CURRENCY EQUIVALENTS

(As of October 1993)

Currency Unit = Jamaican Dollar (J$)
US$1 = J$27.5
J$1 = US$0.036

FISCAL YEAR

April 1 - March 31

WEIGHTS AND MEASURES

kV	-	kilovolt (1,000 volts)
kVA	-	kilovolt-ampere (1,000 volt-amperes)
MVA	-	megavolt-ampere (1,000 kilovolt-amperes)
kW	-	kilowatt (1,000 watts)
MW	-	megawatt (1,000 kilowatts)
kWh	-	kilowatt-hour (1,000 watt-hours)
GWh	-	gigawatt-hour (1 million kilowatt-hours)

ABBREVIATIONS AND ACRONYMS

ACRONYMS

BOJ	-	Bank of Jamaica
BPD	-	Barrels per day
CARICOM	-	Caribbean Community
CLF	-	Conservation Law Foundation of New England
EIA	-	Environment Impact Assessment
ESCO	-	Energy Services Companies
ESMAP	-	Energy Sector Management Assistance Program
ESPIU	-	Energy Sector Policy Implementation Unit
GAP	-	Generator Assistance Program
GEF	-	Global Environment Facility
GOJ	-	Government of Jamaica
ICB	-	International Competitive Bidding
IDB	-	Inter-American Development Bank
IFREE	-	International Fund for Renewable Energy and Energy Efficiency
IRP	-	Integrated Resource Planning
JPSCo.	-	Jamaica Public Service Co.
LCB	-	Local Competitive Bidding
LPG	-	Liquified Petroleum Gas
LRMC	-	Long Run Marginal Cost
MPUME	-	Ministry of Public Utilities, Mining and Energy
NGO	-	Non-Government Organization
NRCA	-	National Resource Conservation Authority
PCJ	-	Petroleum Corporation of Jamaica
PCR	-	Project Completion Report
PIOJ	-	Planning Institute of Jamaica
PPU	-	Private Power Unit
QF	-	Qualified Facility
REPL	-	Rural Electrification Programme Limited
RF	-	Rockefeller Foundation
RFP	-	Request for Proposals
UNDP	-	United Nations Development Programme
UNEP	-	United Nations Environment Programme
USAID	-	United States Agency for International Development

ABBREVIATIONS

SO_2	-	Sulphur Dioxide
CO_2	-	Carbon Dioxide
NOx	-	Nitrogen Oxide
CFL	-	Compact Fluorescent Lamps

JAMAICA

DEMAND SIDE MANAGEMENT DEMONSTRATION PROJECT

GRANT AND PROJECT SUMMARY

Grantee: Jamaica

Cofinanciers:
(a) The Global Environment Trust Fund (GET)
(b) The Inter-American Development Bank (IDB) - joint financing
(c) Rockefeller Foundation
(d) Canadian Trust Fund

Beneficiary: JPSCo.

Amount: SDR2.8 million equivalent (US$3.8 million)

Terms: Grant

Financing Plan:

	Local	Foreign	Total
		US$ million	
GET	0.815	2.985	3.800
IDB	0.507	3.493	4.000
Rockefeller Foundation		0.237	0.237
Canadian Trust Fund	–	0.150	0.150
JPSCo	4.313	–	4.313
Total	5.622	6.878	12.500

Economic Rate Of Return:
B/C = 1.47 (Societal Test)
B/C = 1.31 (Total Resource Cost Test)
B/C = 3.86 (Participant Test)

Map IBRD 23863

MEMORANDUM AND RECOMMENDATION OF THE DIRECTOR LATIN AMERICA AND THE CARIBBEAN COUNTRY DEPARTMENT III TO THE REGIONAL VICE PRESIDENT

1. **Background**. The Jamaican economy is highly energy intensive (because of the bauxite industry), and developments in the energy sector significantly affect the overall economic performance. In 1992, total primary energy consumption (before conversion losses) in Jamaica was about 20 million barrels of fuel oil equivalent (boe). Commercial energy consumption was about 90 percent (17.7 million boe), represented by petroleum (about 88 percent), coal (1.6 percent), and hydropower (0.4 percent). Noncommercial energy consumption (2.3 million boe) consisted of wood, charcoal, and bagasse (10 percent). About 98 percent of the commercial energy needs were met from imported petroleum. Indigenous energy sources (hydropower, bagasse, and peat) are limited, have low potential, and are not yet fully developed. The only viable indigenous energy source appears to be fuel wood. Indiscriminate use of this resource and felling of trees are already having serious adverse environmental effects and Jamaica's forestry resources would have to be managed effectively and efficiently. As far as the development of other renewable energy options is concerned, efforts should be restricted to monitoring international developments. However, solar energy shows economic potential for domestic water heating and possibly for crop drying.

2. In the period 1989-1992, total energy consumption increased by about 17 percent, and commercial energy consumption by about 21 percent. Growth came mainly from the bauxite, alumina, and power sub-sectors. In 1992, imported energy (including energy for the bauxite and alumina sector) cost about US$320 million, an increase of about US$90 million over the 1989 import bill. The import bill for non-bauxite energy was about US$235 million and represented more than 22 percent of foreign exchange earnings from merchandise exports and non-factor services.

3. Demand projections are based on the following assumptions: (a) a real GDP growth at 2.8% p.a. up to 1995-6 and at 3.5% p.a. thereafter; (b) energy demand of bauxite and alumina sector increasing in line with rise in alumina production; (c) income elasticity of demand for energy at 1.6 up to 1995 and 1.2 thereafter; and (d) energy demand of the non-bauxite sector increasing at 4.0% p.a. The long term energy demand is projected to grow at 3.4% p.a. At this growth rate, the energy demand in 2000 would be about 26 million boe and in 2005, 31 million boe.

4. The government's current energy policy calls for expanded power generation by the private sector and eventual privatization of the power utility, Jamaica Public Service Company (JPSCo.), and Petrojam oil refining company, and improvements in energy efficiency on both the supply and the demand sides. The Government's policy to promote energy conservation is being supported by implementing economic pricing of petroleum products and electricity and by initiating demand-side management (DSM) programs through pilot projects, while aiming at the same time to sustain and expand these programs over the long term.

5. Electricity pricing policy in the past has been ad-hoc and tariffs have been adjusted only sporadically with significant time periods between adjustments. However, since April 1990, tariff adjustments have been carried out nearly systematically (in April 1991 and December 1991) to reflect economic cost on one hand and to allow JPSCo. to comply with financial covenants included in the Fourth Power and Energy Sector Deregulation and Privatization loan agreements with the Bank. Because of continued currency depreciation, there is still a small gap between the average tariff level and long run marginal cost. However, the introduction of an index multiplier geared to adjust the base tariff to respond to further currency depreciation helped JPSCo. to achieve a rate of return significantly above the 8% covenanted target. In sum, the Government is committed to encourage energy efficiency and follow a pricing policy that would reflect full economic and financial costs and avoid economic distortions. As a result of electricity tariff increases, public awareness and concern for energy conservation has increased.

6. One of the principal barriers to energy conservation has been considerably lowered by JPSCo. through its commitment to set the electricity tariff structure and level to reflect the economic costs of supply. The Government has taken the important first steps to overcoming the constraints to energy conservation by giving correct price signals to consumers, and by increasing competition in the market place through the reduction of high import duties on equipment which may be more energy efficient than that domestically manufactured.

7. A Regulatory Framework and Privatization Study (in three phases) which included a long-run marginal cost review has been completed by Coopers and Lybrand. This study recommended the following: (i) increasing competition in the sector (generation/supply) by initially focussing on Build-Own-Operate (BOO) schemes for new generation; (ii) restructuring the sector by establishing one generation company and one transmission/distribution company; (iii) changing the ownership of the sector by a full privatization of the generation company and transmission/distribution company; and (iv) amending the Electric Lighting Act and establishing an independent regulatory agency. Phase IV of the study, which includes drafting of the new legal and regulatory framework and implementation of the privatization recommendations, will be carried out by JPSCo. with funding from IDB. A draft of a new Electric Lighting Act should ensure the establishment, among other things, of cost recovery tariffs that would promote investments in energy efficiency. Within this new structure for the power sector in Jamaica, the new legal and regulatory framework should allow JPSCo. to acquire cost-effective savings as necessary to meet the demand for electricity services through an optimal mix of supply and demand side resources (see paras. 11 and 30).

8. In 1990, JPSCo., with consultants funded by the Rockefeller Foundation (RF) and technically supported by the Conservation Law Foundation of New England (CLF) in association with the Resources Development Foundation and the Biomass Users Network, examined the potential for achieving savings in Jamaica through DSM programs in the power sector. A concurrent UNDP/World Bank Energy Sector Management Assistance Programme (ESMAP) report also examined potential energy savings, and recommended that priority in demand-side management be given first to large commercial and industrial and then to small commercial buildings and residences. In addition, in April, 1991 the Inter-American Development Bank (IDB) approved a loan to JPSCo. which included a small energy conservation component.

9. The proposed project was initiated within this context. It incorporates an integrated approach to energy conservation which JPSCo. has developed during project preparation with valuable inputs from various organizations, including the RF, the CLF, the IDB, the ESMAP, and the Global Environmental Facility (GEF). It was formulated with the assistance of an advance of SDR 90,000 from the GEF project preparation advance (PPA).

10. **Project Objectives**. The main GEF objective in funding the project is to demonstrate on a small scale, and within a 5-year time frame: (i) the potential for electricity savings to replace substantial fossil fuel power generation, thereby avoiding additional CO_2, NO_x, and SO_2, emissions; and (ii) strengthen the capacity of the electric power sector and other relevant agencies, public and private, to achieve those savings. The broader, longer term objective is to develop the basis for expanding the scope of the program, if successful, on a Jamaica-wide basis and for replicating similar programs among electric utilities in other developing countries. The project will acquire necessary information and data to develop sustainable programs that overcome market barriers to energy conservation. The project will develop and test mechanisms to address these barriers and, during the last year of project implementation, the information acquired through evaluation of the demonstration activities will be used to design full scale sustainable long term energy efficiency programs. The project has an energy savings target of about 7 peak MW or 30,000 MWh by 1998, with a potential under a follow-up full-scale program of over 38 MW

or more than 190,000 MWh by 2008. These potential savings do not include the cogeneration contribution which is treated separately. The Demonstration project is targeting in the medium term about 2.5 MW from cogeneration to be obtained through standard offer contracts of 2 MW or less.

11. **Project Description**. The project will include six components: a commercial buildings component (31.6 percent of project total cost, excluding contingencies), a small residential component (about 12.2 percent), an industrial component (about 1.4 percent), a program monitoring, evaluation, and quality control component (about 10.5 percent), a DSM Executing Unit (DSMU) institutional building and administrative cost component (about 37.4 percent), and another institution building component of other institutions (about 6.9 percent). The main focus of the project will be on energy savings in the commercial sector. Specifically, the project will: (i) test and/or demonstrate the viability of selected energy savings and efficiency in the commercial sector and also establish the technical, economic, and financial feasibility of installing cogeneration capacity in the commercial building sector, and more specifically in hotels; (ii) implement a small pilot residential program to develop precise information on potential for energy savings and to test strategies to deliver energy efficient services in residential lighting, and to investigate possible benefits in residential solar water heating; (iii) assess potential energy savings in the industrial sector and develop a strategy and action plan for implementation; (iv) develop a monitoring, evaluation, and quality control system to strengthen the implementation, performance and quality of the various DSM programs and measures; (vi) strengthen the JPSCo. DSMU to implement these DSM programs and to enhance market infrastructure development and public awareness for energy conservation by providing technical assistance and training; and (vi) strengthen other institutions and organizations such as the Jamaica Bureau of Standards (JBS), the Natural Resource Conservation Authority (NRCA), local NGOs such as the Jamaica Environment Trust (JET) and other NGOs that would be interested in playing a role during project's design and implementation.

12. **In the commercial sector** the project will include three sub-components: large commercial buildings, small commercial buildings, and cogeneration. For the large commercial buildings sub-component, twenty large buildings (seven new and thirteen existing) will receive comprehensive energy audits focussing primarily on lighting, air conditioning, refrigeration, and water heating. Buildings will be retrofitted with cost-effective measures and energy efficient equipment such as lamps, ballasts, refrigeration, and air conditioning and ventilation systems, room sensors, window glazing, and solar water heaters.

13. The small commercial buildings will include two phases. Phase 1 will include auditing and retrofitting of ten small commercial buildings and an evaluation of these activities. The results of these activities will determine the mechanisms to be used in subsequent demonstration activities during Phase 2 to implement energy efficiency measures in the small commercial participants. Two possible alternatives include: (i) development of a check list type audit to serve as a basis for retrofitting twenty additional small commercial buildings; or (ii) providing -- possibly through equipment vendors -- information, installation and maintenance assistance and financial incentives to encourage customers to select the most efficient models at the time they are replacing equipment.

14. The cogeneration sub-component will evaluate cogeneration possibilities as a complement or alternative to energy conservation in the commercial sector. It will evaluate the potential market, demonstrate the means for achieving cogeneration market penetration in commercial buildings with emphasis on hotels and possibly hospitals, support feasibility studies, assist in the identification of the best and most reliable equipment, and finance consultants services for installation, quality control, and monitoring and evaluation. This component will also assist JPSCo. to refine and implement its cogeneration policy. The component will not finance purchase of equipment. Private investors have shown interest in investing in cogeneration which includes generation of power with heat recovery for

absorption chilling for air conditioning, and heat production for other uses such as water heating and steam production. The RF is interested in supporting this part of the work as a co-financier and in providing technical assistance to JPSCo to refine and implement its cogeneration policy. In order to encourage investment in cogeneration, JPSCo. has prepared a draft policy on cogeneration and interconnection guidelines for small power producers and submitted these drafts to potential investors for their comments and suggestions. In addition, JPSCo. has prepared a draft standard offer contract for the purchase of as-available energy from qualifying facilities as well as a standby and supplemental service agreement for co-generators and small producers. Potential investors in cogeneration have responded favorably to these initiatives.

15. **The residential component** will include three sub-components: lighting, solar water heating (SWH), and refrigeration. The residential lighting sub-component will be carried out in two phases. Phase 1 of the lighting sub-component would provide compact fluorescent lamps (CFLs) at no cost to the participants and would focus on testing and establishing technical criteria regarding equipment performance, customer response, installation problems, and other factors, in about 100 homes (about 300 CFLs). If Phase 1 is successful, then the implementation of Phase 2, which envisions about 30,000 homes (100,000 CFLs), would be implemented. The focus of Phase 2 would be to test the long term sustainability of the CFLs scheme on a self-financing basis and to analyze alternative options that would form the basis for possible full scale implementation, financing, and delivery options. The CFLs would be sold at either a discount or through a cost recovery financing (leasing) option, and will be distributed through either JPSCo's field offices and/or vendors.

16. The SWH sub-component will include an assessment of the solar water heater market in Jamaica, and technical assistance provided by JPSCo. to strengthen that market. The assistance would include: information, installation and maintenance. Moreover, 513 SWH units installed in the new Oakland Housing Development, financed by the Ministry of Public Construction, would be included as part of the monitoring and evaluation component discussed in para. 20.

17. The refrigerators and air conditioning sub-components would assess energy efficiency improvements in residential and commercial refrigeration and air conditioning through studies to refine potential savings estimates, investigate market conditions, and, for the residential refrigerators, customers response to the labelling program to be launched by the JBS.

18. **The industrial sector component** includes an assessment of potential energy savings in this sector, and the development of a strategy to test and demonstrate the viability of these savings as well as policies and actions to foster them. This assessment will analyze the technical, economic, and financial feasibility of such a strategy. The assessment will be conducted in several phases.

19. **The monitoring, evaluation and quality control component** is a crucial component of the project. It includes: (i) the development of a data base that would gather all relevant information about each program before, during and after implementation; and (ii) detailed monitoring and evaluation plans for each element included in the program design of each project component. Each component (commercial, cogeneration, and residential) will incorporate a design for process and impact evaluation. The process evaluation will assess the degree to which: (i) the program goals were understood and focussed; (ii) targeted levels of participation were achieved, successful and realistic; and (iii) the program administration, delivery of services, and financial incentives were appropriate. The impact evaluation will assess: (i) the cost of the measures against improvement achieved in quality of services; (ii) the actual energy savings realized by measure where possible and by facility; and (iii) the persistence of savings and likely savings from a full scale program. Monitoring and evaluation will take place in tandem with implementation activities in order to permit mid-term review during the course of the project. In addition,

Bank supervision missions would assess the efficiency of the DSMU activities. To ensure objectivity in evaluation, outside firms would be selected under Bank guidelines to have the overall responsibility for monitoring and evaluation.

20. **The strengthening of the DSMU and the enhancement of the market infrastructure and public awareness** will consist of transferring the skills, tools and equipment necessary, in the short term, to implement the project successfully and, in the long term, to carry out least-cost planning to develop cost-effective DSM programs and deliver such programs efficiently. This will include technical assistance and training for JPSCo., DSMU and private sector energy efficiency and audit firms and individual consultants. This component will also provide on-the-job-training and seminars, particularly in the areas of DSM program design, economic analysis, integrated resource planning (IRP), utilization of DSM and IRP computer software, marketing techniques, monitoring and evaluation, disposal of solid material resulting from the program, etc. In addition, it will provide technical support to assess the long-term economic sustainability of each DSM programs, to increase public awareness about energy efficiency and to disseminate information on a large scale through campaigns to inform the public at large, schools, government institutions, and private sector enterprises and organizations on the DSM programs to be carried out. Moreover, the potential for development of Energy Service Companies (ESCOs) will be investigated in association with institutions such as the International Funds for Renewable Energy and Energy Efficiency (IFREE), a non-profit organization dedicated to the promotion of environmentally sound energy projects in developing countries, in order to facilitate private sector energy efficiency investments.

21. **The strengthening of other institutions** that would play an important role in the implementation of the project would provide technical assistance to JBS, NRCA, JET and other local NGOs to strengthen the capacity of these institutions to provide the technical services for project's implementation (JBS and NRCA), and to protect the customers and the environment (NGOs). In addition, this component will include campaigns to promote the building code and the labelling program of electric appliances developed by JBS.

22. **Project Implementation**. The project will be implemented by JPSCo.'s DSMU. Part of the technical services will be provided by local energy efficiency specialists from the private sector who received training during previous energy efficiency programs carried out by JPSCo. Technical assistance in policy and planning issues, regulation, and program management, design, monitoring, and evaluation, will be provided to JPSCo. by foreign consultants, jointly with local firms. Detailed engineering and installation will be provided by local and foreign firms.

23. **Project Cost and Financing**. The total project cost is estimated at US$12.5 million. An ongoing IDB loan to JPSCo would provide for US$4.0 million; the Rockefeller Foundation, which has already disbursed more than US$620,000, has pledged an additional US$237,000; the Canadian Trust Fund (CTF) an IDB Trust Fund Facility has pledged US$150,000, and the proposed GET grant would provide US$3.8 million. JPSCo. plans to finance local costs equivalent to $4.31 million. It is also expected that about US$6.5 million would be contributed by participants from the private sector, with about US$3.5 million in cogeneration and the rest in equipment acquisition for the commercial and residential sectors. The details of project cost and financing are shown in Schedule A. About US$4.6 million of a total of about US$6 million would be for the purchase of goods by JPSCo. to be provided to participants in the commercial and residential sectors in the form of cash rebates and/or leasing arrangements financed under specific arrangements with IDB.

24. **Procurement and Disbursement**. The project would involve several categories of procurement (refer to Schedule B of MOD and Table 2 in the Technical Annex) including: (a) goods to be used for

program implementation such as testing and monitoring equipment, computer hardware and software and printers, fax and copying machines; and (b) consultancy services for the detailed design and implementation of the DSM programs including marketing, engineering and architectural design, installation, testing, monitoring and evaluation, other technical assistance and training. The Bank's procurement guidelines would be followed in procuring goods and consultancy services for the GET financed portion of the project (see MOD Schedule B, pages 1 and 2 and Table 2 of the Technical Annex). Portions of the project to be financed by the IDB loan, RF and JPSCo. would follow the procurement guidelines and procedures of the respective institutions. Disbursements from the grant may be made against Statements of Expenditure (SOE's) for the following expenditures: (a) contracts for goods valued below US$50,000 equivalent or less; (b) contracts with firms for services including technical assistance and training for US$100,000 equivalent or less and contracts valued at US$50,000 or less per individual.

25. **Project Sustainability**. The project is intended to build the institutional capability and acquire the necessary data, to develop sustainable programs that overcome market barriers to energy conservation. The utility and customer barriers that inhibit the implementation of energy efficiency in Jamaica include regulatory, information, technical, and financial deficiencies. The project will develop and test mechanisms to address these barriers and to develop full scale program at the end of the third year, based on the lessons learned during the project implementation. The overall economic management policies of the Government which are oriented to promoting a liberalized, market-based economy should provide a favorable environment to achieve this objective.

26. Specific mechanisms to address the barriers include: (i) providing incentives through an appropriate regulatory framework to reward electric utilities for investment in demand-side resources that are cost effective. The various initiatives would be screened using a "sustainability test"; (ii) providing public education to encourage energy savings and voluntary adoption of energy efficient building codes and technical guidelines as well as electrical appliance standards; (iii) increasing customer awareness levels of energy conservation as an important component of the project; (iv) reducing the risk of equipment non-performance through proper testing, design, and installation, with advice on operation and maintenance practices; (v) addressing the financial barriers concerning the customers limited access to capital, high cost of capital, and high thresholds for investment; (vi) developing energy efficiency support infrastructure in the private sector, including human resources, equipment availability, and availability of capital; and (vii) developing the energy efficiency support infrastructure in JPSCo. to design, implement, and evaluate full scale sustainable demand side management programs, and to include demand side management resources in integrated resource planning.

27. Under the JPSCo. privatization plan, it is expected that by January 1994 the operating functions of JPSCo. will be separated into two functions, along the lines of the restructuring of the power sector mentioned above (para. 8). Throughout the privatization stage, a representative of the DSMU will be participating in the meetings of the JPSCo. Privatization Task Force and the Energy Sector Project Implementation Unit of the Ministry of Public Utilities, Mining, and Energy (MPUME) to: (i) assure that the new proposed regulatory framework would include a component for promoting energy efficiency; and (ii) assure the sustainability of DSM in Jamaica. The establishment of a new legal and regulatory framework will be a key element in assuring the long term sustainability of investments in energy efficiency programs at full scale. The DSMU will be working with the Task Force to ensure that the consultants selected to draft this legal and regulatory framework have DSM expertise and know how.

28. **Lessons from Bank Experience**. The Bank has not been involved in previous demand-side management projects in Jamaica and has had limited experience in other parts of the world. A prior energy conservation program in Jamaica funded by the U.S. Agency for International Development

provides some lessons. This program had limited success, primarily because of unattractive financing terms, existing high equipment import duties, excessive bureaucratic requirements, and undue restrictions on sources of acquiring equipment. The proposed project would be designed to overcome these barriers. Another significant finding is that public confidence in the success of the program can be enhanced by providing information on experience elsewhere, and by carrying out a concrete demonstration in the local environment. This is the approach being adopted in this project. The detailed project design takes into account experience in North America and developing countries, such as Thailand, where DSM programs are being implemented. This experience has shown that, to realize the potential energy savings over the long term, it is essential to provide adequate technical assistance for institutional development, equipment testing, and program design and implementation, and to demonstrate clearly to both the utility and the consumers the viability of demand-side management measures.

29. **Rationale for GEF Funding**. GEF involvement is justified by the fact that the project has the potential to benefit the global environment in terms of reduction in greenhouse gas emissions as a demonstration project, thus contributing to human welfare and sustainable development. By introducing DSM and promoting electricity efficiency in the Jamaica power sector, the project contributes to this global perspective.

30. Even though the project has significant global and national benefits, they involve costs and risks. These include the reluctance of manufacturers to move to more efficient technologies, inadequate consumer responses, institutional weaknesses that discourage private sector participation and perceived technological failures for participants which are difficult to quantify. GEF funding would serve as a catalyst in identifying and reducing the barriers that inhibit private investment in demand-side management. Without GEF support, it is unlikely that the Government and the electric utility would be willing to absorb the initial costs and take the inherent risks.

31. The proposed GEF project is also expected to have an important value for other developing countries in selected energy sub-sectors and for selected end-uses. It would demonstrate: (i) how power utilities and the economy can benefit from investments made in electricity conservation; (ii) how institutional problems can be resolved and the utilities can gear up to manage the program and sustain it in the future; and (iii) how major demand-management options can be optimally integrated with supply-side options. The replicability of the program would be ensured through a comprehensive monitoring, evaluation and reporting program.

32. **Issues and Actions Agreed Upon**. The project design addresses the major issues regarding program delivery strategy, monitoring and evaluation criteria, and sustainability. In addition, the demonstration project will evaluate simultaneous JPSCo, government and private sector activities relevant to the implementation of DSM in Jamaica including the operation of Energy Service Companies (ESCOs); the implementation of cogeneration projects by the private sector; and appliance energy efficiency testing and labeling, and associated promotional activities carried out by the Jamaica Bureau of Standards (JBS) and JPSCo.

33. The main actions agreed upon during negotiations are the following: (a) the Government shall cause JPSCo. to maintain the DSMU with organization, structure, functions, management, and staffing satisfactory to the Bank; (b) the Government shall cause JPSCo., not later than November 30 each year, to furnish to the Bank a training program for DSMU personnel satisfactory to the Bank; (c) the Government shall, not later than November 30 each year, furnish to the Bank, for its review, Annual Operating Plans for each part of the project to be carried out during the following year, including the corresponding budgets; (d) the Government shall cause JPSCo., not later than July 31 and January 31, to furnish a semi-annual progress on the project identifying results achieved, main project implementation

issues with recommendations regarding remedial measures to be taken in relation to the project, and implementation of the relevant Annual Operating Plan; (e) under the terms and conditions set in the Loan 3502-JM - Energy Sector Deregulation and Privatization - and in the context of the regulatory framework for the power sector which is under study, the Government shall include specific provisions to encourage investments in energy efficiency satisfactory to the Bank; (f) the Government shall cause JPSCo., not later than June 30, 1994, to approve a Cogeneration Policy and Standard Offer Contract models; (g) the Government shall cause JPSCo. to enter into contractual arrangements, satisfactory to the Bank with: (i) JBS for the purpose of carrying out its proposed program and budget to support project implementation, particularly for testing of equipment[1]; (ii) NRCA for the purpose of supporting project implementation, particularly with regard to environmental impact and disposal of solid waste; and (iii) NGOs and other public entities and professional organizations for the purpose of educating the public and creating public awareness.

