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PROJECT ASSISTANCE COMPLETION REPORT

FOR THE

ENERGY SECTOR ASSISTANCE PROJECT

APRIL 1987

Project No. 532-0065

Loan No. 532-W-016

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Project Assistance Completion Report

Project No. 532-0065

Loan No. 532-W-016

PROAG No. 532-W-016A (82-6)

The Energy Sector Assistance Project (ESAP) was designed to enhance energy efficiency in the public and private sector enterprises thereby reducing Jamaica's almost total dependence on imported crude oil and refined products. The basic components of the ESAP are:

- A. Institution building at the Energy Division, Ministry of Mining, Energy and Tourism (MMET) and the establishment of working relationships between the Energy Division and public and private sector institutions engaged in energy consuming and energy supplying activities;
  - B. An energy conservation program for the public sector;
  - C. An alternative energy program for the public sector; and
  - D. Energy Credit Fund for the private sector
- A. Institution-Building at the Energy Division
- 1. Academic and on-the-job training in the US

Institution building was planned through the implementation of a training program for junior and senior level officers at the Energy Division. Also, staff members from other public sector entities, who interacted with the Energy Division on a regular basis on energy related issues, were extended this opportunity. The training program supported candidates for the master's degree in energy policy, energy management or energy conservation at US universities. Further, it also offered short term on-the-job training under the Conventional Energy Training Program (CETP) sponsored by the Office of Energy AID/Washington. CETP provided course lectures and field training in petroleum exploration, management of refinery operation, energy planning at the national level, long range planning for the electric sector, renewable energy technologies etc.

ESAP sponsored nine candidates for long term educational training at US Universities. Details of the training are provided in Table 1.

In addition to offering educational training abroad, the project also promoted short term and on-the-job training offered in the US and outside Jamaica. Details of such training programs and the participants who took advantage of the training are listed on Table 2.

## 2. Restructuring the Energy Division

The original project objective, as outlined in the project Agreement called for increasing the professional staff at the Energy Division from 23 to 32. After discussions with MMET and a review of the functional needs of the Energy Division, it was decided to reduce the number to 19, upgrade the positions so that competent professionals can be recruited and maintained at the Energy Division. This action, it was felt, would reduce the high turnover of professional staff that was taking place at the Energy Division. Although the proposal to restructure the Energy Division and make it lean and efficient was approved in principle by the Ministry of the Public Service, MMET did not receive official authorization to implement the revised staffing plan for the Energy Division. Consequently, it has not been possible to attract and retain competent professionals at MMET. This problem is not unique to the Energy Division but remains a key problem area for all public sector agencies.

This aspect of institution building at the Energy Division might be cited as the only failure in achieving the broad objectives of the Project. Over twenty professionals from the Energy Division staff resigned during the course of the Project and at present, there are only 9 professionals on the permanent payroll of the Energy Division.

## 3. Long Term Consultants

The three long term positions for the consultants were:

- Energy Planner;
- Alternative Energy Adviser; and
- Conservation Advisor.

### 3.1 Energy Planner

The energy planner's position was initially filled by Mr. Donald Peterson. The job description was rewritten to suit more closely the type of needs at the Energy Division and Energy Division's role in National energy planning. Since the new job description for the energy planner was different from Mr. Peterson's background and experience, Dr. Thomas Tuschak filled the position on a one year assignment in June 1985. Dr. Tuschak was primarily involved in the formulation of a National Energy Policy and Plan that included:

- Energy supply options;
- related investment alternatives;
- energy pricing issues;
- alternative energy options;
- energy conservation policy; and
- institutional issues such as the role of the public and private sectors in energy management and policy.

An energy policy paper was submitted to the Government of Jamaica by a Steering Committee that reviewed these issues and presented the pros and cons of each issue for the GOJ's (Government of Jamaica) consideration. When decisions are made on the issues presented, the Energy Division will monitor the effect of such decisions on the country and its citizens.

The Steering Committee included senior representatives of the different energy consuming and energy supplying sectors. Through the Steering Committee's existence and action, the Energy Division was able to demonstrate the linkages it had established with the different agencies.

### 3.2 Alternative Energy Advisor

This position remained vacant until February 1985 when Dr. Frank Mathews assumed the duties for one year. Dr. Mathews developed the Concept Paper for the Energy Center at the College of Arts Science and Technology (CAST). The Concept Paper outlined the operation of the Energy Center, its organizational structure and the process by which the center could become self-sufficient by receiving payment from its clients for the energy-related services. The alternative advisor assisted in the improvement of meteorological data, the standards laboratory for energy products at the Bureau of Standards and the Alternative Energy Demonstration Center at Knockalva Agricultural School.

### 3.3 Energy Conservation Advisor

The Energy Conservation Advisor's position was filled in February 1983 by Mr. David Keith for a continuous period of four years. He was instrumental in organizing the energy auditing and energy conservation retrofitting programs at MMET. Further, he organized a network of energy coordinators from the public and private sector enterprises. Members of the group met regularly and exchanged experiences on energy conservation activities and promoted new concepts in energy conservation.

### 4. Participants Trained by ESAP

<u>Type and location of Training Programs</u>	<u>Participants</u>	<u>Number of</u>
Short term courses in the US	..	65
Short term courses in Jamaica	..	160
Longterm training at University of West Indies on Energy Management	..	26
Ph.D. Program in the USA (completed)	..	1
M.Sc. Programs in the USA (completed)	..	4
M.Sc. Programs in the USA (on-going)	..	2
B.Sc. Programs in the USA (on-going)	..	2

#### 4.1. Training Programs at MMET

Training programs were conducted at the Ministry of Mining, Energy and Tourism and taught by long and short term consultants. Details on the topics for the training programs, the instructors and the participants (who were generally from the GOJ energy sector agencies such as CAST, University of the West Indies, Petroleum Corporation of Jamaica, Jamaica Public Service, Ministries and private sector enterprises) are given in TABLE No. 3.

Further, MMET sponsored several training programs at MMET, University of West Indies and the College of Arts Science and Technology. The benefit in offering courses in Jamaica was that several students participated in the training program at relatively low cost to the Project. The participants who benefited from the training programs are listed in Table No. 4.

### 5. Publications

Several publications were produced by MMET staff and consultants working on the ESAP. These publications are

available for the general public at the Ministry's Energy Information Center. The important publications are listed below:

<u>Topic</u>	<u>Author/Date</u>
1) Jamaica Energy Auditors Handbook	D. Keith/L. Banta (1983)
2) Jamaican Energy Managers Manual	MME/D. Keith (1985)
3) Energy Tips	MME/D. Keith
4) Preliminary Design - Solar Water Heating Systems for Jamaica	Chroma/S. Chandra (1983)
5) Solar Water Heating Installation Manual	C. Chroma (1983)
6) Review of Potential for Renewable Energy Sources in Jamaica	MME/J. Arnold (1983)
7) Jamaica - Wind Energy Assessment	V. Nelson (1983)
8) Fleet Fuel Conservation Reviews	S. Electric Int'l. (1984)
9) Energy Conservation Manual for the Conservation Industry	D. Bloome (1983)

#### 6. The Economic Planning Unit (EPU)

The EPU staff were trained to enable the group to conduct national energy assessment and generate national energy plans regularly and update the plans when new data became available. The training of the EPU staff was achieved through academic training and on-the-job training. Consultants provided the following training for groups of EPU staff.

Energy Modelling and development	-	14 person-months
Energy Planning Advisor	-	15 person-months
Project Evaluation Training	-	4 person-months
Alternative Energy Assessment	-	2 person-months

#### 6.1. Energy Information Center (EIC)

Prior to the establishment of the EIC there was no institution in Jamaica with the responsibility to provide energy information. Books and reports on energy were highly dispersed and located at some of the libraries in the country. The EIC was established "to increase the information base on energy which can be quickly and easily made available to individuals and organizations working in the energy sector."

The objectives of the EIC are:

- to collect, collate, store and disseminate information on energy to individuals, organizations and researchers. The EIC will be the hub of a network of energy information which will include the Scientific Research Council, University of the West Indies and CAST;
- to increase the stock of books and periodicals at MMET;
- to design a computer based system to provide access to local and international energy bibliographies and data base;
- to establish an information delivery system in print and microfilm.

The stock of the EIC is now in excess of 5000 volumes with subscription to 45 journal titles.

#### 6.2. Public Education Program

The small public education unit, established at MMET in 1979, was included in the Ministry's budget. The staff included an Administrator and two information officers.

