of Engineering Work:

The Project covers two areas where extensive engineering design and construction work will be required:

- 1.a. The energy conservation (energy auditing and retrofitting) program in the public and private sectors, and
- 1.b. The solar water heating program in the public and private sectors.

1.a. The energy conservation program in the public sector envisions the implementation of energy audits and the eventual retrofitting works in the majority of the public (GOJ owned) facilities. The audit would serve as a base for a quantity survey, tendering procedures and a construction contract. The retrofitting will increase the energy efficiency of the facilities by 15% to 20%. This part of the program is managed entirely by the GOJ (See also Part 3 - Construction Management).

A similar energy conservation program will be carried out in the private sector by private engineering consulting firms and construction contractors. Funding for this program will be provided through a credit fund to be established in the National Commercial Bank (NCB). (See also Annex K).

1.b. The solar water heating program in the public sector envisions the eventual installation of solar hot water systems in the majority of the GOJ owned (or partly-owned) hotels and in the public health system hospitals.

The conversion to solar water heating will include the repair and, if necessary, the reinforcing or partial replacement of the roof structure and waterproofing - beside the installation of the new system itself.

In the private sector the Project will cover both the industrial/commercial and the residential subsectors.

The Project envisions the installation of approximately 15 solar water heating systems in the industrial/commercial subsector and about 700 units in the residential subsector.

The summary of Project funds earmarked for engineering works is shown below (in U.S. dollars, as of April 1981):

Program	AID Contribution	GOJ Contribution	TOTAL
(in millions of US dollars)			
1.a. <u>Energy conservation</u>			
- public sector	0.85	1.4	2.25
- private sector	3.0	4.2	7.2
1.b. <u>Solar water heating</u>			
- public sector	1.5	2.3	3.8
- ind/comm subsector	1.0	1.3	2.3
- residential subsector	0.5	0.9	1.4
Total	(6.85)	10.10	(16.95)

2. Institutional Analysis

The organizations described below will have significant roles related to the engineering design, fabrication and construction work to be carried out under the Project.

The National Development Agency (NDA) will serve - under a GOJ contract with the MME - as the construction management (CM) arm of the Energy Division's (ED) Project Implementation Unit (PIU). This agency is a semi-autonomous, GOJ-owned corporation, established mainly for the management of capital projects, funded by external donors. The NDA is staffed with architects and engineers and is capable of producing construction tender packages (design drawings, quantity surveys, specifications, draft contracts, etc.) and of supervising or monitoring the construction phase. Acting similarly to a private A&E consulting firm, this agency, not being supported by the GOJ budget, charges a professional fee for its services.

Various private A&E firms are well established and are highly professional elements of the Jamaican economic structure. These firms can perform the Project related engineering design and construction management services.

Although the Jamaican construction industry has been stagnating during the past few years, a number of construction companies still exist, especially in Kingston. These firms have extensive experience but very limited operating capital and no hard currency to purchase imported construction materials.

In the countryside, an adequate number of skilled workers (e.g. carpenters, masons, painters, etc.) are available for minor repair and renovation work.

Since the character of the engineering (design and construction) works under this Project is unique, none of the above described agencies or firms is well versed in these works. Therefore, it is a condition sine qua non that these entities receive some form of training before their engagement in Project related engineering activities. The MME/ED - through CAST - will organize this training.

The Hospital Maintenance Unit (HMU), Ministry of Construction, is responsible for the maintenance and repair of public health facilities. Although the GOJ reorganization plans foresaw the transfer of HMU from the Ministry of Construction to the Ministry of Health o/a April 1, 1980, this change is being implemented only at the present time. This Unit is in dire need of energy related training in facility maintenance and repair.

The energy conservation industry development - under this Project - is described in detail on Page III-12 and 13 in this PP.

3. Construction Management (CM)

The overall CM responsibility for the public sector components in the Project will rest with the MME/ED through the Project Implementation Unit (PIU), in cooperation with the National Development Agency (NDA). The Energy Division will prepare a general engineering and construction plan for the approval of the Ministry and USAID as a Condition Precedent to disbursement. This plan shall delineate all the responsible organizations/offices for the first construction year in detail and for the second and third year in general. The plan shall be reviewed by all responsible parties periodically (preferably at 6 month intervals) and amended, as necessary, with the approval of the MME and USAID.

The NDA will provide A&E solicitations, tendering assistance and construction supervision services for the engineering works, under a contract with the MME/ED.

Selection of A&E firms will follow the usual GOJ contracting procedures, subject to AID approval. Final design drawings, engineering specifications, quantity survey, cost estimates and tender documents will be prepared by NDA selected private A&E firms and approved by MME/ED and, if necessary, approved by GOJ Cabinet Contracts Committee.

The construction contracts will be awarded by the MME/ED and approved, if necessary, by the GOJ's Cabinet Contracts Committee. Prequalification of construction contractors, invitation for tenders, tender opening, selection of contractors and the award of construction contracts will follow the usual GOJ contracting procedures, subject to AID approval.

In case of only minor renovation to small facilities where the engagement of a general contractor is not necessary (e.g. relatively small and simple work) or not feasible (e.g. remote location), the NDA would sign contracts with local skilled workers for the execution of the work, using small value procurement methods, acceptable to the GOJ and USAID. (Similar to the USG Purchase Order procedure).

The construction supervision in general will be the responsibility of the A&E firm which developed the tender (bid) documents or of the NDA. The same firm or Agency will verify the monthly vouchers of the contractors for reimbursement by the MME.

The Project Implementation Unit, in cooperation with the NDA, will monitor the engineering design and construction progress. Periodic Project review meetings will address the progress of the engineering works with the participation of the interested GOJ, USAID and private parties.

The procedure for the final acceptance of work, will be based on current GOJ practices and regulations.

The overall CM responsibility for the private sector components in the Project will rest with National Commercial Bank, with the assistance of a private consulting engineering firm under contract with the Bank. (Details of the policies and procedures of the credit fund are provided in Annex K).

4. Engineering Cost Estimates

Energy conservation - public sector - AID will contribute \$850,000 and the GOJ the Jamaican dollar equivalent of \$1.4 million for this Project activity, for a total of \$2.25 million. The activity will involve the auditing and retrofitting of public sector facilities, including office buildings, hospitals, schools, public sector enterprises such as the sugar refineries, cement plant, etc. The funds required to carry out retrofitting programs for all of the public sector would far exceed the \$2.25 million proposed for this activity. Since this is a new activity for the GOJ, there are not firm costs estimates of what is required for individual facilities; these estimates will be developed as a part of the energy audit which will be carried out for each facility prior to the initiation of a retrofitting program. The range of possible activities which might be carried out under a retrofitting program (from simple re-wiring of buildings to major overhauls of production systems) means that it is not possible to develop cost estimates for a representative retrofitting activity.

Estimates made by the Energy Division based on selective preliminary audits indicate that it would probably cost \$10-20,000 to retrofit one of the 27 government-owned hospitals, or a total of \$270-\$540,000. A similar amount would probably be involved for each of the 15 government-owned hotels, for a total of \$150-\$300,000. Estimating conservatively a retrofitting cost of perhaps \$2-\$5,000 for each of the few hundred government office buildings, schools, clinics and other public sector buildings, another \$600-\$1.5 million could be utilized. Retrofitting of the complex government-owned sugar refineries could well cost several hundreds of thousands of dollars. The total of \$2.25 million will permit the government merely to carry out a large-enough energy auditing and retrofitting program in the first 3 years of the Project to show that such a program can save considerable amounts of foreign exchange for the GOJ. The 3-year effort is, in effect, a demonstration program. Additional funds, from outside the Project, will be required after the first 3 years to continue the auditing and retrofitting program and to assure that all government facilities are retrofitted and operating at their maximum energy efficiency.

Energy conservation - private sector - AID will contribute \$3.0 million and the GOJ the Jamaican dollar equivalent of \$4.2 million for this Project activity, for a total of \$7.2 million, which will establish a credit fund to finance auditing and retrofitting of private sector facilities, including commercial and industrial firms. GOJ officials and energy experts under contract with USAID to assist in developing this Project activity have estimated that, given the energy inefficiency of the Jamaican private sector, probably \$25-\$50 million and perhaps more, would be required to carry out all the energy auditing and retrofitting programs needed in the private sector to bring that sector up to maximum energy efficiency. The \$7.2 million credit fund will permit a significant number of retrofitting activities

to be carried out sufficient to demonstrate to the private sector that energy auditing and retrofitting programs are sound and profitable investments. The expectation is that additional funds, either from investments made by the private sector itself or loans from the IDB or IBRD, will be made available to continue the auditing and retrofitting and extend the program to a larger percentage of the private sector.

Solar water heating - public sector - AID will contribute \$1.5 million and the GOJ the Jamaican dollar equivalent of \$2.3 million for this Project activity, for a total of \$3.8 million. This activity will involve the design, manufacture and installation of solar water heating units in public sector facilities. The GOJ has assigned highest priority to installing these units in the government owned and operated hotels and hospitals, but the activity will include installation of solar units in other government facilities such as health clinics, schools, agricultural marketing centers as well as the productive enterprises owned and operated by the public sector, e.g., the Jamaica Omnibus Service, cement plant, textile plant, sugar refineries, etc. Preliminary cost estimates have been prepared by the GOJ for the priority installations in the hotels and hospitals (including, where necessary, the repair of roofs). These estimates were reviewed and found to be reasonable and acceptable by the AID engineer who assisted in preparing this engineering analysis. Those estimates alone total approximately \$3.8 million. Information on how the cost estimates for the installation of solar units in the hospitals were derived is included as Annex L and the worksheets showing how the estimates for the hotels were derived are available in the USAID. These estimates will be revised when the detailed engineering design is done for each individual solar installation. Any funds remaining after the priority installations in the hotels and hospitals are completed will be used to install solar units in other government facilities. The total of \$3.8 million will be sufficient to permit the installation of solar units in only a relatively small percentage of government facilities which could utilize them.

Solar water heating - industrial/commercial sector - AID will contribute \$1.0 million and the GOJ the Jamaican dollar equivalent of \$1.3 million for this Project activity, for a total of \$2.3 million, which will establish a credit fund to finance the design, manufacture and installation of solar water heating units in industrial and commercial firms in the private sector. The amount of funds allocated to this Project activity is only a small percentage of the amount needed to install solar units in all the private sector industrial and commercial firms now utilizing hot water heated by electricity produced from petroleum. The effort being made is to install a sufficient number of solar units in the private sector to demonstrate that the installation of solar units is a sound and profitable investment. Unlike solar units for the residential sectors which are relatively standardized and can be mass produced, solar units for industrial and commercial firms must be individually tailor-made for each firm. Cost estimates will be made for each individual activity as a part of the engineering design required for the manufacture and installation of a solar unit for that facility.

Solar water heating - residential subsector - AID will contribute \$.5 million and the GOJ the Jamaican dollar equivalent of \$.9 million for this Project activity, for a total of \$1.4 million to be used to establish a credit fund to provide loans to home-owners who wish to install solar water heating units in their residences. The funds allocated for this activity will permit approximately 700 units to be installed, only a small percentage of the estimated demand. The Jamaica Public Service Co. (the electric utilities company) recently carried out a survey of a sample of its residential users and over 600 home-owners responded that they would like to convert to solar water heating units. Further, interviews with the

leading solar water heating manufacturer in Jamaica have confirmed that there is a considerable interest on the part of many persons in installing solar units and a modest number of units are already being sold each month. Coupled with a major public education program, this low-interest credit fund is expected to give a major boost to the wide-spread acceptance of solar water heating in the residential sector.

Foreign Exchange and Local Currency Breakdown

The foreign exchange (FX) and local currency (LC) breakdown is based on site visits to buildings equipped with solar water heater systems, to solar collector panel fabricators, to private professional consulting engineering firms and relevant GOJ agencies.

It is estimated that Project related engineering costs will consist of the following components:

- A&E services - 15% (all 15% LC)
- Construction - 85% (46.75% LC & 38.25% FX)

The A&E cost component will cover the facility survey, engineering design, preparation of tender package, assistance in tendering and construction supervision (about 10.5% of the total cost). Also included in this component is the cost of the construction management. In this Project the fee for the professional services of the National Development Agency (NDA) will be about 4.5% of the total cost. Thus:

- engineering design and supervision: 10.5%
- construction management : 4.5%
- 15.0% (100% LC)

The construction cost component can be separated into labor cost and material cost - 40% vs 60% of the construction cost or 34% and 51% of the total cost. (34% + 51% = 85%). About three fourths of all the necessary materials is imported, therefore the FX will be 51% x .75 = 38.25% of the total cost. Thus in this cost component the labor cost (34%) and the local material cost (51% - 38.35% = 12.75%) will represent the LC need and the imported material cost (38.35%) the FX requirement.

- construction cost:

- labor cost - 34 LC
- local material - 12.75 LC
- imported material - 38.25 FX
- Subtotal - 85 %

(46.75% LC and 38.25% FX)

To cover the estimated need for FX during the life of Project, it will be necessary to provide up to 40% of the cost of engineering works from AID funds and the rest (up to 60%) from GOJ funds.

V. Implementation Plan

A. GOJ administrative arrangements

The primary GOJ implementing organization will be the Energy Division (ED) in the Ministry of Mining and Energy (MME). Although several other Government institutions will be involved in implementing the Project, the ED will assume responsibility for overall Project performance.

The GOJ will establish a Project Implementation Unit (PIU) in the ED to be headed by a full-time Project Director to monitor the implementation of the Project. Progress of the Project will be monitored by measuring achievements against planned activities. Heads of the various Project components will monitor activities to ensure that schedules are being met. The Project Director will report to the Director of the Energy Division. In addition to the Project Director, the PIU will be staffed with two full-time professional engineers, a full-time financial officer and the required supporting staff.

The financial officer and the staff of the PIU will monitor all financial activities relating to the Project. They will prepare and maintain all financial records and prepare financial reports as required by the various agencies, including the MME, the Ministry of Finance and USAID.

In order to ensure effective monitoring of implementation activities, quarterly progress reports will be prepared by the PIU for distribution within the GOJ and to USAID.

The PIU will coordinate the purchase of local supplies and equipment under the Project. Actual commodity procurement will be carried out by the Department of Supply of the Ministry of Finance, a central purchasing organization in the GOJ.

B. Implementation of individual Project components

1. Project development and management

All activities carried out under this Project component will be under the ED. The long-term energy generalist advisor will be provided under this component of the Project. His/her chief counterpart will be the Project Director, but he/she will also work directly with the Director of Energy and advise him, as appropriate, on overall program development and management of the Division.

The long-term energy generalist advisor will also have responsibility for managing and coordinating all USAID loan-funded inputs into the Project. Approximately one-half his/her time is expected to be devoted to these responsibilities. See Annex A for his/her job description.

The Energy Information Center, included in this Project component, will be established under the ED. At the present time, the MME library serves as the energy library for the ED. Under the Project, the library will be expanded into an Energy Information Center to serve not only the needs of the MME, but also the needs of other GOJ institutions working in the field of energy, as well as the needs of the public for energy information.

2. Energy conservation

Many of the activities under this Project component also relate directly to the ED. The conservation branch of the ED will be directly responsible for managing the Public Education Program. Much of the production of audio-visual and printed material, as well as advertisements and the spot announcements to be used on the electronic media will be prepared by the Agency for Public Information, the GOJ's Information office.

The ED will also be primarily responsible for the public sector energy auditing and retrofitting program. The conservation branch has a team of 12 energy auditors, primarily CAST graduates, who will be carrying out the energy audits of public sector facilities with the assistance of loan-funded consultants. The retrofitting program, based on the energy audits, will also be the prime responsibility of the ED. Actual supervision of the work will be carried out by the National Development Agency (NDA), with the assistance of the GOJ organization responsible for the facility which is being retrofitted. The capital assistance fund which will finance the retrofitting will be managed by the ED through arrangements to be worked out with the Ministry of Finance and the NDA. The actual retrofitting itself will largely be carried out by private contractors under contract to the NDA.

The private sector auditing and retrofitting program involves a credit fund to be established in the National Commercial Bank of Jamaica (NCB) to provide loans to private sector firms who wish to carry out energy conservation measures. Annex K provides details on the policies and procedures of this credit fund as well as the other credit activities described below. Private sector energy auditors will undertake the audits and assist the private firms to develop loan proposals which will be submitted to the NCB. The NCB may seek the advise of the ED on loan proposals, but final approval will be by the NCB itself which will be responsible for managing the credit fund.

The conservation industry development fund will also be established in the NCB to be managed under guidelines to be mutually agreed to between USAID, the NCB and the ED.

The loan funded long-term energy conservation advisor will work directly with the conservation branch of the ED and the chief of that branch will be his/her principal counterpart.

3. Alternative Energy

The ED will be responsible for the public sector solar water heating program and will work out arrangements with the National Development Agency regarding the actual installation of the solar units.

The residential solar water heating program will be carried out through a credit fund to be managed by the NCB. The electric utilities company, the Jamaica Public Service Co. will assist in publicizing the program.

The commercial and industrial solar water heating program will also be carried out by the NCB under a credit scheme to provide loans to private sector firms who wish to install solar water heating systems.

The Bureau of Standards will be responsible for the development of Jamaican standards for the solar water heating industry.

The Meteorological Office will be responsible for installing the climatic stations and for managing the collection and analysis of the climatic data.

CAST will be responsible for the Solar Energy Institute which is being established as a part of that institution.

All of these Jamaican institutions will be responsible directly to the PIU in the ED for effective and efficient implementation of those elements of the Project being financed under this loan program and will submit quarterly reports on the progress of the Project component for which they are responsible.

The alternative energy resource assessments will be under the overall responsibility of the ED, but the ED may assign primary responsibility to other GOJ institutions for particular assessments. For example, the assessment of the potential of Jamaica's forestry resources as an energy source will be carried out by the Forestry Department and the loan-funded consultant who will assist in carrying out the assessment will work directly with that organization.

The loan funded long-term energy conservation advisor will work directly with the alternative energy branch of the ED and the chief of that branch will be his principal counterpart.

C. Contracting for technical assistance

USAID will contract with a U.S. institution to provide most of the technical assistance required in this Project. The ED has limited experience and expertise in contracting with foreign firms and has asked the USAID to undertake the contracting. USAID will prepare the RFP, and along with GOJ representatives review the bids and make the final selection of the contractor. The USAID will not select a contractor which is unacceptable to the GOJ.

range of services for the GOJ in the implementation of the Project, e.g., developing specifications for the purchase of equipment.

The US contractor (or contractors) will especially be needed to assist the GOJ in identifying short-term training courses (as well as in placing the long-term participants) and arranging for the training in the US of those selected to participate in the training program. The placement and administrative services of the AID Office of International Training may be used for some participants through USAID issued PIO/Ps.

The GOJ will not be required to obtain all its technical assistance under this prime contract, and it may wish to enter into separate contracts with other institutions or firms for assistance it requires to implement the Project. These smaller contracts will be host-country contracts, unless the GOJ specifically requests USAID to do the contracting for it. USAID will provide assistance as needed and requested by the GOJ in locating qualified contractors.