34. Conditions of Effectiveness. Effectiveness of the proposed grant will be conditioned on: (a) submission by the Government of a certified copy of the JPSCo Agreement duly executed on behalf of the parties; (b) approval by the Government of a Policy on Energy Efficiency; and (c) adoption of operating guidelines.

35. **Environmental Aspects**. The project would make a positive contribution to the global environment by reducing the emission of green-house gases (GHG) and by deferring or eliminating the need to build additional fossil fuel-fired power plants. Through the life of the energy conservation measures implemented under this project, it is expected that CO_2 emissions would be reduced by over 507,000 tons. Up to 1998, CO_2 emissions are expected to be reduced by over 86,000 tons. The project does not pose any significant adverse environmental impact, although the retrofitting programs would result in substantial quantities of replaced material such as lighting fittings, ballasts, lamps, and other materials. Specific plans and arrangements will be considered for proper disposal and storage (prior to disposal) in close collaboration with the Ministry of Public Service and Environment and the NRCA with the participation of JET, and other interested NGOs. Due to the benefits that it produces for the environment, the project has been classified as Category C.

36. **Program Objective Categories**. Several existing and forthcoming Bank projects and operations are focussed on alleviating the poor health and educational situation in Jamaica. While this project does not have poverty alleviation as its direct target, DSM measures to invest in energy efficiency will delay additional investment in generation and increase economic efficiency. Thus, they would ultimately reduce the electricity bill of Jamaicans and consequently relieve the poor from high electricity cost.

37. **Project Benefits**. The main benefits of the proposed project would be: (i) saving fuel consumption (GWH per annum resulting in liters saved); (ii) avoiding generation capacity expansion; (iii) reducing emissions of greenhouse gases in a cost-effective manner; (iv) building institutional capability in the Jamaica electric power sector and the energy-related private sector to deliver cost-effective energy services throughout the economy; (v) supporting the ongoing Government efforts in testing and adopting energy efficient equipment; (vi) increasing public awareness and helping local NGOs in these efforts; (vii) demonstrating the potential gain to utilities of other developing countries; (viii) providing cost savings to JPSCo. and participants; and (ix) expanding the use of new technologies such as cogeneration with absorption chilling and solar water heating. The power sector in Jamaica would be able to achieve savings of about 38 MW (about 190,000 MWh) by 2008, representing a fuel saving of about 894,000 bbl. A detailed analysis of the project benefits is presented in Section VI of the Technical Annex. The overall

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[1] Testing will be carried out by JBS and other facilities in Jamaica and in facilities overseas as agreed with the Bank.

long term benefit would be to build a sustainable DSM program and to introduce a least cost integrated resource plan. For the five year program, the benefit cost ratio for the total program is 1.47 for the societal test, 1.31 for the total resource cost test, and 3.86 for the participant test.

38. **Risks**. The project faces three main categories of risk: institutional, technical, and market. Regarding the institutional risks, the expected benefits may not be reached if the DSMU is not adequately staffed. However, the commitment of the Government of Jamaica and JPSCo. to energy efficiency, and the close monitoring by the Ministerial Steering Committee of the MPUME will mitigate much of this risk. While the privatization of JPSCo. introduces some degree of uncertainty, the institutional risk should be reduced by the DSMU's location in the future transmission and distribution company that would emerge out of JPSCo restructuring. In addition, the establishment of an adequate regulatory framework will also reduce this risk by providing incentives to the utilities to invest in DSM activities.

39. Regarding the technical risks, issues are related to the unique characteristics of the power in Jamaica (110V, 50HZ, supply of low power quality and high voltage fluctuations). While these technical problems are not inherent to the project itself, they could create technical difficulties in the introduction of new technology such as CFLs. To reduce this risk, testing will be conducted to identify any potential problems related to these issues and other issues (e.g. the high ambient temperatures in a tropical climate) before installation. JBS support in this area would help identify the problems at an early stage in order to find solutions. In addition, degradation and breakdown of equipment as a result of lack of effective operation and good maintenance may affect the performance and efficiency of the measures tested. The project provides for training and assistance in this area to avoid these difficulties, and closer JBS contribution. Finally, regarding market risks, the project may suffer from weak participation and interest in the DSM programs. In that case, the energy savings targets as well as penetration rates in the commercial and residential sectors may not be achieved. To mitigate these risks, project monitoring and evaluation activities will be designed to provide immediate and continuous feedback on project implementation and will serve as the basis for devising program design adjustments necessary to achieve targeted savings. In addition, the information campaign should be intensified to reduce this risk.

Attachments

Washington, D.C
March 29, 1994

JAMAICA
DEMAND SIDE MANAGEMENT DEMONSTRATION PROJECT
Estimated Total Project Costs
(US$ million)

	Local	Foreign	Total
	----------(US$ million)----------		
A. Commercial Sector			
Large Commercial New	0.875	---	0.875
Large Commercial Retrofit	1.625	0.450	2.075
Sub-Total Large	2.500	0.450	2.950
Small Commercial Direct Install (Phase I)	---	0.150	0.150
Small Commercial Phase II	0.225	---	0.225
Sub-Total Small	0.225	0.150	0.375
Cogeneration (1)	---	0.237	0.237
Sub-Total Commercial	2.725	0.837	3.562
B. Residential Sector			
Lighting (Phase I)	---	0.004	0.004
Lighting (Phase II)	---	1.300	1.300
Sub-Total Lighting (1)	---	1.304	1.304
Solar Water Heater (1)	0.024	---	0.024
Refrigerators (1)	0.024	---	0.024
Air Conditioning (1)	0.024	---	0.024
Sub-Total Residential	0.072	1.304	1.376
C. Industrial Sector			
Assessment (1)	---	0.150	0.150
D. Programs Monitoring, Evaluation & Quality Control	0.433	0.748	1.181
E. DSM Unit Institutional Building & Administrative Costs			
Salaries	1.020	---	1.020
Training	0.250	0.050	0.300
Public Relations & Information Campaigns	0.340	---	0.340
Vehicles	---	0.075	0.075
Testing & Monitoring Equipment	---	0.670	0.670
Computers & Software	---	0.300	0.300
Technical Assistance	0.250	1.250	1.500
Sub-Total DSM	1.860	2.345	4.205
F. Institutional Strengthening			
JBS	0.100	0.500	0.600
NRCA	0.030	0.075	0.105
JET and Other NGOs	0.030	0.050	0.080
Sub-Total Institutional	0.160	0.625	0.785
G. Contingencies	0.372	0.869	1.241
Total	5.622	6.878	12.500

(1) These represent specific studies.

Financing Plan [1]:

	Local	Foreign	Total
	(US$ million)		
GET	0.815	2.985	3.800
IDB	0.507	3.493	4.000
Rockefeller Foundation	---	0.237	0.237
Canadian Trust Fund	---	0.150	0.150
JPSCo.	4.313	---	4.313
Total	5.622	6.878	12.500

Note:

(1) For more details about financing plan for each project component, please refer to Table 1 in the Technical Annex.

JAMAICA

DEMAND SIDE MANAGEMENT DEMONSTRATION PROJECT

Summary of Proposed Procurement Arrangements
(US$ million)

Categories	Other	N.G.F./1/	Total
Goods	1.181/2/	4.846	6.027
Services	2.619/3/	2.266	4.885
DSM Adm. Expenses		1.588	1.588
Total	3.800 (3.800)	8.700 --	12.500 (3.800)

Figures in parenthesis refer to financing from the GET.

Notes:

1/ Non GET-grant funds, i.e. items financed by IDB, RF, CTF, and JPSCo.

2/ Purchase of testing and monitoring equipment and software packages through LIB for a total of about US$1.120 million, and computers, printers, and fax and copying machines through Shopping for about US$60,000.

3/ Includes consulting services for marketing, engineering, architectural design, installation, testing, monitoring, evaluation and quality control, technical assistance, and training to be procured under Bank guidelines for consultants.

DISBURSEMENTS

Category	Amount of the GET Grant (US$)	Loan of IDB (US$)	Grant of RF[1] (US$)	Grant of CTF (US$)	% of Expenditures to be Financed
(1) Goods	0.970	1.979	--	--	100% of foreign expenditures, 100% of local expenditures (ex-factory cost) and 70% of local expenditures for other items procured locally.
(2) Services[2]	2.076	1.762	0.237	0.150	100% of foreign expenditures.
(3) Un-allocated	0.754	0.259	--	--	
Total	3.800	4.00	0.237	0.150	

Estimated Disbursements:

Bank FY	94	95	96	97	98
	---------- (in US$ million)----------				
Annual	0.610	1.170	0.910	0.675	0.435
Cumulative	0.610	1.780	2.690	3.365	3.800

Notes:

(1) Rockefeller Foundation has already disbursed about US$690,000 for project's preparation and implementation.

(2) Includes marketing, engineering, architectural design, installation, testing, monitoring and evaluation, consulting, technical assistance, and training.

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DEMAND SIDE MANAGEMENT DEMONSTRATION PROJECT

Timetable of Key Project Processing Events

(a)	Time taken to prepare the project:	18 months
(b)	Prepared by:	JPSCo., IBRD, IDB, CLF, RF, MPUME, Hagler/Bailly and PEA (under a GEF/PPA and IDB/RF funded studies)
(c)	First Bank mission:	September 1992
(d)	Appraisal mission departure:	October 1993
(e)	Negotiations:	January 1994
(f)	Planned date of effectiveness:	June 1994
(g)	Relevant PCRs:	Nil

This report is based on the findings of an appraisal mission to Jamaica in October 1993, comprising Abderrahmane Megateli (Mission Leader and Task Manager), Abigail Osae-Addo (LATEN) and Ignacio Rodriguez (Consultant). The Peer Reviewers were Joseph Gilling and Charles Feinstein. Mr. Zia Mian contributed in the preparation and review of this report. Secretarial assistance was provided by Ms. Miriam Allen. The Project was cleared by Yoshiaki Abe, Director (LA3DR) and Krishna Challa, Chief (LA3TF).

JAMAICA

DEMAND SIDE MANAGEMENT DEMONSTRATION PROJECT

Supervision Plan

Bank Staff Inputs for Project Supervision 1994-1997

Approximate Date	Activity	Anticipated Skill Requirements	Input in Staff Weeks
9/94	Supervision Mission		
	Review staffing arrangements	Task Manager	2
	and office set up	DSM Expert	2
	Review consulting TOR		
	Review training TOR		
	Review reporting arrangements		
	Review lab and testing proposals		
	Review procurement procedures		
3/95	Supervision Mission		
	Review project implementation	Task Manager	2
	Review commercial,	DSM Expert	2
	and residential programs		
	Review procurement progress		
	Review evaluation protocols		
	Review program for special studies		
9/95-9/96	Three Supervision Missions	Task Manager	3
		DSM Expert	6
3/97	Mission Mid-term Review		
	Review project implementation	Task Manager	2
	in terms of project objectives	DSM Expert	4
	Review program impacts		
	Review consulting and training		
	Review corrective measures		
	Review promulgation of codes and standards		
	Review effectiveness of cataloging		
	Review progress on IRP		
	Conduct independent evaluation		
	Review performance of lab testing and certification/labeling		

Schedule D

Jamaica: Financial Relations with the World Bank Group

A. Statement of the World Bank Loans as of September 30, 1993

Loan No.	Fiscal Year 1/	Borrower	Project Name	In millions of U.S. dollars (Less Cancellation) Amount	Undisbursed
43 Loans fully disbursed 2/				764.6	
Of which: SECALs, SALs and program loans 3/					
2105-JM	1982	Jamaica	Structural Adjustment I	(76.2)	
2315-JM	1983	Jamaica	Structural Adjustment II	(60.2)	
2478-JM	1985	Jamaica	Structural Adjustment III	(55.0)	
2848-JM	1987	Jamaica	Trade and Finance Sector Adjustment	(40.0)	
2849-JM	1987	Jamaica	Public Enterprise Sector Adjustment	(20.0)	
3174-JM	1990	Jamaica	Agriculture Sector Adjustment	(25.0)	
3303-JM	1991	Jamaica	Trade and Finance Adjustment II	(30.0)	
2389-JM	1984	Jamaica	Urban Transport 5/	16.0	4.6
2422-JM	1984	Jamaica	Water Supply and Sewerage T.A. Rehabilitation 6/	9.0	2.4
2850-JM	1987	Jamaica	Sugar Rehabilitation	29.9	1.9
2851-JM	1987	Jamaica	Population and Health	10.0	7.0
2869-JM	1987	Jamaica	Fourth Power	18.0	4.2
2899-JM	1988	Jamaica	Education	8.3	1.6
3062-JM	1989	Jamaica	Clarendon Alumina Production	15.0	11.6
3111-JM	1990	Jamaica	Social Sector Development	30.0	22.1
3275-JM	1990	Jamaica	Road Infrastructure Planning	35.0	22.3
3386-JM	1991	Jamaica	Finance and Program Management Improvement	11.5	8.0
3502-JM	1992	Jamaica	Energy Sector Deregulation	60.0	45.4
3580-JM	1993	Jamaica	Reform of Secondary Education	32.0	32.0
3622-JM	1993	Jamaica	Private Sector Development Adjustment	75.0	35.0
			Total (net of cancellations)	1,114.2	
			Of which has been repaid	424.7	
			Total now outstanding	689.5	
			Total undisbursed		198.0

B. Statement of IFC Investments as of October 31, 1993

Investment No.	Fiscal Year 1/	Borrower	Type Business	In million of U.S. dollars Loan	Equity	Total
038	1961	Jamaica Pre-Mix Ltd.	Cement & constr. materials	0.2	--	0.2
136	1969	Pegasus Hotels of Jamaica	Tourism	2.2	0.8	3.0
542	1981	West Indies Glass Company	Glass containers	2.3	--	2.3
598	1982	Jamaica Flour Mills Limited	Food and food processing	5.0	--	5.0
818	1985	The Falcon Fund	Guarantee facility	2.5	--	2.5
815	1985	Eastern Banana Estates 4/	Food and food processing	3.7	0.4	4.1
907	1987	St. Mary's Banana Estates Ltd.	Food and food processing	3.9	1.2	5.1
1129	1989	Eagle Merchant Bank	Commercial bank	5.0	--	5.0
1130	1989	Jamaica Citizens Bank	Commercial bank	5.0	--	5.0
1131	1989	Mutual Security Bank	Commercial bank	5.0	--	5.0
3427	1993	Caribbean Cement Co.	Cement	8.0	--	8.0
		Total gross commitments		42.8	2.4	45.2
		Less cancellations, terminations, participations, sales and repayments		30.1	1.2	31.3
		Total commitments now held by IFC		12.8	1.1	13.9
		Total undisbursed (including participants)		3.0	--	3.0

TECHNICAL ANNEX

DSM PROGRAM DESCRIPTIONS, IMPLEMENTATION ARRANGEMENTS, AND PROJECT BENEFITS

JAMAICA

DEMAND SIDE MANAGEMENT DEMONSTRATION PROJECT

TABLE OF CONTENTS

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DSM PROGRAM DESCRIPTIONS, IMPLEMENTATION ARRANGEMENTS, AND PROJECT BENEFITS

I. JAMAICA's ELECTRICITY SECTOR

A. Sector Issues

Power Sector

1. The basic legislation governing the power sector consists of the Electric Lighting Act of 1890 and the Electricity Development Act of 1974. The Electric Lighting Act empowers the Minister to license any authority or company to supply electricity under the Act's provisions within any area on the island, subject to the terms of the license and regulations made under the Act. The Electricity Development Act established the Electricity Authority as the agency responsible for power sector development. In addition, the Electricity Authority is authorized to regulate the license-holding utilities. Under the Electric Lighting Act, the Government of Jamaica (GOJ) granted to the Jamaica Public Service Company Ltd. (JPSCo.), in 1978, a 39-year "All Island Electric License", which obliges JPSCo. to supply electricity to all parts of the island as the sole supplier of electricity for public consumption. Major objectives of the Government Energy Sector Policy and Strategy are shown in Attachment 1.

Generation System

2. JPSCo. has an installed capacity of about 544 MW, with hydro-capacity totalling 18MW, forming 3% of installed capacity, and the balance of 526 MW, forming 97% of installed capacity, consists of oil-fired units. The steam and the diesel units, which operate on fuel oil, generated 81% of total net electricity output in 1991 while combustion turbines using diesel oil supplied 13%, and hydro plants supplied the remaining 6%. Steam plants are located at Units Bay and Old Harbor, the diesel plant is located at Rockfort, while combustion turbines are located at Hunts Bay and Bogue in Montego Bay area. The five hydro-electric plants are located on the North Coast on the Maggoty, Rio Bueno, Roaring, and Lower and Upper White Rivers.

Transmission and Distribution Systems

3. JPSCo. delivers electricity to the main load centers through a transmission network comprising two levels of transmission voltages, 138 kV and 69 kV. There are about 273 circuit-kilometers of 138 kV lines. In addition, there are about 716 circuit-kilometers of 69 kV lines. The 69 kV transmission system is interconnected to the 138 kV system through 8 substations; total substations number 54. Electricity is sold at medium (24 kV, 13.8 kV, 12 kV and 4 kV) and low (440/220/110V) voltage through a distribution network which includes about 11,200 circuit-kilometers of distribution lines. The distribution lines are primarily overhead bare conductor lines with underground feeders supplying some industrial and commercial loads. JPSCo.'s transmission and distribution system covers the entire island.

Access to Electricity

4. About 63% of the total population of Jamaica live in dwellings which have electricity, compared to 39% in 1976. Electricity consumption is mainly concentrated in the metropolitan areas of Kingston and Montego Bay which respectively represent about 62% and 8% of the country's total consumption.

Average electricity consumption per capita in 1991 was about 850 kWh/year, based on generation. Jamaica's electricity indicators (per capita installed capacity and electricity consumption and access to electricity) are in the middle range of other comparable countries. In 1975, about 54% of Jamaica's population lived in rural areas. Of this total, only 11% were connected to the grid. In order to accelerate the integration of the rural areas to the distribution grid, the Government in 1975 created the Rural Electrification Programme Limited (REPL), an entity separate from JPSCo., to administer the rural electrification program. The program consists of extensions from established transmission lines, and the provision of loans to assist homeowners in carrying out house installations. REPL receives financing under soft terms for the program. Upon their completion, the projects are transferred to JPSCo., at cost, as well as the corresponding liabilities. This institutional arrangement has worked well and the proportion of the rural population connected to the grid has increased to 20%.

System Losses

5. Although JPSCo.'s operational efficiency has improved, system losses have remained consistently high (above 19% of total generation) throughout the period 1986/87-1991/92. Based on a Bank-financed study undertaken in 1988, it is estimated that technical losses on transmission lines, substations, distribution lines and technical transformers, account for about 11% of net generation and 52% of total losses and that non-technical losses amount to about 48% of total losses. Non technical losses have been attributed to metering problems, improper meter wiring, incorrect field information and clerical errors, and unregistered consumption.

Electricity Demand

6. Jamaica's peak demand for electricity was about 330 MW in 1990, and is projected to grow at a rate of 4.7% a year through 2000. JPSCo. sales data (1,650 GWh in 1990) classify customers as residential, small commercial and industrial, large commercial and industrial, and other (mostly street lighting). In 1990, sales to these categories of customers was as follows:

	# of Customers	Sales (MWh)	% of Sales
Residential	273,910	525,084	32
C&I (Small/Medium)	28,920	751,786	45
C&I (Large)	31	208,483	13
Other	2,132	164,911	10
Total	304,993	1,650,264	100

7. Commercial and industrial customers account for 58% of electricity sales, and commercial customers alone are believed to account for 43%. Commercial and industrial customers are further divided into two groups; namely Rate 20, having a demand of less than 20 kW, and Rate 40, having a demand of 20kW to 500 KVA. Some 800 commercial and industrial customers belong to Rate 40. Commercial and industrial customers having demand in excess of 500 KVA are classified as Rate 50 customers.

Electricity Sector Issues and Strategy

8. The government of Jamaica's long-run goal in the power sector includes divestiture:

a) Increasing sector efficiency to meet electricity demand at lowest cost to the nation and consumers;
b) Increasing access to foreign and local funding for system expansion;
c) Providing the stimulus for local capital markets;
d) Transferring to private capital the business risks inherent in investment in the power sector;
e) Reducing public sector debt through the sale of assets; and
f) Reducing the involvement of government in the operation of the power sector.

B. Demand Side Management Issues

9. Until recently, efforts in the power sector in general had focused on the expansion of power supply with little attention to the net benefits of reducing consumption on the demand side. Given the relatively small and untried market in Jamaica for demand side management (DSM) programs and the experience to date with energy conservation projects, it is apparent that JPSCo. will need to play a major role in implementing and demonstrating the feasibility and benefits of DSM. It is unlikely that a purely private venture could be established until the energy service company (ESCO) and shared savings concepts have been adequately demonstrated and proven. Benefits to be attained from DSM measures include energy savings through an absolute reduction in energy consumption through improved efficiency, energy savings through shifting to off-peak periods when fuel costs of generation are lower, and generating capacity savings through load reduction or peak shifting. Some measures provide both energy and capacity benefits e.g. substituting compact fluorescent lamps (CFLs) for incandescent lights used during the peak period, whereas other measures provide energy savings alone, such as air-conditioner efficiency improvements used only in off-peak periods. In spite of the benefits of DSM, several perceived risks and barriers exist to implementing DSM programs generally, and specifically in Jamaica.

10. These include the following:

(a) Lack of information. Utilities, like their customers, typically lack information about the availability, cost and reliability of many efficiency measures, many of which are unavailable on the local market. They also lack information about the efficiency of existing electrical uses, thus making it hard to evaluate the potential gains.

(b) Lack of financing. Most customers do not have money to invest in electrical efficiency improvements. In all but a few businesses, and in all homes, electricity is a minor component of overall costs. Consequently, very few customers can justify spending money on electrical efficiency improvements that do not pay for themselves in a very short period of time. By contrast, the utility, with larger pools of capital and regulated rates of return, operates in an environment which permits significantly longer payback periods, particularly for long-term capacity investments.

(c) Scarce investment resources. Limited capital is available and there is an inherent bias towards investment in mainstream business activities, such as production or marketing rather than conservation.

(d) Traditional attitudes and inertia. Attitudes established when energy was cheap include the operating techniques used in plants and management's treatment of utility costs as fixed, uncontrollable overheads, while energy conservation is regarded as a discretionary expenditure.

(e) High rate of return requirements. Uncertainty regarding the likely savings from energy conservation investments results in companies undertaking only those investments showing obvious, very high returns. In addition, low customer payback requirements and long payback period of some of cost effective DSM measures are serious barriers to purely shared savings schemes.

(f) Risk avoidance. Lack of knowledge and technical or economic uncertainty leads to fears regarding energy conservation retrofit devices, the failure of which might lead to the disruption of the enterprise's productive output.

11. The proposed project will test and demonstrate the marketing, technical, and financial, and economic feasibility of implementing cost effective DSM measures. It will also provide the necessary experience to establish energy efficiency and conservation programs in the commercial, and residential sectors. Also, increased private sector initiatives and market-oriented behavior can be expected to stimulate better performance and productive efficiency. A glossary of key DSM terms is shown in attachment 2.

II. PROJECT DESCRIPTION

A. Project Background

12. JPSCo's DSM program began with an assessment of the potential savings from DSM by consultants funded by Rockefeller Foundation (RF) and technically supported by Conservation Law Foundation of New England (CLF), the Resources Development Foundation, and Biomass Users Network. The results of this assessment, including estimates of potential financial and environmental benefits from DSM, were set forth in a June 1990 report entitled "Power by Efficiency." Potential energy savings were estimated at up to 20% of demand by 2010. This report recommended eight DSM programs that could be implemented in Jamaica. Based on the results of this report, RF initiated support for the development of a pilot DSM project at JPSCo. headquarter to test priorities among the recommended programs. In addition, in April, 1991 the Inter-American Development Bank (IDB) approved an Electricity System Rehabilitation Program Loan to JPSCo. which included a small energy conservation component for an amount of US$2 million.

13. Prior to this, other energy efficiency development were undertaken with the assistance of the UNDP/World Bank Energy Sector Management Assistance Programme (ESMAP). ESMAP supported the development of an Energy Efficiency Building Code by the Jamaica Bureau of Standards (JBS). This code is complete although it has not yet been disseminated. In addition, ESMAP has supported work to develop appliance labels through appliance testing at JBS. Initial testing efforts have focussed on lamps and refrigerators. Finally, an Energy Sector Strategy and Investment Planning Study initiated at the end of 1990 investigated various DSM programs that complemented those presented in the "Power by Efficiency" report, among other things, and recommended that priority should be given first to large commercial and industrial sectors; and then to small commercial buildings and residences.

14. To support a larger DSM development project in Jamaica, Inter-American Development Bank (IDB) and Global Environment Facility (GEF) funds were solicited by the Government of Jamaica. The IDB agreed to increase to US$4.0 million the energy conservation component included in its loan to JPSCo. GEF, on the other hand, agreed to provide US$3.8 million.

15. The proposed project was initiated within this context. It incorporates an integrated approach to energy conservation which JPSCo. has developed during project preparation with valuable inputs from various organizations, including the RF, CLF, IDB, ESMAP, and the Bank. It was formulated with the assistance of a GEF project preparation advance (PPA) of SDR90,000.