With the start of ESAP in 1981, the staffing was increased.

A comprehensive advertisement campaign was introduced during the first three years of the ESAP with the assistance of the Jamaica Information Service for all media, i.e. print, radio and television. An elaborate program to conserve energy was also launched. Its theme, "Conserve, keep some in reserve." Advertisement was less intensively pursued during the latter years of the ESAP. Two Jingles were produced, a Mascot competition, a Festival Queen and a Festival Group were sponsored in the 1983 Festival Competition.

Bill boards and a bus stop sign board program have been in effect for the entire period of the project.

Four complete audio tapes were produced and used extensively in the Mobile Unit Program. Three others were completed by the Jamaica Information Service for radio and television.

The Public Education Program has the equipment to produce and edit 3/4 Uratic material, film and slide presentations, overhead projector and a stencil maker. The mobile unit is also equipped with an alternator/battery and generator power supply, display boards and TV monitor.

At the end of the five year program, the Public Education Program (PEP) has:

- a smooth working organization of 6 people trained in its operation;
- a well equipped facility for preparing and delivering a full range of media presentation;
- a selection of documentary films on energy in Jamaica;
- a large selection of printed material on energy-related topics;
- a self sufficient PEP operating without major outside assistance.

To prepare a base year balance for energy assessment, seven sectors for energy consumption and "useful energy" determination were selected. These sections were:

Manufacturing  
Agriculture  
Tourism  
Household  
Transportation  
Electricity generation  
Commercial and public sectors.

Gross Domestic Product and economic growth projections furnished by the National Planning Institute were used to estimate the useful energy demand in future years. The useful energy demand and the energy supply for future years were inputs to an energy analysis model that was developed by Argonne National Laboratory, especially for Jamaica Economic Planning Unit professionals were trained in the utilization of the model. The model has been transferred and in operation at the National Computer Center.

The energy analysis includes moderate levels of conservation and the associated investment costs. The model is an optimization model and provides the least cost solution selecting energy from alternate sources based on prices.

The Energy Division published two National Energy Plans and in 1986, produced a national energy policy analysis with recommendations for action by a Steering Committee of eminent members drawn from the different energy consuming and energy supplying sectors of Jamaica. The Steering Committee's recommendations are before the decision makers for action. Once the action is taken, MMET will monitor the effect of the actions.

The Economic Planning Unit interacts with the other sections of the Energy Division conducting economic analysis of energy conservation retrofits to decide whether or not the retrofits should be carried out based on the payback period for recovering the investment for the retrofits. The EPU also conducts post retrofit evaluations to determine whether the energy savings and payback periods indicated by the energy audits were in fact replicated after the retrofits are in place. Indirectly, the post retrofit evaluations assessed the quality of the energy audits.

The EPU conducted evaluations of unsolicited proposals for energy projects submitted by consultants and contractors to the Government of Jamaica for funding.

## B. Alternative Energy Program

### 1. Solar Hot Water for Domestic Use

Installation of solar hot water units in public places such as clinics, hospitals, dormitories, markets, hotels etc., was a key element of this program. Loan funding provided the construction and installation costs of solar hot water facilities for fifteen to twenty hospitals and/or hotels and five other public sector productive enterprises. The purpose of the installation was to demonstrate the use of solar hot water to both the domestic and the industrial/commercial sectors in a relatively short time, while at the same time, this activity indirectly contributed to reducing Jamaica's dependence on imported petroleum for heating water. Details of solar hot water installations are shown in Table 5.

The ESAP was responsible for the creation of seven private sector solar hot water design, manufacture and installation companies in Jamaica. Thirty two solar hot water installations were completed during the five year period of the project.

### 2. Jamaica Bureau of Standards

The manufacture of the solar hot water units created the need for a solar standards and testing facility. Such a facility is being established at Jamaica Bureau of Standards. It will include the construction and installation of solar testing instruments. Jamaica Bureau of Standards will develop solar standards for the solar industry as well as standards for energy conservation equipment.

### 3. Meteorological Office

Improvement of the Meteorological Data Base as it applies to solar and wind data, is another activity supported by the ESAP. The measurement of solar and wind data for the minimum of one year and preferably extended over a longer period of time is necessary for planning solar, wind and photovoltaic units for energy generation. Thirteen meteorological sections provide solar and wind data on a regular basis. The data generated at these sites are quality controlled, processed and documented. Monthly totals and averages, mean daily values with standard deviation, daily extremes and graphs of diurnal variation will be published in the Meteorological Office Annual Weather Report. Specific data will be available to private sector for use in solar and wind assessment studies.

The sites for solar and wind measurements and the status of the operation of the measuring equipment is produced below:

Status of Network (at September 30, 1986)

#### Solar Radiation

x - in operation, xx - to be re-activated, xxx - to be activated

\* - discontinuous.

<u>Site</u>	<u>Global</u>	<u>Diffuse</u>	<u>Direct</u>
Duckenfield	X	-	-
Cinchona	XXX	-	-
Manley Int'l. Airport	X	X	X*
Orange River	X	-	-
Bodles	X	-	-
Worthy Park	X	X	-
Alcan - Mandeville	X	-	-
Allsides	X	XXX	-
Black River (PCJ)	X	-	-
Crawford	XX	-	-
Sangster Int'l Airpt.	X	-	X*
Knockalva	X	XXX	-
Smith field	X	-	-
Negril (PCJ)	X	-	-

Discontinuity due to power outages - require DC power back-up supply.

Wind

<u>Site</u>	<u>Direction</u>	<u>Speed</u>
Duckenfield	xxx	xxx
Folly Point Lighthouse	-	x
Manley Int'l Airport	x	x
Hellshire	xx	x
Orange River	-	xxx
Portland Lighthouse	xxx	xxx
Coleyville	-	xx
Spurtree	-	xx
Munro	-	xx
Discovery Bay	-	xxx
Rose Hall Lighthouse	-	xxx
Sangster International Airport	x	x

This project component was coordinated by the Meteorological Office.

#### 4. Research and Development

##### 4.1 Energy Center at CAST

The College of Arts Science and Technology (CAST) was selected as the site for location of the Energy Center. The original concept of a Solar Energy Institute was expanded to an Energy Center. The concept paper for the Energy Center at CAST suggests that the center be:

- The focal point for research in the use of solar energy;
- An educational and consultancy for energy technology.

Presently, the ongoing research activities include:

- Solar hot water heating;
- shallow solar pond;
- solar distillation stills;
- solar lumber kiln;
- solar crop drying;
- wind energy.

The center is equipped with instruments for measuring and testing photovoltaic energy solar radiation, temperature humidity, air velocities and crop drying chambers. The goal is that the center, through the research it conducts and the services it provides, will become a self supporting unit.

#### 4.2. Alternative Energy Demonstration Center

An alternative energy demonstration center at the agricultural school at Knockalva was established to demonstrate the use of alternative energy technology to the rural and agricultural population. The activities at the center include:

- the establishment of a workshop and supply of tools and equipment;
- the establishment of seven acres of Fuelwood plantations;
- installation of demonstration models of wind driven pumping set, solar hot water heaters, solar stills and photovoltaic panels;
- construction of plastic biodigesters;
- a curriculum that incorporates energy technologies into agricultural education program.

#### 4.3 Fuelwood Project

With the assistance of a local fuelwood specialist, established 25 acres of fuelwood plantations for:

- promoting the use and management of fuelwood as an energy source;
- determining suitable soil types, climatic conditions, productivity and species characteristics;
- establishing the economics for fuelwood production and sales.

#### 4.4 Energy Cane Project

Sugarcane production used to be the second largest employer of labor and the third largest foreign exchange earner for Jamaica. With poor maintenance of sugar mills, poor agricultural practices and irrigation systems, sugarcane production had fallen to a level

of 23 tons/acre at Monymusk in the Clarendon plains. Consequently, as recently as 1983, Jamaica has been unable to meet her quota for sale of sugar to the USA and Europe.

Since all the sugar produced was shipped to meet established quota at favorable prices, Jamaica had to import 60,000 tons of sugar to meet domestic needs.

A feasibility study conducted by consultants from the US and Jamaica determined that if high performance energy cane and new agricultural management techniques were employed at the 12,000 acres of government-owned land and about 8,000 acres of privately owned sugar estates and small farms in Clarendon plains near Monymusk, it should be possible to increase the cane output to about 50 tons/acre.