D. Commodity procurement

Commodity procurement will be the responsibility of the Project Implementation Unit (PIU) in the GOJ's Energy Division. As needed, the AID-financed technical assistance contractor may provide assistance in developing the necessary detailed specifications and Invitations for Bids (IFB) for the purchase of the equipment (including books, vehicles, supplies and other commodities). The PIU, utilizing standard GOJ procurement procedures, which will be reviewed and approved by USAID only for procurement made outside of Jamaica requiring AID funding, will issue purchase orders directly to suppliers. AID will issue direct Letters of Commitment (L/COM) to those suppliers guaranteeing payment. The Department of Supply in the Ministry of Finance will be responsible for clearing the commodities through customs upon arrival.

E. Procurement of engineering services (public sector activities)

The procedures for handling the engineering services is explained in the engineering analysis of this Project Paper, Section IV-F. Basically, the GOJ will utilize its normal procedures for contracting for engineering and construction services, which USAID will review and approve. Upon completion of a construction project (e.g. installation of a solar water heating unit in a hospital or an energy conservation retrofitting project), USAID will reimburse the GOJ for 40% of the total cost of the construction job. (As explained in the engineering analysis, USAID and the GOJ have estimated that approximately 40% of the engineering/construction activities to be carried out under this project involve foreign exchange costs.)

D. AID project management

USAID/Jamaica has the necessary delegation of authority to implement this Project. The Project will be managed by the USAID Energy Officer in the General Development Office. The USAID will need to call upon the regional contracts officer in USAID/Haiti and the regional legal advisor in RDO/C Barbados for their services from time to time. USAID will also need to draw upon the engineering services of either USAID/Haiti or AID/W. USAID expects AID/W energy officers to participate in annual evaluations of the Project and to provide technical backstopping during the implementation of the Project.

USAID will approve detailed implementation plans and the criteria for the various loan funds to be established under the Project. USAID will also approve the GOJ selection of contractors and the individual contracts.

E. Logistic support

The GOJ will provide all loan-funded consultants with logistic support, including office space, secretarial assistance, in-country transportation and required office equipment and supplies. The loan-funded vehicles will provide some of the in-country transportation. In lieu of providing the secretarial assistance for short-term consultants, the GOJ may choose to include in the contract with the consultant the provision that he or she may hire a secretary as required to complete his/her report to provide other secretarial services as may be required. Loan funds are provided for the housing, international travel and transportation, shipping and storage of furniture and vehicles of long-term advisors.

F. Evaluation arrangements

The Project will be jointly evaluated annually by the GOJ and the USAID. USAID may wish to call upon AID/W assistance for the evaluation. At the end of two years, an in-depth evaluation will be carried out by an independent outside contractor to be jointly selected by the USAID and the GOJ.

The basis for the Project evaluations will be the Project's Logical Framework, the implementation schedule and subsequent detailed contractor work plans, as well as the Project description provided in this Project Paper. Detailed evaluation work plans will be developed jointly by USAID and the GOJ prior to each evaluation.

G. Implementation schedule

The following section contains an estimated implementation schedule for the principal Project activities.

ESTIMATED IMPLEMENTATION SCHEDULE

MAJOR ACTIONS	ESTIMATED MONTH	RESPONSIBLE ORGANIZATION(S)
Project authorized and funds allotted	0	AID/W
Loan Agreement signed	1	USAID, GOJ
Implementation Letter No. 1 issued	1	USAID
Condition Precedent for initial disbursement met	1	GOJ
GOJ project director on board full time	1	GOJ
Complete RFP for prime implementation contract and send out RFP.		GOJ
Order equipment for ED economics branch	1	GOJ
Develop core book list and order books for EIC	1	GOJ
Prepare plan for utilization of PEP Mobile Unit (condition precedent)	2	GOJ
Prepare specifications for purchase of Mobile unit and order	2	GOJ
Condition Precedent re ordering equipment for PEP program met	2	GOJ
Prepare specifications for equipment for energy conservation public education program and order equipment	2	GOJ
Implementation Plan for public sector auditing/ retrofitting program complete (condition precedent)	2	GOJ
Implementation Plan for public sector solar water heating program complete (condition precedent)	2	GOJ
Implementation Plan for development of Solar Energy Institute complete	3	GOJ
First new ED economist on board	3	GOJ
Complete energy sectoral surveys	3	GOJ
First new staff member for EIC on board	3	GOJ
Develop specifications for EIC computer purchase and order	3	GOJ
Director of EIC to one-month training program in US	4	GOJ
Order equipment for EIC	4	GOJ

MAJOR ACTIONS	ESTIMATED MONTH	RESPONSIBLE ORGANIZATION(S)
Capital assistance fund for public sector retrofitting program established-criteria developed (condition precedent)	4	GOJ
Develop criteria for private sector retrofitting credit fund (condition precedent)	4	GOJ
Develop criteria for private sector (residential) solar water heating program (condition precedent)	4	GOJ
Establish criteria for credit fund for expansion of Jamaica solar industry (condition precedent)	4	GOJ
Receive and review proposals from contractors	4	GOJ
First long term participant in energy economics departs for 2 year training program	5	GOJ
Locate new space for EIC	5	GOJ
Receive core books for EIC	5	GOJ
Two-month short term consultant for EIC	5	GOJ
First long-term participant in public education/energy conservation departs	5	GOJ
First short-term observation trip for PEP staff	5	GOJ
Long term participant in energy auditing departs	5	GOJ
First two long term participants in alternative energy depart	5	GOJ
Prepare and send out RFPs for public sector solar water heating program	5	GOJ
2-weeks training in US for BOS staff who will work on solar standards program	5	GOJ
Interview contractors and select prime contractor	5	GOJ
Receive equipment for ED economics branch	6	GOJ
First public service TV spots on energy conservation (10 new spots prepared during project)	6	GOJ
Receive equipment for energy conservation public education program	6	GOJ

MAJOR ACTIONS	ESTIMATED MONTH	RESPONSIBLE ORGANIZATION(S)
Hire driver/projectionist for Mobile Unit.	6	GOJ
Hire first new information officer for ED energy conservation branch	6	GOJ
3-Months training program for Director of PEP in US	6	GOJ/USAID
Order equipment for solar standards program	6	GOJ
Temporary solar standards accepted by BOS	6	GOJ
2-Months consultant to develop training program for solar systems installers	6	GOJ
Negotiate and sign contract with prime contractor	6	GOJ
Receive and install EIC computer	6	GOJ
Training in computer provided	6	GOJ/contractor
Order additional books for EIC (and periodically throughout project)	6	GOJ
First EIC librarian to 1 month training program in US	6	GOJ
Receive equipment for EIC	6	GOJ
Receive Mobile unit vehicle	6	GOJ
Mobile unit for energy conservation operational	6	GOJ
2-Month consultant to assist in developing program for energy conservation industry development	6	GOJ
Contract with firms to manufacture/install solar water heating systems for residential program	6	GOJ
3-Months consultant to assist expansion of solar industry	6	GOJ
First training program for solar systems installers	6	GOJ
EIC computer system operational	6	GOJ
Establish criteria and procedures for energy conservation industry development credit fund (condition precedent)	6	GOJ

MAJOR ACTIONS	ESTIMATED MONTH	RESPONSIBLE ORGANIZATION(S)
Select consulting engineering firm for public sector solar water heating program	6	GOJ
Implementation/installation of residential solar water heating program	6	GOJ
3-Months consultant with MET to establish meteorological data collection program	6	GOJ
Order equipment for SEI (after condition precedent met)	6	GOJ
3-Months consultant to help SEI prepare program	6	GOJ
Long term energy-generalist advisor on board (for life of project)	7	GOJ
Second new staff member for EIC on board	7	GOJ
EIC to complete national bibliography of energy libraries	7	GOJ
Long-term energy conservation advisor on board (3 years)	7	GOJ
Presentation 1-hr. TV special on energy conservation	7	GOJ
One-month audio-visual consultant for PEP (to return twice more for one-month consultancies during life of project)	7	GOJ
3-Months consultant to prepare manual on energy conservation for building industry	7	GOJ
Long term alternative energy advisor on board (for life of project)	7	GOJ
Order equipment for weather stations	7	GOJ
Develop criteria for industrial/commercial sector solar water heating program (condition precedent)	8	GOJ
Second new ED economist on board	8	GOJ
Installation of solar water heating systems in public sector facilities initiated	8	GOJ
Testing/evaluation for solar standards program to begin	8	GOJ
Training and research program for SEI prepared	8	GOJ

MAJOR ACTIONS	ESTIMATED MONTHS	RESPONSIBLE ORGANIZATION(S)
Building for SEI completed	9	GOJ
New staff for SEI on board	9	GOJ
Complete energy conservation plan	10	GOJ
Second new information officer for ED energy conservation branch on board	10	GOJ
Graphics officer for ED energy conservation branch on board	10	GOJ
Receive, install equipment for weather stations - start data gathering	10	GOJ
Second EIC librarian to 1-month training course in US	11	GOJ
First loan to expand solar industry in Jamaica	11	GOJ
Print and distribute manual on energy conservation for building industry	12	GOJ
2-Months consultant in energy economic planning	13	GOJ
First seminar on energy conservation manual for building industry - others to follow	13	GOJ
New staff member for ED alternative energy branch on board	13	GOJ
First loan under industrial/commercial solar water heating program	13	GOJ
Evaluation of first year of project	13	GOJ/USAID
Second long-term participant in energy economics departs for 2-year training program	15	GOJ
Second two long-term participants in alternative energy depart	15	GOJ
Jamaican standards for solar water heating manufacture established	20	GOJ
2-Months consultant in energy economic planning	25	GOJ
In-depth evaluation of second year of project	25	GOJ/USAID

MAJOR ACTIONS	ESTIMATED MONTH	RESPONSIBLE ORGANIZATION(S)
Third long-term participant in energy economics departs for 2-year training program	27	GOJ
Fifth long-term participant in alternative energy departs	27	GOJ
2-Months consultant in energy economic planning	37	GOJ
Evaluation after 3-years of project	37	GOJ/USAID
Sixth long-term participant in alternative energy departs	39	GOJ
Evaluation of project after 4 years	49	GOJ/USAID
Completion of end-of-project report (evaluation)	60	GOJ/USAID
PACD	60	GOJ/USAID

VI. Conditions, Covenants and Negotiating Status

A. Conditions Precedent to Disbursement.

1. First Disbursement. The standard conditions precedent to initial disbursement of the Loan will apply. These involve the designation of official GOJ representatives and the provision of specimen signature and of a legal opinion concerning the validity of the Loan Agreement. An additional condition precedent to initial disbursement will require the GOJ to submit satisfactory evidence that the Project Implementation Unit has been established and that a Project Director has been appointed and is working in that capacity.

2. Host Country Procurement. In accordance with standard AID practice, the GOJ must obtain, prior to AID disbursement for host country procurement, AID approval of contracts and other procurement actions and procedures as required under Handbook 11.

3. Public Education Program Mobile Unit. Prior to any disbursements, for the purchase of a vehicle and related equipment for the Public Education Program Mobile Unit, the GOJ will develop and obtain AID approval of a detailed implementation plan for the utilization of the Mobile Unit, and for the preparation of energy conservation programs which will be presented by the Mobile Unit.

4. Public sector auditing and retrofitting program. Prior to any disbursements for the public sector auditing and retrofitting program, the GOJ will prepare and obtain AID approval of a detailed implementation plan including an identification of priorities and a schedule for auditing government facilities during the 5 years of the project and for retrofitting such facilities, including a statement of the responsibilities of the various GOJ organizations involved.

5. Public sector solar water heating program. Prior to any disbursements for the public sector solar water heating program, the GOJ will prepare and obtain AID approval of a detailed implementation plan and schedule for the program, including a statement of the responsibilities of the various GOJ organizations involved.

6. CAST Solar Energy Institute. Prior to any disbursements for the purchase of equipment for the CAST Solar Energy Institute, the GOJ shall provide evidence acceptable to AID that the building to house the Institute will be completed by the time the equipment arrives in Jamaica.

7. Credit Programs. Prior to any disbursement for the respective programs to be implemented with funds reloaned by the GOJ to the National Commercial Bank, the GOJ will submit for the respective programs, in form and substance satisfactory to AID, a Reloan Agreement with the National Commercial Bank and, by means of such agreement or otherwise, evidence that the National Commercial Bank will apply acceptable subloan criteria, policies and procedures and has employed sufficient and qualified staff to administer the respective programs.

These conditions precedent may be modified or waived as appropriate by the USAID Mission Director or other AID officials, subject to the limits of conferred authority and applicable AID policies.

B. Special Covenants

1. Counterpart personnel. In view of the importance of the institutional development objectives of this Project, the GOJ will covenant that Jamaican personnel will be assigned to work on a substantially full-time basis with all Loan-funded advisors.

2. Participant training. In further recognition of the importance of institutional development, the GOJ will covenant to provide on a timely basis suitably qualified personnel for training in the United States or elsewhere in general accordance with the Project's implementation schedule. The GOJ will also covenant that such participants will, upon completion of training, be placed in suitable positions, relevant to the objectives of this Project, within the Government. The GOJ's normal bonding requirements will be made applicable to all Jamaicans undertaking such training.

3. Donor coordination. In recognition of the importance of consistency and compatibility of all external donor-funded activities in Jamaica's energy sector, the GOJ will covenant (a) to keep AID generally apprised of such ongoing and contemplated activities by means of a semi-annual letter; and (b) to convene an annual meeting of such donors for the purpose of a general review of progress to date and future actions planned.

4. Project coordination. In view of the several Jamaican organizations, both public and private sector, involved with one or more aspects of the energy sector in Jamaica, the GOJ will covenant to continue its existing energy coordination bodies, the National Energy Commission and its various sub-committees and the National Advisory Council on Energy. Included in the terms of reference of the National Energy Commission will be the periodic review of progress under this Project. The GOJ will also covenant to use its best efforts to promote and ensure coordination and cooperation of the various Jamaican organizations involved in the implementation of this Project.

C. Negotiating Status

The Project has been developed in close consultation with the Energy Division (ED) of the Ministry of Mining and Energy over the past 18 months. The ED has been deeply involved in the Project design and working out the implementation arrangements for the Project. The Minister of Mining and Energy, who is also the Prime Minister, read an earlier, near-final draft of the Project Paper and indicated to USAID his strong support of the Project. Those Project activities involving other Jamaican institutions as implementing agents (CAST, NCB, etc.) have been thoroughly discussed with those institutions and full agreement reached on the Project activity and how it will be carried out. Initial discussions have been held with the Ministry of Finance and Planning and no significant problems have been surfaced. An official letter of request has been received from the Minister of Mining and Energy (who is also the Minister of Finance and Planning and the Prime Minister) and is included as Annex J.

In summary, all participating agencies are familiar with the contents of the Project Paper as it applies to them, and no unusual problems are foreseen in the negotiation of the Loan.

Tax on solar water heaters

Prior to any disbursement for the private sector credit funds for the solar water heating program, the GOJ shall provide evidence acceptable to AID that the 37% tax on water heaters has been removed from solar water heaters.

NOTE: In draft authorization, page Annex I-3, the paragraph will be numbered j and the following paragraph "covenants" will be renumbered k.

JOB DESCRIPTIONS FOR LONG-TERM ADVISORSPOSITION: LONG TERM ENERGY ADVISORQUALIFICATIONS:

Successful completion of academic training in an engineering discipline, plus supplementary studies in business, finance and management. An engineering BS in Mechanical Engineering and an MBA are highly desirable. At least ten years of progressively responsible experience in engineering work of which at least three should be in an energy related field. Must have a highly practical (pragmatic) orientation toward problem solving under field conditions, a broad knowledge (generalist) of energy conservation and alternatives, and the ability to translate current technological developments into practical applications in a developing country environment. Must be effective in both written and oral communication and capable of establishing sound working relationship with key figures in government, business, technical and trade organizations.

His experience should include some of the following:

- Broad engineering base
- Project management
- Energy conservation and management
- Evaluation and costing of technical projects
- Industrial development
- Machine design
- System development
- Machine fabrication
- Training and energy technology transfer

DUTIES AND RESPONSIBILITIES:

1. Serves as advisor to the Director of the Energy Division of the Ministry of Mining and Energy.
2. Assists in the planning, directing, managing, and implementing of all the energy related projects under the ED. Helps in identifying priorities, establishes operating goals and monitors the technical side of work in process. Assists in training the staff of the ED. Provides guidance and assistance to the loan program being implemented by NCB. Helps the Director in establishing standard operating policies and procedures.
3. Serves as an informal link between ED and the USAID project manager.
4. Develops close working rapport with other units in the program such as UWI, CAST, PCJ, SRC and others.
5. Assists the ED and others in negotiating and contracting for services from the private consultant group during the energy audits. Monitors the work of the loan-funded short-term consultants. As necessary helps in developing additional manpower resources.

6. As a key member of the ED team, participates in planning and implementation. Advises on changing needs in the energy field and their implications for broad policy changes in the country.
7. Exercises general management guidance on problem areas, suggests new programs, assists in the public education and information activities, and general research programs or studies.
8. Develops job descriptions or specifications for all staff positions in ED and all other foreign consultants.

POSITION: LONG TERM ENERGY CONSERVATION SPECIALIST

QUALIFICATIONS:

The energy conservation specialist should have a Bachelor's Degree in engineering, preferably mechanical engineering. An MS in engineering is desirable. Registration as a Professional Engineer and membership in energy-related technical societies are also desirable. The specialist should have a minimum of five years engineering experience of progressive responsibility. A significant experience in energy conservation during this period is also required, as is experience in project management. Previous experience in machine design and industrial development would also be valuable assets in the ECO implementation and energy industry phases. The specialist must be thoroughly familiar with the state of the art in energy conservation and must have conducted programs of technical assistance, estimating and evaluating ECO's, for a period of at least one year.

The selected candidate must have experience as an engineer in energy conservation programs in the areas of auditing, technical assistance, and ECO implementation. The energy conservation specialist will assist in coordinating the activities of other loan-funded conservation consultants, as they relate to the various projects described under this program in the field of energy conservation.

DUTIES AND RESPONSIBILITIES

1. The position of resident energy conservation specialist will be largely a working position, although there are significant management responsibilities. The specialist will, by nature of his long-term relationship with MME and other Jamaican organizations, be the primary technology transfer link for energy conservation expertise.
2. The specialist will supervise the performance of energy audits, demonstrating to the MME auditors the sort of ECO's to be looked for. Early programs of technical assistance, ECO pricing, ECO energy saving estimating, and project cost-benefit analysis will be performed by the specialist, and the Jamaican auditors will learn by this example. The specialist will supervise the preparation of ECO packages for approval by the various loan boards, and will be intimately involved in presenting and justifying these packages.
3. In addition to this work on the energy conservation retrofitting programs, the specialist will also help to organize and supervise the efforts of the teams performing the various studies in the area of energy conservation. The specialist will provide technical inputs to these reports and monitor the efforts to ensure that the proper direction is being taken toward timely completion of the reports, maintaining high technical quality.
4. The conservation specialist will also assist in carrying out the public education program for energy conservation. He will assist in identifying additional short-term consultants which are needed to implement this activity as well as providing advice on the various public education programs.