16. Six principal activities were carried out to prepare the project with PPA funding and additional funds support from IDB and RF:

(a) The definition and design of JPSCo's commercial demonstration program.

(b) The preliminary technical and economic analysis of building cogeneration potential.

(c) The definition and design of JPSCo's residential demonstration program for lighting and solar water heaters, and identification of studies to analyze and assess opportunities to increase energy efficiency in other residential end uses, such as refrigerators.

(d) The identification of the needs of JPSCo. and other organizations for institutional capacity building and the development of plans to address those needs.

(e) The identification of needs that may arise in designing and implementing long-term, full-scale demand-side management programs in Jamaica-including those relating to the regulatory framework, sustainability, links with supply-side planning, and replicability in Jamaica.

(f) The development of the evaluation plans for the program.

B. Project Components

17. The main focus of the project will be on the commercial sector. However, the project will include a small pilot test for the residential sector as well as a series of studies to investigate further potential savings in the residential and in the industrial sector. Specifically, the project will have the following components: (i) test and/or demonstrate the viability of energy savings and efficiency in the commercial sector through retrofitting; (ii) as part of the commercial sector, establish the technical, economic, and financial feasibility of installing cogeneration in the commercial building sector and more specifically in hotels; (iii) implement a small pilot residential program to develop more precise information on the potential for energy savings and to test strategies to deliver energy efficiency services in residential lighting and to investigate possible benefits in residential solar water heating; (iv) assess potential energy savings in the industrial sector and develop a strategy and action plan for implementation; (v) develop a monitoring, evaluation, and quality control system to monitor and evaluate the implementation, performance and quality of the various DSM programs and measures; (vi) strengthen the JPSCo. Demand Side Management Unit (DSMU) capabilities to implement these DSM programs and to enhance market infrastructure development, and public awareness for energy conservation by providing technical assistance and training; and (vii) strengthen other institutions and organizations such as the Jamaica Bureau of Standards (JBS), the Natural Resource Conservation Authority (NRCA), local NGOs such as the Jamaica Environment Trust (JET) and other NGOs that would be interested in playing a role during project's design and implementation.

1. Commercial Sector Component

18. Targeted accomplishments expected to be realized from the commercial sector demonstration program include:

(i) Establishing technical potential for energy conservation in the commercial sector.

(ii) Establishing maximum feasible market penetration for conservation in the commercial sector.

(iii) Demonstrating means for achieving conservation in large and small commercial buildings, both new and existing.

(iv) Establishing the steps which will need to be taken and the resources required to foster conservation in the commercial sector cost effectively on a broader scale.

(v) In the course of the demonstration, acquiring a limited amount of energy conservation savings commensurate with the program budget.

19. This component includes two sub-components: large and small buildings. It will provide incentives for the purchase of equipment such as efficient air conditioning systems and lighting and also for the conduct of energy audits. Based on monitoring and evaluation results, full scale programs will be designed the last year of the project.

(a) Large Commercial Buildings Program

20. Energy audits performed to date indicate that the large commercial buildings sector uses energy primarily for lighting, space air conditioning, and, in the case of hotels, hot water. The overall objective of the demonstration activities in this sub-sector will be to identify and test in a suitable range of new and existing buildings all energy saving measures likely to be of economic significance to Jamaica. The demonstration program will also test strategies to implement cost effective DSM that have been used successfully by US utilities (e.g. Northeast Utilities, Florida Power and Light, Bonneville Power Administration, Puget Sound Power and Light, Green Mountain Power, and New England Electric) and involves a combination of services (including comprehensive audits), technical assistance and quality control from the analysis stage through equipment commissioning, and financial incentives to overcome customer market barriers.

21. Twenty buildings will be treated in the course of the demonstration. Initially the goal is to treat seven new and thirteen existing buildings. The services and financial assistance offered for treatment of new buildings will differ somewhat from that offered for treatment of existing buildings in order to address the needs of customers in these two different types of circumstances. Existing buildings are important because they represent the best opportunity to acquire a significant amount of savings quickly, and new building conservation is considered to be an important component of this project because of the significant share of load expected to come from new buildings over the next twenty years.

22. The sample is designed to include the most prevalent building types such as offices and hotels, but also to develop initial experience with less common, but important building types such as hospitals, retail establishments and supermarkets. Effort will be made to include buildings with different building styles, sizes and features. Since hotels are targeted for treatment, an effort will be made to include large

luxury hotels, more moderately sized hotels, and at least one hotel with a decentralized layout suitable for solar. The office buildings will include both large multi-story structures and one-to-two story structures. Hospitals will include both a modest hospital and a larger one, and, if an opportunity for a new hospital project arises, the targeted building mix may be adjusted. An attempt will be made to select some government buildings in the sample of buildings treated.

23. These twenty buildings (with floor area larger than 1,000 square meters and found in the R40 and R50 tariff class) will receive a comprehensive energy audit focussing primarily on lighting, air conditioning, refrigeration, and water heating. Buildings will be retrofitted with cost-effective efficiency measures including, where applicable, measures such as energy-efficient lamps, ballasts, refrigeration, air conditioning and ventilation systems, room sensors, window glazing, and solar water heaters. When it is considered to be cost-effective, this sub-component will provide incentives for the purchase of equipment and for audits.

(b) Small Commercial Building Program

24. Small buildings (R20 tariff class) are far more numerous in number of customers than those found in the large building category. Thus, although savings available in each building are likely to be much lower than those available in a large building, these buildings comprise a significant proportion of JPSCo's commercial load, and possibly one fifth of total sales representing a significant market for energy savings. Typical small commercial end uses include lighting, some refrigeration, some central air conditioning and a few manually operated window air-conditioning units. Only one warehouse is included because opportunities tend to be similar in all warehouses.

25. Unlike the large commercial sub-component, the small commercial sub-component will not address new buildings. This decision was taken because it is not yet well understood how the new building code, that will serve as the basis for the large commercial new construction demonstration work, could be applied effectively in the context of small commercial buildings. Moreover, the JPSCo DSM unit (DSMU) currently has little knowledge of building practices in this market and only limited information about prevalent end uses and conservation opportunities. A new construction sub-component to the small commercial building program should be developed in the future on a basis of information developed through demonstration activities, and when the characteristics of the small commercial market are better understood.

26. Phase 1 of the small commercial building program will include audit and retrofit of ten small commercial buildings and an evaluation of these activities. The results of these activities will determine the mechanism used in subsequent demonstration activities (Phase 2) to deliver energy efficiency to small commercial customers. Two possible alternatives are considered: (i) development of a check list type audit to serve as a basis for retrofitting twenty additional small commercial buildings; and (ii) providing - - possibly through equipment vendors -- information, installation and maintenance assistance and, when it is considered to be cost-effective, financial incentives to encourage customers to carry out the audit and to buy the most efficient equipment at the time of their replacement.

2. Cogeneration Component

27. As part of the commercial sector component, an investigation of cogeneration possibilities will be carried out as a complement or alternative to energy conservation. Within this context, cogeneration is defined as the simultaneous production of two useful forms of energy from the same fuel source. Typically, cogeneration is understood to be the production of electricity at the users site with recovery

of the "waste" heat from the generator to meet the thermal requirements of the facility. The market segment of interest for this activity has been defined as the commercial-scaled building sector. As a result of the market characteristic of this sector (with electric demand being typically less than 2 megawatts (MW) and thermal requirements being low pressure steam and hot water), the reciprocating engine cogeneration systems will be the exclusive focus of interest in this demonstration project. Recoverable heat from reciprocating engines can also be used as the driving energy for absorption chillers, as air conditioning in Jamaica is the major energy requirement in commercial buildings. The combination of the reciprocating engine and absorption chiller, while not been considered seriously yet by private investors -- the options considered so far are heat recovery for hot water and possibly steam--, will receive major attention in this project. The primary focus of cogeneration projects in Jamaica will be in hotels and office buildings, if economically viable.

(a) Hotels

28. Jamaica has been developing as a major tourist destination since the late 70's and as a result there are a large number of major hotels especially on the north coast of the country. These hotels are now marketing their services as "all-inclusive" resorts that results in a nearly continuous demand for electricity, hot water, and air conditioning to meet guest requirements. One representative hotel of this type is a hotel with 280 rooms and all the amenities of a major "all-inclusive" resort hotel. The single largest consumer of electricity at the hotel is air conditioning. About 280 tons of central air conditioning capacity is supplied by three separate units. Chilled water is distributed throughout the facility with some of the longest piping being approximately 1000 feet long. They also have two 60 horse power boilers operating on diesel fuel that provide steam and hot water for the guest rooms, laundry, and kitchen. One boiler at a time operates at an approximate 50% duty cycle to supply the hotel requirements. The second boiler is used for reserve capacity. Under this hotel pilot test case, the best combination of options required to reduce electricity demand through cogeneration will be supported under this component.

(b) Office Buildings

29. Commercial office buildings offer another possibility for cogeneration installations. They are not as attractive cogeneration opportunities as hotels because of their limited hours of use and the lack of a thermal load other than thermally driven (absorption chiller) air conditioning systems.

(c) Cogeneration Policy Issues

30. Several policy and technical issues effecting both the interests of JPSCo. and the interests of the cogeneration system developer must be resolved before there will be a realization of the potential cogeneration capacity in Jamaica. These issues have to do with the financial environment that will provide benefits to both JPSCo. and the cogeneration developer. These are: (i) the value of demand and energy that the cogenerator does not purchase from JPSCo.; (ii) the energy and capacity sales rates for energy and capacity sold by the cogenerator to JPSCo.; and (iii) JPSCo. standby charges for back-up electrical capacity that the cogenerator requires for scheduled and unscheduled down-time of the cogeneration system. Decisions on these issues will require an understanding of the reliability of cogeneration systems and existing and projected electricity tariffs on which a cogeneration policy is based. These issues will be studied under the proposed DSM program with the objectives to: (i) identify the potential market for cogeneration in Jamaica; (ii) evaluate the performance of specific installations representative of commercial building applications; and (iii) support the confirmation or revision of interim JPSCo. cogeneration policy.

31. Specific project goals include:

(i) Establishing the technical, economic, and financial feasibility of installing cogeneration in the commercial building sector.

(ii) Establishing the maximum feasible market potential for cogeneration in the commercial sector.

(iii) Demonstrating the technical assistance means for achieving cogeneration market penetration commercial buildings, both new and existing.

(iv) Establishing the steps which will need to be taken and the resources required to foster commercial building cogeneration resources developed by the private sector, including assisting JPSCo. in refining and implementing its cogeneration policy.

32. The cogeneration component project is a field test activity consisting of eight major efforts: market assessment, site selection, training, system development, site instrumentation, testing/data acquisition, performance/policy evaluation, and reporting. This component will not finance purchase of equipment. RF as a co-financier will support this work. Private investors have shown interest in investing in cogeneration which includes generation of power with heat recovery for absorption chilling for air conditioning, and heat production for other uses such as water heating and steam production. RF is interested in supporting this part of the work as a co-financier. In order to encourage investment in cogeneration, JPSCo. has prepared a draft policy on cogeneration and interconnection guidelines for small power producers and submitted these drafts to potential investors for their comments and suggestions. In addition, JPSCo. has prepared draft standard offer contract for the purchase of as-available energy from qualifying facility as well as standby and supplemental service agreement for co-generators and small producers. Potential investors in cogeneration have responded favorably to these initiatives. In addition, from the preliminary reactions, all of them have indicated that they will provide their own financing. They are looking to JPSCo. for technical assistance from the project to complete their feasibility studies and to identify the best equipment and consulting services.

3. Residential Component

33. JPSCo. has some 300,000 residential (R10) customers. Jamaica's residential customers include both a significant high-use fraction and a very large group with limited electric loads. About 15% of the customers, with annual loads of 3,500 kWh or more per year, are the source of 47% of the loads. At the other end of the spectrum, 25% of the customers, that represent loads under 700 kWh/year, are the source of only 4% of the load.

34. Information about residential consumers comes from a survey of a structure sample of customers completed in 1992[1]. Using this information, estimates of the proportion of JPSCo's electric load by end-use have been developed as shown in the Table below:

[1] Psearch Associates Ltd., "Household Electricity Consumption: A Study of JPS Residential Customers", May 1992. Survey completed in May 1991.

PERCENT OF ELECTRIC LOAD FROM VARIOUS END-USES
AMONG RESIDENTIAL INCOME CLASSES SERVED BY JPSCo.

	Total	US$1000 /Year	$1000-$3500	$3501-$5000	Over $5000	Undeclared
Lighting	18%	27%	16%	16%	15%	16%
Refrigeration	51%	40%	54%	54%	52%	55%
Cooling	1%	1%	1%	1%	2%	1%
Water Heating	2%	2%	1%	3%	6%	3%
Cooking	3%	2%	3%	4%	4%	4%
Entertainment	14%	17%	15%	13%	10%	10%
Miscellaneous	11%	13%	11%	10%	10%	11%

35. According to the survey, refrigeration is by far the most important residential end-use, representing 51% of the total. Because of this, it was considered for inclusion under this demonstration program, in moving in parallel with ongoing JBS efforts in testing and labelling of appliances. An assessment of this end use will be carried out as a sub-component, with the possibility of including this end use in a full scale residential DSM program.

36. Lighting accounts for some 18% of residential electricity end use. There are about 7.14 bulbs per household, of which 5.14 are incandescent bulbs of less than 60 watts; 1.24 are incandescent of more than 60 watts; and 0.76 are fluorescent bulbs. About 24% of customers report having at least one fluorescent bulb, with about 12% of all lamps fluorescent; but these are five times as likely to be found among higher-income groups (46%) than low-income groups (9%). About 12% of customers report using lights for more than three hours a day, with incandescent bulbs of more than 60 watts, while 22% are used for more than three hours per day. Electric water heaters are in 6% of dwellings and account for 2%. However, they are more common and constitute a higher share of load among higher income customers, presenting a finite and attractive program target.

37. The overall goals of the residential program include:

(i) Establishing technical potential for conservation in the residential sector in solar water heating and lighting.

(ii) Establishing maximum feasible market penetration for conservation in solar water heating and lighting in the residential sector.

(iii) Demonstrating means for achieving conservation in solar water heating and lighting in the residential sector.

(iv) Establishing the steps which will need to be taken and the resources required to acquire conservation in solar water heating and lighting from the residential sector cost effectively on a broader scale.

(v) In the course of this demonstration, acquiring a limited amount of conservation savings, commensurate with the program budget.

(vi) Initiating technical and policy studies to form the basis for preparing the ground for the design of a large scale (all end-uses) residential program for the future. This will include an analysis of refrigerators design practices and energy efficiency standards for Jamaica.

38. The residential component will include three sub-components: a lighting, a solar water heater (SWH), and residential refrigerators. Phase 1 of the lighting sub-component would provide compact fluorescent lamps (CFLs) at no cost to the participants and would focus on testing and establishing technical criteria regarding equipment performance, customer response, installation problems, and other factors, in 100 homes (about 300 CFLs). If Phase 1 is successful, then the implementation of Phase 2, which envisions about 30,000 homes (100,000 CFLs), would be implemented. The focus of Phase 2 would be to test the long term sustainability of the CFLs scheme on a self-financing basis (without special government incentives) and to analyze efficient alternative that would form the basis for possible full scale implementation, financing, and delivery options. The CFLs would be sold at either a discount or through a cost recovery financing (leasing) option, and will be distributed through either JPSCo's field offices and/or vendors. Based on monitoring and evaluation results, full scale programs will be designed the last year of the project.

39. Two delivery mechanisms for the CFLs program will be experimented, one through JPSCo. field offices and the other through vendors. In addition, two financing options will be experimented: rebates, if and when appropriate and required and financing through electricity billing. With regard to the delivery mechanisms, each systems has its advantages and disadvantages. The JPSCo. field offices route offers the advantages of covering easily the distribution of CFLs island wide, this providing ready access. In addition, there is no problem of storage and staff to take care of the distribution, thus resulting in a small administrative cost. The disadvantage is that JPSCo is not in the business of retailing, and there is a risk for fraud and mis-management of the CFLs. The vendor route offers the advantage of being part of the market with all the skills required to perform this retailing function. It will also help in promoting competition and energy efficiency in the market place and may ultimately lead to reduction of unit cost of the CFLs to the customer, particularly to those who are not in the program. However this route has also disadvantages such as not covering the whole island because of the small numbers of vendors, have a higher administrative cost because of storage and staff resulting in a distributors price markup, and may also lead to fraud through substituting CFLs of lower quality or replacing them with CFLs that are not even included in the program. Because of the fact that there is not a clear cut situation, the two delivery mechanisms will be tested.

40. The SWH sub-component will include first an assessment of the SWH market in Jamaica, and second a provision of services by JPSCO. to strengthen that market by including information, installation, and maintenance assistance. Moreover, 513 SWH units installed in the new Oakland Housing Development financed by the Ministry of Public Construction, and other individual units already installed would be included as part of the monitoring and evaluation component discussed in para. 123.

41. Systems will include efficient tanks and installation of low flow shower heads wherever an electric element is installed–to minimize the possibility of backup electricity use. The program will review the systems design to include or exclude a backup electric heating element. While experience to date indicates that use of backup element is negligible, this feature may be critical to program marketing.

42. Water heating loads were selected as a key program target because solar water heating is a technology of particular interest to the GEF and the Jamaican Government. There is an existing local market infrastructure, a potential for inter-fuel substitution using an indigenous power supply resource moving away from imported petroleum fuels, and a potential expanding market.

43. Finally, efficiency improvements in residential refrigeration will also be assessed by the project by carrying out studies to define potential savings estimates, investigate market conditions for refrigerators and customers response to the labelling program to be launched by the JBS.

4. Industrial Sector

44. The industrial sector component includes an assessment of potential energy savings in this sector, and the development of a strategy to test and demonstrate the viability of these savings as well as policies and actions to foster them. This assessment will analyze the technical, economic, and financial feasibility of the component of such a strategy. It will include several phases which will be defined on the basis of the preliminary recommendations that would be provided by the assessment.

5. Monitoring, Evaluation and Quality Control Component

45. The monitoring, evaluation, and quality control component is a crucial component of the project (see also chapter V which is devoted entirely to this component). It includes: (i) the development of a data base that would gather all relevant information about each program before implementation and during and after implementation; and (ii) detailed monitoring and evaluation plans for each program that would include all procedures and parameters to monitor and evaluate all elements included in the program design. Each program (large and small commercial, cogeneration, and residential) will receive a process and impact evaluation. The process evaluation will analyze: (i) to what level were the program goals well understood and focussed; (ii) to what degree was the level of participation achieved and how successful and realistic it was; (iii) to what extent was effective the program administration, delivery of services, and financial incentives; and (iv) what criteria and measures are needed to sustain efficiency in the long term. The impact evaluation will include: (i) the cost of the measures and its portion of the cost attributed to energy savings --vs. improvement in quality of services; (ii) the actual energy savings realized by measure where possible and by facility; and (iii) the persistence of savings and the likely savings from a full scale program.

46. While the DSMU will be participating in monitoring and evaluation activities, reputable and qualified international firms will be contracted to carry out this work independently to assure objectivity and reliability. This will take place in tandem with implementation activities in order to permit mid-term review during the course of the project. In addition, the Bank supervision missions would assess the efficiency of the DSMU activities.

6. Strengthening of the DSMU Capabilities and Enhancement of Market Infrastructure and Public Awareness

47. The strengthening of the DSMU capabilities and the enhancement of the market infrastructure and public awareness component will consist of transferring the skills, tools and equipment necessary, in the short term, to implement the project successfully and, in the long term, to carry out least cost planning to develop cost effective DSM programs and deliver such programs efficiently. This will include technical assistance and training to JPSCo. DSMU and the private sector energy efficiency and audits engineers and firms. This component will also provide on the job-training, and seminars, particularly

in the areas of DSM program design, economic analysis, integrated resource planning (IRP), utilization of DSM and IRP computer software, marketing techniques, monitoring and evaluation, disposal of solid material resulting from the program, etc. In addition, it will provide technical support to assess the long term economic and sustainability and test of each DSM programs, and to increase public awareness about energy efficiency and to disseminate information on a large scale through public campaigns to inform the public at large, schools, government institutions, and private sector enterprises and organizations on the DSM programs to be carried out.

48. To develop capacity in JPSCo. and among local consultants and firms in the energy services market for sustaining DSM programs, the project will:

- Provide institutional support and technical assistance to JPSCo.
- Integrate demand-side management planning with JPSCo.'s system and corporate planning.
- Conduct technical and policy studies to create the foundation for a full scale commercial, residential programs and to begin investigating opportunities for DSM industrial programs.
- Investigate the potential for cogeneration (the technical and economic feasibility) and develop a cogeneration policy on the terms and conditions for interconnections and power purchases by JPSCo.
- Demonstrate strategies for surmounting market, economic, and other barriers to implementing and sustaining DSM in Jamaica.
- Provide the information, education, and infrastructure required to promote private investors.
- Investigate regulatory and tariff issues that relate to demand-side management and propose provisions that would be included in the new regulatory framework contemplated under the Energy Sector Deregulation and privatization project.
- Provide a comprehensive training to JPSCo. staff in the various programs outline above.

49. Much of the training for this project will be through on-the-job learning under the supervision or review of experienced personnel. The provisions for this type of training are interwoven into the various program elements. The staff of the DSMU will also need formal training in DSM concepts, and in program design and execution. This can be accomplished by attendance at conferences by senior personnel, visits to utilities with DSM programs, and formal courses and participation in training programs offered by institutions such as the American Society for Demand-Side Management Programs, the American Association of Energy Engineers, private firms and utility companies, etc. Corporate Planning and System Planning personnel will need further training in operation of integrated demand/supply models and economic tools used to compare different types of resources. Managers within JPSCo would benefit from conservation conferences to help build support and understanding for DSM within the organization. System planners will need enhanced training in assessing the impacts of conservation on the need for transmission and distribution and power quality issues to address end-use

equipment issues and investigate power quality conservation opportunities. As discussed in the plan for the residential lighting program, JPSCo field office personnel will need introductory training in installation of compact fluorescent lamps in order to assist customers in selection and purchase of lamps. This training will be provided by the DSMU assisted by the international consultant.

50. In summary, the following annual training trips are proposed for the first three-year period:

	Training Trips	Conferences	Utility Visits
DSMU	4	3	3
Corporate Planning	2	2	2
Field Offices	(in-house training only)		

51. Several specific skills areas that will need to be developed are:

- Energy Efficient Technologies
- Economic Analysis (customer, utility, societal perspectives)
- Program Marketing Techniques (the customer's perspective)
- Program Monitoring and Evaluation Techniques
- Program Management/Implementation Skills
- DSM Program Design
- Integrated Resource Planning
- Efficiency Testing
- Regulatory Aspects

Training within each above skill area will be provided to assist in providing the capabilities needed to assure the success of the DSM programs.

52. Moreover, the potential of development of ESCOs will be investigated in association with institutions such as the International Funds for Renewable Energy and Energy Efficiency (IFREE). IFREE is a non-profit US corporation dedicated to the promotion of environmentally sound energy projects in the developing countries. A representative of IFREE has already visited Jamaica in November 1993, accompanied with a representative of an ESCO from the US. The Bank also held preliminary contact with IFREE for the purpose of understanding IFREE's mission in acting as a catalyst to encourage ESCOs in Jamaica, where IFREE has shown keen interest in promoting investments in energy efficiency through ESCOs. Initially, this interest seems to focus on cogeneration.

53. The enhancement of public awareness would include a series of public campaign and forums to increase public awareness about energy efficiency and to disseminate information on a large scale, to inform the public at large, schools, government institutions, and private sector enterprises and organizations on the programs being carried out and their related benefits. It will also include campaigns to promote the building code and the labelling program of electric appliances developed by JBS. Finally, it will also promote better understanding of energy related environmental aspects and other energy efficiency aspects. In this context, local NGOs are also encouraged to provide public forums in which information about the nature of the project and its possible impacts on environment and customer benefits will be disseminated to increase public awareness. In order for the local NGOs to have the technical capacity to follow-up project implementation, the project would finance an international NGO to provide technical support to local NGOs interested in the project (section D, Chapter IV).

7. Strengthening of Other Institutions

54. The strengthening of other institutions that would play an important role in the implementation of the project would provide technical assistance to JBS, NRCA, JET and others local NGOs to strengthen the capacity of theses institutions in order on one hand to provide the technical services for project's implementation (JBS and NRCA), and on the other hand, to protect the customers and the environment (NGOs). In addition, this component will include campaigns to promote the building code and the labelling program of electric appliances developed by JBS.

III. PROJECT COST ESTIMATES

A. Total Project Cost

55. The total project cost is US$ 12.5 million (Schedule A of the MOD). The categorization of procurement items is given in Schedule B of MOD. Foreign versus local cost components are difficult to categorize within a DSM project at this stage because the exact mix of items will depend on program implementation. The mix of imported, locally assembled, or locally manufactured items is driven by consumer acceptance of various levels of incentives, perceived product attributes and program operation efficacy. Electronic ballasts, compact fluorescent lamps, HVAC systems, laboratory test equipment, and computer hardware and software will be a foreign cost, as well as most of the consultants services, technical assistance, and training.

B. Project Financing

56. An ongoing IDB loan to JPSCo would provide for US$4.0 million, the RF, which has already disbursed more than US$620,000, has pledged an additional US$237,000, The Canadian Trust Fund (CTF) US$150,000 and the proposed GET grant would provide US$3.8 million (see Table 1 for detailed financing plan for each institution). JPSCo. plans to finance local costs equivalent to $4.46 million. It is also expected that about US$6.5 million would be contributed by participants from the private sector, with about US$3.5 million in cogeneration and the rest in equipment acquisition for the large and small commercial sectors.