The agricultural wastes from this operation - bagasse and cane trash - when the cane is cut green, could support a 46 MW steam power plant at Monymusk that could produce 450,000 pounds of steam at 1,250 psig and 850°F. During milling season, the plant could supply about 31 MW to the national grid.

From the cane juice, the sugar is crystallized in a three-phase or "three-strike" process. The residue of this total process is blackstrap or final molasses which is considered essential to maintain the unique flavor of Jamaican rum.

The revenue stream from the sale of electricity, sugar and molasses indicated an economic internal rate of return of 37.7%.

A follow-on study sought to establish the agricultural data (growth, fertilizer requirements, cane trash, sucrose content, fiber content, irrigation needs etc.) for high performance canes in Monymusk and to develop a bankable document as the basis for a private sector group from the US and Jamaica to invest funds to implement an energy cane project at Monymusk.

The study was carried out by RONCO Consultants and Bechtel Corporation. Bechtel's confidence in the feasibility of the project is demonstrated by its proposal to make an equity investment in the project by entering into a joint venture arrangement with the Government of Jamaica to generate and sell electricity to the grid. The Bechtel proposal to GOJ is under discussion.

### C. Energy Conservation Program

The energy conservation program has achieved the target set in the

Implementation Plan. It has significantly improved the technological energy infrastructure of Jamaica by:

- developing institutional capacity within the private sector group of energy auditors, and retrofitting contractors;
- organizing an Energy Coordinator's Association with representation from the public and private sector groups;
- publishing an Energy Conservation Manual for the construction industry - endorsed by the Jamaica Bureau of Standards, the Jamaica Institute of Engineers and Jamaica Association of Architects;
- completing 66 energy audits against the planned 62 in the Implementation Plan identifying energy savings of 165,000 barrels of oil equivalent (BOE)/yr with an expenditure of J\$11.00 million in retrofitting costs;
- retrofitting 53 enterprises with a total energy savings of 38,363 BOE/yr;
- conducting 8 post-audits which has verified energy savings within 95% of the estimates in the audits.

#### 1. Potential and Actual Energy Savings

The energy audits indicated potential energy savings while the post-audits that were completed after the retrofits had been installed represented the actual energy savings for the same energy conservation activity. Closeness of the potential and actual energy savings would mean that the energy audit estimate were on target. The three tables below indicate energy savings with solar hot water and energy conservation retrofits.

##### 1.1 Potential Energy Savings Identified from Audits

Energy audits completed	66
Total Energy used by Plants BOE/yr	<u>587,849</u>
Total Energy Cost/yr @ US\$20 /bbl	<u>11,756,980</u>
Potential Savings BOE/yr	<u>177,087</u>
Potential Savings @ <u>US\$20/bbl</u>	<u>US\$3,541,740</u>
Potential Savings Percentage	30%

## 1.2 Actual Savings from Retrofits

	<u>Cost J\$</u>	<u>BOE</u>	<u>US\$20 /bbl</u>
Energy Conservation Retrofits	4,201,460	38,363	767,260.00
Verified Spin-offs	NIL	8,000	160,000.00
Solar Water Heating	2,903,468	3,264	65,280.00
<u>Total actual savings</u>		<u>49,627</u>	<u>992,540.00</u>

The audits have indicated that with an expenditure of J\$11.0M the potential energy savings in the public sector is \$177,087 BOE/yr or US\$3,541,740 /yr at an annualized cost of US\$20/bbl.

## 1.3 Post Audits

Post-audits and evaluations were conducted of retrofitted sites as verification of audit predictions and estimating the impact of the program on the efforts to reduce importation of fuel as the main thrust of the GOJ energy conservation program eleven (11) such post evaluations indicated actual savings as 14,804 BOE/yr or US\$296,080 / yr or 95% of the audit estimates, and an average percentage savings of 25.7% on BOE used/yr.

The summary of energy audits, energy retrofits and post evaluations of energy conservation are shown in Table 6, Table 7 and Table 8 respectively.

## D. Energy Credit Fund (ECF)

The bulk of the Energy Sector Assistance Project focussed on energy saving opportunities in the public sector. To enable the private sector enterprises to improve energy efficiency in their operations, an Energy Credit Fund was set up and funds were earmarked for improving the energy efficiency of private sector operations through energy conservation retrofits.

### 1. Background

A demand analysis was conducted to establish the existing capacity to borrow money and implement energy retrofits; and to gage the level of funding necessary to promote the operation of the ECF. Fortynine firms chosen for the study, accounted for a fair portion of the Jamaican economic activity. The firms selected represented 20% of JPS electric energy consumption; over 10% of the Gross Domestic Product and more than 33% of the manufactured goods exported.

Of the companies interviewed 65% were interested in having a professional energy audit done to establish ways to conserve electricity and were willing to pay for the audit.

The forty-nine firms interviewed indicated that plans were afoot to make energy conservation investments of almost J\$6 million over the next two years of financing available. Extrapolation to the economy as a whole, implied a potential maximum demand in the private business sector of J\$17.8 million in 1982 - 84 for energy saving conservation equipment and services.

Financing, however, was a crucial element as to whether or not private sector would undertake this investment. Three quarters of the respondents indicated that they would need medium term (over one-year repayment) financing for their energy saving investments.

The availability, terms and conditions of financing would play a critical role in whether the firms surveyed would proceed with their energy saving investment plans. About 97% of the 49 firms indicated a desire for financing energy investments to pay for themselves in a maximum period of five years, 14% in four years, 16% in three years and 8% in two years or less.

With regard to interest rates, most firms indicated that the maximum rate they would be able to pay was 15%. An overwhelming majority indicated that the absolute limit in interest rate would be in the range of 17% per annum.

## 2. Project Goal and Purpose

The goal was to reduce Jamaica's dependence on imported petroleum by tapping energy saving opportunities in the private sector. The project purpose was to strengthen Jamaica's private sector institutional capacity to plan and manage energy programs directed at improving its energy situation in the private sector by providing funds for business and industries for retrofitting their facilities. The purpose was to be achieved by the establishment of an Energy Credit Fund (ECF) to finance local and foreign exchange costs for energy projects in conservation, alternative energy, energy industry development and energy audits. Loans for these projects were designed to be made available to qualified borrowers through commercial banks accredited by the National Development Bank (NDB) to participate in the fund. NDB provides medium and long term fixed interest rate funding assistance to local commercial institutions for on-lending to eligible projects. Nine commercial banks and six merchant banks participated in the Energy Credit Fund through their affiliation to the National Development Bank.

### 3. Definition of Project

The Project consisted of the establishment of an Energy Credit Fund to finance Private sector conservation and alternative energy investments, to provide loans to local energy-related industries and to furnish technical assistance to help establish and upgrade local energy-related industries.

### 4. Project Performance

The interest rate for Energy Credit Fund loans were to be "guided by prevailing market rates." Soon after launching the project the market rates climbed steadily to 21%. According to the demand analysis, since the companies that were interviewed indicated 17% as the upper limit of the interest rate, at 21% there was practically no loan applicants for ECF loans.

The loan application forms were exhaustive and it took over three to four months to prepare an application form acceptable to the commercial or merchant banks. Then, consideration of the loan application by the Commercial Bank and the National Development Bank usually took an additional two to three months before final action could be taken on an application to accept or reject it. The time taken to process applications was a deterrent to disbursing ECF loans quickly and in a timely manner. The economic climate of the country had worsened and most private sector entities, that once considered energy conservation retrofits, were experiencing serious cash flow problems. Consequently, energy was no longer the overwhelming problem. Hence energy conservation investments were delayed.

Private sector companies that wanted to put in energy conservation retrofits, were already steeped in debt making it difficult to accommodate the commercial banks' need for collateral to issue ECF loans. Since most of the collateral was already heavily committed, public sector companies could not furnish sufficient collateral to qualify for ECF loans.

For the above reasons, disbursement of ECF loans was poor. The attached table 9 provides details of all the loans granted by ECF during the life of the Project.

## E. Financial Statements

### 1. Energy Sector Assistance Project (Public Sector)

The Project Agreement obligated US\$7.5 million in loan funds and Government of Jamaica was to provide the equivalent of US\$10.168 million in Jamaican dollars.