POSITION: LONG TERM ALTERNATIVE ENERGY ADVISOR

QUALIFICATIONS:

This person should have an academic degree in engineering or science and substantial background in one or more of the subfields directly related to alternative energy: solar heating and cooling of buildings, solar thermal technology (high-temperature applications), photovoltaic energy conversion, solar resource assessment (meteorological measurements and analysis), or solar applications in agriculture and less-developed countries. Training in management and finance are desirable; in lieu of such training, experience in the management of large projects and project staffs of ten or more people will be acceptable. The person must have experience working under field conditions, have practical knowledge of solar hardware and systems, and have demonstrated ability to produce specific accomplishments and meet goals. The person must be effective in both written and oral communication and have fluent command of the English Language. The person must be capable of establishing sound working relationships with associates in government, business, academic and technical organizations.

His experience and background should include some of the following:

- Specific, documented accomplishments in alternative energy
- Project planning and management
- Uses of modern computing technology
- Training of subordinate personnel and classroom students
- Work in foreign countries
- Specification and construction of physical facilities
- Motivation to solve problems and meet goals

DUTIES AND RESPONSIBILITIES:

1. Serves as a long-term specialist, consulting on alternative energy and reporting to the Chief of the Alternative Energy Branch of the ED.
2. Assists in planning, directing and executing all solar energy related projects in the Energy Division of MME. Identifies solar project resource needs and provides high level technical assistance on individual projects.
3. Assists in planning, directing, and executing the agricultural solar crop drying tasks within the loan program.
4. Develops close working rapport with other units in the program such as USAID, UWI, CAST, BOS, solar manufacturers and others.
5. Orients and guides short-term consultant specialists brought in to assist on specific alternative energy programs.
6. Teaches and instructs Jamaican personnel in classroom and on-the-job situations.
7. Advises on changing needs and technical advances in the alternative energy field, and recommends research guidance to respond to these new situations.

EQUIPMENT LIST

	<u>\$000</u>
Vehicle - Program planning and development	10
EIC: Books and periodicals	300
EIC: Computer	15
EIC: Equipment and supplies	45
1 Microfiche file cabinet with lock	\$ 556
1 Book trolley with 4 wheels	203
1 Visible periodical record	79
1 Newspaper display	162
1 Card catalog - 45 drawer addition	1,000
100 Bags of book shelving	17,500
1 Word Processor	15,000
1 Teletax machine	3,000
1 Microfiche duplicator	1,000
Other equipment	1,500
Supplies	<u>5,000</u>
	\$45,000
ED Economics Branch: Calculators	3
PEP: Mobile unit vehicle	10
PEP: Equipment and supplies for mobile unit	15
1 16mm film projector and screen	500
1 TV receiver and video tape equipment	2,000
1 Slide projector with automatic tape	1,000
1 Portable Public Address system	1,500
Miscellaneous equipment and supplies	<u>10,000</u>
	\$15,000
PEP: Audio visual and other office equipment	45
1 Gestofax machine	5,000
1 IBM selectric composer	10,000
2 Lavalier microphones	200
1 Portable recorder	5,000
1 SEG 1210 P switcher	9,000
1 RM 430 editor	2,500
1 RM 410 remote control unit	300
1 12" TV monitor	1,500
1 Video camera	1,000
Cables, extensions	2,000
Film supply	6,000
Miscellaneous equipment and supplies	<u>2,500</u>
	\$45,000

Conservation: 2 vehicles for ED auditing staff	20
Bureau of Standards: Equipment for developing standards	70

Test equipment:

Measurement transducers	1,600
Solar instruments	4,000
Pumps, valves, plumbing, blowers, insulation, etc.	2,500
Heat exchangers, tanks, heaters	2,500
Recorders	6,000
Miscellaneous supplies	<u>5,000</u>
	\$21,000

Laboratory equipment:

Pyranometers, pyrehimeters, thermocouplers, resistance thermometers, positive displace- ment flow meters, magnetic flow meters, manometers, flow chart recorders, thermo- piles, etc.	\$25,000
Sample US solar collectors	3,000
Sample Jamaican solar collectors	3,000
Test hardware	10,000
Supplies and replacements	<u>8,000</u>
	\$49,000

Meteorological Office - Climatological Stations 60

3 Eppley pyranometers, or equivalent	3,000
3 Mechanical pyranometers, Weather Measure Corp. Model 401 or equivalent	1,950
3 Eppley tracking pyrhemometers or equiva- lent	7,500
5 Mechanical weather stations, MRI Model 1077 or Weather Measure Model WS 755	17,500
5 Data recorder and integrator	6,050
Chart paper, batteries and supplies	12,000
Calibration services	6,000
Security fences	<u>6,000</u>
	\$60,000

Equipment and supplies for CAST's training course for installers 10

Solar water heating units and miscellaneous equipment and supplies

Equipment for CAST SEI		90
Workshop equipment: machine tools, lathes, drill press, cutters, welders, miscellaneous	35,000	
Lab tools: special tools, measuring devices, instruments and others	15,000	
Solar energy equipment: digital data recorder, pyrheliometer, photovoltaic devices, hygrom- eter, pyranometer, anemometer, rain gauge, etc.	35,000	
Miscellaneous equipment and supplies	<u>5,000</u>	
	\$90,000	
Vehicle for CAST SEI		10
Equipment for Solar Crop Drying Program		60
Candidate glazing and absorber materials for testing (\$10,000 per year for 4 years)	40,000	
Material for building of prototype solar dryers (\$5,000 per year for 4 years)	<u>20,000</u>	
	\$60,000	
Equipment and supplies for construction and testing of other prototype alternative energy technologies		100
2 vehicles and trailers for forestry research program		30
Equipment for forestry research program		20
7 vehicles for alternative energy demonstration centers		70
Grand total for equipment, supplies and vehicles		\$989,000

Examples of Energy Conservation
Opportunities for Retrofitting

I. Thermal Systems

A. Boilers

1. Combustion efficiency improvements
2. Water treatment to prevent fouling of heat transfer surfaces
3. Maintenance (such as tube replacement or cleaning) to improve efficiency of heat transfer
4. Heat recovery systems
 - a. Economizers - heat boiler feedwater using exhaust gases
 - b. Air preheaters - heat combustion air using exhaust gases
 - c. Waste heat boilers
 - d. Blowdown heat recovery
5. Cogeneration systems for large industries
6. Refractory repairs or upgrading

B. Steam Distribution

1. Steam line insulation
2. Condensate return systems
3. Steam trap repair or replacement
4. Steam valve repair

C. Burners

1. Combustion efficiency improvement
2. Installation of newer, more efficient burners if warranted

D. Dryers

1. Predrying by mechanical means, such as squeezing
2. Recycle partial exhaust air flow
3. Preheat intake air with exhaust heat
4. Repair air leaks, insulation damage, adjust burners, clean heat transfer surfaces

E. Heat Recovery

1. From waste streams (liquid), such as wash water
2. From waste streams (gas), such as exhaust air or stack
3. From product, such as hot steel ingots or concrete blocks

II. Electrical Systems

A. Motors

1. Replace old motors with new energy-efficient variety
2. Check motor size versus load, replace with smaller motor if applicable
3. Adjust load on motors used to drive fans or pumps to suit conditions (variable rpm)
4. Power factor improvement - to cut distribution losses

B. Lighting

1. Additional use of skylights
2. Replace incandescents or mercury vapor with efficient luminaries such as fluorescents or high pressure sodium
3. Control lighting with switches, timers, etc.
4. Replace old bulbs with new energy efficient types
5. Use light colored paints to improve reflectivity

C. Compressed Air

1. Install receivers to reduce compressor startups and running time
2. Install small, dedicated compressor rear load to prevent long air lines
3. Duct cool air to compressor intake
4. Check system and motor sizing, determine if more efficient system is possible

Commercial Sector

I. Air Conditioning and Ventilation

A. Load reduction

1. External shading of fenestration
 - a. Awnings
 - b. Louvers
 - c. Window film
2. Installation of window screens for natural ventilation
3. Remove heat producing equipment from conditioned spaces
4. Reduce lighting levels
5. Tighten building envelope - caulking and weatherstripping
6. Insulate between conditioned and unconditioned spaces
7. Install automatic door closers
8. Re-roof with light colored material
9. Ventilate attic space
10. Use attic fans as air conditioning replacement

- B. Roof cooling sprays using waste water
- C. Evaporative cooling
- D. Spot cooling and ventilation at work stations
- E. Minimize outside air ventilation component, consistent with health and safety
- F. Install 7-day timers for night and week-end switch-off
- G. Calibrate thermostats
- H. Insulate chilled water lines or cool air ducts
- I. Install variable air volume systems
- J. Install locking thermostats
- K. Shade outside condensers or cooling
- L. Set chilled water temperatures for best efficiency
- M. Replace old air conditioning units with newer models having higher coefficient of performance or energy efficiency ratio
- N. In installations with multiple units, consolidate ducting so that one unit can carry load (following load reduction program)

II. Domestic Hot Water

- A. Recover waste heat from air conditioning condenser to preheat hot water
- B. In laundries or other installations using large quantities of hot water, recover heat from waste water
- C. Install heat pump water heaters in large installations where low grade heat source is available
- D. Consider solar hot water heaters

III. Lighting

- A. Replace incandescent and mercury luminaries with more efficient varieties
- B. Install lighting controls, such as switches and timers
- C. Relamp with efficient bulbs, such as "watt-miser"
- D. Install task lighting for specific areas, rather than overlighting whole space

- E. Install skylights
- F. Replace worn out bulbs
- G. Remove bulbs and disconnect ballasts in areas found to be overlit
- H. Install lighting control systems which monitor light levels and deliver light to meet present levels, rather than overlighting when sunlight is available
- I. Install photocells on security lighting
- J. Install timers on display lighting

IV. Refrigeration

- A. Calibrate thermostats
- B. Consolidate to minimize number of units in use
- C. Charge refrigerant systems and repair leaks
- D. Install more tightly sealed systems, such as replacing open units with sliding door types
- E. Replace old, inefficient systems with newer models having higher COP or EER.

INITIAL ENVIRONMENTAL EXAMINATION

A. Project Location : Jamaica

Project Title : Energy Sector Assistance

Funding (FY and Amount) : \$15,000,000 Loan - FY 81

Life of Project : Five Years (FY 81-85)

IEE Prepared by : Nelson Wall, Georgia Institute
of Technology
Jerome Hulehan, USAID/Jamaica,
and
Tibor Nagy, USAID/Haiti Engineer

Date : April 1, 1981

ENVIRONMENTAL ACTION RECOMMENDED: That this project receive a negative determination and that no additional environmental examinations be carried out in respect to it.

MISSION DIRECTOR'S CONCURRENCE

: *Glenn O. Patterson*
Glenn O. Patterson
Director, USAID/Jamaica

ASSISTANT ADMINISTRATOR'S DECISION

: APPROVED _____

DISAPPROVED _____

DATE _____

Summary of Project: The goal of the Project is to reduce Jamaica's dependence upon imported petroleum. The specific Project purpose is to strengthen the GOJ's institutional capacity to plan and manage energy programs, to expand and improve the Government's energy conservation program and to institute programs in alternative energy, particularly solar hot water heating. The Project implementation period is five years; the entire Project is loan-funded.

There are three major components of the Project: (1) program planning and management, (2) energy conservation and (3) alternative energy.

Program planning and management: AID will provide long and short-term consultants, training, books and periodicals and a limited amount of equipment to strengthen the institutional capacity of the Energy Division of the Ministry of Mining and Energy, the GOJ's principal energy office. The GOJ will provide counterpart personnel and local costs.

Energy Conservation: AID will provide long and short-term consultants, training and funds to assist in improving and expanding the GOJ's public education program in energy conservation and in developing a national energy conservation plan. AID will also provide funds to establish a credit program to assist the private sector to carry out energy auditing and retrofitting programs to improve the energy efficiency of industrial and commercial firms, thus reducing their energy costs. A similar program will be implemented in the public sector utilizing AID technical assistance and funds. The GOJ will provide counterpart personnel and local costs for the retrofitting activities and for the public education program.

Alternative energy: AID will provide long and short-term consultants, training and funds to carry out a program of installing solar-hot water heating units in public sector facilities, private sector firms and residential homes. AID will also assist the GOJ to establish a Solar Energy Institute, develop standards for the solar hot water heating industry, improve the meteorological data base for an expanded solar industry, establish a series of alternative energy demonstration centers, establish a program of solar crop drying and undertake a number of assessments and prototype testing of various alternative energy possibilities. The GOJ will provide counterpart personnel and local costs of these activities.

An evaluation of the Project's components indicates that none of the proposed activities will have a significant negative impact on the physical or natural environment and USAID/Jamaica recommends that the Project be given a negative determination requiring no further environmental review.

IMPACT IDENTIFICATION AND EVALUATION FORM

Impact
Identification
and
Evaluation

Impact Areas and Sub-areas

A. LAND USE

1. Changing the character of the land through:

- a. Increasing the population -----
- b. Extracting natural resources -----
- c. Land clearing -----
- d. Changing soil character -----

N

N

N

N

2. Altering natural defenses -----

N

3. Foreclosing important uses -----

N

4. Jeopardizing man or his works -----

N

5. Other factors

None

B. WATER QUALITY

- 1. Physical state of water -----
- 2. Chemical and biological states -----
- 3. Ecological balance -----
- 4. Other factors

N

N

N

None

C. ATMOSPHERIC

- 1. Air additives -----
- 2. Air pollution -----
- 3. Noise pollution -----
- 4. Other factors

N

N

N

None

D. NATURAL RESOURCES

- 1. Diversion, altered use of water -----
- 2. Irreversible, inefficient commitments -----
- 3. Other factors

N

N

None

E. CULTURAL

1. Altering physical symbols -----	N
2. Dilution of cultural traditions -----	L
3. Other factors	
----- None -----	

F. SOCIO-ECONOMIC

1. Changes in economic/employment patterns	L
2. Changes in population -----	N
3. Changes in cultural patterns -----	L
4. Other factors	
----- None -----	

G. HEALTH

1. Changing a natural environment -----	N
2. Eliminating an ecosystem element -----	N
3. Other factors	
----- None -----	

H. GENERAL

1. International impacts -----	L
2. Controversial impacts -----	N
3. Larger program impacts -----	L
4. Other factors	
----- None -----	

I. OTHER POSSIBLE IMPACTS (not listed above)

----- None -----	
------------------	--

- N - No environmental impact
- L - Little environmental impact
- M - Moderate environmental impact
- H - High environmental impact
- U - Unknown environmental impact

Logical Framework

ANNEX E

Project Title and Number: Energy Sector Assistance (532-0065)

Life of Project:
From FY 81 to FY 85
Total U.S. Funding:
Date Prepared: 5/01/81

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
<p><u>Program Goal:</u></p> <p>To reduce Jamaica's dependency upon imported petroleum.</p> <p><u>Project Purpose:</u></p> <p>To strengthen GOJ's institutional capacity to plan and manage energy programs directed at improving its energy situation, including expanding and improving the GOJ's energy conservation program and instituting programs in alternative energy.</p>	<p><u>Measures of Goal Achievement:</u></p> <p>Reduce Jamaica's dependency on imported petroleum for its commercial energy from 99% to some lesser amount.</p> <p>Alternative energy resources providing an increasing percentage of Jamaica's energy needs (est. 3-5% by end of project).</p> <p>Jamaica's oil import bill decreased as a percentage of total imports.</p> <p>Energy Division of MME fully staffed with qualified energy planners and technicians (professional staff of 32).</p> <p>Energy Information Center fully equipped and operational.</p> <p>National Energy Accounting system established and National Energy model prepared.</p> <p>All GOJ facilities audited and appropriate retrofitting carried out:</p> <p>Energy auditing/retrofitting firmly established as routine and necessary investments required by private sector.</p> <p>Jamaican industry providing increased percentage of hardware required for retrofitting program.</p>	<p>MME records (National Energy Accounting system)</p> <p>Ministry of Finance records.</p> <p>Observation, project monitoring, annual reports, annual evaluations.</p>	<p><u>Assumptions for achieving goal:</u></p> <p>Energy conservation and programs to exploit alternative energy resources are a high GOJ priority that prevails throughout Government programs.</p> <p>GOJ provides human and financial resources necessary for carrying out project activities.</p> <p>Effective coordination and cooperation established and maintained among various government organizations in energy sector.</p> <p>Private sector sufficiently motivated to invest in energy conservation retrofitting projects.</p>

Logical Framework

Project Title and Number: Energy Sector Assistance (532-0065)

Life of Project:
From FY 81 to FY 85
Total U.S. Funding:
Date Prepared: 5/01/81

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
<p><u>Outputs:</u></p> <p>I. <u>Program Planning and Management</u></p> <p>National Energy Plan updated.</p>	<p>Public sector fully committed to converting to solar water heating - several conversions completed, including all GOJ hospitals and hotels.</p> <p>Private sector fully committed to converting to solar water heating - several conversions already completed in residential and industrial/commercial sectors.</p> <p>Standards established for solar water heating industry.</p> <p>Meteorological data base for solar energy programs adequate.</p> <p>CAST SEI fully staffed and operational.</p> <p>Solar crop drying firmly established as effective agricultural technology.</p> <p>All indigenous alternative energy resources in Jamaica assessed for their potential. Project underway to exploit those whose potential is significant.</p> <p>Active program underway to exploit, in environmentally sound manner, forestry resources for their energy potential.</p> <p>Alternative Energy Technologies being effectively demonstrated in rural areas through Alternative Energy Demonstration Centers.</p> <p><u>Magnitude of Outputs:</u></p>		<p><u>Assumptions for Achieving Outputs:</u></p>

Logical Framework

Project Title and Number: Energy Sector Assistance (532-0065)

Life of Project:
From FY 81 to FY 85
Total U.S. Funding:
Date Prepared: 5/31/81

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
<u>Outputs:</u>	<u>Magnitude of Outputs:</u>		<u>Assumptions for Achieving Outputs:</u>
Sectoral energy surveys completed.	Six (agriculture, tourism, industry, household, commercial and transportation).	Observation, project monitoring, annual reports, annual evaluations (for all outputs).	Planned inputs provided. Sufficient qualified participants available (for all outputs).
National Energy Accounting System established.	One		
Increase staff in ED Economics Branch	Increase professional economists from 8-10.		
ED Economics Branch trained in planning and economic analysis.	3 persons trained in post graduate programs in energy economics, several trained in short courses.		
EIC fully staffed and operational with greatly increased holdings.	Increase librarians from 1-3. \$300,000 in books and periodicals.		
<u>II. Conservation</u>			
Energy conservation plan completed	One		
Public Education Program fully staffed and operational - providing energy information to public on regular and continuous basis.	One		
All Government facilities audited and retrofitting programs carried out.	\$2.25 million in retrofitting programs carried out.		
Energy auditing and retrofitting firmly established in private sector as routine and necessary investments.			
Energy consumption reduced in those private sector firms where auditing/retrofitting carried out.	Minimum of 15% reduction in energy consumption in firms retrofitted.		