57. Since the exact proportions are highly dependent on the experience of the program operation, the estimates provide a reasonable, though not precise, expectation of these two cost components. Based on Schedule A, it is estimated that local costs will amount to about US$ 5.6 million while the foreign cost will amount to about US$ 6.9 million. About US$4.6 million out of a total of about US$6 million would be provided in the form of cash rebates, or leasing arrangements for the purchase of goods by JPSCo. and IDB (under specific arrangements) to participants in the commercial and residential sectors for the purchase of equipment. GET will not provide any incentives.

IV. PROJECT IMPLEMENTATION ARRANGEMENTS

A. The DSMU: Organization and Staffing

58. The DSM program will be the responsibility of the DSMU, which is a branch of the Corporate Services Division of JPSCo. It has an authorized strength of fourteen persons, as shown in the organization chart in Figure 2. Thirteen positions are currently filled. Other posts have been advertised, interviews held, and appointments are expected in the near future. The DSMU will increase its staffing requirements to 15 by end of 1993, and to 19 and 25, by 1995 and 1998 respectively, to reflect the implementation requirements for the program, as currently defined. The primary duties of the unit are project planning, and design contract administration, project administration, project analysis, program operation, quality oversight and monitoring and evaluation. The staffing levels identified on the organization chart of the DSMU are adequate for the first phase of its operations. Project planning includes the selection of buildings and homes (Phase 1) to participate in the program; and designing and justifying incentives or cost-sharing terms. This is principally the responsibility of the management of the unit, plus the economist. Project implementation schedule is shown in Figure 3. Contract administration includes the solicitation and evaluation of tenders, preparation and award of contracts, and monitoring the performance of contractors.

B. Project Administration

59. DSMU. In addition to contract management, JPSCo. DSMU personnel will perform ongoing program design, procedure development, budgeting, sampling and selection of customers, project tracking, administering of funds, liaison with funding institutions and other functions. Some of these include:

- Program design and program procedure development will be the responsibility of the manager of each program, with guidance from the DSM unit manager and, as specified in the plans for individual programs, international contractors.

- Budgeting will be a joint responsibility of the program managers and the DSMU Manager.

- Selection of customers will be the primary responsibility of program managers, using protocols approved by the DSMU Manager, JPSCo. management, and funding institutions.

- Project tracking will be the responsibility of the administrative technician, who will assist project managers and the DSMU Manager in following projects. Tracking will include progress of specific building projects through milestones, progress of programs in meeting market penetration targets, and tracking the expenditure of funds. Processing of rebate applications and assembly of data on customers and their loads for program evaluation will also be part of this function.

- Administration of funds will, initially, be subject to the approval of the DSMU Manager, who will sign off on all individual project expenditures. The DSMU Manager will be responsible for assuring that the proper authorizations have been secured from JPSCo. and funding institutions before expenditures are approved. In this respect he will work closely both with JPSCo's contracting offices and with upper management. As programs expand, procedures

will be developed to pre-authorize expenditures based on the initiative of program managers or the Technical manager as appropriate.

- With support from JPSCo. management, the DSMU Manager will take the lead in establishing the appropriate connections and accountability between the DSMU and other parts of JPSCo.

- For the residential sector, DSMU personnel will provide primary quality assurance, with initial training and on-call support from international contractors. In the commercial sector, contractors will provide primary quality assurance, but JPSCo. personnel will be responsible for additional oversight.

- Administration and control of funds provided to JBS, NRCA, and local NGOs will be according to agreed work programs and signed contractual arrangements.

60. In addition to these direct roles in program administration described above, DSM unit personnel will maintain the following activities in support of programs:

- With assistance from international contractors, designing and guiding the ongoing product testing efforts detailed elsewhere in this plan using DSMU program managers and supporting consultants.

- Spending significant time assisting evaluators by reviewing evaluation plans, providing access to program data, being interviewed by evaluators, providing access and introductions to program participants and contractors, and reviewing evaluation products.

- Continuing the data collection on commercial sector buildings and loads, as described under the commercial program under the responsibility of the consultant to the DSMU.

- Assisting in load research to identify system loads, and daily and seasonal consumption patterns by rate group; to support proposed revisions to the billing structure (e.g., extending penalties for poor power factor to a larger group of commercial customers); and to investigate power quality, including harmonic distortion, if any.)

- Assisting in customer education, including response to and investigation of complaints regarding energy efficiency.

- Supporting on-going management and development of the Generator Assistance Program (GAP). This program provides rewards to selected customers with standby generators for the voluntary interruption of JPSCo. service through planned outages at times of capacity shortage. In time, this program will be capable of responding to shortages due to system emergencies.

- Coordinating and providing liaison with private sector ongoing efforts in energy conservation investments, e.g. ESCO's.

- Holding regular meetings with interested NGOs, and members of the public to inform on and discuss the progress of the project (para. 81).

61. Contractors. Because Jamaica already has trained engineers, architects, installers, and building operators, the focus will be on enhancing local capability as much as possible while reliably meeting the project goals.

62. The table below provides estimates of the number of buildings treated and primary contracts which must be administered for this program to proceed. The indicated number of contracts are minima, assuming that other administrative tasks (such as database development and market planning) will not be contracted out.

Potential Number of Contracts under JPSCo. Demonstration Program

	Audits	Install	Quality Control	Design Assistance
Large Commercial	20 bdgs 3-4 cont.	20 customer agreements	1 review multiple customer/vendor agreements	1
Small Commercial Ph1	10 bdgs 1-2 cont.	10 bdgs 5 suppliers 3 installers	Same as above	1
Small Commercial Ph2	20 bdgs	5 suppliers 3 installers	Same as above	1
Res. Lighting				
100 home 100,000 lamp		1 installer 3 suppliers 3 suppliers		1
Res. Water Heat		30 customer agreements		1
Product Testing		3-5 agreements		
Evaluation	1-2 contractors			1

63. Not all of the contracts will be in effect at any one time, but there will be a large number of contracts being developed and managed at any one time. For this work to be managed by three project officers (two commercial and one residential) and two technicians, JPSCo. will develop standardized contracts.

Energy Auditors

64. Six local contractors were identified by JPSCo. for the purpose of the commercial energy audits so far carried out. Of these, two already are, or may soon be sufficiently experienced to carry out many aspects of energy audits independently of any international consultants (subject to the same quality control oversight as for all contractors). The other contractors need further work with international consultants before they can be considered qualified to participate alone in this activity.

65. About 15 other engineers have attended energy auditing courses put on in the past by the Ministry of Public Utility, Mines, and Energy (MPUME) or the College of Arts, Science, and Technology (CAST). However, their level of experience was considered inadequate by JPSCo. for the audits to be

carried out. There are also many young engineers who have so far had no exposure to energy analysis and audits. To achieve a certain level of expertise, basic training will be required as well as work in close association with experienced contractors and auditors.

66. Contracts for energy audits with foreign firms will include a requirement for hands on training of local engineers through the project. As part of the project, recommendations will be made to include training of local auditors as an important aspect in the selection process.

67. Vendors will provide all the required analysis for the residential water heating programs, subject to training as discussed below. Analysis requirements for the lighting program will be handled by installers for the Phase 1, and by JPSCo. field office personnel and vendors for the Phase 2, with some additional training as necessary.

Designers, Installers and Vendors

68. Through a mix of foreign and local contractors, there is an adequate supply to design, install, and supply all of the conservation measures envisioned in this plan. International contractors will be used for highly technical work (e.g., cogeneration systems) where local contractors lack experience. Equipment will be purchased under competitive bidding procedures. Installers will, in many cases, need to be trained to follow new, more exacting procedures. However, the personnel pool available in Jamaica is sufficiently capable to handle this aspect.

Evaluators

69. Evaluation of the demonstration project will be carried out by contractors under the direct management of the DSMU and control of the financing institutions. The economist of the DSMU will also serve as the evaluation specialist within the unit. Details are provided in Section B of Chapter V of this Technical Annex.

C. Equipment Testing

70. To date, equipment testing for lighting, water heaters, and refrigerators has been carried out by the Jamaica Bureau of Standards (JBS). The DSMU has, however, been concerned over the delays in obtaining test results from the JBS and the slow progress in labeling of electrical appliances. It took two years to construct and commission a testing laboratory for refrigerators, and many months later, the first test results have not been received. There have been similar, if lesser, delays over the tests of water heaters and fluorescent bulbs. The situation has several causes, some of which are the responsibility of the Bureau. However, since appliances are subject to frequent change, delay in testing can obviate the value of tests. The program outlined below assumes timeliness of performance. The Government of Jamaica is committed in enhancing JBS's resources and capability to conduct tests, which is critical to the success of the demonstration project and to the long term sustainability of energy efficiency initiatives. The project will assist JBS to carry out its role in supporting the testing and other programs. However, JBS needs to become financially self-sufficient as soon as possible by using fees to cover the services it renders, thus covering all of its administrative and operating costs. If this is not available, alternative testing facilities to JBS may in some cases be considered. Attachment 3 gives a presentation of the role of JBS and budget and program to play this role.

71. Refrigerators. As part of an ESMAP funded Appliance Labeling Project, the JBS is testing the efficiency of residential refrigerators. Results are expected shortly. This testing program will be carried forward as new models become available throughout the demonstration period, with funding from the project. Furthermore, JBS initiated an appliance energy efficiency labelling program with JPSCo. which will be made available to the public through a public campaign and education program.

72. Compact Fluorescent and Circline Lamps. A first round of tests of CFLs has been completed by the JBS. A second set of lamps has recently been received to perform sensitivity tests at different voltages. Further tests will be carried out on circline lamps. On the basis of these tests, a selection of CFLs will be made for participation in the residential lighting program and equipment will be qualified for use in commercial programs. As additional products become available on the Jamaican market, periodic testing by the JBS will continue, and JPSCo. will periodically publish a list of products which meet their energy efficiency standards.

73. High Efficiency Motors. High efficiency motors present a significant opportunity to increase efficiency which has not been extensively utilized in Jamaica. Concerns have been expressed by engineers in Jamaica about the durability of high efficiency motors on JPSCo. power, given the variable power quality and voltage and the different frequency from the US. Motor testing is an expensive undertaking; only a couple of motor testing facilities exist in the US which are not run by manufacturers. This aspect will be investigated under the industrial assessment study.

74. Air Conditioning Units. Single room and small split system air conditioning units are a major source of load in Jamaica. Many of the units in Jamaica have never been tested for efficiency, and those US units which have been tested have not been tested on 50 hz power. The JBS has established a testing laboratory for refrigerators, but there is no plan for a similar air-conditioning laboratory. The testing of air-conditioners will be done overseas, but under conditions which simulate the Jamaican environment and power system. Two laboratories in the US have indicated that they can provide these testing services. Local dealers will be asked to provide samples of their products for testing, and to bear the cost of testing. The cost of shipping will be borne by the project. Like for refrigerators, JBS has initiated an appliance energy efficiency labelling program with JPSCo.

75. Solar Collectors. As new solar water heaters become available, they will be subjected to the same product tests as have been performed to date. Also, as part of research into future program options, an efficient water heater certification program will be established. Initial research will indicate whether this will be possible based on comparison of manufacturer's specifications to JPSCo's standards, or additional laboratory testing will be required.

D. Environmental Aspects

76. Environmental Issues. The environmental benefits of the project include reducing the demand for additional power plant capacity which would eventually translate into reduced CO_2, NO_x and SO_x air emissions in the country, and eventually help to reduce the global CO_2 sink. In addition to evaluating the global environmental benefits, the project has also identified and addressed the local environmental issues that DSM could introduce to Jamaica in the longer term; and the project provides technical assistance to the Government of Jamaica to address these potential issues which include: (a) solid waste disposal of retired and replaced lamps, ballasts and electrical appliances; (b) noise and emissions abatement criteria for introduced cogeneration units; and (c) refrigerant requirements, and CFC consumption criteria for new on-stream absorption chillers and air conditioning units given the fact that Jamaica is a signatory to the Montreal Protocol.

77. Existing Environmental Policy Framework. The NRCA is the national U.S./EPA type Agency with responsibility for developing the national environmental policy framework, and for providing specific regulations governing the environmental issues identified under the project. The current environmental policy framework pertaining to these issues, i.e, solid waste disposal, air quality criteria, noise criteria, and CFC are still in embryonic stages of development.

78. With regard to solid waste disposal, the NRCA has developed the regulatory framework and appropriate site selection criteria, in recognition of the fact that current waste disposal practices in the country are environmentally unacceptable with potential problems including inadequate and badly selected waste dump sites, uncontrolled landfills, and institutional weakness in the collection and proper disposal of urban solid wastes.

79. With respect to air emissions standards, criteria for SO_2 and NO_x have been recently developed with Bank assistance under the Power IV Project, and the NRCA is in the process of developing criteria for the other priority air pollutants, and applicable noise criteria.

80. With respect to CFC emissions, efforts are still very rudimentary, and there is currently no policy framework for addressing CFC consumption requirements for new and existing appliances, and for the proper recycling and disposal of these appliances; per the spirit of the Montreal Protocol.

81. Technical Assistance (TA) under the Project. The project addresses the environmental issues directly related to the programs objectives and proposes recommendations for managing the environmental issues in the medium to long term; since this DSM demonstration program is not the appropriate vehicle for addressing Jamaica's overall solid waste disposal issues, and its air quality issues and obligations under the Montreal Protocol. The project provides TA in three key areas:

- Strengthening of NRCA: The project would provide funding to NRCA to assist the GOJ in developing and completing its current environmental policy framework regarding solid wastes disposal, air quality, and CFC emissions. Additionally under the project, NRCA (in consultation with international expertise) would distill best practice and experience in the proper disposal of retired electrical appliances that may contain PCBs, heavy metals and CFC.

- Supporting Local NGOs: Local NGOs should be provided with information about the nature of the project and its possible impact on environment, energy efficiency and customer direct benefits. Within the spirit and objectives of the GEF, and recognizing the role that the NGO would play in successful implementation of this project, the project would provide funding to the interested NGOs, among them the Jamaica Environment Trust (JET), to assist in four key areas: (a) assisting JPSCo. to identify and contact local organizations and associations with a pertinent interest in energy and DSM; (b) organizing meetings and public forums too involve the communities and to get their views; (c) disseminating relevant information to the public and thereby increasing public awareness levels on the merits of the program; and (d) assisting in program design, and implementation by providing an appropriate forum for public participation and education. While a lead NGO has been identified by the National Environmental Societies Trust, other NGOs which will show interest in the project will be also be encouraged to participate in the various meetings and public forums that would be held. International NGOs with experience in energy and environment as well as DSM would be selected on a competitive basis to provide support and technical know how to strengthen these local NGOs.

- Other Studies: Additional relevant environment related investigative work would be identified under the program to help in the longer term design and implementation of DSM activities in the country.

82. Recommendations for Further Environmental Work. The project recommends that the GOJ continue its efforts through the NRCA to strengthen the country's policy framework regarding urban solid waste disposal; air quality, and water quality criteria:

- The project recommends that the GOJ seek Montreal Protocol assistance to put it to develop the appropriate framework and implementation arrangements for CFC use, recycling and disposal of retired CFC based appliances, and criteria for new absorption, refrigeration and electrical appliances.

E. Procurement and Disbursement

83. The project would involve several categories of procurement (refer to Schedule B of MOD and Table 2 in the Technical Annex) including: (a) goods to be used for program implementation such as testing and monitoring equipment, computer hardware and software and printers, fax and copying machines; and (b) consultancy services for the detailed design and implementation of the DSM programs including marketing, engineering and architectural design, installation, testing, monitoring and evaluation, technical assistance and training. The Bank's procurement guidelines would be followed in procuring goods and consultancy services for the GET financed portion of the project (see MOD Schedule B, pages 1 and 2 and Table 2 of the Technical Annex). Portions of the project to be financed by IDB loan, RF. and JPSCo. would follow the procurement guidelines and procedures of the respective institutions.

84. Goods financed by GET should be procured through: (a) Limited International Bidding for the procurement of testing and monitoring equipment for an estimated amount of US$670,000, and the purchase of software for an estimated amount of US$450,000 which to the extent possible will be packaged in contracts of US$150,000 or more each, for an aggregate amount of about US$1.12 million; and (b) Shopping for goods such as computers, printers, and fax and copying machines for an aggregate of about US$60,000 in packages not exceeding US$25,000 per contract. Consultants would be selected and hired following procedures consistent with "Bank Guidelines for the Use of Consultants by World Bank Borrowers (August 1981)". In the evaluation of bids following ICB procedures, domestic and regional preference would be applicable in accordance with Bank guidelines. Prior Bank review of full bidding documentation and approval of contract awards would be required for all goods procured under ICB and LIB. For consultancy contracts with consulting firms valued at less than US$100,000 up to an aggregated amount of US$1.8 million and with individual consultants valued at less than US$50,000 up to an aggregated amount of US$800,000, the Bank's prior review would cover only TOR. With these arrangements, the bank's prior review would cover about 70% of the contracts to be financed by the GET grant, which is satisfactory, given the nature of the items to be financed.

85. The grant will be disbursed as follows: (a) 100% of foreign expenditures for imported goods; (b) 100% of local expenditures (ex-factory) for locally manufactured goods; (c) 70% of total expenditures for other goods procured locally; (d) 100% of total expenditure for monitoring, evaluation and quality control consultancy services, technical assistance, and training. Disbursements may be made against Statement of Expenditures (SOE's) for the following expenditures: (a) contracts for goods valued below US$50,000 equivalent or less; (b) contracts with firms for services including technical assistance and training for US$100,000 equivalent or less and contracts valued at US$50,000 or less per individual. For all contracts above the amount indicated above full documentation is required. The supporting documents

for SOE's will be retained by JPSCo. and will be available for review by supervision missions upon request. All other requests for disbursements would be fully documented. Retroactive financing up to US$300,000 equivalent for technical assistance and training will be permissible for expenditures incurred between October 1, 1993 and the date of grant agreement signing. A Special Account will be established for the project with an initial deposit of US$250,000 from the GET grant.

86. The project is expected to be completed on June 30, 1998 and the closing date is expected to be December 30, 1998.

F. Auditing and Reporting

87. JPSCo. would forward semi-annually progress reports on the project, within the fourth weeks following each semester. Detailed reporting requirements will be established during the first supervision mission. Furthermore, JPSCo. shall maintain records and separate accounts to reflect the operations, resources and expenditures in respect of the project. These records will be audited by independent auditors acceptable to the Bank, and JPSCo. shall provide these audit records to the Bank within six months of the end of the fiscal year.

V. MONITORING, EVALUATION, AND QUALITY CONTROL

A. Introduction

88. The ability to monitor, evaluate, and control the quality of the implementation of the various DSM programs is critical to the ability of the DSMU to identify and initiate needed remedial actions and assure the cost-effectiveness of the various DSM programs. In order to implement an effective DSM strategy with adequate monitoring and evaluation, the DSMU with the evaluation contractor will identify research projects, develop specifications for the projects, develop databases for use by other contractors and internal organizations, contract with firms to provide the research, manage the contracts to obtain the required information, and facilitate the process for using the evaluation and monitoring results within the DSMU.

89. In conducting evaluations, the critical parameter is information on programs' performance. Data will be collected to represent conditions prior to the implementation of the programs as well as after the programs have been implemented. Baseline information, estimates of savings and market effects will be collected and/or estimated. Data collection techniques will include: interviews, surveys, audits, engineering design studies, on-site metering, site visits, utility billing and customer data, and program related data forms. A variety of data analysis techniques will be applied to these data including: simple to complex engineering analysis, descriptive and multi-variate statistical analysis, and qualitative analysis.

90. The evaluation activity includes a number of components. Initially, evaluation plans for each of the projected programs must be developed and implemented. As program implementation progresses, evaluation plans must be refined. Finally, as the demonstration project approaches completion, evaluation plans for the full scale programs would be developed in tandem with the development of the full scale programs themselves.

B. Program Organization

91. The evaluation of the demonstration programs will serve both to provide information on the demonstration programs and enhance the capability within Jamaica to conduct later evaluations. JPSCo will need to learn how to manage evaluations and conduct future evaluation activities, both through contractors, and, when appropriate, themselves. It is expected that some degree of independent evaluation will always be needed. To assure objectivity and bring in the needed technical expertise, the evaluations will be carried out mainly by contractors.

92. Evaluation Team. A firm will be contracted through international bidding to have overall responsibility for evaluation and quality control. The terms of reference will require the international firm to both conduct evaluations and train local professionals in program evaluation. It is expected that the international firm will design the detailed evaluation plans, supervise and review the work of local evaluatorS, and organize the development and edit final evaluation reports. Local subcontractors are likely to be used to perform most of the interviews, measurements, and analysis. In addition to using local contractors, the evaluation contractor may bring in specialist subcontractors to bring in the best expertise in such areas as metering design or analysis of commercial building simulations.

93. Management. The evaluation contractor will report to the Manager of the DSMU, through a member of the Unit's staff assigned the responsibility for evaluation. The DSMU will be responsible for providing the evaluation contractor with the necessary data on projects, access to and cooperation of building owners, contractors, and JPSCo personnel, and any other elements required for the evaluation. These requirements will be specified in detail in the evaluation plan. The Unit will also assist the evaluation contractor if any difficulties come up in locating or working with other contractors.

94. The evaluation contractor will develop detailed plans for the evaluation of each program. These plans will be reviewed by JPSCo and funding institutions, revised as needed, and approved.

95. For the commercial buildings, even more specific measurement plans will be developed after the specific the DSM measures are selected. This added step is necessary because of the measure-oriented nature of the evaluation (see detailed plans, below). Measurement plans will be reviewed by the DSMU staff, revised by the evaluation contractor as needed, and then implemented by the evaluation contractor.

C. Evaluation Questions and Organization

96. Each program (Large Commercial, Small Commercial, Residential Lighting, Residential Water Heating) will receive a process and impact evaluation.

97. Process Evaluation. The process evaluation will be designed to address the following questions:

- Were the goals of the program well understood? Did the program focus on the goals?
- To what degree did the program achieve its goals (the issue of program savings set aside for the impact evaluation)? Were the program goals realistic?
- With what specific segments and overall proportion of the targeted market was the program successful? Where was it not successful? What are the implications for potential program penetration? How and to what degree can these results be improved?

- What types of measures were installed versus not installed? What are the implications for potential program savings? How and to what degree can these results be improved?

- How successful and efficient was the program administration? How and to what degree can these results be improved? This includes:

  - Effectiveness of the means of selection of participants. Were the appropriate customers screened out versus selected?

  - Were the services provided appropriate, timely, and efficient?

  - Were communications between JPSCo, customers, and contractors effective? Were the appropriate expectations from the program communicated to customer?

- How effective was the delivery of technical services (analysis, equipment selection, installation, commissioning, quality control, assistance with operation and maintenance). How and to what degree can these services be improved?

- How effective were the financial incentives at encouraging participation? Assuming that any other problems in program marketing and services are resolved, are there indications of the likely effect of larger or smaller incentives or different types of financing and cost recovery schemes? (e.g., loans as compared to partial grants, or payments to contractors versus customers)

98. The process evaluation will consist largely of interviews with utility staff and contractors (usually in person) and participating and nonparticipating customers (largely by telephone), plus site visits to assess the quality, suitability, comprehensiveness, persistence of, and satisfaction with conservation measures.

99. Impact Evaluation. The impact evaluations will be designed to address these questions:

- How much did the measures in each building, individually, and in total, cost JPSCo? What was the total cost (including customer contribution?) What portion of this cost can be allocated to energy savings (as compared to other benefits)?

- How much was saved in each building on an annual basis? To the degree discernable, what savings can be attributed to individual measures?

- What is the likely persistence of savings?

- What can be learned from the impact analysis to make future programs more cost-effective or comprehensive?

- What is the likely savings potential and cost from an expanded program?

- Estimate both societal and JPSCo cost-effectiveness of full-scale programs, using the criteria established for this demonstration program with any enhancements developed by JPSCo during the demonstration.

100. The impact evaluations will be designed, to the extent feasible and economic, to estimate both peak savings and energy savings by peak and off-peak period, consistent with JPSCo's resource planning periods. Cost/benefit projections for a future program will be carried out consistently with JPSCo's planning process.

101. Cost estimates will separately consider administrative cost, since this is likely to be much higher for a demonstration program than for a full-scale program. Estimates of potential cost-effectiveness of full-scale programs will include a reasonable estimate of administrative costs for those programs, given the pilot program experience.

102. Phased implementation of the pilot programs is an option for these programs which meet established targets prior to the end of the five years pilot. Phased implementation of commercial and/or residential programs would allow JPSCo. to solicit additional participants as a mean to better understand site-specific problems and solutions.

D. Program-Specific Evaluation Plans

103. Given differences between end-use of electricity in Jamaica as compared to the U.S. where most conservation evaluation methods have been tested, each evaluation will, to a limited degree, be experimental. JPSCo. may adjust the evaluation plan as constraints on analysis become clear, or as certain methods appear to have better prospects. This plan indicates the scope of effort, the likely direction, and the degree to which process evaluation, impact evaluation, and ongoing program operation will be integrated. Firms bidding to provide the evaluation will have an opportunity to elaborate or propose alternatives.

104. Residential Lighting. Following the design of the residential lighting program, the program evaluation will proceed in two phases.

1. Phase 1

105. This evaluation will be used to assess the appropriateness of the bulbs selected for the program, the typical number of bulbs which can be installed in a home, and their persistence, cost-effectiveness, and savings. At the same time, the effort will be used to collect preliminary data on the cost of delivering a direct-install type of program (installation of lamps by utility contractors). While this style of program is not in current plans for later programs, data on its cost, ease of administration, and effectiveness will provide a useful comparison point for the Phase 2, as described below.

106. As part of this evaluation, JPSCo. DSMU personnel and installers will be requested to maintain records detailing what bulbs were removed (at what wattage and location in the home) and what CFLs were installed in each home, along with the date of installation. JPSCo's program management will also be requested to record findings from each quality control inspection in a standardized format. Careful records of any customers who refuse to participate in the program and their reasons will also be maintained.