A breakdown of the budget is shown below:

Project Cost Estimates

The estimated total project cost was US\$17.688 M, including

- a) USAID (Loan) US\$7.5 M  
 b) GOJ contribution US\$10,168 (equivalent).  
 Budget components are:

	<u>Budget (US\$000)</u>		
	<u>USAID</u> <u>Fx</u>	<u>Lc</u>	<u>GOJ</u>
<u>Institution Building</u>			
Programme Administration	-	-	1231
Training	1143	172	286
Technical Assistance	1998	-	128
Economic Planning	3	-	347
Information & Public Ed.	471	33	1359
	<u>3615</u>	<u>206</u>	<u>3351</u>
<u>Energy Conservation</u>			
Commodities	61	-	76
Engineering & Construction	1627	-	3544
	<u>1688</u>		<u>3620</u>
<u>Alternative Energy</u>			
Engineering & Construction	1050	60	2039
Staffing (Agencies)	-	-	367
Specialist	60	-	-
Commodities	562	-	791
	<u>1672</u>	<u>60</u>	<u>3197</u>
Contingency	259		-
Total	<u>7500</u>		<u>10,168</u>

When the Project was launched in September 1981, the exchange rate was 1 US\$ = J\$1.78. During the course of the five year life of the Project, the J\$ was steadily devalued until now the exchange rate stands at 1 US\$ = J\$5.5. Although the J\$ was devalued, the cost of engineering materials and engineering construction costs

did not keep pace with the devaluation. Consequently, it was possible to achieve more than what was called for in the Implementation Plan for solar hot water installations and conservation retrofits with less funds than what was budgeted.

Since the pipeline for the Project indicated that funds were available, in 1985 the GOJ and USAID agreed to deobligate US\$ 1 million from the foreign exchange component of the budget. It effectively reduced the USAID loan funds to US\$6.5 million and GOJ budget to US\$8.33 million in J\$.

As of September 30, 1986, the expenditures and estimated commitments were as follows:

<u>Total Expenditures and Commitments</u>	
<u>USAID</u>	<u>GOJ</u>
<u>US\$</u>	<u>US\$ Equivalent</u>
4,698,848*	4,603,020** (J\$15,770,821)

\*The uncommitted US\$ funds have been reprogrammed to address energy saving opportunities in rural water supply systems.

\*\*Since the exchange rate changed steadily from J\$1.78 to J\$5.5, over the five year period, a quarterly weighted rate of exchange has been used to calculate the US\$ equivalent of the GOJ expenditures.

## 2. Energy Credit Fund

The Energy Sector Assistance Project (Private Sector) authorized US\$5.9 million in loan funds to the Energy Credit Fund and the Government of Jamaica agreed to provide US\$5.6 million in equivalent J\$. A breakdown of financial plan and cost estimate for the Project is as follows:

### COST ESTIMATE AND FINANCIAL PLAN

	AID (US\$000 FX)	GOJ (US\$000 LC)
A. Establishment of Energy Credit Fund** .....	5,700.....	5,600
1. Loans to Industrial/Commercial enterprises for energy audits, retrofits and alternative energy systems	4,000	4,000

TABLE 1

LONG TERM EDUCATIONAL TRAINING SPONSORED BY ESAP

No.	NAME	INSTITUTIONAL AFFILIATION IN JAMAICA	U.S. University	DEGREE	TOPIC	COMPLETION DATE
1.	Nigel Grant	Director, Economic Planning Unit, Energy Division, MMET	Williams College	M.A.	Economics	March, 1984
2.	Earl Taylor	Trained for position of Director, Jamaica Public Service (Electric Utility)	University of Pennsylvania	Ph.D	Energy Management	March, 1984
3.	Steven Marsden	Director, Solar Program MMET	University of Pennsylvania	M.S.	Energy Management and Policy	July, 1984
4.	Edward Alexander	Director, Renewable Energy, MMET	University of Pennsylvania	M.S.	Energy Management and Policy	December, 1984
5.	Herbert Phinn	Energy conservation Unit, MMET	Florida International Unit	B.S.	Mechanical Engineering	August, 1987
6.	Jericho Hanson	Economic Planning Unit, MMET	University of Pennsylvania	M.S.	Energy Management and Policy	December, 1986
7.	Dean Brown	Energy Center, College of Arts Science & Technology	University of Miami	B.S.	Mechanical Engineering	September, 1987

TABLE 1 Cont'd

8. F. Mosaka-Wright	Economic Planning Unit, MMET	University of Pittsburgh	M.A.	Energy Economics	September 30, 1987
9. Arvill Benjamin	Energy Conservation Unit, MMET	University of Pittsburgh	M.S.	Mechanical Engineering	September 30, 1987

The list of candidates, who participated in short term energy-related training sponsored by the ESAP, is furnished in Table 2.

TABLE 2

Short term training in Energy-related topics sponsored  
by ESAP and Conventional Energy Training Program (CETP)

<u>No.</u>	<u>Name</u>	<u>Affiliation</u>	<u>Training/Course</u>	<u>Place</u>	<u>Duration</u>
1.	Valrie Llewelyn	Contract Officer, Energy Division MMET	Procurement & Supply Management	AAPC-World Trade Trade Center New York	September 29 to October 17, 1975
2.	Nigel Grant	Economic Planning Unit, MMET	Bio-energy users network	Thailand	September to October, 1985
3.	Winston Boyne	Project Director, MMET	-do-	-do-	-do-
4.	T. Faloon	SIRI	-do-	-do-	-do-
5.	Vascol Scantlebury	Conservation, MMET	Communications	University of Pennsylvania	Jan. 13 - April 4, 1986
6.	Sharon Smith	Admin. Office, Energy Center, CAST	Energy Technology	Washington D.C.	Mar. 17 - 21, 1986
7.	Keith Porter	Dept. of Forestry Min. of Agriculture	Energy from Biomass & Wastes	I.G.T. Washington	April 7 - 10, 1986
8.	Steve Marston	Engineer, P.C.J.	Energy Cane	Bechtel Inc. San Francisco - USA	June 21 - 28, 1986
9.	Leonard Edwards	Conservation, MMET	Computer Technology & Applications for Devmt.	State University of New York, Stony Brook	Sept. 22 - Oct. 10, 1986
10.	George Allen	Contracts, MMET	Procurement and Supply	AAPC World Trade Centre - USA	Sept. 29 - Oct. 24, 1986
11.	K. Thompson	Project Director MMET	Energy Audit Tehniques	St. Lucia	Dec. 5 - 9, 1983

TABLE 2 Cont'd

12.	K. Tomlinson	Renewable Energy, MMET	)	Energy Technology Conference & Exposition	Washington D.C..	March 19 - 20, 1984
13.	R. Richardson	Conservation, MMET	)			
14.	A. Benjamin	Conservation, MMET	)			
15.	N. Grant	Economic Planning Unit, MMET	)	CARICOM Energy Seminar	Antigua	April 30 - May 12, 1984
16.	Blossom Mullings	Energy Library, MMET	)	Energy Information System Workshop	Trinidad	May 13 - 19, 1984
17.	Mr. O. St. Ridsen	Permanent Secretary, MMET	)	Renewable Energy	California	June 5 - 10, 1984
18.	Mr. N. Grant	Economic Planning Unit, MMET	)		California	June 5 - 10, 1984
19.	Mr. V. Scantlebury	Conservation, MMET	)	Managerial Effectiveness Program	Trinidad	June 10 - 19, 1984
20.	Mr. W. Boyne	Project Director, MMET	)	Bio-Energy Conference	CARIO	Nov 17 - 24, 1984
21.	Mr. C. Rowe	Director, Conservation, MMET	)	Seventh World Energy Engineering Congress	Atlanta	Nov. 27 - 30, 1984
22.	Mr. S. Marston	Engineer, PCJ	)	-do-	-do-	-do-
23.	Mr. Calvin Gray	Metrological Office	)	Workshop on Metrological Data	Barbados	Dec. 10 - 14, 1984
24.	Mr. Winston Boyne	Project Director, MMET	)	Round Table Conference on Alternative Energy	California	April 1985
25.	Cloan Rowe	Director, Conservation, MMET	)	Energy Conservation Technology & Exhibition	Houston, Texas	April 1983
26.	Carmen Prat	Supply Division, MMET	)	Supply Management USA	APC World Trade Centre, USA	April 1983