Logical Framework

Project Title and Number: Energy Sector Assistance (532-0065)

Life of Project:
From FY 81 to FY 85
Total U.S. Funding:
Date Prepared: 5/01/81

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Retrofitting credit fund operating effectively - other sources of credit provided to fund.	\$7.2 million in loans disbursed.		
Energy conservation manual for construction industry prepared and seminars to disseminate recommendations held.	One Four seminars		
III. <u>Alternative Energy</u>			
Increased staff in ED Alternative Energy Branch.	Increase professional staff from 8-10		
GOJ strategy for development of indigenous alternative energy resources developed.			
Coordinated network of institutions established to carry out development of alternative energy resources.			
Solar water heaters installed in GOJ hospitals, hotels and public sector enterprises.	15 hospitals, 5 hotels, 5 public sector enterprises.		
Solar water heaters installed in residential sector.	700		
Solar water heating industry firmly established.			
Nation-wide demand for solar water heating systems created.			
Solar water heating systems installed in industrial/commercial firms.	15		

Logical Framework

Project Title and Number: Energy Sector Assistance (532-0065)

Life of Project:
From FY 81 to FY 85
Total U.S. Funding:
Date Prepared: 5/01/81

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Vehicles	One		GOJ able to attract and hire additional qualified staff (for all inputs).
Additional staff	2 Economists		
Equipment	\$3,000 for calculators		
<u>Energy Information Center</u>			
Technical assistance	6 mos. of consultants		
Additional staff	2 librarians		
Books and periodicals	\$300,000		
Computer and other equipment	\$60,000		
Training	3 1 mo. training programs		
<u>II. Conservation</u>			
<u>Conservation Plan</u>			
Technical assistance in development of Conservation Plan.	6 mos. of consultants, 1 long-term advisor (for all elements of conservation program)		
<u>Public Education Program</u>			
Additional GOJ personnel	2 information specialists, 1 graphic arts specialist, 1 driver-projectionist.		
Adequate GOJ support	Media and material production (\$2,663,000)		
Technical assistance	6 mos. of consultants.		
Training	1 long-term participant in public information, 3 mos. training for PEP Director, 2 1 mo. training programs for other information officers.		
Mobile unit - vehicle and equipment	one vehicle, \$22,000 in equipment.		

Logical Framework

Project Title and Number: Energy Sector Assistance (532-0065)

Life of Project:
From FY 81 to FY 85
Total U.S. Funding:
Date Prepared: 5/01/81

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
<u>Auditing and Retrofitting Program</u>			
Public sector retrofitting fund	AID - \$850,000; GOJ - \$1.4 million		
Training in auditing	Various short courses, 2 long-term participants		
GOJ staff	13 energy auditors		
Vehicles	Two		
Private sector retrofitting fund	AID - \$3 million; GOJ - \$4.2 million		
Training for private sector auditors	Various short courses (\$50,000)		
<u>Energy Conservation Industry Development</u>			
Technical assistance for Energy Conservation Industry Development.	15 mos. consultant		
Credit fund for Energy Conservation Industry Development.	AID - \$500,000; GOJ - \$500,000		
<u>Energy Conservation Manual for construction industry</u>			
Technical assistance	4 mos. consultant		
Production/Distribution of manual	\$30,000 (GOJ)		
<u>III. Alternative Energy</u>			
Technical assistance for Alternative Energy Branch	1 long-term advisor		
Additional GOJ personnel	2 engineers		
Training	6 long-term participants, variety of short courses		

Logical Framework

Project Title and Number: Energy Sector Assistance (532-0065)

Life of Project:
From FY 81 to FY 85
Total U.S. Funding:
Date Prepared: 5/01/81

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
<u>Solar water heating program</u>			
Capital Assistance Fund - public sector program.	AID - \$1.5 million; GOJ - \$2.3 million		
Technical assistance for public sector program.	3 mos. consultant		
Credit fund for private sector program.	AID - \$1.5 million; GOJ - \$2.2 million		
Technical assistance for public sector program.	3 mos. consultant		
<u>Development of standards</u>			
Equipment for standards program.	\$70,000		
Training in U.S.	2 short term courses		
GOJ staff	2 additional personnel from BOS		
<u>Meteorological program</u>			
Equipment for meteorological program	\$50,000		
Technical assistance	3 mos. consultant		

Logical Framework

Project Title and Number: Energy Sector Assistance (532-0065)

Life of Project:
From FY 81 to FY 85
Total U.S. Funding:
Date Prepared: 5/01/81

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
<u>Expansion of solar industry</u>			
Credit fund	AID - \$500,000; GOJ - \$700,000		
Technical assistance	10 mos. consultants		
Technical assistance for training of solar installers	3 mos. consultant		
Equipment for training of solar installers	\$10,000		
<u>Development of CAST Solar Energy Institute</u>			
Equipment	\$90,000		
Construction of building	\$280,000		
Staff	(3-7 personnel)		
Technical assistance	12 mos. consultants		
Training	Various short-term courses		
Vehicle	One		
<u>Solar crop drying program</u>			
Equipment	\$60,000		
Grants and credit fund	AID - \$220,000; GOJ - \$100,000		
<u>Assessments of Alternative Energy Resources</u>			
Technical assistance	12 mos. of consultants		
Equipment	AID - \$50,000; GOJ - \$50,000		

Logical Framework

Project Title and Number: Energy Sector Assistance (532-0065)

Life of Project:
From FY 81 to FY 85
Total U.S. Funding:
Date Prepared: 5/01/81

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
<u>Forestry program</u>			
Technical assistance in forestry assessment.	3 mos. consultant		
Technical assistance in forestry research.	1 long-term advisor (2 years)		
Vehicles	Two		
Equipment	\$20,000		
Training	one short course		
GOJ staff	2 persons		
<u>Alternative Energy Demonstration Centers</u>			
Technical assistance	11 mos. of consultants		
GOJ staff	1 - 7 persons		
Vehicles	7		
Printed material	\$52,000 (GOJ)		
Equipment	\$52,000 (GOJ)		
Credit fund	\$250,000 (GOJ)		

TO ILLUSTRATE, BOTH SHORT AND LONG TERM PROJECTIONS OF ENERGY SOURCES AND USES IN JAMAICA WOULD BE USEFUL IN DECIDING WHETHER TO EMPHASIZE CONSERVATION VERSUS DEVELOPMENT OF ALTERNATIVE ENERGIES IN SHORT RUN, AND IN TURN MAY FACILITATE BETTER DECISIONS ON WHICH ALTERNATIVE ENERGIES SHOULD BE DEVELOPED AND IN WHAT PARTS OF COUNTRY. PROJECTIONS MAY ALSO BE USEFUL IN ATTRACTING OTHER DONORS TO CONTRIBUTE TO A COORDINATED EFFORT IN THIS SECTOR. ENERGY AUDITS TO BE CARRIED OUT BY GOJ SHOULD PROVIDE A USEFUL STARTING POINT FOR THIS ANALYSIS.

2/3

G1771

THUS, AT THE TIME MISSION CHOOSES TO SUBMIT TO, PROJECT'S RATIONALE AND ITS PLACE WITHIN THE BROAD SPECTRUM OF ACTIVITIES THAT COULD BE CARRIED OUT IN THE SECTOR SHOULD BE CLEAR: USAID AND GOJ'S SHORT AND LONG TERM STRATEGY IN DEALING WITH THE ENERGY PROBLEM SHOULD BE SOUND; AND PROJECT DESIGN IN TERMS OF MAJOR COMPONENTS TO BE IMPLEMENTED SHOULD BE CLEARLY SET FORTH.

--B. PROJECT COMPONENTS:

PROJECT EFFORTS IN ALTERNATIVE ENERGIES WERE SEEN AS BEING GENERALLY IN RIGHT DIRECTION, GIVEN VARIOUS STUDIES CONDUCTED AND GOJ INTERPRETS AND EXPERIENCE TO DATE. HOWEVER, THERE APPEAR TO BE SOME PROMISING AREAS WHERE STUDIES HAVE NOT YET BEEN CONDUCTED. SOURCES AND USES STUDY, RECOMMENDED ABOVE, MAY PROVIDE ADDITIONAL INSIGHT INTO THESE AREAS AND MAY PROMOTE CONSIDERATIONS OF ADDITIONAL ALTERNATIVES (SUCH AS MINI-HYDROPOWER) NOT CONSIDERED PROMISING AT PRESENT TIME BECAUSE OF LIMITED EXPERIENCE. MISSION SHOULD GIVE BROADEST POSSIBLE CONSIDERATION TO WIDE ARRAY OF ALTERNATIVES, ELIMINATING ONLY THOSE WHICH ARE CLEARLY NOT FEASIBLE. INTENT HERE IS TO PRECLUDE ELIMINATION OF POSSIBILITIES AT TOO EARLY A STAGE. LOAN FINANCING OF THOSE ALTERNATIVES ULTIMATELY SELECTED WOULD THEN BE PROVIDED FOR APPLIED RESEARCH AND DEVELOPMENT OF MODELS FOR (WITH) BY FIELD TRIALS, DEMONSTRATIONS AND ACTUAL PRODUCTION AND

DISTRIBUTION OF THE TECHNOLOGY. SPECIAL EMPHASIS SHOULD BE PLACED ON THOROUGH FIELD TESTING UNDER A VARIETY OF JAMAICAN CONDITIONS OF EACH TECHNOLOGY, AND INDICATED MODIFICATIONS MADE, BEFORE PROMOTION OF COMMERCIALIZATION PHASE. IN AREA OF CONSERVATION, MISSION MAY WANT TO CONSIDER IMMEDIATELY AN IN-DEPTH STUDY OF SAVINGS WHICH COULD BE ACHIEVED THROUGH CONSERVATION MEASURES, DEVELOPMENT OF CONSERVATION PLAN, PLANS PROGRAM DESIGNED TO CARRY OUT THOSE MEASURES. SUCH STUDIES WOULD SERVE THE SHORT TERM PURPOSE OF PROVIDING INFORMATION TO THE GOJ ON WHICH THEY COULD TAKE ACTIONS AS WELL AS SET THE STAGE FOR ACTION PROGRAMS BY OTHER DONORS OR THOSE PROPOSED UNDER THE LOAN. STUDIES COULD BE FUNDED THROUGH FD AND S FUNDS; HOWEVER, MONIES ABOVE DLS 200,000 LEVEL WOULD BE CONTINGENT UPON FUNDING AVAILABILITY AT A LATER DATE.

--C. IMPACT REPORT:

PROJECT WILL ATTEMPT TO INTRODUCE SMALL PIGS UNITS ON FARMS WITH SUFFICIENT LIVESTOCK TO MAINTAIN THEM; THIS EXCLUDES BULK OF SMALL FARMERS. MORE SHOULD BE LEARNED ABOUT ENERGY PROCUREMENT AND USE AMONG RURAL AND URBAN POOR, THEIR ENERGY NEEDS AND COSTS. SUCH AN INVESTIGATION WOULD SERVE AS A BASIS FOR DEVELOPMENT OF APPROPRIATE ENERGY CONSERVING TECHNOLOGY THAT WOULD IMPACT DIRECTLY UPON THE POOR SEGMENTS OF JAMAICA.

--D. INSTITUTIONAL ARRANGEMENTS:

DISCUSSION FOCUSED ON PROPOSED INSTITUTIONAL ARRANGEMENTS, WHICH ENVISION MINISTRY OF MINING AND NATURAL RESOURCES AS IMPLEMENTING AGENCY, BUT WITH GROUPS SUCH AS THE UNIVERSITY OF THE WEST INDIES, JAMAICA SCIENTIFIC RESEARCH COUNCIL, MINISTRY OF AGRICULTURE, JAMAICA SCHOOL OF AGRICULTURE, AND THE COLLEGE OF ARTS SCIENCE AND TECHNOLOGY, PLAYING KEY ROLES ESPECIALLY IN RESEARCH AND DEMONSTRATION OF ALTERNATIVE ENERGY PROTOTYPES. OTHER ORGANIZATIONS SUCH AS THE JAMAICA PUBLIC SERVICE CO. COULD ALSO BECOME INVOLVED IN CONSERVATION AND PROMOTION OF SOLAR HOT WATER HEATERS. IT IS RECOMMENDED THAT NUMBER AND STRENGTHS/WEAKNESSES OF PARTICIPATING INSTITUTIONS SHOULD BE CONSIDERED CAREFULLY IN ORDER NOT TO DILUTE INSTITUTION BUILDING OBJECTIVES AND TO OBVIATE POTENTIALLY SERIOUS COORDINATION DIFFICULTIES. IN SETTING PROJECT OBJECTIVES AND PLANNING FOR IMPLEMENTATION MISSION SHOULD ALSO CONSIDER GOJ'S CAPABILITY TO IMPLEMENT PROJECT DUE TO STAFFING CONSTRAINTS RESULTING FROM OVERALL GOVERNMENT BUDGETING STRINGENCIES AND SHORTAGES OF TECHNICAL PERSONNEL. MISSION MAY WISH TO CONSIDER ALTERNATE IMPLEMENTATION ARRANGEMENTS, E.G., THROUGH JAMAICA PUBLIC

SERVICE COMMISSIONS, IF SUCH GROUPS ARE ABLE TO ATTRACT CAPABLE EMPLOYEES MINISTRY UNABLE TO HOLD.

3. PROGRAM SCOPE AND COST - PRELIMINARY PROGRAM WOULD FOCUS ON MOST PROMISING AREAS FOR (A) INCREASING JAMAICAN ENERGY SUPPLY THROUGH ALTERNATIVE TECHNOLOGIES, (B) CONSERVING ENERGY USES AND (C) STRENGTHENING INSTITUTIONAL CAPABILITY FOR ENERGY PLANNING AND MANAGEMENT BASED ON REAL FOOD ACHIEVING ENERGY BALANCE AT AFFORDABLE COST. WHILE FINANCING OF TECHNOLOGY TESTING AS WELL AS IMPLEMENTATION OF PROVEN TECHNOLOGIES (INCLUDING CONSERVATION PROGRAMS) WOULD BE INCLUDED, PID DID NOT JUSTIFY PROPOSED DOLLARS 10 MILLION LOAN AMOUNT. INTERIM REPORT SHOULD MAKE CASE FOR MINIMUM AMOUNT NEEDED TO UNDERTAKE A MEANINGFUL ENERGY PROGRAM.

4. SEPTEL FOLLOWS WITH ALLOTMENT. CHRISTOPHER

BT

#0325

W-3

UNCLASSIFIED

Certification Pursuant to Section 611 (e) of the Foreign Assistance Act
of 1961, as Amended

SUBJECT: Jamaica, Energy Sector Assistance Loan

I, Glenn O. Patterson, as Director of the United States AID Mission to Jamaica, having taken into account, inter alia, the maintenance and utilization of projects in Jamaica previously financed or assisted by the United States, do hereby certify that, in my judgement, Jamaica has both the financial capability and the human resources to maintain and utilize effectively the proposed Energy Sector Assistance Loan.

This judgement is based primarily on the facts developed in the Project Paper for the proposed loan of \$14,051,100 and A.I.D.'s review of the financial assistance previously provided to Jamaica.

Glenn O. Patterson
Director

Date

5C(1) - COUNTRY CHECKLIST

Listed below are, first, statutory criteria applicable generally to FAA funds, and then criteria applicable to individual fund sources: Development Assistance and Economic Support Fund.

A. GENERAL CRITERIA FOR COUNTRY ELIGIBILITY

1. FAA Sec. 116. Can it be demonstrated that contemplated assistance will directly benefit the needy? If not, has the Department of State determined that this government has engaged in a consistent pattern of gross violations of internationally recognized human rights?

Portions of the contemplated Assistance will benefit the needy directly, other portions indirectly. The Department of State has no determination of gross human rights violations in Jamaica.

2. FAA Sec. 481. Has it been determined that the government of recipient country has failed to take adequate steps to prevent narcotics drugs and other controlled substances (as defined by the Comprehensive Drug Abuse Prevention and Control Act of 1970) produced or processed, in whole or in part, in such country, or transported through such country, from being sold illegally within the jurisdiction of such country to U.S. Government personnel or their dependents, or from entering the United States unlawfully?

NO

3. FAA Sec. 620(b). If assistance is to a government, has the Secretary of State determined that it is not controlled by the international Communist movement?

The Government of Jamaica is not controlled by the International Communist Movement

4. FAA Sec. 620(c). If assistance is to government, is the government liable as debtor or unconditional guarantor on any debt to a U.S. citizen for goods or services furnished or ordered where (a) such citizen has exhausted available legal remedies and (b) debt is not denied or contested by such government?

NO

5. FAA Sec. 620(e)(1). If assistance is to a government, has it (including government agencies or subdivisions) taken any action which has the effect of nationalizing, expropriating, or otherwise seizing ownership or control of property of U.S. citizens or entities beneficially owned by them without taking steps to discharge its obligations toward such citizens or entities?

NO

A.

6. FAA Sec. 620(a), 620(f); FY 79 App. Act, Sec. 108, 114 and 606. Is recipient country a Communist country? Will assistance be provided to the Socialist Republic of Vietnam, Cambodia, Laos, Cuba, Uganda, Mozambique, or Angola? NO
7. FAA Sec. 620(1). Is recipient country in any way involved in (a) subversion of, or military aggression against, the United States or any country receiving U.S. assistance, or (b) the planning of such subversion or aggression? NO
8. FAA Sec. 620 (1). Has the country permitted, or failed to take adequate measures to prevent, the damage or destruction, by mob action, of U.S. property? NO
9. FAA Sec. 620(1). If the country has failed to institute the investment guaranty program for the specific risks of expropriation, inconvertibility or confiscation, has the AID Administrator within the past year considered denying assistance to such government for this reason? An Investment Guaranty Agreement is in effect
10. FAA Sec. 620(o); Fishermen's Protective Act of 1967, as amended, Sec. 5. If country has seized, or imposed any penalty or sanction against, any U.S. fishing activities in international waters:
 a. has any deduction required by the Fishermen's Protective Act been made?
 b. has complete denial of assistance been considered by AID Administrator? N,A
11. FAA Sec. 620; FY 79 App. Act, Sec. 603.
 (a) Is the government of the recipient country in default for more than 6 months on interest or principal of any AID loan to the country?
 (b) Is country in default exceeding one year on interest or principal on U.S. loan under program for which App. Act appropriates funds? NO
12. FAA Sec. 620(s). If contemplated assistance is development loan or from Economic Support Fund, has the Administrator taken into account the percentage of the country's budget which is for military expenditures, the amount of foreign exchange spent on military equipment and the Percent of total budget for military expenditure is 7% and includes domestic police force.

A.12.

amount spent for the purchase of sophisticated weapons systems? (An affirmative answer may refer to the record of the annual "Taking Into Consideration" memo: "Yes, as reported in annual report on implementation of Sec. 620(s)." This report is prepared at time of approval by the Administrator of the Operational Year Budget and can be the basis for an affirmative answer during the fiscal year unless significant changes in circumstances occur.)