107. Interviews with staff will focus on program administration issues, as well the acceptance and appropriateness of the lamps for specific applications. The review will especially focus on the training of contractors to market the program to customers, identify appropriate opportunities and match the right lamp to each situation. Review of program records will provide a preliminary assessment of program accomplishments and any quality issues.

108. The evaluators will perform site visits to a random sample of 40 of the participant homes to further assess the program's success and impact. These visits will occur at least two months after lamps were installed. The evaluators will assess whether the lamps appear appropriate, whether they are still in place, and whether all reasonable opportunities to install lamps in high-use fixtures have been pursued by JPSCo's contractor. As part of these visits, a customer interview will also be conducted. This interview will provide further data on customer satisfaction, contractor performance, assessment of the quality of the lighting, and hours of operation. JPSCo. staff will subsequently visit with these customers annually to assess if the lights are still in place and operating.

109. Initial estimates of savings are based on hours of operation from the residential survey, initial wattage from the residential survey, and estimated saving based on equipment performance data from the JPSCo. lighting tests. An updated estimate of program savings will be developed once the Phase 1 demonstration is completed, based on data from the JPSCo. data base on the number of CFLs and the wattage installed and replaced.

110. Additionally, a sample of 20 dwellings will be metered to assess actual hours of use and to enhance estimates of savings. This is important because prior evaluations of residential programs in the United States indicate that customers cannot accurately estimate their hours of use for lighting. Metering will consist of low-cost time-of-day run time meters designed for this purpose, and will be left in place for two weeks per home. These meters are capable of logging the number of hours of use for peak versus off-peak periods. The metered buildings will be a subset of those where site visits provide estimated hours of operation. This will provide an opportunity to systematically compare customer estimates with metered data. This should prove useful in later evaluation efforts.

2. Phase 2

111. Assuming that Phase 1 demonstrates potential feasibility and cost-effectiveness, the evaluation of this phase of the program will focus on assessing the administrative delivery system, the program marketing and incentives, and impact on a broader population.

112. JPSCo. field personnel and/or vendors will be required to track the date, type, number sold, and location of sale for each of the bulbs sold. The process evaluation will involve interviews with the program management, vendors, JPSCo. field office personnel, and customers. A key question will be how well the field office personnel and vendors were able to help customers select the right lamps for their home. Another key question will be how well the accounting and inventory procedures worked at identifying which bulbs went in which homes (this will be critical for the impact evaluation). Also, it will be important to know how well the marketing worked at creating awareness, in order to assess the success of the incentives.

113. Additional interviews with vendors of fluorescent lamps will be held a year after the program initiation to help assess the impact on the demand for the lamps. A telephone or mail survey of a sample of at least 100 of the participants will be used to collect more information on how participants heard about the program, the family and housing characteristics of participants, whether the customers would likely install additional efficient lamps, given the opportunity, the hours of operation, the suitability of the lamps, how many of the bulbs were actually installed, and other pertinent issues.

114. This will be complemented by an additional 50 site visits to randomly selected participants, to assess the same factors more reliably. The impact evaluation, based on a strategy employed by Northeast Utilities, will involve a random sample of participants and nonparticipant, selected out of the residential

survey sample to have similar demographic characteristics. Billing data will be compared for four months prior to and after the installation of lamps. Experience at Northeast Utilities indicates that a simple pre/post comparison adjusted for the comparison group consumption changes is sometimes as effective as more sophisticated models at estimating savings, as long as the sample is screened to remove homes with seasonal loads (e.g., air conditioning) or aberrant use patterns. Given the lesser size of non-lighting loads and seasonal loads in Jamaica, this simple technique is likely to be equally or more effective in this case. Savings during peak versus off-peak hours will be estimated based on the metered sample from the 100-home pilot program. The billing data comparison inherently considers free riders and snapback, but may count any spillover as free riders. Process evaluation surveys of nonparticipant will be used to check for this effect.

115. This strategy depends largely on the ability to get the requisite billing data out of JPSCo's billing system. If this proves to be infeasible, an alternative method will be employed. Under this method: (1) an engineering estimate of savings will be developed based on pre- and post-installation wattage and customer estimation of hours of use from the phone and site surveys, and (2) that estimate will be adjusted based on observations from the evaluation of the 100 home sample regarding reported versus actual hours of use.

116. The evaluation will be completed eight months after the last installation. Extrapolation of potential savings to the population as a whole will be based largely on the results of the 100 building field test, because it was a statistical sample. However, response from the program mechanism chosen for the 100,000 CFLs program will be based on the diversity of customers who participated in that program. This analysis may be used in considering the delivery vehicle for later programs.

117. Large Commercial Building Retrofit Program. The large commercial building program evaluation will be the most significant in terms of the impact on JPSCo's potential DSM capability, and will also require the most effort. A primary evaluation effort will be directed at the buildings participating in the JPSCo. program. A second effort will be directed at those buildings which undergo conservation treatment with ESCOs under the auspices of IFREE, if applicable.

1. Buildings Treated by the Project

118. The evaluation will rely on JPSCo. collection of detailed, accurate records regarding building audits, measure selections, payments, and program progress. This information will be stored in the program database and in project management files. The program database will include information on the status of the installation of each measure type in each building, to aid in planning evaluations.

119. The process evaluation will utilize in-person staff, contractor, and customer interviews to review the effectiveness of the customer selection, technical screening of buildings, building analysis, measure proposal, contractor selection (including analysis, installation and equipment providers), design, installation, quality control, and operations and maintenance assistance aspects of the programs. In addition, customer interviews will be used to assess program incentives, the extent of free riders and the impact of the program on typical practices and the overall market for energy efficiency and long term sustainability. There will be an additional focus on how customers financed their share of the cost of conservation measures. The role of internal capital, ESCOs, banks, and other parties will be reviewed through interviews.

120. The impact evaluation will focus separately on two elements: (1) the overall savings realized in buildings and the resulting benefits and costs, (2) the savings, benefits, and cost from individual

measures. Given the small number of buildings, statistical sampling is impractical. Also, because commercial loads tend to be highly dependent on occupancy, weather, and operation, a simple comparison of bills before and after installation may produce results of limited reliability and will tell very little about savings from measures. With these considerations in mind, the evaluation will utilize four complementary approaches.

- 1) For each of a first group of ten buildings, a custom metering strategy will be designed, based on the measures installed. These strategies may involve connected load metering, run time metering, and in the case of more complex control measures, hourly end-use and local ambient condition (weather) metering. In addition, data on occupancy levels and (where not measured on-site) weather conditions will be collected. This information will be used to estimate building and measure-level savings. Metering will generally occur for a period of 2-3 months before installation and another 2-3 months after measure commissioning. However, different periods may be selected if necessary based on the pattern of use of specific equipment. Estimation of savings will involve simple calculations for some measures, and use of simulation models for others. Where appropriate, total building loads will be metered along with end-uses to assess overall savings considering measure interactions. Metering may also be utilized during the commissioning period to help evaluating the impacts of measure commissioning on loads and savings. The buildings to be metered in this way will be selected to provide a cross-section of measures, and to include those measures where savings estimates will most benefit from the detailed metering.

- 2) For a second group of ten buildings, savings will be estimated based on engineering re-visits to the sites to adjust the savings estimates from the energy audit. Operators will be interviewed regarding operating conditions, and the equipment will be visually inspected.

- 3) Spot metering will be used as appropriate to meter connected loads, and operating hours will be estimated. Where appropriate, information on the results of metering at the first ten sites will also be used to reconsider engineering estimates for similar equipment. The lesser effort for these buildings is designed to make maximum use of the metered data while minimizing costs.

- 4) A year after all measures are installed and commissioned, a simple pre-installation/post-commissioning comparison of monthly bills will also be conducted for each pre-existing building. This comparison may be adjusted according to weather conditions or occupancy levels. In the case of buildings where cogeneration equipment is also being installed, JPSCo. loads and customer-generated power will be added together to estimate overall loads. In a similar manner, billing data for new and renovated buildings will be compared to estimates in energy audits to adjust engineering estimates.

121. The custom metering approach described in the first bullet above, will allow for evaluation of individual measures, will produce some results earlier than the billing data approach, and will help explain the level of savings found. This information is essential for identifying technical program issues (e.g., equipment calibration or commissioning problems), and will also be important for assessing the potential conservation resource in Jamaica. This approach will also serve to help train Jamaican engineers in assessing loads and measure savings.

122. The billing data analysis described in the second and fourth bullets will serve as a cross-check on the custom metering approach and will also help assess the usefulness of this simpler evaluation method in Jamaica for later programs, once there is a library of basic metered information to use to estimate the load shape of savings. While simple billing analyses have not proven very useful for small groups of commercial buildings in the US, given Jamaica's lesser climatic fluctuations, it may prove more reliable in some situations.

123. To support the metering analysis and help explain its findings, the evaluators will conduct technical site visits during or after the metering to each building site to inventory measures, check into their operation, and look for explanations for peculiar findings. JPSCo. personnel will also conduct follow-up site visits on an annual basis to review the persistence of savings.

124. The evaluation will produce progress reports based on the completion of the process evaluation and the completion of metered studies in individual buildings. A final report will be produced based on the billing analysis 16 months after commissioning of the final building.

125. Estimation of technical potential will be undertaken by extrapolating results for specific building types to the overall population as detailed by JPSCo's customer data and the commercial building survey. Potential program acceptance rates will be assessed by observing the acceptance levels for the program, and comparison to experience of similar, more mature programs in the United States and elsewhere.

2. Buildings Treated by ESCOs

126. If applicable, as an adjunct to the evaluation of the buildings treated by the program, JPSCo. will commission an administrative and technical process evaluation of the treatment of Jamaican buildings by ESCOs. For evaluation planning purposes, it is estimated that up to four major buildings will undergo retrofit by ESCOs independently of the JPSCo. program during the program period. If the number is significantly larger or smaller, the evaluation plans being presented here would need to be modified.

127. This evaluation will first summarize the buildings affected and measures installed through ESCO-sponsored conservation during the demonstration program. A comparison will be made of the types of customers reached, their investment criteria, and the nature and payback of the measures installed.

128. Interviews will be conducted with IFREE, the ESCOs, and the customers to assess problems encountered and the level of satisfaction with the services provided. With the customers' permission post-hoc reviews will be conducted by an experienced conservation engineer of the energy audits, the energy services contract, the building site and the measurement protocols for estimating savings. The intent of these reviews will be to assess how well the recommended measures addressed the full depth of conservation potential which is cost-effective to JPSCo. In addition, it will assess whether the approach to these recommended measures was economical, and whether the measurement strategy and related agreements provide customers with a reasonable indication of savings.

129. These analyses will be synthesized into a report assessing the comparative level of success of the ESCOs as compared to the JPSCo. program in achieving reliable and comprehensive savings.

3. Commercial New Construction Program

130. Evaluation of buildings under this program will occur essentially as part of the evaluation of the Large Commercial Building Retrofit Program. Since many of the designers and developer/owners of new

and existing buildings will be the same parties, and the efforts will occur simultaneously, this will lead to more efficient and cohesive evaluation. However, several issue will require additional focus in new buildings.

131. For the process evaluation, there will be additional focus on how the program worked with the design process and the design team. In particular, the success of the program in interfacing with the design process during the early design stages will be important. Cost estimation procedures for incremental cost will also be an important issue.

132. New buildings will be included in the metered sample. However, for new and renovated buildings within this group of ten, there will be no "pre-installation" load data, because the building did not exist or would have been substantially changed even if the program had not occurred. For these buildings within this first group of ten, the evaluation will rely on simulation of loads from the "baseline" building, based on the energy code and pre-program plans, in comparison to the "as built" building to estimate savings. These simulations will be calibrated to match load patterns from the metered data. Billing data will be used as a cross-check on data.

4. Small Commercial Buildings

133. The evaluation of the small commercial program, following the program design, will occur in two phases. The process evaluation of Phase 1 will be an assessment of the effectiveness of the ten building project as a learning exercise. Interviews with staff, contractors, and vendors will be used to assess the effectiveness of the program in learning about candidate measures, their costs, savings, reliability, and availability. The process evaluation will also summarize lessons learned in these areas, based on the experience of the quality control and installation contractors.

134. The impact evaluation of the Phase 1 will be similar to the metered and billing data approaches for the large commercial building program, except that measurement and analysis strategies will be simpler, in keeping with the nature of the measures and buildings under study. An interim evaluation report will be developed four months after the completion of the first demonstration stage, which will assist in developing the Phase 2 evaluation.

135. The details of the Phase 2 evaluation will depend to a large degree on the selected program delivery approach. If a vendor-driven equipment replacement approach is utilized, separate process analyses will be conducted for each vendor network that sells different types of equipment. If a direct-install approach using utility-hired contractors is selected, there wili be more focus on the utility contractor and the standardized tools used to identify measures, along with the procedures for buying equipment in volume. Since small building programs are often burdened with a higher administrative cost per unit of savings than programs for larger buildings, a key question will be whether the selected approach can deliver services to small customers which are affordable and effective.

136. Technical site visits will be used to assess whether the selected program approach is resulting in the installation of measures in appropriate situations and whether equipment is being installed and operated effectively. Process interviews will focus on the decision making process among vendors and contractors.

137. The impact evaluation strategy for the Phase 2 of the small commercial buildings effort will depend on the selected program approach. If a utility contractor/direct install approach is used, the evaluation will employ a comparison of bills before and after the installation of measures, supported by

spot metering of loads during site visits to help explain findings. Bills will also be analyzed over the same period for a comparison group of 50 buildings selected for their similarity to the participant group, to adjust for dramatic climatic or economic changes. Given the small size of the participant group, this comparison exercise will only provide general observations to be included in the final analysis. It will provide some idea of the variability of small commercial loads in Jamaica and will also help train local analysts in comparison methods which will prove useful for later, larger programs.

138. If a vendor-based equipment replacement program approach is employed, impact evaluation approaches will depend on the scale and diffusion of the program (savings per site and number of sites); one option is to utilize engineering estimates of savings and site visits to confirm that equipment is installed and operating. Another approach would be to conduct a billing data study. The approach will be designed after the program details are in place.

Cogeneration

139. Because the cogeneration program is really part of the large commercial retrofit and new commercial program, process and impact evaluation of cogeneration will be folded into those evaluations. It is possible that cogeneration systems will be installed in some buildings which are part of JPSCo's program sample and some which are not. Buildings where cogeneration is installed outside of the conservation program sample will be treated in a similar manner to the IFREE buildings. Comparison of completion rates, equipment installed and savings from buildings which underwent technical assistance from JPSCo and those which did not will provide indications of the importance and impact of detailed analysis of alternative systems, outside quality control, and other services provided by JPSCo.

140. An important process, to be addressed through customer interviews, is the workability of JPSCo's cogeneration policy and pricing and its impact on the amount and type of equipment installed. It will be particularly important to assess whether the buy back price has proven adequate to encourage the installation of absorption chillers as an adjunct to cogeneration. Customer interviews will also focus on satisfaction with the technical services offered by JPSCo. and private contractors, equipment performance and reliability, any power-quality related problems, and plans for future cogeneration.

141. Through review of the energy analyses and the actual costs and savings from installed systems, the evaluation should provide an assessment of the place of cogeneration in relation to conservation in cost-effectively reducing utility loads. Where do cogeneration and conservation measures compete? Does the installation of conservation measures impact the viability or sizing and configuration of cogeneration equipment? Where is it more cost-effective, from an economic perspective, to install conservation measures as compared to installing a larger cogeneration system?

142. For participants in the conservation and cogeneration programs, data on pre- and post-installation loads on JPSCo. will be of limited use in assessing cogeneration, because the building loads will be changing due to conservation. For this reason, to evaluate both conservation and cogeneration efforts, it will be important to meter the cogeneration equipment itself. JPSCo. will install recording meters wherever customers themselves do not have this equipment in place. This will provide the best record of power generated by time of day, outages, etc. Data on sales to JPSCo. will be useful corroborating information, as will records of purchases from JPSCo. Cogeneration system metering may be carried out for a period of two to three months, while billing information will be available for a year. This metering strategy may be extended to one or two buildings installing cogeneration systems outside of the demonstration program if they are likely to provide useful points of system comparison.

143. The evaluation will compare customer fuel use against electric output to assess cumulative fuel efficiency under local operating conditions. This will be used, in association with patterns of operation and cost data, to estimate the overall system cost-effectiveness. This will be compared for various system types to help assess (1) the minimum size and air conditioning load factor that a commercial building must have in order to become a viable cogeneration site, and (2) the system configurations which provide the most net benefits to JPSCo. for various building sizes and types.

144. Analysis will occur over the course of the first six months of operation, at which point the summary results will be reported. A summary report will be developed nine months after all systems have been installed. Subsequently, JPSCo. will conduct periodic reviews and summaries of savings and reliability on an annual basis to assess persistence.

145. Estimation of technical potential will be undertaken by extrapolating results for specific building types to the overall population as detailed by JPSCo's customer data and the commercial building survey. Potential program acceptance rates will be assessed by observing the acceptance levels for the program, and comparison to experience of similar, more mature programs in the United States and elsewhere.

E. Technical Challenges

146. The technical challenges include the following:

(i) The field of conservation evaluation is complex, and requires a sophisticated synthesis of data from different perspectives. For such an exercise, technology transfer becomes more difficult than for more straight-forward engineering.

(ii) Independence is crucial for reliable evaluation.

(iii) At the same time, evaluation is greatly dependent on the methodical, detailed collection of data on program progress and activities by the utility. The most common downfall of evaluations is inadequate record-keeping.

(iv) To lay the basis for future evaluations, it will be necessary to train a sufficient number of local social scientists and engineers in the fields' methods.

F. Strategies to Meet the Challenges

147. The first of these challenges can be reduced by securing an international bidding procedure for selecting the most qualified firm. This contractor will create the first examples of metering design and analysis plans, outline reports, etc for Jamaica. Participation of local contractors will increase after these initial examples are set forth. The concept of evaluation independence must be strongly supported by JPSCo. To maintain credibility, it will require some degree of outside oversight. It is common for regulators, boards, and other overseer to take a role in assuring that the evaluations are carefully designed and carried out in an independent manner. For the project, the evaluation contractor will assist in this role, and will report the project's findings to the financing institutions of the project as well as JPSCo.

148. The issue of data collection has been addressed both in the program designs and in the detailed evaluation plans. However, experience in the US indicates that, in the struggle to initiate programs, data collection can still take a back seat to implementation. To prevent this, the evaluation contractor will conduct a "data audit" early in the progress of each program to assure that the data being collected is

sufficient for evaluation purposes, and will report the results to financiers and JPSCo. management.

149. The last issue is the most problematic. There are capable social scientists locally available, but not so many with the technical orientation necessary to evaluate the engineering process. It has so far proven even more difficult to find engineers capable of and interested in the evaluation process as a distinct technical challenge.

150. The personnel issue can partially be addressed by systematically surveying the ranks of available academic personnel, and economic, management, and engineering consultants to identify interested persons, and making the results of this survey available to international consultants interested in bidding on the evaluation work. However, it may be necessary to rely on international consultants to play an ongoing role in evaluation work for some time.

G. Probability of Attaining Goals

151. Typically, impact evaluations result in an estimated range of likely cost and savings which, while not precise, is sufficient to judge the merits of continuing or adjusting program designs, plus sufficient information on program processes to enhance or redirect programs. It is very likely that this effort will result in this level of information.

152. The primary risks relate to the schedule and cost of the evaluations. Metering costs will be difficult to determine before there are detailed, building-specific measurement and analysis plans. With this in mind, alternative approaches have been built into these evaluation plans, but unseen complications may occur. Thus, as this effort proceeds, the schedule, and either budget or scope of the efforts stands a good chance of requiring adjustment.

H. Replicability

153. Commercial building savings vary from site to site. However, data from a sample of twenty large and thirty small buildings should prove useful in extrapolating to the overall stock.

154. The limited number of cogeneration sites and system configurations will provide limited ability to draw inferences about the overall building stock. However, it should prove feasible to define a range of applications and systems which have significant savings potential. Later program efforts will provide more precision and clarity as to the limits to resource potential. The residential program evaluation results should prove highly replicable to additional buildings.

155. As to the evaluation methods themselves, they should prove applicable to other countries performing benchmark, first-time evaluations. However, as the scale of Jamaica's programs increases, evaluation methods need to change. There will be less need for exhaustive metering of sites. Residential evaluations are likely to rely more on massed statistical analysis of billing data, and commercial evaluations will rely more on both on billing information and site engineering assessments. This evaluation plan involves the first steps in those directions, but further adaptation of evaluation techniques to Jamaica will be required in the coming years.

I. Full-Scale Evaluation Plan

156. At the end of the demonstration program, as part of the process for planning full-scale programs, a set of evaluation plans for those programs will be developed. As these programs will be designed to

saturate customer markets, the analysis will place more emphasis on review of the program design, marketing, and success with respect to meeting the needs of diverse customer groups.

J. Quality Control of Project Implementation

157. The scope and complexity associated with the in-field implementation of DSM programs is directly akin to running a multi-million dollar, small-to-medium-sized business enterprise. Sound business operating practice and fiscal management considerations would dictate, therefore, that formal quality control procedures be instituted to ensure cost-effective and efficient program delivery.

These procedures pertain to four general areas of concern for the Demonstration Project:

- Field Resource Allocation, Scheduling and Management. Implementation can involve hundreds of personnel of varying skill levels and technical specialization (e.g. auditors, metering specialists, installation technicians, inspectors, etc.), as well as significant amounts of equipment apart from the installed measures themselves (e.g. meters, trucks, specialty tools and testing devices, etc.). Computerized and manual tracking systems will be combined to ensure an efficient scheduling and allocation of these resources so as to control the deployment lead times and utilization rates, focus on critical path activities and interactions within and among simultaneously active projects, and monitor the day-to-day location and assignment of applied resources.

- Logistics Management and Inventory Control. The Demonstration Project will involve millions of dollars of equipment which has to be procured, transhipped, warehoused, inventoried, installed, tested, inspected, etc. Computerized controls will be provided to track equipment during each of these stages so that at any point in time all capital stocks can be properly accounted for.

- Administrative and fiscal Controls. The Demonstration Project will produce a tremendous amount of paperwork in terms of audit reports, project-specific technical and financial feasibility analyses, equipment purchase invoices and routing forms, inspection reports, payments to contractors, metered data files, and rebate and loan applications. The Project will provide a quality control system design far in excess of typical management information systems.

- Development of Quantitative Performance Standards. The Quality Control component of the Demonstration Project will develop unambiguous, quantitative figures-of-merit, benchmarks, indices, etc. which allow program implementation and managers to compare actual performance against hoped-for or expected performance goals and targets. Where standards are not being met, remedial procedures will be developed.

VI. PROJECT BENEFITS AND RISKS

A. Program Cost Effectiveness

158. JPSCo. has screened all proposed programs for the project for cost-effectiveness, using a model developed by the U.S. Electric Power Research Institute (EPRI) to evaluate DSM programs. This screening was conducted based on the Societal Test (economic), which excludes all taxes, and include all of the components of the Total Resource Cost Test (TRC--financial), one of several tests commonly performed in examining the cost-effectiveness of DSM programs in North America. Under the Societal and TRC tests, the benefits of undertaking a DSM program include the avoided costs associated with the energy savings from the program. The costs include utility program costs and the cost to the program participant. This is a comprehensive test for determining DSM program cost-effectiveness, and is used by many utilities and regulatory bodies as the primary test for determining whether or not programs should be implemented. A credit for environmental externalities was not considered in the Societal Test in order to provide a more conservative estimate. The assumptions are included as Attachment 4.

159. For the analysis of the DSM programs, average long-run marginal cost derived from a recent study by JPSCo./Coopers and Lybrand - US Cents (USc) 5.58/kWh for energy on-peak, USc 3.98/kWh for off-peak energy, and US$10.67/kW/month for generation capacity were used. Conservatively, measures in the various programs were judged cost effective if they cost less than the pure generation avoided cost of about USc6.74/kWh (excluding transmission and distribution costs). This value is actually quite lower than the system LRMC (including transmission and distribution) which is considered to be about USc14.9/kWh. A benefit cost analysis for each of the proposed programs showed that all of the programs are cost-effective and have costs lower than JPSCo. long run marginal cost of generation. Costs include customer measure costs, utility incentives, utility program administration costs, and excludes taxes. However, during the evaluation of the measures, all the tests were analyzed, i.e. the customer, the utility, and the TRC. A summary of the benefit cost analysis is shown in Table 3.

160. It is estimated that the set of DSM programs will save over 30,000 MWh and up to 7 MW over the five year period (by 1998) at an annualized cost of energy saved of USc4.73/KWh. For the five year program, the benefit/cost (B/C) ratio for the total program is 1.47 for the societal test, 1.31 for the TRC test, and 3.86 for the participant test. Tables 4 and 5 with Figures 4 to 7 show the energy and demand reductions by program over the five year and the 15 year (full scale implementation of programs). The set of programs, assuming all elements of the project are implemented as planned, will achieve a lower cost energy resource than electricity supply options and thus provides a cost effective resource for Jamaica to invest in energy efficiency. Table 6 provides the cost effectiveness screening calculations for a full scale fifteen year program.

161. A B/C analysis was also carried out for the full-scale implementation (15 years) of a DSM program for the measures and programs to be tested under the demonstration. For the 15 year program, the B/C ratio for the total program is 1.79 for the societal test, 1.54 for the TRC test and 3.88 for the participant test. For the societal test, a conservative estimate was also considered by only including the credit for the avoided generation component of the JPSCo. System peak demand savings were estimated at over 38 MW for the fifteen year program or over 190,000 MWh by 2008. These potential savings do not include the cogeneration contribution which is treated separately, and is expected to contribute an additional 2.5 MW during the demonstration project, and up to 20 MW in the medium term, through Standard Offer Contracts of 2 MW or less. In addition, further peak MW reductions can be achieved through the implementation of load management measures such as promotion of time-of-use and

interruptible tariffs as considered by JPSCo. and supported by the Minister of the Ministry of Industry Commerce and Trade (MICT).