TABLE 2 Cont'd

27.	Claon Rowe	Director, Conservation, MMET	Energy Saving Workshop	Houston, Texas	April 16 - 20, 1983
28.	R. Miller	Planning Unit, JPS	Inter-regional Training Course on Electric System Expansion Planning	Argonne National Laboratory Illinois	April 18 - June 17, 1983
29.	Maurice Stewart		Energy Management	Stony Brook	April 25 - June 3, 1983
30.	Mr. Al Hall	JPS	Solar Energy and Wind Workshop	Minneapolis/St. Paul, Minnesota	May 30 - June 4, 1983
31.	Jerico Hanson		Energy Project Management and Analysis	University of Connecticut	June 3, 1983 10 weeks
32.	B. Chevannes	Public Education Program, MMET	Mass Communication	University of Pennsylvania	Aug. 28 - Dec. 17, 1983
33.	Hon. Douglas Fletcher	Member, National Energy Conservation Committee			
34.	Marco Breakenridge	Chief, Renewable Energy, MMET	Renewable Energy Technology,	California	Aug. 28 - Sep. 1983
35.	Mr. Keith Bisnott	Ministry of Public Utilities			
36.	Mr. A. Binger	Technical Director, SRC	5th World Engineering Congress	Atlanta	Sept. 15 - 17, 1983
37.	Mr. K. Porter	Dept. of Forestry Min. of Agriculture	-do-	Puerto Rico	-do-

TABLE 2 Cont'd

38.	Valrie Llewellyn	Contr., MMET	Procurement and Supply Management	AAPC World Trade Centre - N.Y.	Sept. 29 - Oct. 24, 1983
39.	J. E. Munroe	Engineer, MMET	Energy Audit Techniques	St. Lucia	Dec. 5 - 9, 1983
40.	Steve Marston	Engineer, PCJ	Energy Technology Conference	Washington D.C.	Feb. 1982      5 days
41.	Robert Bryan	Chief, Economic Planning Unit, MMET	Energy Technology Conference	Washington D.C.	Feb. 1982      5 days
42.	Courtney Jackson	Economic Planning Unit, MMET	Energy Technology Conference	Washington D.C.	"                  "
43.	C. Wright	(CAST)	Alternative Energy Training	Gainsville, Florida	May - Aug. 1982      4 mths.
44.	Jennifer McDonald	PIQJ	Energy Management	University of Connecticut	June - Aug. 1982      3 mths.
45.	Vascol Scantlebury	Conservation, MMET	"	Stony Brook, New York	- May 1982
46.	Leonard Edwards	Conservation, MMET	Practical Energy Conservation	University of Tennessee	July - Aug.              2 mths.
47.	Roosevelt DaCosta	BOS)	Solar Instrumentation	Arizona DSET	Sept. 1982              2 weeks
48.	Ainsworth Lawson		Small Hydropower	Denver Research Institute	Oct. 1982              1 mth.
49.	Courtney Jackson	Economic Planning Unit, MMET	Long range Energy Planning Model Training in energy data gathering and assessment.	Argonne National Laboratory	Oct. 1982              18 days
50.	Trevor Smith	-do-	-do-	-do-	-do-
51.	I. Ilori	-do-	-do-	-do-	-do-
52.	Melody Daley	-do-	-do-	-do-	-do-

TABLE 2 Cont'd

53.	Raymond Richardson	Conservation, MMET	-do-	-do-	-do-	
54.	Robert Bryan	Chief, Economic Planning Unit, MMET	Energy Management	Stony Brook, New York	Oct. - Nov 1982	2 mths.
55.	Henry Lowe	Director of Energy MMET	Conference on Energy Analysis Planning & Policy Development	Washington D.C.	Feb. 27 - March 4, 1983	
56.	Courtney Jackson	-do-	-do-	-do-	-do-	
57.	Nigel Grant	Economic Planning Unit, MMET	Fundamentals of Management	Institute of Public Service University of Connecticut	July 1 - July 15, 1983	

TRAINING PROGRAMMES BY MMET

<u>Programme/Topic</u>	<u>Coordinator</u>	<u>Participants</u>
1) Energy Division Retreat - Planning	MMET/META Systems	Ministry Staff
2) Energy Auditors Training Course (1983)	Keith/Banta	25 Engineers - Private/Public Sector
3) Project Evaluation Workshop (1983)	Arnold/Energy Div.	MMET Staff
4) Lighting Energy Efficiency Workshop (1983)	David Keith	Energy Coordinators Association
5) Air Conditioning Efficiency Workshop (1983)	David Keith	Energy Coordinators Association
6) Hotel Industry Energy Efficy. Workship (1983)	David Keith	Hotel Managers & Engineers
7) Post Harvest Losses & Refrig. Systems Design	Ron Alwood/D.Keith	Argonomist Caribbean Region
8) Diploma Course - Energy Management	UWI/MMET	26 Engineers Private/Public Sector
9) Fleet Management Workshop (1984)	John Doke/Gerry Johnson	Fleet Mgers. Public/Private Sector
10) Energy Credit Fund Symposium (1985)	ECF/D. Keith	Private Sector
11) Solar Crop Drying Workshop (1985)	F. Mathews/A. Skelton	Agricultural Sector (40 perticipants)
12) Project Evaluation & Risk Analysis (1985)	J. Arnold/Dr. Richman	Energy Sector & MME
13) Energy Management in Industry (1985)	D. Keith/L/ Banta	Engineers & Plant Managers
14) Energy Mgmt. & Transportation Fleet (1985)	J. Doke	Fleet Managers
15) Steam Boiler Operation (1985)	D. Keith	Boiler Operators
16) Solar Hot Water System Designs (1982 & 1985)	Chandra/F. Mathews	Public/Private Sector
17) Solar Installers Course (1983)	Chroma	Public/Private Sector
18) Automation & User Seminar (1985)	Ruhl	E.I.C. Network

TABLE 4

Training Programs sponsored by ESAP in Jamaica  
Details of the topics and participants

NAME	TITLE OF COURSE	PLACE	DURATION
Valrie Simpson	"In House Computer training in combination of computer technology, PC, DOS, lotos & D Base III	Ministry of Mining & Energy	May 20 - July 16, 1986
Barbara Chevannes	"	"	"
Angella Williams	"	"	"
Dorette Blake	"	"	"
Nova Gordon	"	"	"
Ainsworth Lawson	"	"	"
Valrie Llewellyn	"	"	"
Patricia Buchanan	"	"	"
Mrs. Thelma Maitland	Advanced Word Processing	DATAMAC	June 23, 1 da/wk for 4 wk
Mrs. Joan Simpson	"	"	"
Mrs. Joan Mullings	"	"	"
Miss Sybil Peart	"	"	"
Miss Adella Gordon	"	"	"
Donavon Stewart	Fundamentals of Systems Analysis & Production	Institute of Management	Aug. 18 - Oct 6, 1986

TABLE 4 Cont'd

Ann Marie McCook	Beginners Spanish	Language Training Centre	Sept 22 - Oct 10, 1986
Thelma Maitland	Spanish Phase II	"	"
Mrs. Esmie Townsend	Computer Language & Word Processing	DATAMAC	October 25, 1985
Barbara Chevannes	Production Manager	CODE JAMINTEL	Feb. 2 - 10, 1986
Joy Mendez	Computer Concepts & Word Processing	DATAMAC	April 7 - , 1986
Muriel Wilson	"	"	"
Beryl Cole	"	"	"
Maureen Scott-Thomas	Application of Micro-computers to Library & Information Management	UWI, Mona	April 7 - 11, 1986
Barbara Chevannes	Science & Technology by Radio	UWI, Mona	April 21 - May 2, 1986
Dorett Blake	Cataloguing and Classification	UWI, Mona	July 7 - 11, 1986
Pancita Cole	Diploma in Systems Analysis & Production	Institute of Management May 12 - Aug. , 1986	
C. K. Donaldson	"In House Computer training in combination of computer technology, PC, DOS, LOTOS & D Base III	Ministry of Mining & Energy	"
Donna Dallas	"	"	"
Veronica Stone	"	"	"
Maureen Scott-Thomas	"	"	"
Mrs. V. Mitchell	Computer Training Programme	DATAMAC	May 20 -