13. FAA Sec. 620(t). Has the country severed diplomatic relations with the United States? If so, have they been resumed and have new bilateral assistance agreements been negotiated and entered into since such resumption? NO

14. FAA Sec. 620(u). What is the payment status of the country's U.N. obligations? If the country is in arrears, were such arrearages taken into account by the AID Administrator in determining the current AID Operational Year Budget? NO

15. FAA Sec. 620A, FY 79 App. Act, Sec. 607. Has the country granted sanctuary from prosecution to any individual or group which has committed an act of international terrorism? NO

16. FAA Sec. 666. Does the country object, on basis of race, religion, national origin or sex, to the presence of any officer or employee of the U.S. there to carry out economic development program under FAA? NO

17. FAA Sec. 669, 670. Has the country, after August 3, 1977, delivered or received nuclear enrichment or reprocessing equipment, materials, or technology, without specified arrangements or safeguards? Has it detonated a nuclear device after August 3, 1977, although not a "nuclear-weapon State" under the nonproliferation treaty? NO

B. FUNDING CRITERIA FOR COUNTRY ELIGIBILITY

1. Development Assistance Country Criteria

a. FAA Sec. 102(b)(4). Have criteria been established and taken into account to assess commitment progress of country in effectively involving the poor in development, on such indexes as: (1) increase in agricultural productivity through small-farm labor intensive agriculture, (2) reduced infant mortality, (3) control of population growth, (4) equality of income distribution, (5) reduction of unemployment, and (6) increased literacy?

Yes the criteria have been established and demonstrate both a high degree of commitment and a satisfactory rate of progress in all six (6) cases.

B.1.

b. FAA Sec. 104(d)(1). If appropriate, is this development (including Sahel) activity designed to build motivation for smaller families through modification of economic and social conditions supportive of the desire for large families in programs such as education in and out of school, nutrition, disease control, maternal and child health services, agricultural production, rural development, and assistance to urban poor?

Motivational material for family planning is built into all appropriate AID programs in Jamaica.

2. Economic Support Fund Country Criteria

a. FAA Sec. 502B. Has the country engaged in a consistent pattern of gross violations of internationally recognized human rights?

NO

b. FAA Sec. 533(b). Will assistance under the Southern Africa program be provided to Mozambique, Angola, Tanzania, or Zambia? If so, has President determined (and reported to the Congress) that such assistance will further U.S. foreign policy interests?

N.A.

c. FAA Sec. 609. If commodities are to be granted so that sale proceeds will accrue to the recipient country, have Special Account (counterpart) arrangements been made?

N.A.

d. FY 79 App. Act, Sec. 113. Will assistance be provided for the purpose of aiding directly the efforts of the government of such country to repress the legitimate rights of the population of such country contrary to the Universal Declaration of Human Rights?

NO

e. FAA Sec. 620B. Will security supporting assistance be furnished to Argentina after September 30, 1978?

N.A.

5C(2) - PROJECT CHECKLIST

Listed below are statutory criteria applicable generally to projects with FAA funds and project criteria applicable to individual fund sources: Development Assistance (with a subcategory for criteria applicable only to loans); and Economic Support Fund.

CROSS REFERENCES: IS COUNTRY CHECKLIST UP TO DATE?
HAS STANDARD ITEM CHECKLIST BEEN REVIEWED FOR THIS PRODUCT?

A. GENERAL CRITERIA FOR PROJECT

1. FY 79 App. Act Unnumbered; FAA Sec. 653 (b); Sec. 634A. (a) Describe how Committees on Appropriations of Senate and House have been or will be notified concerning the project; (b) Is assistance within (Operational Year Budget) country or international organization allocation reported to Congress (or not more than \$1 million over that figure)?

Project included on page 253 of the FY 81 Congressional Presentation for LAC.
2. FAA Sec. 611(a)(1). Prior to obligation in excess of \$100,000, will there be (a) engineering, financial, and other plans necessary to carry out the assistance and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?

YES
3. FAA Sec. 611(a)(2). If further legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purpose of the assistance?

N.A.
4. FAA Sec. 611(b); FY 79 App. Act Sec. 101. If for water or water-related land resource construction, has project met the standards and criteria as per the Principles and Standards for Planning Water and Related Land Resources dated October 25, 1973?

N.A.
5. FAA Sec. 611(e). If project is capital assistance (e.g., construction), and all U.S. assistance for it will exceed \$1 million, has Mission Director certified and Regional Assistant Administrator taken into consideration the country's capability effectively to maintain and utilize the project?

A 611 (e) certification is included in the Project Paper.
6. FAA Sec. 209. Is project susceptible of execution as part of regional or multilateral project? If so why is project not so executed? Information and conclusion whether assistance will encourage regional development programs.

Project is not susceptible of execution as part of regional or multilateral project,

A.

7. FAA Sec. 601(a). Information and conclusions whether project will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; (c) encourage development and use of cooperatives, credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture and commerce; and (f) strengthen free labor unions.

Parts of the project are addressed directly to items (b), (c), and (e) and indirectly to items (a) and (d). All of the listed goals are accepted by the GOJ.

8. FAA Sec. 601(b). Information and conclusion on how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).

Any such effect would be indirect, except insofar as US private firms will do technical assistance or provide commodities under the project.

9. FAA Sec. 612(b); Sec. 636(h). Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized to meet the cost of contractual and other services.

The GOJ is contributing 58 % of the total cost of the project in local currency. The US does not own any Jamaican currency.

10. FAA Sec. 612(d). Does the U.S. own excess foreign currency of the country and, if so, what arrangements have been made for its release?

NO

11. FAA Sec. 601(e). Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise?

YES

12. FY 79 App. Act Sec. 608. If assistance is for the production of any commodity for export, is the commodity likely to be in surplus on world markets at the time the resulting productive capacity becomes operative, and is such assistance likely to cause substantial injury to U.S. producers of the same, similar, or competing commodity?

N.A.

B. FUNDING CRITERIA FOR PROJECT

1. Development Assistance Project Criteria

a. FAA Sec. 102(b); 111; 113; 281a. Extent to which activity will (a) effectively involve the poor in development, by extending access to economy at local level, increasing labor-intensive production and the use of appropriate technology, spreading investment out from cities to small towns and rural areas, and insuring wide participation of the poor in the benefits of development on a sustained

Parts of the project will contribute directly to meeting some of these goals. Part of the project is one of institutional development of the MME's Energy Division. The improved planning and implementing capability will increase its ability to move toward the listed goals, all of which are also stated GOJ goals.

B.1.a.

basis, using the appropriate U.S. institutions; (b) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and otherwise encourage democratic private and local governmental institutions; (c) support the self-help efforts of developing countries; (d) promote the participation of women in the national economies of developing countries and the improvement of women's status; and (e) utilize and encourage regional cooperation by developing countries?

b. FAA Sec. 103, 103A, 104, 105, 106, 107.

Is assistance being made available: (include only applicable paragraph which corresponds to source of funds used. If more than one fund source is used for project, include relevant paragraph for each fund source.)

(1) [103] for agriculture, rural development or nutrition; if so, extent to which activity is specifically designed to increase productivity and income of rural poor; [103A] if for agricultural research, is full account taken of needs of small farmers;

(2) [104] for population planning under sec. 104(b) or health under sec. 104(c); if so, extent to which activity emphasizes low-cost, integrated delivery systems for health, nutrition and family planning for the poorest people, with particular attention to the needs of mothers and young children, using paramedical and auxiliary medical personnel, clinics and health posts, commercial distribution systems and other modes of community research.

(3) [105] for education, public administration, or human resources development; if so, extent to which activity strengthens nonformal education, makes formal education more relevant, especially for rural families and urban poor, or strengthens management capability of institutions enabling the poor to participate in development;

(4) [106] for technical assistance, energy, research, reconstruction, and selected development problems; if so, extent activity is:

(i) technical cooperation and development, especially with U.S. private and voluntary, or regional and international development organizations;

(ii) to help alleviate energy problems;

(iii) research into, and evaluation of, economic development processes and techniques;

(iv) reconstruction after natural or manmade disaster;

N.A. for (1) and (2) and (3).

i) US private firms will provide technical assistance in energy to the GO. under this project.

ii) Project is primarily designed to alleviate energy problems in Jamaica

iii) Part of the project is directed at research into new techniques of developing energy.

iv) N.A.

N.A.

N.A.

B.1.b.(4).

(v) for special development problem, and to enable proper utilization of earlier U.S. infrastructure, etc., assistance;

N.A.

(vi) for programs of urban development, especially small labor-intensive enterprises, marketing systems, and financial or other institutions to help urban poor participate in economic and social development.

N.A.

c. [107] Is appropriate effort placed on use of appropriate technology?

Technology selected is based on extensive project analysis.

d. FAA Sec. 110(a). Will the recipient country provide at least 25% of the costs of the program, project, or activity with respect to which the assistance is to be furnished (or has the latter cost-sharing requirement been waived for a "relatively least-developed" country)?

Jamaica is contributing over 25% of total project costs.

e. FAA Sec. 110(b). Will grant capital assistance be disbursed for project over more than 3 years? If so, has justification satisfactory to the Congress been made, and efforts for other financing, or is the recipient country "relatively least developed"?

N.A.

f. FAA Sec. 281(b). Describe extent to which program recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual resources to encourage institutional development; and supports civil education and training in skills required for effective participation in governmental and political processes essential to self-government.

Project was jointly conceived and developed by AID and the MME. A major part of the project is aimed at improving the institutional capacity of the MME.

g. FAA Sec. 122(b). Does the activity give reasonable promise of contributing to the development of economic resources, or to the increase or productive capacities and self-sustaining economic growth?

Jamaica's economic future is dependent upon its ability to solve its energy problem.

2. Development Assistance Project Criteria (Loans Only)

a. FAA Sec. 122(b). Information and conclusion on capacity of the country to repay the loan, including reasonableness of repayment prospects.

Repayment performance to date indicates reasonable repayment prospects.

b. FAA Sec. 620(d). If assistance is for any productive enterprise which will compete in the U.S. with U.S. enterprise, is there an agreement by the recipient country to prevent export to the U.S. of more than 20% of the enterprise's annual production during the life of the loan?

N.A.

B.

3. Project Criteria Solely for Economic Support Fund

a. FAA Sec. 531(a). Will this assistance support promote economic or political stability? To the extent possible, does it reflect the policy directions of section 102?

b. FAA Sec. 533. Will assistance under this chapter be used for military, or paramilitary activities?

This energy project will contribute directly to Jamaica's efforts to promote economic stability. The PP has concluded that the project is technically and economically sound.

→ NO

PROJECT AUTHORIZATION

COUNTRY: Jamaica
 PROJECT: Energy Sector Assistance
 PROJECT No: 532-0065

1. Pursuant to Part I, Chapter 1, Section 104 of the Foreign Assistance Act of 1961, as amended, I hereby authorize a Loan to the Government of Jamaica (the "Cooperating Country") of not to exceed Fourteen Million Fifty One Thousand One Hundred United States Dollars (\$14,051,100) to assist in financing foreign exchange and local costs of goods and services for the Energy Sector Assistance Project.

2. The Project consists of assisting the Cooperating Country in its efforts to:

- Improve its institutional capacity to plan and manage energy projects;
- Improve and expand its energy conservation program;
- Initiate projects in alternative energy.

AID assistance in this Project will be comprised of financing for technical services, participant training, commodity procurement and credit.

3. The Project Agreement, which may be negotiated and executed by the officer(s) to whom such authority is delegated in accordance with AID regulations and Delegations of Authority, shall be subject to the following essential terms and covenants and major conditions, together with such other terms and conditions as AID may deem appropriate.

a. Interest Rate and Terms of Repayment (Loan)

The Cooperating Country shall repay the Loan to A.I.D. in U.S. Dollars within twenty (20) years from the date of first disbursement of the Loan, including a grace period of not to exceed ten (10) years. The Cooperating Country shall pay to A.I.D. in U.S. Dollars interest from the date of first disbursement of the Loan at the rate of (i) two percent (2%) per annum during the first ten (10) years, and (ii) three percent (3%) per annum thereafter, on the outstanding disbursed balance of the Loan and on any due and unpaid interest accrued thereon.

b. Source and Origin of Goods and Services

Goods and Services, except for ocean shipping, financed by A.I.D. under the Loan shall have their source and origin in countries included in A.I.D. Geographic Code 941, except as A.I.D. may otherwise agree in writing. Ocean shipping financed by A.I.D. under the Loan shall, except as A.I.D. may otherwise agree in writing, be financed only on flag vessels of the United States and the Cooperating Country.

c. First Disbursement

Prior to the first disbursement under the Loan, or to the issuance by AID of documentation pursuant to which disbursement will be made, the Cooperating Country shall, except as A.I.D. may otherwise agree in writing, furnish to AID, in form and substance satisfactory to AID, evidence that the Project Implementation Unit has been established and that a Project Director has been appointed and is working full-time in that capacity.

d. Disbursement for Host Country Contracts

Prior to disbursement for each procurement, by the Cooperating Country of goods or services under the Loan, or to the issuance by AID of any documentation pursuant to which disbursement will be made, therefore, the Cooperating Country shall have obtained written approval by AID of respective procurement procedures and such procurement and contracting documentation as AID may specify in implementation letters.

e. Public Education Program: Mobile Unit

Prior to any disbursements for the purchase of a vehicle and related equipment for the Public Education Program Mobile Unit, the Cooperating Country, except as AID may otherwise agree in writing, shall obtain AID approval of a detailed implementation plan for the utilization of the Mobile Unit, and for the preparation of energy conservation programs which will be presented by the Mobile Unit.

f. Public sector auditing and retrofitting program

Prior to any disbursements for the public sector auditing and retrofitting program, the Cooperating Country, except as AID may otherwise agree in writing, shall obtain AID approval of a detailed implementation plan including an identification of priorities and a schedule for auditing government facilities during the 5 years of the project and for retrofitting such facilities, including a statement of the responsibilities of the various GOJ organizations involved.

g. Public sector solar water heating program

Prior to any disbursements for the public sector solar water heating program, the Cooperating Country, except as AID may otherwise agree in writing, shall obtain AID approval of a detailed implementation plan and schedule for the program, including a statement of the responsibilities of the various GOJ organizations involved.

h. CAST Solar Energy Institute

Prior to any disbursements for the purchase of equipment for the CAST Solar Energy Institute, the Cooperating Country, except as AID may otherwise agree in writing, shall provide evidence acceptable to AID that the building to house the Institute will be completed by the time the equipment arrives in Jamaica.

i. Credit Programs

Prior to any disbursement for the respective programs to be implemented with funds reloaned by the GOJ to the National Commercial Bank, the Cooperating Country, except as AID may otherwise agree in writing, shall submit for the respective programs, in form and substance satisfactory to AID, a Reloan Agreement with the

National Commercial Bank and, by means of such agreement or otherwise, evidence that the National Commercial Bank will apply acceptable subloan criteria, policies and procedures and has employed sufficient and qualified staff to administer the respective programs.

j. Covenants

The Loan Agreement shall contain covenants by the Cooperating Country providing in substance, as follows:

- (i) that Jamaican personnel will be assigned to work on a substantially full-time basis with all Loan-funded advisors;
- (ii) that it will provide on a timely basis suitably qualified personnel for training in the United States or elsewhere in general accordance with the Project's implementation schedule, that such participants will, upon completion of training, be placed in suitable positions, relevant to the objectives of this Project, within the Government, and that the Cooperating Country's normal bonding requirements will be made applicable to all Jamaicans undertaking such training;
- (iii) that AID shall be informed of ongoing and contemplated external donor-funded activities in the energy sector by means of semi-annual letter reports and that an annual meeting of donors will be convened to review progress of and planning for such activities;
- (iv) that energy coordination bodies, such as, the National Energy Commission (NEC) and its sub-committees and the National Advisory Council on Energy shall be continued, that the NEC will periodically review the progress of this Project and that it shall use its best efforts to promote and ensure coordination and cooperation of the various Jamaica organizations involved in the implementation of this Project.



Rec'd 5/4/81

ANNEX J

JAMAICA HOUSE
KINGSTON, JAMAICA

27th April 1981

Dear Mr. Patterson,

re USAID/Jamaica Energy Sector
Development Project

The Government of Jamaica is desirous of pursuing to finality, the programme of assistance for energy through the United States Agency for International Development. The major areas are - Energy Conservation and Alternative Energy Usage Development Project.

The Project Document is now being refined in consultation with officers of the U.S.A.I.D. Mission and officers of the Ministry of Mining and Energy and other relevant Government Departments and Agencies.

This request is without prejudice to any further discussions and negotiations needed, either by the U.S. Government or Jamaican Government, prior to the signing of any loan and or grant agreement by the Ministry of Finance for and on behalf of the Government of Jamaica.

This project is viewed to be of paramount importance to the Jamaican energy sector development, and your assistance is therefore urged.

Yours sincerely,

Edward Seaga
Prime Minister &
Minister of Mining & Energy

Mr. Glen O. Patterson,
Director - USAID/Jamaica,
c/o Embassy of the United States of America,
2 Oxford Road,
Kingston 5

Description of Operating Policies and
Procedures for Credit Funds

I. Summary

These Policies and Procedures are concerned with that portion of the Project involving private sector energy conservation and alternative energy sources for industrial and commercial enterprises as well as solar water heating devices for residential use. Loan funds primarily for the foreign exchange costs of these activities will amount to US\$5,600,000. An amount in Jamaican dollars equivalent to US\$7,500,000 (approximately J\$13,350,000) will be provided by the GOJ for local costs incurred under these components of the Project.

A breakdown of these credit funds by Project component follows:

<u>CREDIT FUNDS</u>			
	<u>AID</u>	<u>GOJ</u>	<u>TOTAL</u>
	<u>US\$ Million</u>		
<u>Energy Conservation</u>			
Retrofitting for Industrial/ Commercial Enterprises	3.0	4.2	7.2
Energy Conservation Industry Development	0.5	0.5	1.0
<u>Alternative Energy</u>			
Industrial/Commercial Solar Water Heating	1.0	1.3	2.3
Capacity Expansion (New or Existing) of Solar Equipment Manufacturers	0.5	0.5	1.0
Loans for Commercial Solar Drying	0.1	0.1	0.2
Residential Solar Water Heating	<u>0.5</u>	<u>0.9</u>	<u>1.4</u>
	5.6	7.5	13.1

Although the funds are divided into various Project activities, the credit fund will actually function and be administered as a single fund. Funds may, with the approval of USAID, be moved from one Project activity to another, depending upon the progress of the various activities. The amounts allocated

to the various Project activities are the best estimates of the USAID and the GOJ as to the amounts required at the present time.

The Energy Fund to be established is to be administered by the National Commercial Bank of Jamaica Limited (NCB) acting as Executing Agent for the GOJ. A written agreement between GOJ and NCB shall be developed, and concurred in by the USAID, which spells out the respective responsibilities and obligations of the GOJ and NCB.