B. Greenhouse Gas Emissions Reduction.

162. Through the life of the energy conservation measures included in this project, it is expected that CO_2 emissions would be reduced by over 507,000 tons. Up to 1998, CO_2 emissions are expected to be reduced by over 88,000 tons. The fuel saved is the marginal fuel which in the case of Jamaica is fossil fuel. A fuel saving due to DSM savings of more than 894,000 bbl of oil over the life of energy conservation measures is considered.

C. Project Risks.

163. The success of the DSM program depends on an effective DSM organization, products and technologies supported by the program, and widespread interest and participation in the programs. If this does not occur, the program would not achieve its energy savings targets and demand reduction objectives. JPSCo. would have to construct some of the power plants that it expected to defer or avoid through the DSM investment.

164. Other risks are associated with the project such as institutional risk, technological risk, and market risk. The institutional risk is the most serious. The DSMU needs to be staffed with qualified personnel and the level of staffing recommended in the program must be met by the DSMU. DSMU personnel, through technical assistance, would be supported by competent personnel acquired from other agencies, or through performance contracting. Without the full complement of staff, savings targets may not be met. DSMU performance could be seriously affected and would put JPSCo. behind in its construction schedule for new generation to meet loads. Strong commitment of JPSCo. and its top management is crucial to ensure the development and success of the DSM organization in order to reduce such a risk. Furthermore, the creation of a DSM Sub-Committee within the MPUME Minister's Steering Committee is planned to secure the cooperation and commitment of other government ministries and agencies to support the DSM program.

165. There is also the possibility of market risk due to a lack of interest in the DSM programs by large portions of the potential participants in each sector. If the market will not respond to the marketing, technical and financial incentives offered by JPSCo., the savings would not be achieved. To mitigate potential risk in this area, in each program, all incentives are designed to benefit the customer or participant and reduce or even eliminate the extra cost of efficient products. Program incentives can be tailored to meet individual customer's needs, depending upon the program.

166. The relationship between encouraging DSM through the adoption of standards and codes and offering incentives at the project level is complex. Often, these options are viewed as alternatives to one another. It is more appropriate to view these options as complementing one another. For example, part of the DSM plan addresses efficiency standards and codes for energy consuming equipment and buildings. Adoption of these standards as regulations would reduce the cost for financial incentives offered in programs and would promote the adoption of higher efficiency levels.

167. In determining appropriate financial incentives to offer at the project level, equipment standards, building codes, energy pricing, and the markets targeted are considered. Financial incentives are structured to move the market by offering customers an incentive attractive enough to stimulate

participation. For example, in new construction, this may be the incremental difference in cost between meeting the current building code and meeting increased efficiency levels.

168. Program elements include marketing to increase public awareness, training to increase professional expertise, technical assistance to facilitate customer participation, and steps to assure quality control. By working with other DSM professionals from throughout the world, the Jamaicans are in a position to adapt this experience to the Jamaican situation. By monitoring and evaluating program efforts on an on-going basis, adjustments can be made to improve program performance in a timely manner.

VII. MARKET BARRIERS AND LONG-TERM SUSTAINABILITY

A. Introduction

169. The project is intended to build the institutional capability and acquire necessary data, through demonstration activities, to develop sustainable programs that overcome market barriers to energy conservation. Currently many barriers operate to inhibit the implementation of energy efficiency in Jamaica including regulatory barriers, information and technical barriers, and financial barriers impacting the utility and the customer. These barriers in combination with a weak energy efficiency support infrastructure both in the private sector and at the utility significantly impact the ability to sustain long term efficiency efforts. The project will develop and test mechanisms to address these barriers and, during the last year of project implementation, the information acquired through evaluation of demonstration activities will be used to design full scale sustainable long term energy efficiency programs in Jamaica.

B. Regulatory Barriers

170. In Jamaica, as elsewhere, the concept of energy efficiency as an energy resource is relatively new. Accordingly, the process of developing and implementing government and regulatory incentives for cost effective efficiency that are at least as favorable as those in place for supply side resources is only at its early stages. For example, there is no mechanism in place yet that rewards JPSCo. for acquiring cost effective DSM as an alternative to more expensive supply resources. Moreover, despite some initial efforts to harmonize the tax and duty treatment of efficiency equipment with that accorded to supply side resources some inequalities persist. Finally, building and appliance codes, and mechanisms for their implementation must be further developed and strengthened.

171. Regulatory incentives to encourage and reward utilities for investment in demand side management resources that are cost effective vis a vis supply resources are essential. JPSCo currently is a public, completely integrated electric utility. There is little incentive for the company to invest in cost effective energy efficiency in the present arrangement and type of tariff existing in Jamaica. Focussing on the lack of incentives for DSM in JPSCo's current structure is not productive however, as there is an initiative well underway to privatize the company. Thus, efforts to address the utility's incentives with respect to DSM must be addressed in the context of the privatization initiative and the new legal and regulatory framework to restructure the power sector under the Energy Sector Deregulation and Privatization Bank Loan (Ln. 3502-JM).

172. A Regulatory Framework and Privatization (three Phases) Study which included a long run marginal cost review has been completed by Coopers and Lybrand. This study recommended the

following: (i) increasing competition in the sector (generation/supply) by initially focussing on Build-Own-Operate (BOO) schemes for new generation; (ii) restructuring the sector by establishing one generation company and one transmission/distribution company; (iii) changing the ownership of the sector by a full privatization of the generation company and transmission/distribution company; and (iv) amending the Electric Lighting Act and establishing an independent regulatory agency. Phase IV of the study which includes drafting of the new legal and regulatory framework and implementation of the privatization recommendations will be carried out by JPSCo. with funding from IDB. It is expected that this study will be completed in May 1994. A draft of a new Electric Lighting Act should ensure the establishment, among other things, of cost recovery tariff that would promote investment in energy efficiency. Within this new structure of the power sector in Jamaica, the new legal and regulatory framework should allow the utility to acquire cost-effective savings as necessary to meet the demand for electricity services through an optimal mix of supply and demand side resources.

173. To assist the regulator in developing these mechanisms, an expert on DSM regulation will be retained as part of the project to lay out alternatives and assist in the selection of the most appropriate mechanism for Jamaica. In determining the appropriate structure, the regulator will consider the results to date of this DSM program which will be provided by the DSMU. In addition, flexibility will be built into the regulatory mechanism to allow for amendment and enhancement as additional experience is acquired and evaluation results from this project become available that document the most effective strategies to overcome market barriers to conservation.

174. Tax treatment and duties for efficient equipment. To permit energy efficiency to compete on an equal basis with supply side resources, energy efficiency measures must receive, at a minimum, the same tax and duty treatment as that accorded to supply side resources. The government of Jamaica has already made some positive steps in this direction reducing duties on equipment from 35% to 15%. In addition, implementation of the government's more general trade liberalization policies should result in elimination of many tax and duty distortions. To inform that process, the DSMU will investigate whether additional inequalities in tax or duty treatment persist between supply and demand side resources and will work with the government of Jamaica to eliminate any disparate treatment. In addition, over the course of the project, the DSM Program Manager will explore options with the Jamaica government to jump start energy efficiency markets by providing short term favorable tax or duty treatment, if considered cost effective.

175. Appliance standards and building codes and their enforcement. Building energy efficiency codes and appliance standards can be effective mechanisms to move the private sector towards increased efficiency. Because of political pressures and other considerations, building codes and appliance standards and labelling are not complied with. However, they are useful to standardize better practices and equipment. Some progress has been made in Jamaica with respect to building codes and appliance standards. To increase the chance of compliance, an information campaign will be launched to educate the public and professional organizations such as the Societies of Architects and Engineers.

176. In 1992, the JBS succeeded in having an Energy Efficiency Building Code enacted by the Government. While not yet distributed, this is a significant positive development. To reap its full benefit, appropriate mechanisms must be developed to ensure adequate implementation. For Kingston and St. Andrew such a mechanism will be attempted by assigning a seat to JPSCo. on the building permit approval committee of the St. Andrew and Kingston Corporation. As a member of the committee, JPSCo. will be in a position to educate other members about the requirements of the building code. The

JPSCo. representative is appropriately a member of the DSMU. Through the participation of its personnel on the committee, the DSMU will monitor the success of this mechanism. If the results of this mechanism are favorable, the DSMU will explore opportunities to replicate it in other parts of the island.

177. In addition, the new construction component of the demonstration project will serve to encourage compliance with the energy efficiency building code. The code will be used as the efficiency baseline that must be exceeded to establish eligibility for financial incentives.

178. With regard to appliance standards and labelling, there is an initiative underway by JBS to develop appliance energy efficiency labels for refrigerators coupled with a marketing campaign by JPSCo. to highlight the benefits of more efficient models. It is envisioned that labelling would also be developed for other appliances, particularly air conditioners. As part of the demonstration program, the refrigerator labelling and promotion campaign will be monitored and evaluated. Based on the results of monitoring and evaluation, further activities by JPSCo. towards the development of appliance labels and standards will be considered when the full scale DSM programs are designed in the last year of the demonstration program.

C. Information, Technical and Financial Barriers

179. Customers experience various barriers to implementing conservation including lack of information, perceived risks of unfamiliar equipment and financial barriers. The pilot program will test the model whereby utilities implement programs offering services and financial incentives to overcome customer market barriers. The results of the demonstration project, tracked through monitoring and evaluation, will serve as the basis for 1) designing effective full scale programs that provide services and incentives to effectively overcome customer market barriers at the least possible cost to the utility and 2) developing sustainable mechanisms to funds these programs.

180. Information. One reason why customers fail to implement cost effective energy efficiency measures is lack of information and awareness regarding opportunities for conservation that are applicable to their facilities. The demonstration activities will provide customers with information through energy audits identifying measures applicable in the customer's facility and its benefits and costs. In addition, the program will develop information on reliable efficiency measures through equipment testing efforts and evaluation of measures implemented in customer premises.

181. The program will also create increased awareness of efficiency opportunities by JPSCo. customers. In efforts related to this project, the DSM unit will continue current public education campaigns to: 1) stress to the public the need for conservation, 2) identify opportunities to improve energy efficiency and 3) explain the benefits of energy efficiency measures. Specific marketing campaigns will be carried out regarding compact fluorescent lamps and efficient refrigerator models.

182. The project will, moreover, strengthen the capability of a local environmental non-governmental organization (NGO) to monitor program implementation and educate Jamaicans on the importance of energy efficiency to reduce environmental impacts of increased energy services. In addition, the DSMU will regularly up-date other relevant organizations such as consumer groups, and professional organizations, on the progress of the program. These up-dates will serve to alert the Jamaican community of the opportunities for increased efficiency.

183. Risks of Equipment Non-Performance. Another significant barrier to customer implementation of cost effective energy efficiency is the real and-or perceived risks of nonperformance of unfamiliar energy efficiency equipment. This risk will be addressed by the pilot demonstration project through a variety of utility services. First, the utility will test efficiency equipment to identify models that perform adequately in Jamaica. Second the utility, through quality control, will ensure that equipment is selected, designed and installed properly and will advise the customer on appropriate operation and maintenance practices. In appropriate circumstances, the utility will encourage customers to enter into service contracts to ensure that equipment is maintained. Finally, by co-investing in efficiency measures, the utility will demonstrate its endorsement and confidence in efficiency equipment by assuming part of the financial risks of non-performance.

184. Financial barriers. Customers may experience some or all of the following types of financial barriers to implementing energy efficiency: limited access to capital, high cost of capital and high thresholds for investment. The measures outlined above addressing some of the risks of equipment non-performance help to reduce some of these barriers. To fully address financial barriers, however, the demonstration project will co-share the cost of efficiency measures.

185. Through demonstration program evaluation, the need for continued financial incentives and the level of incentives necessary will be examined. If evaluation demonstrates that ongoing utility co-investment is necessary to overcome customer financial barriers, recovery of appropriate investment by the utility will be provided for in the refinements to the regulatory structure.

D. Development of the Private Sector Energy Efficiency Infrastructure

186. In order to ensure long term sustainability of initiatives to improve energy efficiency, the private sector infrastructure to support energy efficiency must be developed, including human resources, equipment availability and availability of capital. First, with respect to human resources, a pool of skilled energy auditors, designers of energy efficiency installations, equipment installers, and program evaluators must be created. The project will address these needs through formal training programs, certification procedures and on-the-job training.

187. Second, steps must be taken to create availability of energy efficient equipment in Jamaica through vendors and retailers. The project will advance this objective through a variety of mechanisms. First, through the energy auditing process, energy efficiency measures applicable in Jamaica will be identified, pretested and demonstrated through implementation in customer premises. Second, as part of the project, equipment providers will be identified and equipment will be purchased. Through this process relationships with these providers will be developed and procurement procedures worked out. Moreover, it is possible with respect to the small commercial program and the residential lighting program, that JPSCo. will work directly with vendors and provide appropriate incentives to enable them to stock and sell to JPSCo. customers efficient equipment. Increased initiatives to work directly with vendors to market conservation will be incorporated in full scale program plans. The demonstration program evaluation will specifically investigate vendor needs and the results of these investigations will inform the development of full scale programs to ensure that vendor needs are addressed. In addition, the DSMU manager will have an ongoing responsibility for identifying international efficient equipment providers and investigating local capability to manufacture efficient equipment and for promoting local manufacture where appropriate.

188. Finally, there is a need to increase the availability of private sector funds for energy efficiency. In this regard, the project will be kept informed of an initiative to introduce ESCOs coordinated by the IFREE. This institution may fund review of a number of audits initiated during the Rockefeller Foundation supported groundwork for this project and submit finalized audits to the US National Association of Energy Service Companies (NAESCO) as prospective projects for private sector investment. JPSCo. will remain abreast of the progress of these attempts to interest private sector investors and will ensure that demonstration project activities do not compete with them. In addition, JPSCo. will solicit cooperation by customers undergoing efficiency treatments through ESCOs and the cooperation of the ESCOs themselves to evaluate the results of these activities. JPSCo. will seek to review ESCO related audits, review building treated by ESCOs, review the protocols for savings verifications and evaluate the ESCO process. To encourage participation in JPSCo. monitoring by customers and ESCOs, JPSCo. will seek to perform this monitoring with minimal disruption and irritation to these entities. The results of these evaluation efforts and the evaluation of the demonstration activities will serve to develop a long term strategy to implement demand-side management that leverages the greatest possible private sector investment without sacrificing cost effective demand side management opportunities.

E. Development of the Energy Efficiency Support Infrastructure in JPSCo.

189. Within JPSCo., capability must be created to design, implement and evaluate full scale sustainable demand side management programs, to integrate demand side management resources in system planning, and to set in place the organizational structures to support DSM. Capability to design, implement and evaluate full scale demonstration programs will be created through on the job training and participation in relevant seminars. Moreover, expert assistance will be available during the last year of the demonstration project to aid JPSCo's DSM unit in developing full scale program designs based on the results to date from demonstration project activities. Finally the demonstration project will develop much of the information necessary to develop full scale programs.

190. The pilot project will develop the capability of JPSCo. to integrate DSM resources in system planning, through providing necessary computer models, training JPSCo. planning personnel and on the job experience. By the second year of the project, the JPSCo. planning division should be evaluating DSM as a resource when conducting system planning.

191. Finally, with respect to organization, the evaluation of the project will evaluate the functional relationship between the DSMU and the JPSCo. planning division and the management structure for the DSMU and discuss alternatives to improve these. Based on the evaluation results, improvements in the organizational structure will be addressed in the development of full scale program plans.

F. Development of the Energy Efficiency Support Infrastructure in JBS

192. The JBS will play a crucial role in the implementation of the project through testing, standards, and labelling of equipment, and promulgation of energy efficiency building codes, and in the long term sustainability as Jamaica proceeds into full scale implementation beyond this demonstration project. The project includes a sub-component to support JBS. However, the amount of financial support included in this project is smaller than what JBS has requested. In addition, the Bank recommended to JBS to become a self-financing institution in the near future with funds provided by the fees it charges its customers. Finally, the Bank recommended to the Ministry of Industry, Commerce, and Tourism (MICT) to support JBS in building its Energy Laboratory which is important for the project. Contingency testing plans overseas and particularly in the USA have been considered.

VIII. AGREEMENTS REACHED

193. The following agreements were reached by the Bank with the Government during negotiations:

(a) The Government shall cause JPSCo. to maintain the DSMU with organization, structure, functions, management, and staffing satisfactory to the Bank.

(b) The Government shall cause JPSCo., not later than July 31, each year, to furnish to the Bank a training program satisfactory to the Bank.

(c) The Government shall, not later than July 31, each year, furnish to the Bank, for its it's review, operating plans for each part of the project to be carried out during the following year, including the corresponding budgets.

(d) The Government shall cause JPSCo., not later than May 31 and November 30, to furnish a semi-annual progress on the project identifying results achieved, main project implementation issues with recommendations regarding remedial measures to be taken in relation to the project, and implementation of the relevant Annual Operating Plan.

(e) Under the terms and conditions set in the Loan 3502-JM - Energy Sector Deregulation and privatization and in the context of the structure of the regulatory framework for the power sector, the Government shall include specific provisions to encourage investments in energy efficiency satisfactory to the Bank.

(f) The Government shall cause JPSCo., not later than August 31, 1994, cause JPSCo. to approve a Cogeneration Policy and Standard Offer Contract models.

(g) The Government shall cause JPSCo. to enter into contractual arrangements, satisfactory to the Bank with: (i) JBS for the purpose of carrying out its proposed program and budget to support project implementation, particularly for testing of equipment; (ii) NRCA for the purpose of supporting project implementation, particularly with regard to environment impact and disposal of solid waste; and (iii) NGOs and other public entities and professional organizations for the purpose of educating the public and creating public awareness.

194. In addition, before effectiveness agreements should be reached on operating guidelines for the project which should: (i) present the project to the DSMU staff that will be responsible for its implementation; (ii) provide information to all participants about the project and its organization; (iii) provide broad rules for the reallocation of resources from one category to another in the light of the results achieved; (iii) the role played by each co-financiers and the coordination that should exist among them; (v) the role played by each participating Government institutions such as JBS, NRCA, other government institutions, and non-government organizations; and (vi) other aspects dealing with supervision, project monitoring and evaluation, and reporting. Finally, and also before effectiveness, the Government should have submitted to the Bank a development policy letter on energy efficiency which is acceptable to the Bank and a certified copy of the JPSCo. agreement duly executed on behalf of the two parties.

ATTACHMENTS

TECHNICAL ANNEX
ATTACHMENT 1

JAMAICA
DEMAND SIDE MANAGEMENT PROJECT

Jamaica: Energy Sector Policy and Strategy
(Ministry of Public Utilities, Mining and Energy Document)

Background

1. Within the framework approved by the Government of Jamaica, the Ministry of Public Utilities, Mining and Energy has prepared a comprehensive energy sector policy and strategy. The broad objectives of the policy and strategy are:

(a) ensuring energy supplies to Jamaica at the least economic cost through a combination of public and private sectors investments under a deregulated and liberalized environment;

(b) diversification of the energy base; optimal development of indigenous energy resources where economically feasible; and ensuring security of supplies;

(c) efficiency in energy production, conversion and use with the overall objective of reducing the 'energy intensity' of the economy;

(d) reduction of adverse environmental effects and pollution caused by the production, storage, transport and use of energy;

(e) implementation of appropriate and economic pricing policies to ensure that adequate energy supplies are delivered to all economic sectors efficiently and an improved energy supply network is sustained; and

(f) establishment of an appropriate regulatory framework to protect the consumers, investors and sector entities.

2. The energy sector policy and strategy has been designed to achieve these objectives through the establishment of an enabling environment for:

(a) attracting private sector participation and investments through deregulation, liberalization and appropriate regulatory framework;

(b) development of indigenous energy supplies where appropriate;

(c) encouraging energy conservation and efficiency;

(d) fully protecting the environment while ensuring that adequate energy supplies are available to the country to sustain desired rate of economic growth; and

(e) sustaining appropriate institutional arrangements for the sector.

3. The policy and strategy is outlined in a Government document which: (a) reviews the global and national developments and their relevance to Jamaica's energy sector; (b) identifies and evaluates short to medium term energy sector policy options that are needed to consolidate the economic gains and policy initiatives of the past years; and (c) recommends strategies to sustain economic growth without encountering energy supply shortages. This Attachment provides a brief summary of the above.

Overview

4. Domestic Energy Resource Base. Without unexpected and significant discoveries of oil and gas or unforeseen technological breakthroughs, likelihood of finding adequate indigenous energy sources is limited. Jamaica will continue to rely on imported oil to meet most of its energy requirements during the next ten to fifteen years. The only viable indigenous energy source appears to be fuel wood. Indiscriminate use of this source is already having serious adverse environmental effects and Jamaica's forestry resource would have to be properly managed. Solar water heaters have an economic potential, provided appropriate fiscal and pricing polices are introduced to encourage their use. As far as the development of other renewable energy options is concerned, efforts should be restricted to monitoring international developments.

5. Security of Supplies. Jamaica is situated within the highly competitive US Gulf Coast and Caribbean petroleum supply region. Current petroleum requirements are about 19 million barrels a year. These are small relative to the total regional supply which for island refineries alone amounts to over 400 million barrels a year. In addition to international majors, a number of independent traders operate in the region. Being a marginal buyer, the security of supplies for Jamaica is reasonably assured.

6. Energy and the Economy. About 63% of the population lives in dwellings with electricity and 85% of the households are within 300-500 feet of existing electric power distribution lines. In comparison with countries at a similar stage of development, the level of energy consumption in Jamaica is fairly high. This is primarily because of the requirements of the highly energy intensive bauxite and alumina industry. Historically, the energy intensity of the economy has remained fairly high. At present, for every unit of GDP value added, about 11% energy input is required. The income elasticity of demand for non-bauxite energy is estimated at 1.6.

7. Energy Consumption and Costs. Energy consumption grew at about twice the rate of GDP. In 1992, on per capita basis, net energy consumption increased at about 1.2% and the total energy consumption at about 2.5%, while the GDP (1986 prices - preliminary estimates) increased by about 1.2%. Total energy requirements in 1992 were at 19.8 million barrel of oil equivalent (boe), with a per capita requirement at 8.0 boe. In 1992, energy imports cost US$320 million and in 1991 US$328 million. Non-bauxite energy imports cost US$235 million and accounted for about 22% of foreign exchange earnings from merchandise exports.

8. Demand Projections are based on the following assumptions: (a) a real GDP growth at 3% p.a. up to 1995 and at 5% p.a. thereafter; (b) energy demand of bauxite and alumina sector increasing in line with rise in alumina production; (c) income elasticity of demand for energy at 1.6 up to 1995 and 1.2 thereafter; and (d) energy demand of the non-bauxite sector increasing at 4.8% p.a. up to 1995 and at 6% p.a. thereafter. The long term energy demand is projected to grow at 4.3% p.a. At this growth rate, the energy demand in 2000 would be about 27 million boe and in 2005 at 34 million boe.

TECHNICAL ANNEX
ATTACHMENT 1

Least Cost Energy Supply Options

9. Power Sector Jamaica Public Service Company (JPSCo.) has a current installed capacity of 553 MW, and a system peak of nearly 358 MW. This permits a safe operating reserve of only 39 MW. Because of this narrow reserve margin, new base load generating capacity is urgently needed to improve the system reliability and reduce fuel consumption. In Jamaica for every one kWh of electricity not supplied, about US$1.50 (J$37.50) is lost in economic production. The objective of the Least Economic Cost Power Expansion Plan (LCEP) is that all new capacity ensures that:

(i) a reliable and appropriate technology is adopted;
(i) the unit sizes are compatible with the system size; and
(ii) the timing of new units neither creates overcapacity nor develops capacity shortages.

10. Based on the LCEP, 460 MW of new capacity is needed during the next 10 years. The investment requirements for the power sector are estimated at: (i) about US$860 million for the new power generation capacity in the next 15 years. Of this about US$200 million would be needed in local finances and the rest in foreign capital. In addition JPSCo. would require US$134 million during next five years followed by another US$200 million between 1997 and 2005 for maintenance, rehabilitation and support programs to sustain the new investments. This means that during the next decade on the average about US$85 million would have to be invested every year in the power sector. While the LCEP is subject to up-dating and annual reviews, if power outages are to be avoided in the short term, implementation of the options for the next four years must proceed on time. These include the provision of 130 MW of new generation capacity between 1993 and 1997.

11. In view of large investment outlays and GOJ's objective to gradually improve and maintain minimum required levels of expenditures in the social sectors (health, nutrition and education), all new investments in the energy sector should be through the private sector. In 1990 GOJ approached the World Bank and Inter American Development Bank (IDB) to seek their support in bringing new base load capacity into the system based on: (a) the LCEP; (b) a structured process; and (c) private sector participation. The World Bank and IDB agreed to support a Private Sector Energy Development Program. Loans totalling US$117.5 million to create an enabling environment to attract private sector investments in the energy sector were approved by these banks. In addition the European Investment Bank has approved a loan of ECU 9 million to support this program.

12. Because of initial delays in implementing the LCEP, JPSCo. decided to advance the erection of one 30 - 35 MW gas turbine (GT) generator, originally scheduled in the private sector in 1995, to 1993 in the public sector. The construction of this unit is now under progress. Negotiations for a security package for the 60 MW slow speed diesel generation plant (diesel) in the private sector, to be commissioned in 1995, are in the final stages with a private sector company.