1  
28  
1

TABLE 4 Cont'd

Mrs. J. Haughton	"	"	"
Miss M. Myles	"	"	"
Miss H. Thomas	"	"	"
Miss P. Bartley	"	"	"
Miss H. Skyers	"	"	"
Miss N. Gordon	"	"	"
Miss E. Maddan	"	"	"
Miss C. Dougherty	"	"	"
Miss C. Bassaragh	"	"	"
Mrs. A. Harris	"	"	"
Mr. P. Green	"	"	"
Miss D. Clarke	"	"	"
Miss B. Mullings	"	"	"
	Energy Information Network	CAST Library	May 20 - 22 & 24, 1985
Miss C. Dougherty	"	"	"
Mr. P. Green	"	"	"
Miss E. Peck	"	"	"
Miss A. Gordon	"	"	"
Miss A. Meikle	"	"	"
Mr. S. Eccles	Project Formulation	Staff College	May 13 - 31, 1985

TABLE 4 Cont'd

Mrs. F. Mosaka-Wright	"	"	"
Mr. J. Hanson	MDP I, II & III (Management Development Programme)	Staff College	May 13 (I) June 3 (II) June 23 (III), 1985
Miss Merlene Campbell	Computer Language and Word Processing	DATAMAC	Oct. 28
Miss Edith Douglas	"	"	"
C. Jackson	Strategic Management Seminar	Ministry of Mining & Energy	Sept. 2, 8 & 17, 1984
A. Lawson	"	"	"
P. Earle	"	"	"
C. Roberts	"	"	"
B. Chevannes	"	"	"
B. Mullings	"	"	"
S. White	"	"	"
B. M. Clarke	"	"	"
P. Darby	"	"	"
L. Daiz	"	"	"
A. Geddes	"	"	"
C. Roach	"	"	"
G. Perkins	"	"	"
Valrie Llewellyn	Contracts & Procurement	Kingston, USAID Office	Oct. 22 - 26, 1984

TABLE 4 Cont'd

Pancita Cole	"	"	"
Arvil Benjamin	"	"	"
Mr. M. Hall	Public Relations Seminar	CARIMAC	Feb. 9 & 16, 1985
C. Jackson			
H. Skyers	Acc. Basic I	FACT	April 15 - May 3, 1985
Mrs. T. Maitland		Secretarial College	
Mrs. T. Maitland	Computer Training Programme	DATAMAC	May 20 -
Miss J. Cox	"	"	"
Miss C. Crawford	"	"	"
Mrs. S. O'Reggio	"	"	"
Miss E. Peck	Computer Technology	Ministry of Mining & Energy	Aug. 11 - 23, 1984
Miss A. Meikle	"	"	"
Miss L. Taylor	"	"	"
Miss A. Gordon	"	"	"
Mrs. R. Dayes	"	"	"
Mr. G. Allen	"	"	"
Mrs. P. Cole	"	"	"
Miss Y. McKenzie	"	"	"

TABLE 4 Cont'd

Ms. B. Stewart	"	"	"
Mrs. V. Llewellyn	"	"	"
Ms. S. Carr	"	"	"
Ms. D. Scott - GSD	"	"	"
Mr. D. Mitchell	"	"	"
Mr. A. Benjamin	"	"	"
Mr. K. Spaulding - M&Q	"	"	"
Mrs. A. Austin	"	"	"
Mr. C. Taylor	Basic Graphics		Aug. 20 - 24, 1984
Mrs. V. Llewellyn	Understanding & Managing Human Behaviour	"	Sept. 26 - 27, 1984
Miss B. Chevannes	Understanding & Managing Human Behavior	"	Sept. 26 - 27, 1984
Mr. V. Scantlebury	General Management	Staff college	Sept. 24 - Dec. 12, 1984
S. O. Ridsen	Strategic Management Seminar	Ministry of Mining & Energy	Oct. 2, 8 & 17, 1984
W. L. Boyne	"	"	"
N. Grant	"	"	"
Blossom Mullings	Automated Info. and Retrieval Systems		
Raymond Richardson	JIE/CCEO Conference on Maintenance Engineering in the Caribbean	Kingston, Jamaica	Sept. 8 - 11, 1983
Solvalyn Eccles	Diploma in Energy Management	UWI, Mona	April 84 - Nov. 1984

TABLE 4 Cont'd

Arvil Benjamin	"	"	"	
Peter Earle	"	"	"	
Sybil Peart	Word Processing	Alpha Business College	July 10 - Sept. 4, 1984	
C. Roberts	Project Evaluation	Staff College	July 16 - 31, 1984	
C. Taylor	16MM Film Projection		July 23 - 26, 1984	
Mr. J. Hanson	Computer Technology	Ministry of Mining & Energy	Aug. 11 - 23, 1984	
Mr. R. Ilori	"	"	"	
Mrs. F. Mossaka-Wright	"	"	"	
Mr. D. Stewart	"	"	"	1
Mrs. J. Mullings	"	"	"	33
Miss B. Mullings	"	"	"	1

TABLE 5

Solar Water Heating

The project document proposed the construction of twenty five (25) solar hot water systems at an estimated cost of J\$4.09 million. The project will have completed 32 installations at a cost of J\$2.903 M with energy savings of 3264 BOE/yr or US\$65280/yr (at annualized cost of US\$20/bb), and an average payback period of 8.0 years.

Summary of Installations

<u>Site</u>	<u>Project Total</u>
Hospitals	14
Education Institutions	7
Hotels	3
Health Centres	4
Markets	3
Office	1
Total	<u>32</u>

TABLE 5 Cont'd

Solar Hot Water Systems - Details

(Cost of a barrel of crude oil at US\$20.00)

Site	<u>System Size</u>		Volume	Contract		
	Sq. Ft.	Gallons	Sum J\$	BOE/Yr	US\$/Yr	
<u>Hospitals</u>						
Annotto Bay	8161	880	153,572	24	480	
Falmouth	504	640	118,117	90	1800	
Isaac Barrant	608	1120	71,625	108	2160	
Linstead	660	648	81,616	65	1300	
Mandeville	1334	1640	114,906	175	3500	
May Pen	840	840	72,132	82	1640	
National Chest	1240	1440	113,336	141	2820	

TABLE 5 Cont'd

Site	<u>System Size</u>		Volume Gallons	Contract Sum J\$	<u>Savings</u>	
	Sq. Ft.				BOE/Yr	US\$/Yr
Percy Junior Hospital	1,536		1,560	160,463	166	3,320
Port Antonio Hospital	840		880	147,474	94	1,880
Princess Margaret Hospital	960		1,240	156,067	121	2,420
Savanna-la-mar Hospital	624		800	91,368	21	420
St. Ann's Bay Hospital	1,584		1,620	121,303	35	700
Spanish Town Hospital	1,652		1,920	134,717	188	3,760
Victoria Jubilee Hospital	1,536		8,000	432,972	945	18,900
	14,743		23,228	1,969,188	2,282	45,640
<u>Edn. Inst'ns</u>						
Brooklyn T. Centre	216		240	23,640	23	460
Curphy Home	216		270	25,260	26	520
Jamaica Maritime Inst.	360		480	44,988	47	940
Portmore (HEART)	1,824		1,500	160,246	160	3,200
Shortwood T. College	1,024		1,920	80,805	188	3,760
Tivoli Gardens H. School	192		240	23,803	23	460
Ebony Park (HEART)	1,824		1,500	121,642	159	3,180
	5,656		6,150	480,384	626	12,520

TABLE 5 Cont'd

<u>Hotels</u>					
Royal Caribbean	1,920	2,500	210,395	115	2,300
Casa Montego	1,512	2,000	89,658	70	1,400
Inn-on-the Beach	512	1,000	56,273	98	1,960
	3,944	5,500	356,353	283	5,660
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
<u>Health Centers</u>					
Story Hill	96	120	6,290	12	240
Mavis Bank	72	80	7,285	8	160
Race Course	72	80	6,940	8	160
May Pen	48	60	3,287	6	120
	223	340	23,802	34	680
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
<u>Markets</u>					
Old Harbour	96	120	8,350	12	240
Lucea	96	120	10,290	12	240
Chapleton	120	120	12,240	12	240
	312	360	30,880	36	720
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>

TABLE 5 Cont'd

<u>Office</u>						
Jamaica House						
Kitchen	48	82	11,715	21	420	
Laundry	144	200	31,146	9	180	
	192	282	42,861	30	600	
	<u>          </u>					
<b>TOTAL</b>	<b>25,061</b>	<b>35,860</b>	<b>2,903,468</b>	<b>3,264</b>	<b>65,280</b>	
	<u>          </u>					