The terms of the USAID loan to the GOJ include a grace period of ten years followed by a ten year repayment period, with interest at 2% per annum during the grace period and 3% per annum thereafter. The GOJ will pass the funds on to the NCB with the same repayment period stipulated by USAID (i.e., 10 years grace followed by 10 years repayment for principal). The interest rate to the NCB will be 6-8% per annum. Whereas GOJ will undertake the obligation to repay AID in US dollars, the NCB will be required to repay the GOJ in local currency which will not be keyed to changes in the US dollar exchange rate.

Monies available under the Fund will be re-lent by the NCB in the form of sub-loans to end-users, which will be industrial and commercial firms and households (sub-borrowers). Re-lending will be effected at rates of interest and on terms as further described later. The commercial risk on the sub-loans will be undertaken by the NCB.

II. Organizational Aspects

A. Fiscal Responsibility

Fiscal responsibility for the operations of the Fund will be entrusted to the NCB as Executing Agent of the GOJ. Due regard will be given by NCB to protecting the integrity of the Fund and the interest of the Government and fulfilling the objectives established for the Fund. Policy matters are to be coordinated with the Ministry of Mining and Energy (MME).

B. NCB Eligibility

The eligibility of the NCB to continue to serve as Executing Agent of the Fund will be subject to the continuing evaluation of the GOJ and USAID. Such evaluation will be based on the opinion of the GOJ and USAID as to the institution's ability to manage the sub-loan program.

C. Duration

The Fund will commence operations as soon as possible after the loan agreement between AID and the GOJ is signed and the conditions precedent to disbursement for the credit funds are met, with a mandate to conduct lending operations for a period of at least 20 years. This period will allow funds to be re-lent as they are repaid by original sub-borrowers.

D. Conduct of Business

All operations carried out by the Fund shall be conducted in accordance with this written statement of Policies and Procedures. Any amendment of this statement shall be subject to the approval of USAID and MME.

E. Management

The Fund will be administered by a Senior Project Officer within the NCB. It will be this officer's responsibility to coordinate the technical and credit evaluations in connection with the sub-loans to ascertain that the loans are within the guidelines as set forth in this statement and to prepare the reports necessary for the Advisory Board to review the operations of the Fund. Staff as necessary to carry out these responsibilities will be provided to the Senior Project Officer by the NCB, and will include the services of a Project Engineer, who will attest to the technical feasibility of the sub-projects and confirm that the sub-projects meet the technical criteria for sub-loans.

F. Advisory Board

The Fund shall have an Advisory Board which will be chaired by a representative of the Ministry of Finance and will also contain one representative each from MME, Jamaica Public Service Company Limited and the NCB, and other representatives as may be mutually agreed to by the USAID and the GOJ.

The Advisory Board shall meet in regular sessions not less frequently than quarterly, and in special sessions as called by the Chairman of the Board.

The Advisory Board shall be asked to assist the Senior Project Officer of the Fund by giving advice, opinions and guidance on:

1. the overall activities of the Fund and its programs;
2. proposed changes in policies, procedures or interest rates;
3. the interaction of the Fund with other Government agencies and programs;
4. ways in which the Fund can be made more effective and helpful in the overall energy conservation and alternative energy effort;
5. exceptions to the guidelines; and
6. other operational matters.

G. Accounting and Audit

The Senior Project Officer shall be responsible for the design and maintenance of an accounting system for the Fund, based on generally accepted accounting principles and practices consistently applied, in sufficient detail to facilitate the formulation of reports needed or requested by the Advisory Board,

the GOJ, and/or USAID. Periodic summary reports (at least quarterly) providing data on the Fund's operations will be prepared and submitted to the Advisory Board, the GOJ and USAID. The accounts of the Fund shall be audited by independent external auditors satisfactory to the GOJ and USAID at the close of each fiscal year. In addition, immediately following the second year of the Fund's establishment, an in-depth evaluation of the Fund's operations will be carried out by an independent, outside contractor jointly selected by USAID and the GOJ.

H. Independence of Accounts

Receipts and disbursements of the Fund shall not be co-mingled with other funds managed by the NCB nor will the funds of any other agency of the GOJ.

III. Sub-Loan Policies and Guidelines

A. Criteria for Borrowers

1. of majority age;
2. sole proprietorships, partnerships, corporations and residential home owners;
3. creditworthy - offering a reasonable assurance of repayment.

B. Criteria for Sub-loan Projects

Each of the various Project activities will have its own criteria for funding approval, some requiring much more in-depth technical or marketing analysis than others. For instance, in the energy conservation retrofitting program, there is a condition precedent to funding that an energy audit be made and that all operations and maintenance energy conservation opportunities (ECOs), i.e. those with a payback period of less than one year and not having significant capital cost, as identified by the audit, be implemented. Other criteria are yet to be established, such as a determination as to which products are needed to implement ECOs in Jamaica. (The MME, together with outside technical assistance, will be preparing such criteria and also will be establishing, in cooperation with USAID, a funding allocation scheme).

It will be the ultimate responsibility of the Senior Project Officer in the NCB to ascertain that the sub-loan project meets the credit and technical guidelines as finally annexed to these policies and procedures.

C. Loan Size and Term

The following chart provides guidelines for the size and terms of sub-loans within the various Fund categories:

CREDIT FUNDS

	<u>US\$'000</u>		
	<u>Total Funds Available</u>	<u>Maximum Loan Size</u>	<u>Maximum Terms</u>
<u>Energy Conservation</u>			
Industrial/Commercial Retrofitting	7,200	250	5-7 years
Energy Conservation Industry Development	1,000	100	5-7 years
<u>Alternative Energy</u>			
Industrial/Commercial Solar Water Heating	2,300	250	5-7 years
Solar Equipment Manufacturers Capacity Expansion	1,000	100	5-7 years
Loans for Commercial Solar Drying	200	25	5 years
Residential Solar Water Heating	1,400	10	3 years

For those sub-projects which have been approved, loan preparation costs incurred prior to loan approval may be included in the sub-loan. The Fund may also be used to provide loans to firms to undertake energy audits designed to lend to the development of a retrofitting project which would be eligible for funding under the Project.

D. Interest Rate

Rates to be charged by the NCB to sub-borrowers under the energy conservation retrofitting program and the solar hot water heating program will be a maximum of 4 points above the rate at which funds are lent by GOJ to the NCB (i.e., initially, rates would be 10-12 per cent to sub-borrowers based on the GOJ's rate of 6-8 per cent to the NCB). During the course of the Project, consideration will be given to increasing the interest rate so that it approaches the current commercial rate. Loans under programs involving the energy conservation industry development, expansion of capacity of solar equipment manufacturer and the solar crop drying program will be made at current commercial rates. The interest rate will be determined in negotiations between the GOJ and USAID prior to signing the loan agreement. However, rates to sub-borrowers shall be periodically reviewed by the Advisory Board and may be changed if deemed advisable by the Board and concurred in by USAID.

Interest rates charged by the NCB on individual sub-loans are to be fixed at authorization and not varied during the life of the particular sub-loan.

E. Repayment Schedule

Repayment schedules shall conform to the maxima established for each category. Payments shall be made not less frequent than semi-annually.

F. Grace Period

At the discretion of the NCB, a moratorium generally varying up to one year on principal repayment may be allowed, within the maximum sub-loan terms established herein.

G. Procurement Provisions

Standard procurement practices of AID will be followed.

H. Collateral

The NCB is expected to adhere to existing prudent banking practices, requiring such collateral under the sub-loans as might be necessary, desirable and available.

IV. Operating and Administrative Procedures

A. Applications

Prospective sub-borrowers should obtain an application form from the NCB, complete the form and return it, together with the supporting information requested, to a lending officer in any office of the NCB.

B. Preliminary Screening

Upon receipt of the completed application form, the NCB's lending officer will review the application to assure that all of the information requested is in hand. The application and related papers then will be transmitted to the Senior Project Officer in the NCB's main office for recording and screening. The application is to be reviewed at the same time by both a Credit Officer and the Project Engineer and, should either have sufficient cause for an outright declination, the Senior Project Officer should be informed immediately. If an energy audit, marketing plan or production analysis is necessary (depending upon the type of sub-loan) or is incomplete, the prospective sub-borrower is to be so informed.

C. Project Appraisal and Approval

When all of the conditions precedent have been fulfilled, the sub-loan project application will pass through the NCB's normal procedures for term lending, the Senior Project Officer having attested that all of the lending guidelines have been met. Following review by the proper authorities in the NCB, the sub-loan will be either approved or declined.

D. Disbursement Procedures

Once final approval has been granted for the sub-loan and, assuming no foreign exchange is required, i.e., all of the necessary equipment or raw materials are available domestically, the NCB will disburse local funds to the sub-borrower or his contractor. In the case of sub-loans requiring imported goods, the NCB will open a letter of credit covering the purchase or equipment by the sub-borrower. Upon a drawing being made under the Letter of Credit, the NCB will make the payment and request reimbursement from USAID through the MME for the requisite foreign exchange.

E. Reporting and Monitoring Procedures

In order to maintain proper monitoring of the program, the following reports will be required to be submitted to the Advisory Board on at least a quarterly basis:

1. Status report on drawdowns by the NCB.
2. Detail (including purposes) of loans disbursed, approved, arrearages and collections during the quarter and totals to date.
3. Any other information required by the Advisory Board.

In addition to the aforementioned reports, an annual report of the Fund's operations by external auditors shall be required.

F. Files and Records

The NCB shall be required to keep records in accordance with accepted accounting practices on all transactions under the Fund as well as proof of any security bond, mortgage or title furnished by sub-borrowers as security. In addition, during the effective period of a sub-loan and for one year thereafter, the NCB shall, on request, be required to give the GOJ or its representatives access to its sub-loan files and records at any time, within reason, so as to permit GOJ to examine and make copies of such records.

COST ESTIMATES FOR SOLAR HOT WATER SYSTEMS - HOSPITALS

HOSPITAL		ROOF				WATER HEATING SYSTEM				TOTAL COST (J\$)	RANKS	
PARISH	LOCATION	TYPE	CONDITION	AGE (YR)	REPAIR COST (J\$)	ELDS (#)	COLLECTOR AREA REQ'D (sf)	WATER STORAGE (gal)	COLLECTOR/COST (J\$)		Cost/ED	Rank
Clardn	Lionel Town	Pitched & Slab	Fair	20	20,000.00	14	950	20,000.00	73,000.00	113,000.00	112.1	17
	May Pen	Flat - Slab	Fair	12	8,000.00	68	565	10,000.00	43,000.00	61,000.00	67.9	14
	Chapelton	Pitched	Poor	20	14,000.00	71	710	15,000.00	54,000.00	83,000.00	116.9	16
Hanvr	Lucea	Slab	Fair	20	10,000.00	111	1,110	10,000.00	71,000.00	91,000.00	82.3	5
Kgn & St. And.	Kgn. Public	Pitched & Slab	Poor	20	61,000.00	153	3,760	15,000.00	282,000.00	358,000.00	95.2	9
	Victoria Jubilee	Slab	Fair	20	7,000.00	159	1,330	5,000.00	102,000.00	114,000.00	85.7	8
	Bustamante	Pitched - Zinc	Poor	20	70,000.00	260	2,160	Nil	* 120,000.00	127,000.00	51.8	1
	Nat'l Chest	Ground Space	Good	20	5,000.00	135	1,120	5,000.00	73,000.00	83,000.00	74	3
Manch	Mandeville	Flat - Slab	Inadequate	20	30,000.00	63	1,350	Nil	103,000.00	133,000.00	100	10
	Spauldings	Pitched	Fair	20	25,000.00	121	1,210	10,000.00	92,000.00	127,000.00	65	12
Portl	Buff Bay	Pitched - Zinc	Poor	20	40,000.00	110	940	20,000.00	100,000.00	160,000.00	170	18
	Pt. Antonio	Pitched & Slab	Fair	20	8,000.00	112	1,120	Nil	73,000.00	81,000.00	72	2
St. Ann	St. Ann's Bay	Pitched & Slab	Fair	20	25,000.00	135	1,120	Nil	86,000.00	111,000.00	100	10
	Alexandria	Pitched - Zinc	Fair	20	12,000.00	60	500	Nil	38,000.00	50,000.00	100	10
St. Cath.	Spanish Town		Construction		being		implemented		by	MME		
	Linstead	Pitched - Slab	Fair	20	8,000.00	132	1,100	Nil	84,000.00	92,000.00	83	7
St. Elz	Black River	Pitched & Slab	Fair/Poor	20	30,000.00	128	1,070	Nil	82,000.00	112,000.00	105	12
St. Jms	Cornwall Regional	Slab	Fair	12	10,000.00	224	1,860	Nil	143,000.00	153,000.00	82	5
St. Mary	Pt. Maria	Pitched & Slab	Fair/Poor	20	20,000.00	130	1,080	Nil	93,000.00	113,000.00	105	12
	Annotto Bay	Pitched & Slab	Fair/Poor	20	20,000.00	119	990	Nil	86,000.00	106,000.00	107	13
St. Ths	Prin. Margaret	Pitched - Zinc	Poor	20	5,000.00	220	1,840	Nil	139,000.00	144,000.00	78	4
	Isaac Barrant	Flat Slab	Fair	18	4,000.00	64	565	20,000.00	41,000.00	65,000.00	115	15
Trelwy	Ulster Spring	Pitched - Zinc	Fair/Poor	20	17,000.00	33	275	10,000.00	21,000.00	47,000.00	170	18
	Falmouth	Pitched	Fair	20	10,000.00	102	1,020	10,000.00	65,000.00	85,000.00	83	6
Westm.	Savanna-la-Mar	Slab	Doubtful	20	34,000.00	197	1,640	10,000.00	124,000.00	168,000.00	102	11
	Total				493,000.00	3,694	31,645	160,000.00	2,188,000.00	2,841,000.00		
	+ 20% (contingency & inflation)				591,800.00			192,000.00	2,625,800.00	3,409,200.00		

* Portion of Bustamante done by MME

Footnote on Alternative Energy Demonstration

Centers Budget - See Section E, Financial Analysis (Inflated budget)

USAID assistance will only be provided to the one pilot Alternative Energy Demonstration Center. Therefore, the loan will fund only 5 person months of consultants and one vehicle. Funding has been reduced, however the subtotals have not been changed and therefore no longer total correctly.

Local currency financing

Delete paragraph 2 of IV-E Financial Analysis - Single page narrative

MISSING PAGE

NO. IV E 1 & 2

PROGRAM PLANNING AND DEVELOPMENT

(\$000s)

TABLE IV-E-1

ACTIVITY	YEAR I			YEAR II			YEAR III			YEAR IV			YEAR V			TOTAL		
	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ
	FX	LC		FX	LC		FX	LC		FX	LC		FX	LC		FX	LC	
MME staff (Director, PIU and Economics Branch)	-	-	63	-	-	87	-	-	87	-	-	87	-	-	87	-	-	411
Long term energy advisor	50	-	-	100	-	-	100	-	-	100	-	-	100	-	-	450	-	-
<u>Training</u>																		
3 Postgraduate Programs in Energy Economics	45	-	8	45	-	16	45	-	16	-	-	8	-	-	-	135	-	48
Short courses and observation tours	20	10	25	20	10	25	20	10	25	20	10	25	20	10	25	100	50	125
Vehicle and maintenance (PIU)	10	-	3	-	-	3	-	-	3	-	-	3	-	-	3	10	-	15
Energy Surveys and analysis	-	-	12	-	-	56	-	-	83	-	-	56	-	-	56	-	-	263
<u>Energy Information Center</u>																		
EIC staff	-	-	11	-	-	21	-	-	21	-	-	21	-	-	21	-	-	95
6 mos. consultant	30	-	-	10	-	-	10	-	-	10	-	-	-	-	-	60	-	-
Books and Periodicals	80	-	3	70	-	4	70	-	4	50	-	4	30	-	6	300	-	21
Computer	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15	-	-
Search contract	3	-	-	3	-	-	3	-	-	3	-	-	3	-	-	15	-	-
Telephone charges	-	8	-	-	8	-	-	8	-	-	8	-	-	8	-	-	40	-
Equipment and Supplies	14	1	1	14	1	1	9	1	1	4	1	1	-	-	1	41	4	5
3 1-mo. training programs	10	-	3	-	-	-	-	-	-	-	-	-	-	-	-	10	-	3
<u>Economic Planning</u>																		
6 mos. consultants	10	-	-	20	-	-	30	-	-	-	-	-	-	-	-	60	-	-
Equipment	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-
TOTALS	290	19	129	282	19	213	287	19	240	187	19	205	153	18	199	1199	94	986

IV-E-3

CONSERVATION
(\$000s)

TABLE IV-E-1

ACTIVITY	YEAR I		YEAR II			YEAR III			YEAR IV			YEAR V			TOTAL			
	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID	GOJ	
	FX	LC		FX	LC		FX	LC		FX	LC		FX	LC		FX	LC	
Long term conservation advisor	50	-	-	100	-	-	100	-	-	-	-	-	-	-	-	250	-	-
Planning: 6 mos. consultants	30	-	-	20	-	-	10	-	-	-	-	-	-	-	-	60	-	-
<u>Public Education Program:</u>																		
MME/ED staff	-	-	55	-	-	55	-	-	55	-	-	55	-	-	55	-	-	275
API consultant services	-	-	20	-	-	20	-	-	10	-	-	10	-	-	10	-	-	70
Advertising (Electronic Media)	-	-	122	-	-	138	-	-	134	-	-	140	-	-	157	-	-	691
Advertising (Print Media)	-	-	121	-	-	127	-	-	133	-	-	139	-	-	145	-	-	665
Audio-visual Material Production (video, slides, films)	-	-	41	-	-	47	-	-	49	-	-	51	-	-	53	-	-	241
Billboards and posters	-	-	146	-	-	153	-	-	160	-	-	167	-	-	174	-	-	800
Brochures, leaflets and bulletins	-	-	33	-	-	35	-	-	37	-	-	39	-	-	41	-	-	185
Equipment, supplies, miscellaneous	-	-	9	-	-	12	-	-	16	-	-	20	-	-	24	-	-	81
5 mos. consultants	30	-	-	10	-	-	10	-	-	-	-	-	-	-	-	50	-	-
1 postgraduate program in public information	45	-	8	-	-	8	-	-	-	-	-	-	-	-	-	45	-	16
3 mos. training for Director	10	-	2	-	-	-	-	-	-	-	-	-	-	-	-	10	-	2
2 1-mo. training for Info. officers	4	-	1	4	-	1	-	-	-	-	-	-	-	-	-	8	-	2
Other short-term training	-	-	-	30	10	-	20	10	-	-	-	-	-	-	-	50	20	-
<u>Mobile Unit:</u>																		
Vehicle and maintenance	10	-	3	-	-	3	-	-	3	-	-	3	-	-	3	10	-	15
Equipment and supplies for Unit	5	1	-	2	1	1	2	-	1	2	-	2	2	-	3	13	2	7
Equipment, maintenance and supplies for PEP	45	-	6	-	-	4	-	-	13	-	-	17	-	-	21	45	-	61