13. Policy Options To avoid untimely power outages in the country, the timing and implementation of the proposed 130 MW of new generation capacity should not be compromised. In the longer term, up-dated LCEP's should be used to solicit private sector sponsors. The criteria and General Guidelines for the preparation and solicitation of project proposals outlined in this report should be strictly adhered to. While all investments in new power generation facilities should ideally be through the private sector route, JPSCo. should ensue a strategy to deal with new proposals for the generation of electricity by the private sector as follows:

(a) based on an updated LCEP, the future needs of the power system be clearly defined and a list of projects with probable time frames be published so that the prospective private sector sponsors can focus on the pre-defined needs of the Jamaican generation system and respond to specific timetable and capacity requirements;

(b) based on the updated LCEP, JPSCo. should establish a capacity sequencing profile, documentation and security package which should include the criteria and guidelines. This package should be used to invite private sector proposals on a standardized format for submission to the GOJ and JPSCo. This would help in avoiding undue strain on the public sector's technical resources to evaluate unstructured or unsolicited projects or proposals; and

(c) a technical panel should be established as central focus for receiving, reviewing and evaluating these proposals. This panel should be led by the ministry responsible for energy and include officials from the National Investment Bank of Jamaica (NIBJ), the Energy Sector Project Implementation Unit[1] (ESPIU) within the Ministry of Public Utilities, Mining and Energy and JPSCo. The recommendations of this panel should be submitted to the Minister's Steering Committee on Private Power for consideration and recommendation to GOJ.

14. A regulatory framework and privatization study which included a long run marginal cost study has been completed by Coopers and Lybrand. This study recommended the following: (i) increasing competition in the sector (generation/supply) by initially focussing on Build-Own-Operate (BOO) schemes for new generation; (ii) restructuring the sector by establishing one generation company and one transmission/distribution company; (iii) changing the ownership of the sector by a full privatization of the generation company and transmission/distribution company; and (iv) amending the Electric Act and establishing an independent regulatory agency. The amendment of the Electric Act should ensure the establishment of an appropriate environment for sound tariff policies and promoting efficiency in the sector. Financing to implement the privatization of JPSCo. and establishment of regulatory framework should be sought from IDB and other sources, including concessional.

15. Petroleum Sector A number of studies on the local refinery have shown that the recent costs of petroleum supplies to Jamaica have not been optimal:

(a) In 1981 and 1982, the marketing companies imported over 2.3 million barrels per year (MMB/yr) of refined petroleum products (at an average cost of about US$88 million/yr). International affiliates of the local marketing companies extended credits and working capital to local companies without financial charges to finance these imports. After 1983, Petrojam became the sole importer of over 3.9 MMB/yr of refined products. For these imports, Petrojam had to arrange expensive credits through financiers such as Mark Rich, Austin Blades and BCCI. These financing institutions charged between 3% to 4% of the cif in LC and confirming house costs. Interest rates have varied about 1% to 2% above LIBOR rates. Following the liberalization of petroleum product imports, Jamaica is expected to save at least about US$0.30 per barrel in avoided financing costs;

1/ Energy Sector Policy Implementation Unit (ESPIU) should play key role in coordinating and ensuring the timely implementation of energy sector projects and policy decisions. The establishment of ESPIU should also strengthen the role of the Minister's Steering Committee of Private Power (MBC).

(b) Petrojam refinery, for a number of years, has operated below the optimum capacity factor of about 83%. A regional least cost petroleum supply study concluded that Jamaica could reduce its supply costs by streamlining the product specifications to the current market needs. This study also estimated that, at the minimum, benefits from the reduced supply cost could be up to US$15 million/yr. The single largest reduction could come from the estimated difference between built up refinery rack prices and spot market prices;

(c) small and relatively simple refineries, as is the case with most refineries in the region, are not cost effective. They do not offer the best long term method of maintaining supplies to the region. In the case of Jamaica, it is believed that Petrojam can compete with imported products and be a part of the least cost petroleum supply option provided it:

(i) operates at an optimum utilization factor of 83% with minor upgrading (cost about US$15.5 million); or
(ii) adds a catalytic cracking facility and operates at full utilization factor (cost about US$130 million); or
(iii) implements extensive upgrading through the addition of a catalytic cracker and increase in capacity (cost about US$737 million).

16. Deregulation of the Petroleum Sector: Considering that the economics of rehabilitating and modernizing the refinery is dependent on large new investments, the least cost petroleum supply option, within the macroeconomic constraints, is that all new investments in the refining sector should only be made by the private sector. The strategy to achieve this should be based on the findings and recommendations of the Deregulation of the Petroleum Sub-sector and Privatization of Petrojam study which was done by Arthur D. Little (ADL). ADL study has concluded that the Petrojam refinery is slightly uneconomic from national economic perspective relative to a terminal only operation, but San Jose Accord benefits could somewhat offset this disadvantage. Therefore, the deregulation of the petroleum industry could entail a continued operation of the refinery.

17. To achieve full liberalization of the petroleum industry, while ensuring that the Petrojam refinery remains in operation, the study recommended:

(iv) remove all price controls;
(v) fix product tariffs 5% higher than crude oil;
(vi) guarantee fair access to Petrojam's loading rack;
(vii) enact Fair Competition Act, Anti-Dumping legislation and haulage regulations;
(viii) establish petroleum quality standards and enforce qualification and registration standards for marketers, haulage and distributors; and
(ix) establish environmental regulations under the NRCA.

18. Analysis by GOJ indicates that initially the refinery would require a 10% protection so that it can move from a low operational factor to an optimum utilization factor. This level of protection should be granted for 12 months and thereafter it should be reviewed with a view to reducing it to 7.5%.

Prior to privatization of the refinery, the protection level should be brought down to the ADL's recommended level of 5%. Within this framework, the liberalization of the petroleum industry was implemented on April 1, 1993 and the de facto monopoly of the refinery has now been removed.

19. Privatization of the Petroleum Sector As far as the strategy for privatization is concerned, ADL has recommended that both the refinery and industry rack be divested as one package. However, adequate time should be allowed to fully understand the impact of the liberalized environment before privatization takes place. This period is recommended at 18 months.

20. As far as the other Petroleum Sector Entities are concerned, the following options merit consideration:

(a) PCJ's subsidiaries which are financially viable and can be sold should be divested. The ones which cannot be sold but are necessary for the economy, should be transferred to appropriate ministries or departments. The ones which have no potential to become financially viable and can not be sold, should be closed; and

(b) PCJ should be restructured to meet the public sector's current needs. The current needs mainly are to use it to assist in divesting the refinery and other sub-sector entities. For this purpose only a small staff is needed.

21. The current system of selling household kerosene appears to be unsafe, expensive and it is possible that some product is still being used for adulteration. Open drums are being carried on the backs of trucks and even on the back of motor bikes. At the present time, the best method would be to: (a) remove subsidy from kerosene so that there is no incentive to use it for adulteration; (b) discontinue the package sale of kerosene, which has proven to be expensive; (c) as the distribution network for the supply of kerosene is still in place revert, to this system; (d) introduce kerosene stamps for the eligible people which should be redeemable at the supply centers like the food stamps; and (e) with this mechanism, there would be no need to use dye for kerosene. The benefits of this system would be: (i) kerosene handling would revert to safe method of sale; (ii) heavy cost currently incurred in package or small handling and purchase of dye would be avoided; and (iii) subsidy would be provided to only the deserving public. In parallel with these policy initiatives, to encourage the conservation of forestry reserves, government may consider removing all taxes on two burner kerosene and LPG cooking stoves.

22. Petroleum Supply Accords Analysis shows that the benefits derived from the regional petroleum supply accords are limited and their advantages are confined to availability of medium to long term foreign exchange cash flow. As far as their relationship to the security of supply or the ownership of the refinery is concerned: (a) it makes no difference whether the refinery is owned by the public or private sector (in the early 1980s the refinery was owned by Esso); and (b) the security of supply is not a major concern in this region. Strategies for obtaining supplies under these Accords should rely on regular and careful evaluation of their benefits to determine if advantages justify continuation.

Energy Efficiency and Conservation Strategy

23. Efficiency improvements on the supply side are programmed in the system loss reduction programs. On the demand side a project is being prepared through the Global Environmental Facility (GEF) of the United Nations, UNEP and the World Bank, IDB and Rockefeller Foundation. The main

objectives of this project are to: (a) develop institutional mechanism to assess end use efficiency potentials; (b) design and recommend specific programs to capture these potentials; (c) evaluate the effectiveness of the proposed programs; and (d) develop the necessary institutional capabilities for implementing these programs. Adequate resources should be allocated for the preparation and implementation of this project. This should be done through JPSCo. In addition GOJ should also consider to promote the use of low or zero energy appliances and transport equipment (e.g. bi-cycles, mopeds, motor cycles and small engine cars) through the market mechanism by either eliminating or introducing low taxes and duties on such equipment.

24. The success of the on-going programs depends on the institutional capabilities of local counterparts in addition to availability of counterpart funds. It would be appropriate for such funds to be provided out of the Stabilization Fund, and for the DSM project to include a reallocation of JPSCo.'s revenues to finance energy efficiency programs. These allocations should be made immediately so that the program can progress as designed. GOJ may also consider the introduction of an energy tax to fund these programs.

25. Energy Pricing Energy prices in the country should reflect the economic cost of products. All indirect or cross subsidies should be phased out. If subsidies are to be provided, they should be on direct basis, e.g. subsidy on kerosene through kerosene stamps; and on electricity through life line tariffs for poor consumers. In this context MPUME should investigate the possibility of establishing a load limiter tariff to provide basic requirements of households below certain income levels. These requirements may be limited to providing electricity for lighting, cooking and powering a radio.

26. Rate setting principles should be established early in the planning process and should be coordinated closely with the regulatory studies. The basic principles now in place should remain unchanged but will need modification to reflect power purchases from private suppliers and encourage investments in energy efficiency. These principles are:

(a) rates should reflect full costs including duties and taxes that are applied to all other industries;

(b) overall revenue requirements to be established on the basis of existing loan agreements with international agencies and GOJ to meet rate of return and/or self financing tests with adjustments for inflation based on a retail price index minus an incentive factor for productivity improvement;

(c) indexing of foreign exchange and fuel cost fluctuations;

(d) tariffs should be structured according to marginal cost principles according to peak and off peak cost, voltage level, capacity and energy costs, etc.;

(e) pass through of purchased power charges and adjustments with initial contracts subject to regulatory board approval; and

(f) introduction of an incentive mechanism to ensure energy efficiency.

27. The analysis of the petroleum products pricing formula indicates that it could be resulting in excess costs of supply. As some of the cash generated forms part of the consolidated surpluses of public sector enterprises in meeting the IMF tests, it is essential that under any revised pricing regulatory framework, adjustments should be made to the tax in order to retain the surpluses as part of public revenues. The pricing formula or guidelines should be reviewed with a view to:

(a) rationalize and establish realistic guidelines for the refinery and the marketing companies to calculate import parity petroleum prices so that GOJ can monitor pricing movements to ensure that price gouging does not take place;

(b) reduce the frequency of changing prices from weekly to monthly changes; and

(c) the strategy for the supply of subsidized household kerosene should be changed to reduce costs and improve availability by using the mechanism of kerosene stamps and selling kerosene through the established sales channels.

28. The petroleum product specifications should be reviewed and revised to conform to the least cost petroleum supply option for Jamaica. In the case of turbo fuel, its import and specifications should be left to the marketing companies, letting them decide the quality of product they need in order to meet their contractual obligations. This would have a positive foreign exchange benefit.

Environmental Strategy

29. Considerable institution building is required to consolidate environmental strategy. The cost of environmental protection measures to international standards should be internalized as project costs and thus reflected in the price of petroleum products and electricity. The following environmental action programs are recommended in connection with existing and proposed energy projects:

(a) Environmental Impact Assessments (EIA) of new energy related project should be mandatory;

(b) cleaning up of existing sources of pollution notably JPSCo. power stations (Hunts Bay) and the Petrojam refinery should be the highest priority;

(c) pollution abatement through conservation and energy efficiency improvements should be encouraged;

(d) NRCA should be strengthened to fulfill its mandate under the Act, and to ensure compliance by JPSCo., Petrojam and private sector of legislation and required standards;

(e) establishing baseline data for air quality, noise levels, and forest resources;

(f) establishing standards for environmental zones such as the Kingston metropolitan area, tourist areas, etc.; and

(g) reducing the indiscriminate felling of trees by reducing or eliminating taxes on small kerosene and gas stoves which are mainly used by the poor population.

TECHNICAL ANNEX
ATTACHMENT 2

GLOSSARY OF KEY DSM PROGRAM TERMS

A majority of the definitions contained in this glossary were taken directly from an Oak Ridge National Laboratory report.[1]

Achievable potential is an estimate of the amount of energy savings that would occur if all cost-effective, energy-efficient options promoted through utility DSM programs were adopted.

Add-ons are purchases of new or additional equipment of a type previously not present in an existing facility, such as the purchase of a food freezer for a home that previously had none or the purchase of a second room air-conditioner.

Administrative costs are expenses incurred by the utility for program planning, design, management, and administration. They include labor, office supplies, data processing, and other such costs. They exclude the costs of marketing, purchase of equipment for programs, incentives, and monitoring and evaluation.

Annual participation is the number of customers enrolled in a particular program for a given year.

Annual participation rate is the ratio of the number of participating units in a particular year to the number of eligible units.

Base market is the set of customers or technologies against which participation in a program is measured.

Bill credit is a payment in the form of a reduction in a customer's electricity bill.

Capitalized refers to equipment or other utility investments to be used over a multi-year period and therefore eligible for inclusion in the utility's rate base.

Cash incentive is a monetary award or inducement in the form of a rebate or payment.

Coincident peak demand is the load (in kW) of an end-use, customer, or group of customers at the time the utility experiences its greatest demand for electricity.

Commercial sector is the group of nonresidential customers that provides services, including retail, wholesale, finance, insurance, and public administration.

Cumulative effects are the changes in electricity use and demand caused by all of a program's participants from the program's inception through the current year.

Cumulative participation is the number of participating units from the start of a program through the current year.

Cumulative participation rate is the ratio of the number of participating units from the start of a program through the current year to the number of eligible units.

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[1] Hirst, Eric and Sabo. Electric-Utility DSM Programs: Terminology and Reporting Formats. Oak Ridge National Laboratory: ORNL/CON-337, 1992.

Customer Class is a group of customers with similar characteristics, such as economic activity or level of electricity use.

Customer unit is a measure of participation that is based on customers, households, or buildings in contrast to technology units.

Demand-side management measures are actions taken by a customer (e.g., installation of energy-efficient equipment) to modify the amount of timing of electricity use.

Demand-side management programs are organized utility activities that are intended to affect the amount and timing of customer electricity use.

Demolition Rate is the annual percentage decrease in a population.

Early replacement is the removal of equipment before it reaches normal retirement age and the substitution of new equipment for the old.

Economic potential is an estimate of the possible energy savings assuming that all energy-efficient options will be adopted and all existing equipment will be replaced with the most efficient equipment whenever it is cost-effective to do so, without regard to market acceptance.

Eligible market is the subset of the total market that is qualified to participate in a program based on the program's participation criteria.

Energy effects refer to the changes in aggregate electricity use (in GWh/year) for customers that participate in a utility DSM program.

Energy-efficiency programs (sometimes called energy-conservation program) are aimed at reducing the energy used by specific end-use devices and systems without degrading the services provided, thereby reducing overall electricity consumption (kWh), often without regard for the timing of program-induced savings. Such savings are generally achieved by substituting technically more advanced equipment to produce the same level of end-use services (e.g., lighting or warmth) with less electricity.

Equipment cost is the price of components that the utility purchases directly for a DSM program, including the cost of DSM measures distributed free to participants.

Expensed refers to utility costs that are treated as current expenses rather than as capital costs; the utility cannot earn a return on expensed costs.

Externalities are those costs or benefits which are considered external to a conventional economic analysis. A typical example of an externality is the pollution effects on the environment.

Growth Rate is the annual percentage increase in a population.

Incentive is an award offered to encourage participation in a DSM program and the adoption of recommended measures.

Incentive programs offer cash or non-cash awards to customers, trade allies, or employees to encourage participation in a DSM program and the adoption of recommended measures.

Incremental costs is the difference in price, particularly between that of an efficient technology or measure and the alternative standard technology, in some early retirements and retrofits, the full cost of the efficient technology is the incremental cost.

Incremental participation is the number of annual participants in the current year minus the annual participants in the previous year.

Load shape refers to the time-of-use pattern of customer electricity use, generally a 24-hour pattern or an annual (8,760-hour) pattern.

Load-shifting programs aim to move electricity consumption from one time to another (usually from the on-peak to off-peak periods during a single day).

Market potential is an estimate of the possible energy savings that would occur because of normal market forces (i.e., likely customer adoption over time of various actions without a DSM program).

Marketing cost includes all expenses directly associated with the preparation and implementation of the strategies designed to encourage participation in a program.

Monitoring and evaluation cost refers to expenditures associated with the collection and analysis of data used to assess program operation and effects.

Net effect (sometimes called program effect) is the change in electricity use or demand for a participating customer that can be attributed to the utility DSM program, expressed in MWh/year and MW.

New participants are customers who take part in a program during the current year and did not participate in the program during the previous year.

Non-utility costs are those expenses incurred by customers and trade allies that are associated with participation in a DSM program, but that are not reimbursed by the utility.

Normal replacement is the removal of worn-out (and perhaps obsolete) equipment and the installation of new equipment.

Operating and maintenance costs are non-capital, equipment-related expenses that continue over the life of the equipment; they include fuel costs as well as costs for maintaining and servicing equipment.

Participant costs are those expenses associated with taking part in a DSM program paid by the customer and not reimbursed by the utility.

Participants refers to the units used by a utility to measure participation in its DSM programs; such units of measurement include customers or households for residential programs and customers, floor area, or kW-connected for commercial and industrial customers.

Participation rate is the ratio of the number of participants in a program to the number eligible for the program, with both the numerator and denominator defined in the same units.

Payback acceptance curve is a curve which describes the percentage of customers that would invest in a resource if it provided an acceptable simple payback.

Peak clipping programs aim to reduce electricity demand (kW) at certain critical times, typically when the utility experiences system peaks.

Potential market refers to the maximum effect (in MW or GWh) a DSM program could achieve; it includes technical potential, economic potential, and market potential.

Rate discount is an incentive in the form of lower electricity prices for specified periods.

Rebate is money given to customers, contractors, homebuilders, or other trade allies who make equipment choices to help defray the incremental cost of DSM measures.

Repeats are customers from the prior year who continue to participate in a program.

Replacement programs affect the efficiency of new equipment and systems bought to take the place of comparable equipment.

Retrofit is replacement or upgrading of equipment before it reaches normal retirement age.

Retrofit program upgrade existing facilities and equipment.

Saturation (a measure of stock) is the ratio of the number of specific types of appliances or equipment to the total number of customers in that class or to the total number of appliances or equipment in use (e.g., the fraction of existing homes with double-pane windows).

Simple Payback is the cost of a resource divided by the annual benefits it provides.

Target market is the group of customers (a subset of the eligible market) that is the focus of utility marketing efforts.

Technical potential is an estimate of possible energy savings based on the assumption that existing appliances, equipment, building-shell measures, and industrial processes will be replaced with the most efficient commercially available units regardless of cost.

Total market refers to all the customers in a given class.

Total program costs are all expenses associates with a DSM program regardless of whether they are borne by the utility, participating customer, or trade allies. The costs paid by customers and trade allies are first adjusted for incentives from the utility to avoid double-counting costs.

Turnover is the replacement of existing equipment that has reached the end of is useful life (same as normal replacement).

Utility costs are all the expenses (administrative, equipment, incentives, marketing, monitoring and evaluation and other) incurred by a utility in a given year for operation of a DSM program regardless of whether the costs are capitalized or expensed.

Valley-filling programs typically seek to increase off-peak electricity consumption (without necessarily reducing on-peak demands).

TECHNICAL ANNEX
ATTACHMENT 3

JAMAICA
DEMAND SIDE MANAGEMENT DEMONSTRATION PROJECT

Role of JBS

JBS Understanding of the DSM Project

1. JBS understands the DSM project primary objectives to be:
   - Obtain more efficient use of energy
   - Obtain more widespread us e of renewable energy

The realization of these objectives will significantly lessen Jamaica's dependence on Fossil Fuel thus leading to significant savings of foreign exchange and improved environmental conditions. The mechanisms to be used in achieving the project objectives are:

- Development of the local expertise needed to identify and assess feasible, economic energy efficiency potential
- Designing specific programs to realize the potential.
- Monitoring and Evaluating the specific programs.
- Development of local institutional capabilities to implement the specific programs.
- Conversion of model demonstration programs into full scale national implementation programs.
- Conversion of model demonstration programs into full scale national implementation programs.

JBS further understands that some of the specific programs included in the DSM project are:

- Energy Efficiency Labelling of Refrigerators and Freezers.
- Energy Efficiency in Buildings
- Energy Efficiency Lighting.
- Utilization of Solar Collectors and Systems

These are all programs that require major standardization, testing and quality inputs in order to be successful and therefore will require an input by the JBS.

Role of JBS in DSM Project

2. The Jamaican public has always been skeptical of self certification and will not readily accept or participate in programs where implementer is involved setting the product standard, conducting the standard compliance tests and quality checks. In this type of marketplace the JBS envisage that it should have the following role in order to give the program its best chance of success.

- Development and promulgation of all national product and code of practice standards required for the DSM program.

- Evaluatory testing of all products to be supplied to the program to determine compliance with required standards.

- Sample shipment testing to determine compliance of delivered shipments with evaluatory testing standard.

- Certification of installation quality for solar water heaters and systems.

- Energy labelling of all appliances falling under the DSM project including the printing, issuing and controlling of labels.

- Enforcement of the Energy Labelling, Energy Building Code and 1 other mandatory national standards falling under the DSM project.

- Policy direction of all public education campaign associated with national standards falling under the DSM project.

- Investigation of quality related consumer complaints.

- An input into warranty conditions to be extended to products or system.

Current Capabilities and Difficulties

3. Capabilities. The JBS has the following capabilities in relation to the specific programs that its participation is expected.

State of the art Refrigerator/Freezer Test Chamber with the associated measuring equipment and test software on all models of refrigerators and freezers. The facility allows up to six (6) models of refrigerators of freezers to be tested simultaneously.

- A computerized Solar Laboratory consisting of a simulated insolation collector test loop, a dual plane tracking collector test loop and a water heater system test loop capable of assessing all collectors or complete collector water heating systems safety and performance parameters.

- A package of discrete measuring devices which can assess all the performance parameters of energy efficient fluorescent or incandescent lamps.

- Ongoing standards review and development committee for appliance testing & labelling, solar energy and energy building code.

- Adequate national mandatory labelling and test standards to ensure all vendors and manufacturers of refrigerators or freezers in Jamaica conform to energy labelling.

- Code requirements, guideline documents and compliance forms for the energy efficiency building code. These constitute the full range of items needed for practicing architects and engineers to met the code.

- A team of trained local experts capable of training practicing architects and engineers to design or retrofit buildings to meet the energy code.

- Solar collector and solar hot water heating system installation standards that permit adequate safety and performance assessment of these products.

- On site engineering programming skills capable of dealing with any hardware or software problems that may arise from time to time.

4. Difficulties. The JBS has the following difficulties in relation to the specific programs that its participation is expected:

- No institutional funding provision to deal with contingencies, maintenance or training

- Extremely rapid staff turn-over due to uncompetitive salaries in a fast rising cost of living environment. The laboratory handling energy testing has lost five (5) of its nine (9) staff members in the last twelve (12) twelve months and have not been able to recruit any replacement to date.

- The inability of the JBS to attract or retain the type of staff that can adequately handle the testing as well as software and hardware problems which arise periodically.

- Insufficient capable staff to man testing operations, ensure agreed on turn around time and succession planning.

- Only one staff member capable of operating the Test Chamber and performing his job as department head, limiting severely the actual time he can spend in testing or trouble shooting during the work day. The staff member's departmental statute arose from the above mentioned rapid staff turn-over problem.

- A Refrigerator/Freezer Test Chamber which has blower fans to motor coupling problems and has been the source of about seven (7) months of testing delays.

- Test software development problems resulting in about twelve (12) months of delay. This arose from the inability of World Bank/CIDA funding to support the preferred North American Software development.

- Untrained and inexperienced Solar Laboratory staff who could not handle the solar collector and systems testing speedily. Several months has to be allowed for understanding and activation of the test circuits and even to date one of the three (3) test circuit has not been successfully activated.

- The Solar Laboratory test circuits do not allow more than one collector and system to be tested at a time.

- Previously trained staff for operation of the Solar Laboratory has long left the JBS and the JBS cannot afford the cost of bringing back the American who had set up the laboratory to retrain present staff.

Proposed Action Plan to Eliminate Difficulties

5. The following set of proposals if implemented in full will eliminate all the problems currently being experienced with the JPS energy testing capability and ensure an ongoing capability to furnish timely and reliable testing.

- To pay staff employed to the Energy Laboratories salaries and benefits comparable to the private sector and thus be able to recruit and maintain the expertise required to obtain efficient work.

- To recruit two (2) engineers (one mechanical and one electrical) with computer programming skills to operate the Solar & Energy Efficiency Testing Laboratories respectively and to allocate adequate staff as required.

- To bring back Expert from FSET Labs in Phoenix for two (2) weeks to conduct a training and systems activation assignment in the hardware and software areas of the Solar Laboratory.

- To replace the existing four (4) blower fans/motors on the Refrigerator/Freezer Test Chamber with motors that have extended shafts on which blower fans are directly mounted this eliminating recurring coupling problems and fan motors failures.

- To establish a contingency fund from which will enable overtime work, and consultancy assignments such as software improvements and special assignments to be undertaken.

- To price testing so that it is cost effective or as close to cost effectiveness as is possible.

- To define turn-around times in light of initial testing experience and ensure that the schedules are met at all cost.

Budget

6. The attached budget shows the resources required to achieve the above mentioned action plan and how it should be financed. The approach taken in formulating a budget aims at creating as close as possible as self sustaining operation, (i.e. a financially viable operation) within the shortest time-frame. It is clear that the solar and Refrigerator/Freezer Test Labs by themselves or taken together cannot be financially viable and therefore other laboratories must be added to broaden the earning base and keep Energy Labelling test fees affordable. A five (5) year period facilities on stream bearing in mind that laboratory space will have to be constructed and that while the Jamaican Government is committed to the laboratory construction it has only been able to provide a token provision in its 1993-94 budget. If the Jamaican Government could be persuaded to provide construction funding in the 1994-95 Financial Year then the project's time-table should hold up.