TABLE 6

Summary of Audits Completed

No.	Site	Audit Cost J\$	A U D I T S		Estimated Savings			Pay Back Years
			Estimated Retrofit Cost	BOE Used/Yr	BOE/Yr	%age of Use	*US\$/Yr	
<u>1982/83</u>								
1	Jamaica Daily News	800	10,000	1,108	32	2.8	640	2.8
2	National Chest Hospital	800	215,008	1,105	423	38.0	8,460	4.6
		<u>1,600</u>	<u>225,008</u>	<u>2,213</u>	<u>455</u>		<u>9,100</u>	
<u>1983/84</u>								
3	Coffee Industry Board	800	67,000	1,858	206	11.08	4,120	2.96
4	Port Authority Building	800	13,200	1,150	192	16.07	3,840	0.6
5	May Pen Hospital	800	12,364	548	137	25.0	2,640	0.85
6	J.I.D.C. & B.O.S. Building	800	2,000	3,781	1,288	34.01	25,760	1 mth.
7	S.R.C. Building	800	0 & M	389	85	21.85	1,700	-
8	Ministry of Agriculture H.Q.	800	25,896	1,862	234	12.57	4,680	1.0
9	Post and Telegraphs Dept.	800	43,728	3,109	1,087	34.96	21,740	0.4
10	National Arena	800	11,000	183	33	18.00	660	3.0
11	Caribbean Products Ltd.	6,325	734,782	22,473	11,570	57.48	231,400	0.6
12	Jamaica Frozen Foods	4,000	66,450	1,210	383	32.10	7,660	1.6
13	Zero Processing	4,000	202,440	5,778	2,399	41.52	47,980	0.8
14	Rose Hall Hotel	5,000	533,503	18,804	9,948	52.09	198,960	0.5
15	Jamaica Soya Products	5,250	116,495	20,162	970	4.07	19,400	1.1
16	W.I. Pulp & Paper	4,000	41,039	4,058	837	20.63	16,740	0.4
17	New Kingston Hotel	4,150	532,669	12,327	1,771	14.37	35,420	2.7
18	Trelawny Beach Hotel	5,500	453,990	9,563	1,404	14.68	28,080	2.9
19	Ariguanabo Textiles	6,200	307,133	15,164	6,511	42.29	130,220	0.4
20	Ministry of Foreign Affairs	4,856	36,000	1,081	224	20.7	4,480	1.5
21	U.W.I. Hospital	5,000	135,000	23,162	572	2.5	11,440	2.1
22	Americana Hotel	5,500	415,628	12,570	2,822	22.45	56,440	1.3

TABLE 6 Cont'd

Summary of Audits Completed

No.	Site	Audit Cost J\$	Estimated Retrofit Cost	A U D I T S			Estimated Savings	
				BOE Used/Yr	BOE/Yr	%age of Use	*US\$/Yr	Pay Back Years
			<u>1985/86</u>					
58	National Commercial Bank	5,250	322,086	1,279	656	51.3	13,120	4.5
59	JAMINTEL Centre	5,000	32,864	8,021	256	3.2	5,120	1.2
60	Shortwood Teachers College	3,800	22,399	930	183	19.7	3,660	1.1
61	Registrar of Companies		40,867	251	35	13.9	700	10.6
62	Jamaica Information Service	13,000	50,152	730	198	21.2	3,960	2.3
63	Jamaica Bauxite Institute	3,500	11,200	632	35	5.52	700	2.9
64	Radio Jamaica Ltd.	12,000	344,000	1,738	657	38.0	13,140	4.8
65	Planning Institute of Ja.	5,690	84,163	410	250	61.0	5,000	3.1
66	Jamaica Broadcasting Corp.	15,830						
	<u>Sub Total</u>	<u>51,070</u>	<u>821,131</u>	<u>16,146</u>	<u>2,550</u>	<u>15.8</u>	<u>51,000</u>	<u>2.9</u>
	<u>TOTAL</u>	<u>263,795</u>	<u>10,794,982</u>	<u>587,849</u>	<u>177,087</u>	<u>30.1</u>	<u>3,541,740</u>	<u>6.55</u>

\*Annualized Savings at US\$20/bbl

TABLE 6 Cont'd

23	Holiday Inn Hotel	9,400	263,447	9,960	4,113	41.3	82,260	0.6
24	W.I. Pulp and Paper	4,640	135,913	4,060	1,138	28.0	22,760	1.1
25	Montego Beach Hotel	5,000	149,520	4,270	655	15.5	13,100	2.1
26	Casa Montego Hotel	4,880	222,805	2,426	996	41.0	19,920	2.0
27	Ministry of Education	800	1,972	1,516	113	7.4	2,260	0.2
28	St. Ann's Bay Hospital	800	10,400	2,059	101	4.9	2,020	0.9
29	Ministry of Health	800	16,755	1,442	115	7.8	2,300	1.3
30	Ministry of Finance	800	58,000	1,202	467	38.9	9,340	1.1
31	Kingston Public Hospital		400,817	14,445	4,556	30.8	91,120	0.8
32	MME/MPUT Offices	800	42,859	1,891	708	37.4	14,160	0.6
33	U.W.I.		66,922	14,936	1,693	11.3	33,860	0.4
34	Jamaica Hilton Hotel	5,250	63,550	14,879	796	5.3	15,920	0.7
35	Ministry of Social Security	800	140,292	496	816			
36	Gordon House	4,200	17,412		28		560	5.7
37	National Gallery	800	5,980	2,110	98	4.6	1,960	0.6
38	Caribbean Steel Mills	5,000	300,916	38,200	8,664	4.9	173,280	0.3
39	Midland Cold Storage	5,000	68,450	2,719	118	41.1	2,360	5.3
40	FIDCO Saw Mill	4,200	23,954	5,058	143	2.8	2,860	1.5
41	Cornwall Regional Hospital	6,300	68,300	12,993	3,118	24.0	62,360	0.2
42	Seprod Group of Companies	14,000	111,500	30,700	13,551	44.1	271,020	0.1
43	Caribbean Cement Company	14,800	1,470,000	169,760	56,748	33.4	1,134,960	0.2
44	Runaway Bay Hotel	3,500	166,800	7,245	4,808	66.4	96,160	0.3
45	Ocho Rios Sheraton	5,000	620,600	12,981	5,704	43.9	114,080	1.0
	<u>Sub Total</u>	<u>152,725</u>	<u>8,168,482</u>	<u>514,580</u>	<u>151,920</u>		<u>3,038,400</u>	

1984/85

46	Hedonism II	5,500	267,530	9,811	1,183	12.1	23,660	2.1
47	Bellevue Hospital	4,661	91,311	3,199	469	21.3	9,380	1.8
48	Savanna-La-Mar Hospital	6,000	60,105	768	207	27.0	4,140	2.6
49	Mandeville Hospital	5,400	69,819	1,112	317	28.5	6,340	2.0
50	Spanish Town Hospital	5,000	52,600	2,018	344	17.05	6,880	1.4
51	Jamaica House & Gordon House	6,500	53,335	1,985	161	8.10	2,320	4.2
52	U.D.C. Corporation	4,000	241,289	8,936	1,382	15.5	27,640	1.6
53	Tivoli Gardens High School		10,975	2,155	71	3.3	1,420	1.4
54	Norman Manley Int'l. Airport	8,000	395,400	18,277	3,101	17.0	62,020	1.2
55	Bustamante Children Hospital	5,000	61,700	1,975	436	22.1	8,720	1.3
56	Port Antonio Hospital	7,450	216,800	1,448	200	13.8	4,000	9.9
57	U.W.I. Laundry	5,550	60,500	3,226	695	21.5	13,900	0.8
	<u>Sub Total</u>	<u>58,400</u>	<u>1,581,364</u>	<u>54,910</u>	<u>8,566</u>		<u>171,320</u>	