IV-E-4

CONSERVATION

(\$000s)

TABLE IV-E-1

ACTIVITY	YEAR I		YEAR II			YEAR III			YEAR IV			YEAR V			TOTAL			
	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ
	FX	LC		FX	LC		FX	LC		FX	LC		FX	LC		FX	LC	
<u>Auditing and Retrofitting</u>																		
<u>Public Sector:</u>																		
Training short term	20	10	10	20	10	10	20	10	10	-	-	-	-	-	-	60	30	30
Equipment	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	-	-
MME staff	-	-	63	-	-	63	-	-	63	-	-	63	-	-	63	-	-	315
Retrofitting Capital Fund (Engineering design and construction)	170	-	280	340	-	560	340	-	560	-	-	-	-	-	-	850	-	1,400
2 vehicles and maintenance	20	-	6	-	-	6	-	-	6	-	-	6	-	-	6	20	-	30
2 postgraduate programs in energy auditing	45	-	8	45	-	16	-	-	8	-	-	-	-	-	-	90	-	32
<u>Private Sector:</u>																		
Retrofitting credit fund (Engineering design and construction)	300	-	420	450	-	630	600	-	840	750	-	1,050	930	-	1,260	3000	-	4,200
Training course for auditors	30	-	10	20	-	10	-	-	10	-	-	10	-	-	10	50	-	50
2 months consultant to NCB	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20	-	-
<u>Energy Conservation Industry Development</u>																		
3 mos. consultant - survey	-	-	-	30	-	10	-	-	-	-	-	-	-	-	-	30	-	10
Consultants (TA) - 12 mos.	-	-	-	30	-	-	30	-	-	30	-	-	30	-	-	120	-	-
Credit fund	-	-	-	100	-	100	200	-	200	200	-	200	-	-	-	500	-	500
<u>Energy Conservation Manual</u>																		
3 mos. consultant	30	-	10	-	-	-	-	-	-	-	-	-	-	-	-	30	-	10
Production/distribution of manual	-	-	-	-	-	30	-	-	-	-	-	-	-	-	-	-	-	30
Seminars (1 mo. consultant)	-	-	-	10	-	5	-	-	-	-	-	-	-	-	-	10	-	5
TOTALS	894	11	1,374	1211	21	2044	1,332	20	2,308	982	0	1,972	932	0	2,025	5351	52	9,723

IV-E-5

ALTERNATIVE ENERGY
(\$000s)

TABLE IV-E-1

ACTIVITY	YEAR I			YEAR II			YEAR III			YEAR IV			YEAR V			TOTAL		
	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID	GOJ	
	FX	LC		FX	LC		FX	LC		FX	LC		FX	LC		FX	LC	
Long-term Alternative Energy Advisor	50	-	-	100	-	-	100	-	-	100	-	-	100	-	-	450	-	-
MME staff	-	-	69	-	-	69	-	-	69	-	-	69	-	-	69	-	-	345
6 M.A. training programs	90	-	16	90	-	24	45	-	24	45	-	24	-	-	16	270	-	104
Short-term training	20	10	10	20	10	10	20	10	10	20	10	10	20	10	10	100	50	50
Vehicle	10	-	3	-	-	3	-	-	3	-	-	3	-	-	3	10	-	15
<u>Solar water heating program</u>																		
<u>Public sector:</u>																		
Capital assistance fund (Engineering design and construction)	300	-	460	600	-	920	600	-	920	-	-	-	-	-	-	1500	-	2,300
3 mos. consultant	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	-	-
<u>Private sector:</u>																		
Residential sector credit fund (Engineering design and construction)	200	-	360	200	-	360	100	-	180	-	-	-	-	-	-	500	-	900
Industrial sector credit fund (Engineering design and construction)	100	-	130	150	-	195	200	-	260	250	-	325	300	-	390	1000	-	1,300
3 mos. consultant - industrial	30	-	10	-	-	-	-	-	-	-	-	-	-	-	-	30	-	10
<u>Standards for solar water industry</u>																		
Equipment	50	-	-	5	-	-	5	-	-	5	-	-	5	-	-	70	-	-
BOS staf.	-	-	19	-	-	19	-	-	19	-	-	19	-	-	19	-	-	95
Training in US	15	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8
Building	-	-	85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	85
<u>Improvement of Meteorological Data</u>																		
MET staff	-	-	10	-	-	10	-	-	10	-	-	10	-	-	10	-	-	50
3 mos. consultant	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	-	-

9-E-6

ALTERNATIVE ENERGY

(\$000s)

TABLE IV-E-1

ACTIVITY	YEAR I			YEAR II			YEAR III			YEAR IV			YEAR V			TOTAL		
	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ
	FX	LC		FX	LC		FX	LC		FX	LC		FX	LC		FX	LC	
Equipment	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	60	-	-
Installation of equipment	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
<u>Expansion of solar industry</u>																		
Credit fund	-	-	-	100	-	100	200	-	200	200	-	200	-	-	-	500	-	500
10 mos. consultants	-	-	-	20	-	-	40	-	-	40	-	-	-	-	-	100	-	-
<u>Training - Solar Unit Installers</u>																		
3 mos. consultant	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	-	-
Equipment and supplies	5	-	5	5	-	5	-	-	-	-	-	-	-	-	-	10	-	10
<u>Research and Development</u>																		
<u>CAST SEI:</u>																		
Building	-	-	280	-	-	-	-	-	-	-	-	-	-	-	-	-	-	280
CAST staff	-	-	30	-	-	30	-	-	30	-	-	30	-	-	30	-	-	150
Equipment	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	90	-	-
12 mos. consultants	60	-	-	20	-	-	20	-	-	20	-	-	-	-	-	120	-	-
Vehicle and maintenance	10	-	3	-	-	3	-	-	3	-	-	3	-	-	3	10	-	15
Short-term training	20	-	-	50	-	-	30	-	-	10	-	-	10	-	-	120	-	-
<u>Solar crop drying</u>																		
Equipment and materials	15	-	10	15	-	10	15	-	10	15	-	10	-	-	-	60	-	40
Grants to industries	-	-	-	-	40	-	-	60	-	-	20	-	-	-	-	-	120	-
Credit fund	-	-	-	-	30	30	-	40	40	-	30	30	-	-	-	-	100	100
3 mos. consultant	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	-	-
<u>Assessments of A.E. resources</u>																		
12 mos. consultants	30	-	10	30	-	10	30	-	10	20	-	10	10	-	10	120	-	50
Equipment/supplies	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	50	50	50

IV-E-7

ALTERNATIVE ENERGY

(\$000s)

TABLE IV-E-1

ACTIVITY	YEAR I		YEAR II			YEAR III			YEAR IV			YEAR V		TOTAL				
	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ			
	FX	LC		FX	LC		FX	LC		FX	LC		FX	LC				
<u>Forestry Resources</u>																		
3 mos. consultant	30	-	10	-	-	-	-	-	-	-	-	-	-	-	-	30	-	10
Forestry Department staff	-	-	50	-	-	50	-	-	-	-	-	-	-	-	-	-	-	100
2 yr. Research specialist	50	-	-	100	-	-	50	-	-	-	-	-	-	-	-	200	-	-
Training - short courses	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	-	-
2 vehicles and trailer and maintenance	30	-	6	-	-	6	-	-	6	-	-	6	-	-	6	30	-	30
Equipment	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20	-	-
<u>Alternative Energy Demonstration Centers</u>																		
11 mos. consultants	50	-	-	30	-	-	30	-	-	-	-	-	-	-	-	110	-	-
MME staff	-	-	10	-	-	30	-	-	30	-	-	60	-	-	60	-	-	190
Offices	-	-	4	-	-	12	-	-	13	-	-	25	-	-	26	-	-	80
Vehicles (7) and maintenance	10	-	3	30	-	12	30	-	21	-	-	21	-	-	21	70	-	78
Production of printed material	-	-	2	-	-	9	-	-	14	-	-	14	-	-	14	-	-	52
Credit fund	-	-	-	-	-	100	-	-	150	-	-	-	-	-	-	-	-	250
Tools equipment	-	-	2	-	-	8	-	-	14	-	-	14	-	-	14	-	-	52
Office supplies	-	-	1	-	-	3	-	-	3	-	-	7	-	-	8	-	-	22
TOTALS	1,485	20	1,618	1575	90	2,037	1,525	120	2,049	735	70	900	455	20	719	5775	320	7,323

IV-E-8

SUMMARY
(\$000s)

TABLE IV-E-1

ACTIVITY	YEAR I			YEAR II			YEAR III			YEAR IV			YEAR V			TOTAL		
	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID	GOJ	
	FX	LC		FX	LC		FX	LC	GOJ	FX	LC		FX	LC		FX	LC	
<u>Program Planning and Management:</u>																		
Consultants	90	-	-	130	-	-	140	-	-	110	-	-	100	-	-	570	-	-
Training	75	10	36	65	10	41	65	10	41	20	10	33	20	10	25	245	50	176
Equipment, Books, Supplies	112	1	4	84	1	5	79	1	5	54	1	5	30	-	7	359	4	26
Vehicles	10	-	3	-	-	3	-	-	3	-	-	3	-	-	3	10	-	15
Miscellaneous (service contractors, surveys, etc)	3	8	12	3	8	56	3	8	83	3	8	56	3	8	56	15	40	263
GOJ staff	-	-	74	-	-	108	-	-	108	-	-	108	-	-	108	-	-	506
TOTALS	290	19	129	282	19	213	287	19	240	187	19	205	153	18	199	1199	94	986
USAID: FX - \$1,199,000																		
LC - 94,000																		
<u>\$1,293,000</u>																		
5% contingency 64,650																		
USAID TOTAL \$1,357,650																		
GOJ TOTAL \$ 986,000																		

IV-E-9

SUMMARY

(\$000s)

TABLE IV-E-1

ACTIVITY	YEAR I		YEAR II			YEAR III			YEAR IV			YEAR V			TOTAL			
	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID	GOJ	
	FX	LC		FX	LC		FX	LC		FX	LC		FX	LC		FX	LC	
<u>Conservation:</u>																		
Consultants	160	-	10	200	-	30	150	-	10	30	-	10	30	-	10	570	-	70
Training	154	10	39	119	20	50	40	20	28	-	-	10	-	-	10	313	50	137
Equipment and Supplies	80	1	15	2	1	17	2	-	30	2	-	39	2	-	48	88	2	149
Vehicles	30	-	9	-	-	9	-	-	9	-	-	9	-	-	9	30	-	45
Credit fund	300	-	420	550	-	730	800	-	1,040	950	-	1,250	900	-	1,260	3,500	-	4,700
Capital assistance	170	-	280	340	-	560	340	-	560	-	-	-	-	-	-	850	-	1,400
GOJ staff	-	-	118	-	-	118	-	-	118	-	-	118	-	-	118	-	-	590
Miscellaneous (contracts, production of material, advertising)	-	-	483	-	-	530	-	-	513	-	-	536	-	-	570	-	-	2,632
TOTALS	894	11	1,374	1,211	21	2,044	1,332	20	2,308	982	-	1,972	932	-	2,025	5,351	52	9,723
USAID: FX -	\$5,351,000																	
LC -	52,000																	
	<u>\$5,403,000</u>																	
5% contingency	270,150																	
USAID TOTAL	\$5,673,150																	
GOJ TOTAL	\$9,723,000																	

01-1-11

SUMMARY
(\$000s)

TABLE IV-E-1

ACTIVITY	YEAR I		YEAR II		YEAR III		YEAR IV		YEAR V		TOTAL							
	USAID		GOJ		USAID		GOJ		USAID		GOJ							
	FX	LC	FX	LC	FX	LC	FX	LC	FX	LC	FX	LC						
<u>Alternative Energy</u>																		
Consultants	420	-	30	300	-	10	270	-	10	180	-	10	110	-	10	1280	-	70
Training	155	10	34	160	10	34	95	10	34	75	10	34	30	10	26	515	50	162
Equipment and Supplies	250	10	28	35	10	36	30	10	37	30	10	41	15	10	32	360	50	174
Vehicles	60	-	15	30	-	24	30	-	33	-	-	33	-	-	33	120	-	138
Credit fund	300	-	490	450	30	785	500	40	830	450	30	555	300	-	390	2000	100	3,050
Capital assistance (Engineering design and construction)	300	-	460	600	-	920	600	-	920	-	-	-	-	-	-	1500	-	2,300
GOJ staff	-	-	188	-	-	208	-	-	158	-	-	188	-	-	188	-	-	930
Building construction	-	-	365	-	-	-	-	-	-	-	-	-	-	-	-	-	-	365
Grants	-	-	-	-	40	-	-	60	-	-	20	-	-	-	-	-	120	-
Miscellaneous (installation of equipment, office rental)	-	-	8	-	-	20	-	-	27	-	-	39	-	-	40	-	-	134
TOTAL	1485	20	1,618	1,575	90	2,037	1,525	120	2,049	735	70	900	455	20	719	5775	320	7,323
USAID: FX -	\$5,775,000																	
LC -	320,000																	
	<u>\$6,095,000</u>																	
5% contingency	304,750																	
USAID TOTAL	\$6,399,750																	
GOJ TOTAL	\$7,323,000																	

IV-E-11

SUMMARY
(\$000s)

TABLE IV-E-1

ACTIVITY	YEAR I		YEAR II			YEAR III			YEAR IV			YEAR V			TOTAL			
	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID	GOJ	
	FX	LC		FX	LC		FX	LC		FX	LC		FX	LC		FX	LC	
Program Planning and Management	290	19	129	282	19	213	287	19	240	187	19	205	153	18	199	1199	94	986
Conservation	894	11	1,374	1211	21	2,044	1,332	20	2,308	982	-	1,972	932	-	2,025	5351	52	9,723
Alternative Energy	1485	20	1,618	1575	90	2,037	1,525	120	2,049	735	70	900	455	20	719	5775	320	7,323
TOTALS	2669	50	3,121	3058	130	4,294	3,144	159	4,597	1,904	89	3,077	1,540	38	2,943	12325	466	18,032

USAID: FX - \$12,325,000
 LC - 466,000

 \$12,791,000
 5% contingency 639,550
 USAID TOTAL \$13,430,550
 GOJ TOTAL \$18,032,000

SUMMARY
(\$000s)

TABLE IV-E-1

ACTIVITY			YEAR I			YEAR II			YEAR III			YEAR IV			YEAR V			TOTAL	
	USAID	GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID	GOJ
	FX	LC	FX	LC	FX	LC	FX	LC	FX	LC	FX	LC	FX	LC	FX	LC	FX	LC	
	<u>USAID</u>	<u>GOJ</u>																	
Program Planning & Management	1,293,000	986,000																	
Conservation	5,403,000	9,723,000																	
Alternative Energy	6,095,000	7,323,000																	
	\$12,791,000																		
5% contingency	639,550																		
TOTAL	\$13,430,550	\$18,032,000																	

SUMMARY
(\$000s)

TABLE IV-E-1

ACTIVITY	YEAR I		YEAR II			YEAR III			YEAR IV			YEAR V			TOTAL			
	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ
	FX	LC		FX	LC		FX	LC		FX	LC		FX	LC		FX	LC	
Consultants	670	-	40	630	-	40	560	-	20	320	-	20	240	-	20	2420	-	140
Training	834	30	109	344	40	125	200	40	103	95	20	77	50	20	61	1073	150	475
Equipment and supplies	442	12	47	121	12	58	111	11	72	86	11	85	47	10	87	807	56	349
Vehicles	100	-	27	30	-	36	30	-	45	-	-	45	-	-	45	160	-	198
Credit fund	600	-	910	1000	30	1,515	1,300	40	1,870	1,400	30	1,805	1200	-	1,650	5500	100	7,750
Capital assistance	470	-	740	940	-	1,480	940	-	1,480	-	-	-	-	-	-	2350	-	3,700
GOJ staff	-	-	380	-	-	434	-	-	384	-	-	414	-	-	414	-	-	2,026
Building construction	-	-	365	-	-	-	-	-	-	-	-	-	-	-	-	-	-	365
Miscellaneous	3	8	503	3	48	606	3	68	623	3	28	631	3	8	666	15	160	3,029
TOTALS .	2669	50	3,121	3063	130	4,294	3,144	159	4,597	1,904	89	3,077	1540	38	2,943	12325	466	18,032

USAID: FX - \$12,325,000
 LC - 466,000
 12,791,000
 5% contingency 639,550
 USAID TOTAL \$13,430,550
 GOJ TOTAL \$18,032,000

VI-E-14

PROGRAM PLANNING AND DEVELOPMENT

(\$000s)

(with inflation)

TABLE IV-E-2

ACTIVITY	YEAR I			YEAR II			YEAR III			YEAR IV			YEAR V			TOTAL		
	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID	GOJ	
	FX	LC		FX	LC		FX	LC	GOJ	FX	LC	GOJ	FX	LC	GOJ	FX	LC	
MME staff (Director, PIU and Economics Branch)	-	-	63	-	-	37	-	-	96	-	-	106	-	-	117	-	-	469
Long term energy advisor	50	-	-	110	-	-	121	-	-	133	-	-	146	-	-	560	-	-
<u>Training</u>																		
3 Postgraduate Programs in Energy Economics	45	-	8	50	-	18	55	-	20	-	-	11	-	-	-	150	-	57
Short courses and observation tours	20	10	25	22	11	28	24	12	31	26	13	34	29	14	37	121	60	155
Vehicle and maintenance (PIU)	10	-	3	-	-	3	-	-	4	-	-	4	-	-	5	10	-	19
Energy Surveys and analysis	-	-	12	-	-	62	-	-	100	-	-	75	-	-	83	-	-	332
<u>Energy Information Center</u>																		
EIC staff	-	-	11	-	-	23	-	-	25	-	-	28	-	-	31	-	-	118
6 mos. consultant	30	-	-	11	-	-	12	-	-	13	-	-	-	-	-	66	-	-
Books and Periodicals	80	-	3	70	-	4	70	-	4	50	-	4	30	-	6	300	-	21
Computer	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15	-	-
Search contract	3	-	-	3	-	-	4	-	-	4	-	-	5	-	-	19	-	-
Telephone charges	-	8	-	-	9	-	-	10	-	11	-	-	12	-	-	50	-	-
Equipment and Supplies	14	1	1	14	1	1	9	1	1	4	1	1	-	-	1	41	4	5
3 1-mo. training programs	10	-	3	-	-	-	-	-	-	-	-	-	-	-	-	10	-	3
<u>Economic Planning</u>																		
6 mos. consultants	10	-	-	22	-	-	36	-	-	-	-	-	-	-	-	68	-	-
Equipment	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-
TOTALS	290	19	129	302	21	226	331	23	281	230	25	263	210	26	280	1363	114	1,179

IV-E-15

CONSERVATION
(\$000s)

(with inflation)