TABLE 7

ENERGY CONSERVATION RETROFITS

<u>SITE</u>	<u>TECHNOLOGY DEMONSTRATED</u>	<u>Capital Cost J\$</u>	<u>Energy BOE/Yr</u>	<u>Savings US\$/Yr</u>	<u>Pay Back Yrs.</u>
<u>1983/84</u>					
1. Kingston Public Hosp	Boiler Fuel - switching to HFO	100,905	645	12,900	1.4
2. Caribbean Products	Insulation - Condensate Return	72,417	2,044	40,880	0.3
3. Kingston Public Hosp.	Insulation - Blowdown Heat Recov.	13,727	742	14,840	0.2
4. W.I. Pulp & Paper	Insulation	9,200	374	7,480	0.2
5. Post & Telegraphs	Bldgs. EMS, Air Cond. Timers	2,441	241	4,820	0.1
6. Min. of Foreign Affairs	A/C Load Reduction - Film	35,412	220	4,400	1.46
7. Ja. Soya Products	Insulation	34,156	169	3,380	1.8
8. Ja. Frozen Foods	Insulation	17,850	156	3,120	1.0
9. Inn-On-the-Beach	Solar/A.C. Heat Recovery	56,273	98	1,960	5.2
10. Port Authority Bldg.	Bldgs. EM A/C Timers	2,421	89	1,780	0.25
11. Jack Tar Hotel	Boiler Water Treatment	20,756	56	1,120	3.4
12. Shortwood Teacher's College	Flourescent Lighting	12,957	43	860	2.7
13. Bustamante Children's Hosp.	A.C. Heat Recovery	7,050	33	660	1.9
		<u>386,565</u>	<u>4,910</u>	<u>98,200</u>	<u>0.27</u>

14.	Long Pond Sugar Fac.	Boiler Heat Recovery	450,000	7,945	158,900	0.5
15.	Rose Hall Hotel	Flourescent Lighting	123,600	992	19,840	1.1
16.	W. I. Pulp & Paper	Insulation	28,645	677	13,540	0.4
17.	Americana Hotel	Insulation - Condensate Return	36,000	484	9,680	0.7
18.	Trelawny Beach Hotel	Room EMS Door Switches	41,102	350	7,000	1.1
19.	Americana Hotel	Room EMS	106,829	289	5,780	3.4
20.	Trelawny Beach Hotel	Insulation	42,005	247	4,940	1.5
21.	Jack Tar Hotel	A/C Heat Recovery	59,800	237	4,740	2.3
22.	Oceana Hotel	A/C Heat Recovery	41,824	227	4,540	1.7
23.	Casa Montego Hotel	A/C Load Reduction - Film	10,200	193	3,860	0.5
24.	Jack Tar Hotel	A/C Rehabilitation	16,933	196	3,380	0.9
25.	MME/MPTU	Selective Lighting Switches	8,561	63	1,260	1.2
26.	Casa Montego Hotel	Boiler Water Treatment	20,751	56	1,120	3.4
27.	Jam. Conference Centre	A/C Load Reduction - Film	25,949	48	960	4.1
28.	Min. of Agriculture	" " " "	21,131	47	940	4.1
29.	Tivoli Gardens High School	H.P. Sodium Lighting	19,764	34	860	4.2
			<u>1,053,794</u>	<u>12,258</u>	<u>245,160</u>	<u>0.78</u>

1985/86

30.	Frome Sugar Factory	Boiler Modifications	366,000	5,484	109,680	0.61
31.	" " "	Insulation	140,000	3,466	69,320	0.4
32.	Seprod Group	Insulation	73,505	1,774	35,480	0.4
33.	Cornwall Reg. Hosp.	Boiler Conservation to HFO	108,986	133	2,660	7.4
34.	Long Pond	Insulation	217,835	606	12,120	3.3
35.	National Gallery	A/C Load Reduction	50,661	98	1,960	4.7
36.	Cornwall Reg. Hosp.	Flourescent lighting	113,239	129	2,580	8.0
37.	Cornwall Reg. Hosp.	A/C Recovery	72,161	254	508	2.6
38.	Trade Board	A/C Load Reduction	50,661	98	1,960	4.7
39.	Registrar of Co.	Flourescent Lighting	9,125	28	560	3.0
40.	U.W.I. Laundry	Steamline Insulation	10,336	225	4,500	0.4
41.	Min. of Foreign Aff.	A/C Load Reduction	46,026	21	420	20.0
		<u>Subtotal</u>	<u>1,234,812</u>	<u>12,165</u>	<u>243,300</u>	<u>0.9</u>

1986/87

42. Jamaica House	Security Lighting, A/C				
	Load Reduction	1,109,299	91	1,820	10.9
43. J.B.C.	Security Lighting	74,458	48	960	14.1
44. CAST	"	33,487	126	2,520	2.4
45. Min. of Finance	High Efficiency A/C	330,240	1,513	30,260	2.00
46. Supreme Court	-do-	147,415	641	12,820	1.1
47. Mines & Geology	-do-	151,898	969	19,380	1.4
48. Kingston Public Hosp.	-do-	156,780	1,020	20,400	1.4
49. Rural Hospitals	-do-	170,866	2,750	55,000	0.6
50 J.B.C.	High Efficiency A/C	55,504	340	6,800	1.5
51. Min. of Education	-do-	105,735	700	14,000	1.4
52. V/Jubilee Hospital & Blood Bank )	-do-	107,764	799	15,980	1.2
53. Min. of Education	Security Lighting	82,843	33	660	22.8
	Sub-total	<u>1,526,289</u>	<u>9,030</u>	<u>180,600</u>	<u>5.15</u>
	TOTAL	4,201,460	38,363	767,260	1.9

TABLE 8

## POST EVALUATIONS ENERGY CONSERVATION PROJECT

SITE	ECO's (Retrofits)	A U D I T		E S T I M A T E S		A C T U A L		B O E		'used/ Yr	%age Savings
		BOE/Yr Savings	Cost J\$	Pay Bk/ Yrs	BOE Yr/ Savings	Cost J\$	Pay Bk/ Yrs	US\$ Savings Per Yr*			
Min. of Foreign Affairs	Window Tinting	224	36,000	0.81	142	35,412	2.26	2,840	1,081	13.1	
W. I. Pulp and Paper	Insulation	1,138	99,729	1.20	1,276	22,286	0.24	25,520	L		
Frome Sugar Factory	Lagging Steam Lines	3,120	140,000	0.28	3,466	140,000	0.4	69,320	4,060	31.4	
Whyndham Hotel - Rose Hall	Flourescent Lighting	992	123,604	1.06	832	123,705	1.4	16,640	17,030	4.9	
St. Ann's Bay Hospital	Solar Hot Water System	55	121,303	13.8	147	89,229	5.5	2,940	2,059	7.1	
Kingston Public Hospital	Boiler Conversion	4,774	1,005,030	0.15	4,085	126,747	0.3	81,700	14,445	28.3	
Shortwood Teacher's Coll.	Flourescent Lighting	79	12,959	0.88	432	12,950	0.27	8,640	930	46.5	
Long Pond	Installation Preheaters	4,000	780,000	2.0	3,590	537,250	1.1	17,800	5,800	61.9	
Casa Montego Hotel	Solar System	240	143,000	5.7	265	113,658	3.9	5,300	2,426	10.9	
Royal Caribbean Hotel	Solar System	702	204,492	3.0	138	131,619	8.7	2,760	516	26.7	

\*Annualized at US\$20/bbl  
Exchange Rate US\$1.0 = J\$5.5

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TABLE 9

ENERGY CREDIT FUND LOANS

PROJECT I.D. NO.	BORROWER	PURPOSE OF LOAN	COMMITMENT		UNDISBURSED AMT.		DISBURSEMENT & AVAILABILITY OF LOAN
			US\$	J\$	US\$	J\$	
9(3-4)-30-4-020	Chemquip Water Treatment Ltd.	Purchase of raw materials, storage containers and local machinery	57,565	130,000	57,565	-	30.11.86
5-(3-2)-30-4-020	Kingston Ice Making Co. Ltd.	Purchase of ice moulds and to defray cost of duties and other related expenses	102,067	577,855	102,067	577,855	31.10.86
4(18-1)-30-4-002	Jamaica Property	Scotchint job	-	181,185	-	925	31.05.86
6-(3-3)-30-4-020	Jamaica Oxygen & Acetylene Ltd.	Purchase of CO <sub>2</sub> storage tanker and food freezer	109,031	39,530	-	-	31.03.86
8-(8-1)-30-4-020	Serge Island Dairies Ltd.	Feasibility Study done by Econergy Engineering Services	30,000	30,000	-	-	31.03.86
7(12-1)-30-4-020	Diesel Equipment & Services Co. Limited	Purchase of Diesel Pump Test Stand & Customs Duty	36,600	70,000	-	-	31.01.86
3(2-1)-30-4-020	Homelectrix Mfg. Company Limited	Manufacture of energy savings device	21,285	239,318	21,285	43,714.30	31.12.85
10-(8-2)-30-4-003	Seprod Limited (1)	Purchase of centrifuges	143,300	859,800	143,300	859,800	31.03.86