TABLE IV-E-2

ACTIVITY	YEAR I			YEAR II			YEAR III			YEAR IV			YEAR V			TOTAL		
	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ
	FX	LC		FX	LC		FX	LC		FX	LC		FX	LC		FX	LC	
Long term conservation advisor	50	-	-	110	-	-	121	-	-	-	-	-	-	-	-	281	-	-
Planning: 6 mos. consultants	30	-	-	24	-	-	12	-	-	-	-	-	-	-	-	66	-	-
<u>Public Education Program:</u>																		
MME/ED staff	-	-	55	-	-	61	-	-	67	-	-	74	-	-	81	-	-	338
API consultant services	-	-	20	-	-	22	-	-	12	-	-	13	-	-	14	-	-	81
Advertising (Electronic Media)	-	-	122	-	-	152	-	-	162	-	-	186	-	-	230	-	-	852
Advertising (Print Media)	-	-	121	-	-	140	-	-	161	-	-	185	-	-	213	-	-	820
Audio-visual Material Production (video, slides, films)	-	-	41	-	-	52	-	-	59	-	-	68	-	-	77	-	-	297
Billboards and posters	-	-	146	-	-	168	-	-	194	-	-	222	-	-	254	-	-	984
Brochures, leaflets and bulletins	-	-	33	-	-	39	-	-	45	-	-	47	-	-	61	-	-	225
Equipment, supplies, miscellaneous	-	-	9	-	-	13	-	-	20	-	-	26	-	-	35	-	-	103
5 mos. consultants	30	-	-	11	-	-	12	-	-	-	-	-	-	-	-	53	-	-
1 postgraduate program in public information	45	-	8	-	-	9	-	-	-	-	-	-	-	-	-	45	-	17
3 mos. training for Director	10	-	2	-	-	-	-	-	-	-	-	-	-	-	-	10	-	2
2 1-mo. training for Info. officers	4	-	1	4	-	1	-	-	-	-	-	-	-	-	-	8	-	2
Other short-term training	-	-	-	30	10	-	20	10	-	-	-	-	-	-	-	50	20	-
<u>Mobile Unit:</u>																		
Vehicle and maintenance	10	-	3	-	-	3	-	-	4	-	-	4	-	-	5	10	-	19
Equipment and supplies for Unit	5	1	-	2	1	1	2	-	1	2	-	3	2	-	5	13	2	10
Equipment, maintenance and supplies for PEP	45	-	6	-	-	4	-	-	15	-	-	23	-	-	31	45	-	79

CONSERVATION

(\$000s) (with inflation)

TABLE IV-E-2

ACTIVITY	YEAR I			YEAR II			YEAR III			YEAR IV			YEAR V			TOTAL		
	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ
	FX	LC		FX	LC		FX	LC		FX	LC		FX	LC		FX	LC	
<u>Auditing and Retrofitting</u>																		
<u>Public Sector:</u>																		
Training short term	20	10	10	22	11	11	24	12	12	-	-	-	-	-	-	66	33	33
Equipment	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	-	-
MME staff	-	-	63	-	-	69	-	-	76	-	-	84	-	-	92	-	-	384
Retrofitting Capital Fund (Engineering design and construction)	170	-	280	340	-	560	340	-	560	-	-	-	-	-	-	850	-	1,400
2 vehicles and maintenance	20	-	6	-	-	7	-	-	8	-	-	9	-	-	10	20	-	40
2 postgraduate programs in energy auditing	45	-	8	50	-	16	-	-	8	-	-	-	-	-	-	95	-	32
<u>Private Sector:</u>																		
Retrofitting credit fund (Engineering design and construction)	300	-	420	450	-	630	600	-	840	750	-	1,050	900	-	1,260	3000	-	4,200
Training course for auditors	30	-	10	22	-	11	-	-	12	-	-	13	-	-	14	52	-	60
2 months consultant to NCB	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20	-	-
<u>Energy Conservation Industry Development</u>																		
3 mos. consultant - survey	-	-	-	33	-	10	-	-	-	-	-	-	-	-	-	33	-	10
Consultants (TA) - 12 mos.	-	-	-	33	-	-	36	-	-	40	-	-	44	-	-	153	-	-
Credit fund	-	-	-	100	-	100	200	-	200	200	-	200	-	-	-	500	-	500
<u>Energy Conservation Manual</u>																		
3 mos. consultant	30	-	10	-	-	-	-	-	-	-	-	-	-	-	-	30	-	10
Production/distribution of manual	-	-	-	-	-	33	-	-	-	-	-	-	-	-	-	-	-	33
Seminars (1 mo. consultant)	-	-	-	11	-	5	-	-	-	-	-	-	-	-	-	11	-	5
TOTALS	894	11	1,374	1242	22	2117	1,367	22	2,456	992	0	2,207	946	0	2,382	5441	55	10,536

IV-E-17

ALTERNATIVE ENERGY

(\$000s) (with inflation)

TABLE IV-E-2

ACTIVITY	YEAR I		YEAR II			YEAR III		YEAR IV		YEAR V		TOTAL						
	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ			
	FX	LC		FX	LC		FX	LC		FX	LC		FX	LC				
Long-term Alternative Energy Advisor	50	-	-	110	-	-	121	-	-	133	-	-	146	-	-	560	-	-
MME staff	-	-	69	-	-	76	-	-	84	-	-	92	-	-	101	-	-	422
6 M.A. training programs	90	-	16	99	-	26	55	-	29	60	-	32	-	-	24	304	-	127
Short-term training	20	10	10	22	11	10	24	12	10	26	13	10	29	14	10	121	60	50
Vehicle	10	-	3	-	-	3	-	-	4	-	-	4	-	-	5	10	-	19
<u>Solar water heating program</u>																		
<u>Public sector:</u>																		
Capital assistance fund (Engineering design and construction)	300	-	460	600	-	920	600	-	920	-	-	-	-	-	-	1500	-	2,300
3 mos. consultant	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	-	-
<u>Private sector:</u>																		
Residential sector credit fund (Engineering design and construction)	200	-	360	200	-	360	100	-	180	-	-	-	-	-	-	500	-	900
Industrial sector credit fund (Engineering design and construction)	100	-	130	150	-	195	200	-	260	250	-	325	300	-	390	1000	-	1,300
3 mos. consultant - industrial	30	-	10	-	-	-	-	-	-	-	-	-	-	-	-	30	-	10
<u>Standards for solar water industry</u>																		
Equipment	50	-	-	5	-	-	6	-	-	7	-	-	8	-	-	76	-	-
BOS staff	-	-	19	-	-	21	-	-	23	-	-	25	-	-	28	-	-	116
Training in US	15	-	8	-	-	-	-	-	-	-	-	-	-	-	-	15	-	8
Building	-	-	85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	85
<u>Improvement of Meteorological Data</u>																		
MET staff	-	-	10	-	-	11	-	-	12	-	-	13	-	-	14	-	-	60
3 mos. consultant	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	-	-

IV-E-18

ALTERNATIVE ENERGY
(\$000s) (with inflation)

TABLE IV-E-2

ACTIVITY	YEAR I		YEAR II			YEAR III			YEAR IV			YEAR V			TOTAL			
	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID	GOJ	
	FX	LC		FX	LC		FX	LC		FX	LC		FX	LC		FX	LC	
Equipment	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	60	-	-
Installation of equipment	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
<u>Expansion of solar industry</u>																		
Credit fund	-	-	-	100	-	100	200	-	200	200	-	200	-	-	-	500	-	500
10 mos. consultants	-	-	-	22	-	-	48	-	-	53	-	-	-	-	-	123	-	-
<u>Training - Solar Unit Installers</u>																		
3 mos. consultant	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	-	-
Equipment and supplies	5	-	5	6	-	6	-	-	-	-	-	-	-	-	-	11	-	11
<u>Research and Development</u>																		
<u>CAST SEI:</u>																		
Building	-	-	280	-	-	-	-	-	-	-	-	-	-	-	-	-	-	280
CAST staff	-	-	30	-	-	33	-	-	36	-	-	40	-	-	44	-	-	183
Equipment	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	90	-	-
12 mos. consultants	60	-	-	22	-	-	24	-	-	26	-	-	-	-	-	132	-	-
Vehicle and maintenance	10	-	3	-	-	3	-	-	4	-	-	4	-	-	5	10	-	19
Short-term training	20	-	-	55	-	-	36	-	-	13	-	-	14	-	-	138	-	-
<u>Solar crop drying</u>																		
Equipment and materials	15	-	10	17	-	11	19	-	12	21	-	13	-	-	-	71	-	46
Grants to industries	-	-	-	-	40	-	-	60	-	-	20	-	-	-	-	-	120	-
Credit fund	-	-	-	-	30	30	-	40	40	-	30	30	-	-	-	-	100	100
3 mos. consultant	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	-	-
<u>Assessments of A.E. resources</u>																		
12 mos. consultants	30	-	10	33	-	11	36	-	12	26	-	13	14	-	14	139	-	60
Equipment/supplies	10	10	10	11	11	10	12	12	10	13	13	10	14	14	10	60	60	50

ALTERNATIVE ENERGY

(\$000s) (with inflation)

TABLE IV-E-2

ACTIVITY	YEAR I		YEAR II			YEAR III			YEAR IV			YEAR V			TOTAL			
	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ
	FX	LC		FX	LC		FX	LC		FX	LC		FX	LC		FX	LC	GOJ
<u>Forestry Resources</u>																		
3 mos. consultant	30	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10
Forestry Department staff	-	-	50	-	-	55	-	-	-	-	-	-	-	-	-	30	-	10
2 yr. Research specialist	50	-	-	110	-	-	60	-	-	-	-	-	-	-	-	-	-	105
Training - short courses	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	220	-	-
2 vehicles and trailer and maintenance	30	-	6	-	-	7	-	-	-	-	-	-	-	-	-	10	-	-
Equipment	20	-	-	-	-	-	-	-	8	-	-	9	-	-	10	30	-	40
															20	-	-	-
<u>Alternative Energy Demonstration Centers</u>																		
11 mos. consultants	50	-	-	33	-	-	36	-	-	-	-	-	-	-	-	119	-	-
MNE staff	-	-	10	-	-	33	-	-	36	-	-	79	-	-	87	-	-	245
Offices	-	-	4	-	-	13	-	-	14	-	-	34	-	-	37	-	-	102
Vehicles (7) and maintenance	10	-	3	30	-	13	30	-	25	-	-	28	-	-	31	70	-	100
Production of printed material	-	-	2	-	-	9	-	-	16	-	-	18	-	-	20	-	-	65
Credit fund	-	-	-	-	-	100	-	-	150	-	-	-	-	-	-	-	-	250
Tools equipment	-	-	2	-	-	9	-	-	16	-	-	18	-	-	20	-	-	65
Office supplies	-	-	1	-	-	3	-	-	4	-	-	10	-	-	11	-	-	29
TOTALS	1,485	20	1,618	1,625	92	2,068	1,607	124	2,105	828	76	1,007	525	28	861	6069	340	7,659

IV-E-20

SUMMARY
(\$000s) (with inflation)

TABLE IV-E-2

ACTIVITY	YEAR I			YEAR II			YEAR III			YEAR IV			YEAR V			TOTAL		
	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID	GOJ	
	FX	LC		FX	LC		FX	LC		FX	LC		FX	LC		FX	LC	
<u>Program Planning and Management:</u>																		
Consultants	90	-	-	143	-	-	169	-	-	146	-	-	146	-	-	694	-	-
Training	75	10	36	72	11	46	79	12	51	26	13	45	29	14	37	322	60	215
Equipment, Books, Supplies	112	1	4	84	1	5	79	1	5	54	1	5	30	-	7	318	4	26
Vehicles	10	-	3	-	-	3	-	-	4	-	-	4	-	-	5	10	-	19
Miscellaneous (service contractors, surveys, etc.)	3	8	12	3	9	62	4	10	100	4	11	75	5	12	83	19	50	332
GOJ staff	-	-	74	-	-	110	-	-	121	-	-	134	-	-	148	-	-	587
TOTAL	290	19	129	302	21	226	331	23	281	230	25	263	210	26	280	1363	114	1,179

USAID: FX - \$1,363,000
LC - 114,000
\$1,477,000

5% contingency 73,850

USAID TOTAL \$1,550,850

GOJ TOTAL \$1,179,000

SUMMARY
(\$000s)

(with inflation)

TABLE IV-E-2

ACTIVITY	YEAR I			YEAR II			YEAR III			YEAR IV			YEAR V			TOTAL		
	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ
	FX	LC		FX	LC		FX	LC		FX	LC		FX	LC		FX	LC	GOJ
Conservation:																		
Consultants	160	-	30	222	-	32	181	-	12	40	-	13	44	-	14	647	-	101
Training	154	10	39	128	21	53	44	22	32	-	-	13	-	-	14	326	53	151
Equipment and Supplies	80	1	15	2	1	18	2	-	36	2	-	52	2	-	71	88	2	192
Vehicles	30	-	9	-	-	10	-	-	12	-	-	13	-	-	15	30	-	59
Credit fund	300	-	420	550	-	730	800	-	1,040	950	-	1,250	900	-	1,260	3,500	-	4,700
Capital Assistance	170	-	280	340	-	560	340	-	560	-	-	-	-	-	-	850	-	1,400
GOJ staff	-	-	118	-	-	130	-	-	143	-	-	158	-	-	173	-	-	722
Miscellaneous (contracts, production of material, advertising)	-	-	463	-	-	584	-	-	621	-	-	708	-	-	835	-	-	3,211
TOTAL	894	11	1,374	1,742	22	2,117	1,367	22	2,456	992	-	2,207	946	-	2,382	5,441	55	10,536

USAID: FX - \$5,441,000
 LC - 55,000
\$5,496,000

5% contingency 274,800

USAID TOTAL \$5,770,800

GOJ TOTAL \$10,536,000

SUMMARY
((\$000s) (with inflation))

TABLE IV -E-2

ACTIVITY	YEAR I			YEAR II			YEAR III			YEAR IV			YEAR V			TOTAL		
	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ
	FX	LC		FX	LC		FX	LC		FX	LC		FX	LC		FX	LC	
<u>Alternative Energy:</u>																		
Consultants	420	-	30	330	-	11	325	-	12	238	-	13	160	-	14	1473	-	80
Training	155	10	34	176	11	36	115	12	39	99	13	42	43	14	34	588	60	185
Equipment and Supplies	250	10	28	39	11	39	37	12	42	41	13	51	22	14	41	388	60	201
Vehicles	60	-	15	30	-	26	30	-	41	-	-	45	-	-	51	120	-	178
Credit fund	300	-	490	450	30	785	500	40	830	450	30	555	300	-	390	2000	100	3,050
Capital Assistance	300	-	460	600	-	920	600	-	920	-	-	-	-	-	-	1500	-	2,300
GOJ staff	-	-	188	-	-	229	-	-	205	-	-	249	-	-	174	-	-	1,131
Building construction	-	-	365	-	-	-	-	-	-	-	-	-	-	-	-	-	-	365
Grants	-	-	-	-	40	-	-	60	-	-	20	-	-	-	-	-	120	-
Miscellaneous (installation of equipment, office rental)	-	-	8	-	-	22	-	-	16	-	-	52	-	-	57	-	-	169
TOTAL	1485	20	1,618	1,625	92	2,068	1,607	124	2,105	828	76	1,007	525	28	761	6069	340	7,659
USAID: FX - \$6,069,000																		
LC - 340,000																		
			\$6,409,000															
5% contingency			320,450															
USAID TOTAL			\$6,729,450															
GOJ TOTAL			\$7,659,000															

IV-E-23

SUMMARY:
(\$1000) (with inflation)

TABLE IV-E-2

ACTIVITY	YEAR I		YEAR II		YEAR III		YEAR IV		YEAR V		TOTAL	
	USAID		GOJ		USAID		GOJ		USAID		GOJ	
	FX	LC	FX	LC	FX	LC	FX	LC	FX	LC	FX	LC
	<u>USAID</u>	<u>GOJ</u>										
Program Planning & Management	1,477,000	1,179,000										
Conservation	5,496,000	10,536,000										
Alternative Energy	6,409,000	7,659,000										
	\$13,382,000											
5% contingency	669,100											
TOTAL	\$14,051,100	\$19,374,000										

SUMMARY

(\$000s) (with inflation)

TABLE IV-E-2

ACTIVITY	YEAR I		YEAR II			YEAR III			YEAR IV			YEAR V			TOTAL			
	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ	USAID		GOJ
	FX	LC		FX	LC		FX	LC		FX	LC		FX	LC		FX	LC	
Consultants	670	-	50	695	-	43	675	-	24	424	-	26	350	-	28	2,814	-	181
Training	384	30	109	376	43	135	238	46	122	125	26	100	72	28	85	1,236	173	551
Equipment and Supplies	442	12	47	125	13	62	118	13	83	97	14	108	54	14	119	794	66	419
Vehicles	100	-	27	30	-	39	30	-	57	-	-	62	-	-	71	160	-	256
Credit	600	-	910	1000	30	1,515	1,300	40	1,870	1,400	30	1,805	1,200	-	1,650	5,500	100	7,750
Capital Assistance	470	-	740	940	-	1,480	940	-	1,480	-	-	-	-	-	-	2,350	-	3,700
GOJ staff	-	-	380	-	-	469	-	-	469	-	-	541	-	-	495	-	-	2,440
Building Construction	-	-	365	-	-	-	-	-	-	-	-	-	-	-	-	-	-	365
Grants	-	-	-	-	40	-	-	60	-	-	20	-	-	-	-	-	120	-
Miscellaneous	3	8	483	3	9	668	4	10	737	4	11	835	5	12	975	19	50	3,712
TOTALS	2669	50	3,121	3169	135	4,411	3,305	169	4,842	2,050	101	3,477	1,681	54	3,423	12873	509	19,274
USAID: FX -	\$12,873,000																	
LC -	509,000																	
	<u>\$13,382,000</u>																	
5% contingency	<u>669,100</u>																	
USAID TOTAL	\$14,051,100																	
GOJ TOTAL	\$19,274,000																	

IV-E-25

SUMMARY

(\$000s)

(with inflation)

TABLE IV-E-2

ACTIVITY	YEAR I		YEAR II		YEAR III		YEAR IV		YEAR V		TOTAL							
	USAID		GOJ		USAID		GOJ		USAID		GOJ							
	FX	LC	FX	LC	FX	LC	FX	LC	FX	LC	FX	LC						
Program Planning and Management	290	19	129	302	21	226	331	23	281	230	25	263	210	26	280	1363	114	1,179
Conservation	894	11	1,374	1,242	22	2,117	1,367	22	2,456	992		2,207	946		2,382	5441	55	10,536
Alternative Energy	1,85	20	1,618	1,625	92	2,063	1,607	124	2,105	828	76	1,007	525	28	761	6069	340	7,559
TOTALS	2669	50	3,121	3,169	135	4,411	3,305	169	4,842	2,050	101	3,477	1,681	54	3,423	12873	509	19,274
USAID: FX - \$12,873,000																		
LC - 509,000																		
<u>\$13,382,000</u>																		
5% contingency 669,100																		
USAID TOTAL \$14,051,100																		
GOJ TOTAL \$19,274,000																		