TECHNICAL ANNEX
ATTACHMENT 3

Item #	Description	Estimated Expenses in J$M					Project Costs
		1994	1995	1996	1997	1998	
1	Salary & Benefits Cost for two engineers to man Solar & Energy Efficiency Labs.	1.20	1.32	1.45	1.60	1.76	$7.33
2	Support staff (technicians & secretarial) for engineers in Item 1.	0.15	0.17	0.18	0.38	0.42	$1.30
3	Training & debugging of software at JBS by DSET expert for 2 weeks to enable staff to fully operate solar lab hardware and software	0.25	--	--	--	--	$0.25
4	Replacement of 4 blower motor fan to eliminate the fan creep & motor burning phenomena	0.07	--	--	--	--	$0.07
5	Maintenance/hardware & software improvements	0.20	0.06	0.07	0.30	0.09	$0.72
6	Utilities	0.10	0.12	0.25	0.50	0.55	$1.52
7	Stationery & Supplies	0.05	0.06	0.07	0.08	0.09	$0.35
8	Establishment of energy labelling test facility for motors	--	--	2.50	--	--	$2.50
9	Establishment of energy labelling test facility for gas & electric stoves	--	--	3.75	--	--	$3.75
10	Establishment of energy labelling test facility for washer & dryers	--	--	1.87	--	--	$1.87
11	Establishment of energy labelling test facility for Air Conditioning Units up to 10 tons	--	--	12.5	--	--	$12.50
12	Consultancy Service for design, purchase & construction bidding including contractor selection, management of construction and commissioning phases, as well as energy labelling	--	1.00	0.50	0.25	--	$1.75
TOTAL EXPENSES		2.02	2.73	23.14	3.11	2.91	$33.91

TECHNICAL ANNEX
ATTACHMENT 3

Item #	Description	Estimated Expenses in J$M					Project Costs
		1994	1995	1996	1997	1998	
1	Fees charged for testing and energy labelling (payable by distributors & manufacturers of the energy consuming products to be labelled	0.27	0.31	0.48	1.20	$3.33	
2	Government of Jamaica contribution to the development & maintenance of national energy standards	0.28	0.42	1.04	1.07	1.71	$4.52
3	World Bank/GEF/RF/IDB contribution grant to establishment of test facilities. Training and software improvements	0.47	1.00	21.12	0.47	--	$23.06
4	JPS contribution to obtaining and maintaining quality energy efficient products	1.00	1.00	0.50	0.50	--	$3.00
TOTAL EXPENSES		2.02	2.73	23.14	3.11	2.91	$33.91

TECHNICAL ANNEX
ATTACHMENT 4

JAMAICA
DEMAND SIDE MANAGEMENT

Assumptions for Cost/Benefit Analysis Using EPRI/DSMANAGER Model

1. System Load Shapes. Four system load shapes were used for each month: an average weekday, an average saturday, an average sunday, and the peak day of the month. A total of 48 system load shapes per year were used. Energy conservation measure and customer load shapes were imported from local energy audits or from adjusted U.S. data when not available.

2. Discount Rate. A discount rate of 12 percent was used throughout. The analysis was carried out in 1993 constant US$.

3. Exchange Rate. An exchange rate of 27 J$ per 1 US$ was used.

4. Peaking Period. The system peaking period was estimated from 9 AM to 4 PM and from 7 PM to 9 PM. Although JPSCo. considers a peaking period from 8 AM to 10 PM, a shorter more critical period was used in the cost benefit analysis in order to avoid underestimating the benefits of reducing the evening peak. The system peak day of the year was used for determining the fraction of capacity credit.

5. Value of Capacity and Energy. Because of the large differential in the demand charge under the proposed rates that will be implemented in April 1994, the base case was run using the proposed rates.

6. For the utility and societal perspective, the JPSCo. Long Run Marginal Cost (LRMC) was used. For a conservative evaluation of the DSM. program, the values for the transmission and distribution LRMC were not used. The generation LRMC used was US$ 10.67/kW/month. The energy component of the LRMC used was the following: 5.58 USc/kWh for on-peak energy, and 3.98 USc/kWh for off-peak energy.

7. The credit for technical losses is as follows: R50 and R40 at 6 percent, and R20 and R10 at 10 percent.

Class	Current Tariffs		Proposed Tariffs	
	Energy USc/kWh	Capacity US$/kW/month	Energy USc/kWh	Capacity US$/kW/month
R10	15		15	
R20	15		15	
R40	11	7.65	5	31.88
R50	11	5.04	5	23.68

8. Equipment Prices and Taxes. The price of equipment was determined using data from local building energy audits. U.S. equipment retail prices where used when data was not available. The following import duties for equipment were used: energy efficient lighting 5 percent, air conditioning and other electrical equipment 15 percent, solar water heating 5 percent (rates would vary from 0 percent for locally manufactured, 5 percent from CARICOM countries, and 15 percent from other countries). The following sales tax was used: energy efficient lighting and solar water heating 0 percent, air conditioning and other electrical equipment 12.5 percent.

9. Definition of Large Commercial. Includes R40 and R50 customers, with an estimated total energy consumption of 335,903 MWh and 463 customers in 1992, based on extrapolation of survey, and review of customer billing data. Due to the lack of information for properly disagregating the sector by subsector, the large commercial was disagregated by two representative load shapes. A load where most of the consumption is occurring during daylight hours (office buildings and retail) and a load where most of the consumption is even during the entire 24 hour period (hotels, and hospitals). For the evaluation of the five-year DSM Demonstration Project for the large commercial office building type component, the loads utilized for the participating facility was similar to that of the JPSCo. headquarters building (about three times the average load) rather than the average load for that customer class (total load for that customer class divided by the number of customers) since those are the type customers targeted under the five year program. For the evaluation of the fifteen year program (full scale implementation) however, the average customer load was utilized. The breakdown for end-use in large commercial office-type buildings is as follows: air conditioning 55 percent, lighting 25 percent, other 20 percent. Air conditioning and lighting are the targeted end-uses. The breakdown for end-use in hotel-type buildings is as follows: air conditioning 60 percent, refrigeration 15 percent, lighting 10 percent, hot water 5 percent, other 10 percent. 75 percent of customers and 60 percent of the energy are considered to be in the office-type buildings and the remaining 25 percent and 40 percent of the energy in the hotel-type buildings.

10. Standard ballasts are assumed as the base case. In the office-type buildings, 10 percent of total lighting energy is assumed to be incandescent, and the remaining 90 percent fluorescent tubes. Operating hours are estimated at 3636 h/year. In the hotel-type buildings, 60 percent of total lighting is estimated to be incandescent, and the remaining 20 percent fluorescent. Operating hours of lamps on average is estimated at 3000 h/year.

11. Air conditioning systems as a percent of total air conditioning loads in office-type buildings were estimated as follows: 15 percent chillers, 50 percent DX, 10 percent window units, 25 percent split systems. For hotel-type buildings, the estimates were as follows: 60 percent chillers, 30 percent split systems, 10 percent window units.

Water heating is considered only in the hotel-type buildings, with 8760 hours of operation.

12. Definition of Small Commercial. End-use breakdown is as follows: lighting 50 percent, refrigeration 25 percent, air conditioning 15 percent, water heating 5 percent, other 5 percent.

Hours of operation are estimated at 2704 h/per year (11h/day * 5 * 52). 30 percent of lighting consumption is from incandescent, and the remaining 70 percent fluorescent. 100 percent of air conditioning is window units. Small commercial are all in the R20 class, representing 26,842 customers and 323, 953 kWh.

13. Definition of End Use Load Shapes. Hourly load shapes were required for several different end uses for both office type buildings and hotel type buildings. The end uses include air conditioning, kitchen/cooking lighting refrigeration and total building. Where possible, the shapes were developed from JPS data. For hotel type buildings, the proportion of energy for each end use was estimated from an energy audit of an existing hotel. The monthly and hourly distribution was estimated from in formation in another energy audit.

14. For the office building the air conditioning load shape was determined from the energy audit of the JPSCo. facility. The other end use load shapes were from research in the United States at Bonneville Power Authority (BPA). The total office load shape was from the BPA research except that the BPA air conditioning was removed and replaced with the JPSCo. air conditioning load shape.

15. Residential and Commercial Solar Water Heating Assessment

The energy savings for the residential solar water heating was 95% of the customers electric consumption 2613 Kwh (2750 Kwh *.95). The estimated incremental cost of the system was $700.

16. The commercial solar system was based upon the analysis contained in the energy audit of the Half Moon Hotel[1]. Although several systems were analyzed for the hotel, one the most promising was utilized. This system would conserve 7221 Kwh per year and cost approximately $3270 per system.

The residential and commercial hotel load shape was used to represent the distribution of this energy over the year.

17. The end operating hours were estimated from the end-use load shape used in DSManager It was assumed that approximately 90% of the end use technology was connected at the end use peak. Therefore, the actual operating hours were assumed to be approximately 10% less than the hours of the end use load shape.

18. The connected demand of the base technology was based upon a four bulb fluorescent fixture with magnetic core ballasts. Based upon Source 1, the connected load of this technology is .188 Kw. The energy savings and total costs were provided by Source 2. The cost assumes that one sensor controls two fixtures each with four fluorescent bulbs.

19. The participants for the Large Commercial Existing and New were assumed to be 4.5 times larger than the average office type or hotel type building. This larger size is similar to the JPSCo. building for the office type buildings, as explained before. The average Small Commercial building consumption was only 12068 Kwh. It was assumed that the

[1] May 1992, Page 170.

demonstration program would be directed to Small Commercial customer approximately 10 times larger than the average. This would result in customer that have peak demands consistent with General Service Rate 20.

The Large Commercial New assumed the following participation:

Year	Office	Hotel
1994	0	0
1995	1	0
1996	1	1
1997	1	1
1998	1	1
Total	4	3

20. Because each participant was assumed to have 4.5 times the consumption of the average customer, in DSManager 4.5 participants were entered for each actual program participant.

21. In the fifteen year plan it was assumed that the number of new buildings added on the system would be approximately 4% of the existing. It was assumed that 50% of these buildings would participate.

The Large Commercial Existing assumed the following participation:

Year	Office Type	Hotel Type
1994	1	0
1995	1	1
1996	2	2
1997	2	2
1998	1	1
Total	7	6

22. For the fifteen year plan, it was assumed that over the ten years after the five year plan, 50% of the existing buildings would participate.

The Small Commercial Phase 1 program assumed the following participation:

Year	Office Type
1994	3
1995	7
1996	0
1997	0
1998	0
Total	10

23. The Small Commercial Phase 2 program assumed the following participation:

Year	Office Type
1994	0
1995	0
1996	7
1997	7
1998	6
Total	20

24. The Residential Compact Fluorescent program assumed the following participation in terms of dwellings with efficient bulbs assuming 1.8 bulbs per dwelling:

Year	Dwellings with Compact Fluorescent
1994	167
1995	5555
1996	11111
1997	16667
1998	22222
Total	55722

This results in a total of 100,000 bulbs.

The Solar Water Heating program assumed the following participation:

Year	Residential	Commercial
1994	3	3
1995	3	3
1996	3	3
1997	3	3
1998	3	3
Total	15	15

The participants were assumed to install a mix of efficient technologies.

The Commercial and Residential Refrigeration Assessment program assumed the following participation:

Year	Residential	Commercial
1994	25	25
1995	50	25
1996	50	25
1997	50	25
1998	50	25
Total	225	125

The participants were assumed to install a efficient refrigeration unit.
The Commercial and Residential Refrigeration Assessment program assumed the following participation:

Year	Residential	Commercial
1994	25	25
1995	50	25
1996	50	25
1997	50	25
1998	50	25
Total	225	125

The participants were assumed to install a efficient refrigeration unit.

The Commercial and Residential Air Conditioner Assessment program assumed the following participation:

Year	Residential	Commercial
1994	25	25
1995	50	50
1996	50	50
1997	50	50
1998	50	50
Total	225	225

The participants were assumed to install a efficient air conditioner unit.

25. Administration and Rebate Costs

The administration and rebate costs for the five year plan were provide by JPSCo. staff.

26. The administration costs for the 15 year plan were assumed to be 30% of the customer incremental costs. This is the upper range estimated in an analysis for Bonneville Power Authority.

TABLES AND FIGURES

TECHNICAL ANNEX
ATTACHMENT 5

JAMAICA

DEMAND SIDE MANAGEMENT PROJECT

List of Documents Available in Project File

A. Technical

1.	Power by Efficiency, Conservation Law Foundation of New England	June 1990
2.	JPSCo. "Working Paper"	November 1992
3.	Jamaica Energy Sector and Investment Planning Study, ESMAP	August 1992
4.	Cogeneration Prefeasibility Study - Erickson	October 1993
5.	PPA Terms of Reference	February 1993
6.	Draft PPA Studies Report JPSCo.	August 1993
7.	Draft Cogeneration Policy	June 1993
8.	Draft Standard Offer Contract	August 1993

B. Institutional

1. The Electricity Lighting Act
2. JPSCo. Memorandum of Associations
3. Natural Resource Conservation Authority Act

TECHNICAL ANNEX
TABLE 1

JAMAICA
DEMAND SIDE MANAGEMENT DEMONSTRATION PROJECT
Table 1. Detailed Financing Plan
(in US$ million)

Project Components	GET	IDB	RF	CTF	JPSCO	Total
A. Commercial Sector						
Large Commercial New	—	—	—	—	0.875	0.875
Large Commercial Retrofit	—	0.450	—	—	1.625	2.075
Sub-Total Large Com.	—	0.450	—	—	2.500	2.950
Small Commercial Direct Install (Phase I)	—	0.150	—	—	—	0.150
Small Commercial Phase II	—	—	—	—	0.225	0.225
Sub-Total Small Com.	—	0.600	—	—	0.225	0.375
Cogeneration	—	—	0.237	—	—	0.237
Sub-Total Commercial	—	0.600	0.237	—	2.725	3.562
B. Residential Sector						
Lighting (Phase I)	—	0.024	—	—	—	0.004
Lighting (Phase II)	—	1.300	—	—	—	1.300
Sub-Total Lighting (1)	—	1.304	—	—	—	1.304
Solar Water Heater Ass.	—	0.024	—	—	—	0.024
Refrigerators Ass.	—	0.024	—	—	—	0.024
Air Conditioning Ass.	—	0.024	—	—	—	0.024
Sub-Total Residential	—	1.376	—	—	—	1.376
C. Industrial Sector						
Assessment	—	0.150	—	0.150	—	0.150
D. Programs Monitoring & Evaluation & Quality Control	0.591	0.590	—	—	—	1.181
E. DSM Unit Institutional Building & Administrative Costs						
Salaries	—	—	—	—	1.020	1.020
Training	0.300	—	—	—	—	0.300
Public Relations/Information Campaigns	—	—	—	—	0.340	0.340
Vehicles	—	0.075	—	—	—	0.075
Testing & Monitoring Equipment	0.670	—	—	—	—	0.670
Computers & Software	0.300	—	—	—	—	0.300
Technical Assistance	1.000	0.500	—	—	—	1.500
Sub-Total DSM Unit	2.270	0.575	—		1.360	4.205
F. Institutional Strengthening						
JBS	—	0.600	—	—	—	0.600
NRCA	0.105	—	—	—	—	0.105
JET and Other NGOs	0.080	—	—	—	—	0.080
Sub-Total Institutional	0.185	0.600	—	—	—	0.785
G. Contingencies	0.754	0.259	—	—	0.228	1.241
Total	3.800	4.000	0.237	0.150	4.313	12.500

TECHNICAL ANNEX
TABLE 2

JAMAICA
DEMAND SIDE MANAGEMENT DEMONSTRATION PROJECT
Table 2. Categorization of Procurement Items
(US$ million)

Estimated Cost	Goods	Tech. Assis., Cons. Serv. & Training	JPSCo. Adm. Expenses	Total
A. Commercial Sector				
Large Commercial New	0.875	—	—	0.875
Large Commercial Retrofit	2.075	—	—	2.075
Sub-Total Large	2.950	—	—	2.950
Small Commercial Direct Install (Phase I)	0.150	—	—	0.150
Small Commercial Phase II	0.225	—	—	0.225
Sub-Total Small C.	0.375	—	—	0.375
Cogeneration	—	0.237	—	0.237
Sub-Total Commercial	3.325	0.237	—	3.562
B. Residential Sector				
Lighting (Phase I)	0.004	—	—	0.004
Lighting (Phase II)	1.300	—	—	1.300
Sub-Total Lighting (1)	1.304	—	—	1.304
Solar Water Heater	—	0.024	—	0.024
Refrigerators	—	0.024	—	0.024
Air Conditioning	—	0.024	—	0.024
Sub-Total Residential	1.304	0.072	—	1.376
C. Industrial Sector				
Assessment	—	0.150	—	0.150
D. Programs Monitoring Evaluation & Quality Control	—	1.181	—	1.181
E. DSM Unit Institutional Building & Administrative Costs				
Salaries	—	—	1.020	1.020
Training	—	0.300	—	0.300
Public Relations/Information Campaigns	—	—	0.340	0.340
Vehicles	0.075	—	—	0.075
Testing & Monitoring Equipment	0.670	—	—	0.670
Computers & Software	0.300	—	—	0.300
Technical Assistance	—	1.500	—	1.500
Sub-Total DSM	1.045	1.800	1.360	4.205
F. Institutional Strengthening				
JBS	—	0.600	—	0.600
NRCA	—	0.105	—	0.105
JET and Other NGOs	—	0.080	—	0.080
Sub-Total Institutional	—	0.785	—	0.785
G. Contingencies	0.353	0.660	0.228	1.241
Total	6.027	4.885	1.588	12.500

TECHNICAL ANNEX
TABLE 3

JAMAICA

DEMAND SIDE MANAGEMENT PROJECT

Table 3: Summary of Benefits of Five-Year DSM Program
1994 - 1998: Societal Test

1. Levelized Total DSM Investment Cost (US$/KWh)	0.0473
2. Benefit Cost Ratio	1.47
3. NPV of Net Benefits (US$ Million)	3.545
4. Total Fuel Oil Savings (bbl[1])	894,408
5. Total CO_2 Reductions[1],[2] (tons)	507,611
6. Total CO_2 Reductions by 1998 (tons)[3]	88,590
7. Total Fuel Foreign Exchange Savings (at US$15 bbl) (in Million US$)[1]	13.4

[1]. Based on a total cumulative GWh saved under 5 year investment program of 426,564 MWh (benefits considered through year 2017 - considering the life of each measure).

[2]. 1.19 Kg of CO_2/KWh.

[3]. Based on cumulative energy savings of 74,445 MWh by 1998.

TECHNICAL ANNEX
TABLE 4

JAMAICA

DEMAND SIDE MANAGEMENT PROJECT

Table 4. JAMAICA: Jamaica Public Service
MW Savings by Plan (5 Year) by 1998

	1994	1995	1996	1997	1998	2008[1]
Residential & Commercial A/C Window Units Plan	0.009	0.028	0.046	0.065	0.083	0.370
Large Commercial Plan Existing Buildings	0.244	1.018	2.359	3.615	4.202	14.979
Large Commercial Plan New Buildings	0.000	0.217	0.492	0.928	1.588	5.992
Residential Compact Fluorescent	0.002	0.064	0.189	0.376	0.625	1.254
Res. & Comm. Refrig. & Freezer Plan	0.006	0.014	0.023	0.031	0.040	9.479
Small Commercial Phase I and II CFL	0.002	0.004	0.006	0.009	0.012	0.039
Solar Water Heater Plan Res. & Commercial	0.019	0.063	0.106	0.145	0.170	4.155
Summary of all Plans	0.281	1.408	3.221	5.169	6.720	36.264

[1] These savings reflect those that can be achieved through a 15 year full-scale DSM program based on the measures tested by the Demonstration Project.

TECHNICAL ANNEX
TABLE 5

JAMAICA

DEMAND SIDE MANAGEMENT PROJECT

Table 5. MWh Savings by Plan (15 Year) by 1998

	1994	1995	1996	1997	1998	2008[1]
Residential &Commercial A/C Window Units Plan	36	107	178	249	320	1,422
Large Commercial Plan Existing Building	982	4.293	9,209	13,793	16,227	61,787
Large Commercial Plan New Buildings	0	900	2,139	4,133	6,169	23,882
Residential Compact Fluorescent	18	629	1,851	3,684	6,128	12,287
Res. & Comm. Refrig. & Freezer Plan	44	111	178	245	312	73,966
Small Commercial Phase I and II CFL	17	35	60	85	110	362
Solar Water Heater Plan Res. & Commercial	86	292	492	672	787	17,766
Summary of all Plans	1.185	6,367	14,082	22,862	30,054	191,473

[1] These savings reflect those that can be achieved through a 15 year full-scale DSM Program based on the measures tested by the Demonstration Project.

TECHNICAL ANNEX
TABLE 6

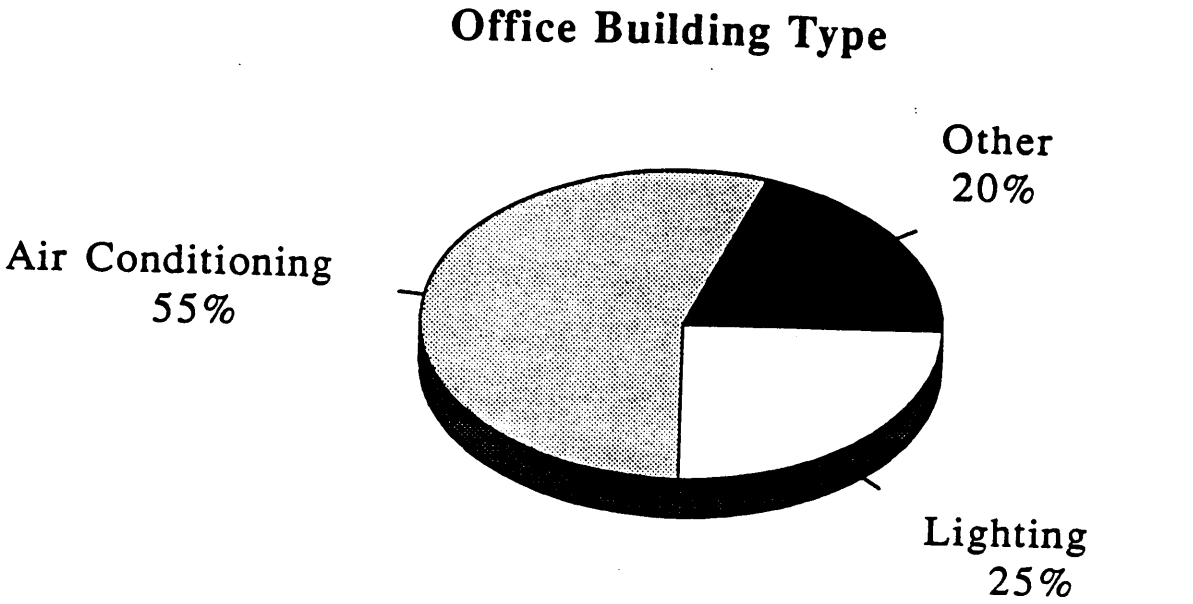
JAMAICA

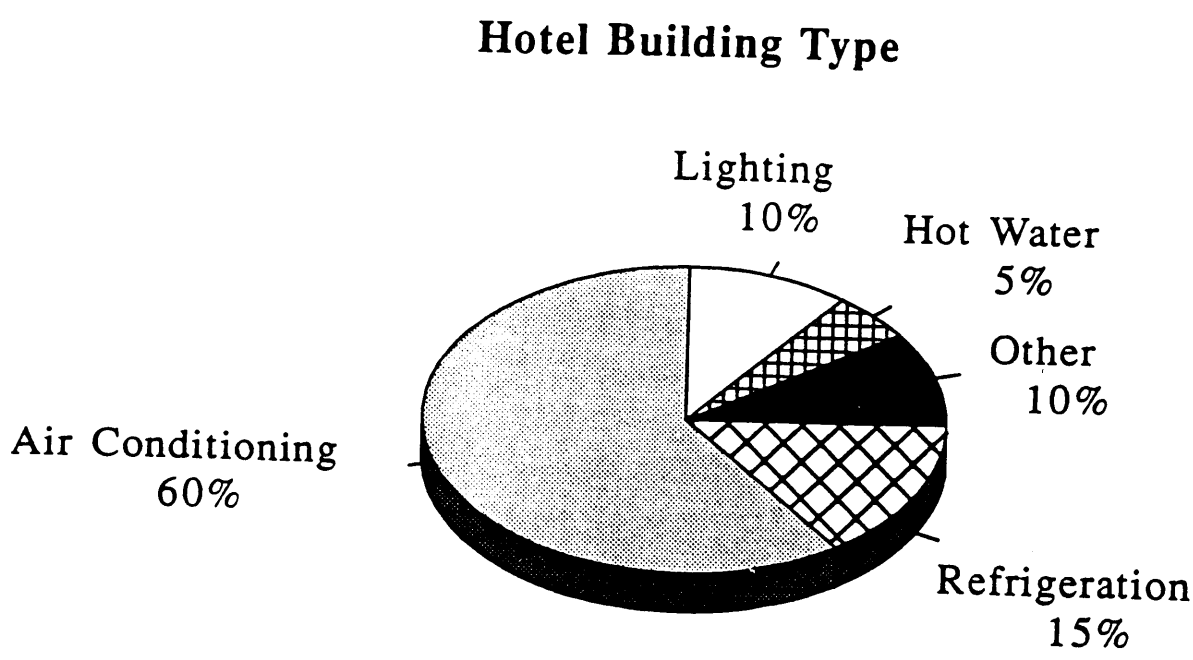
DEMAND SIDE MANAGEMENT PROJECT

Table 6: Cost Effectiveness Screening Calculations
For a Full-Scale 15 Year Program

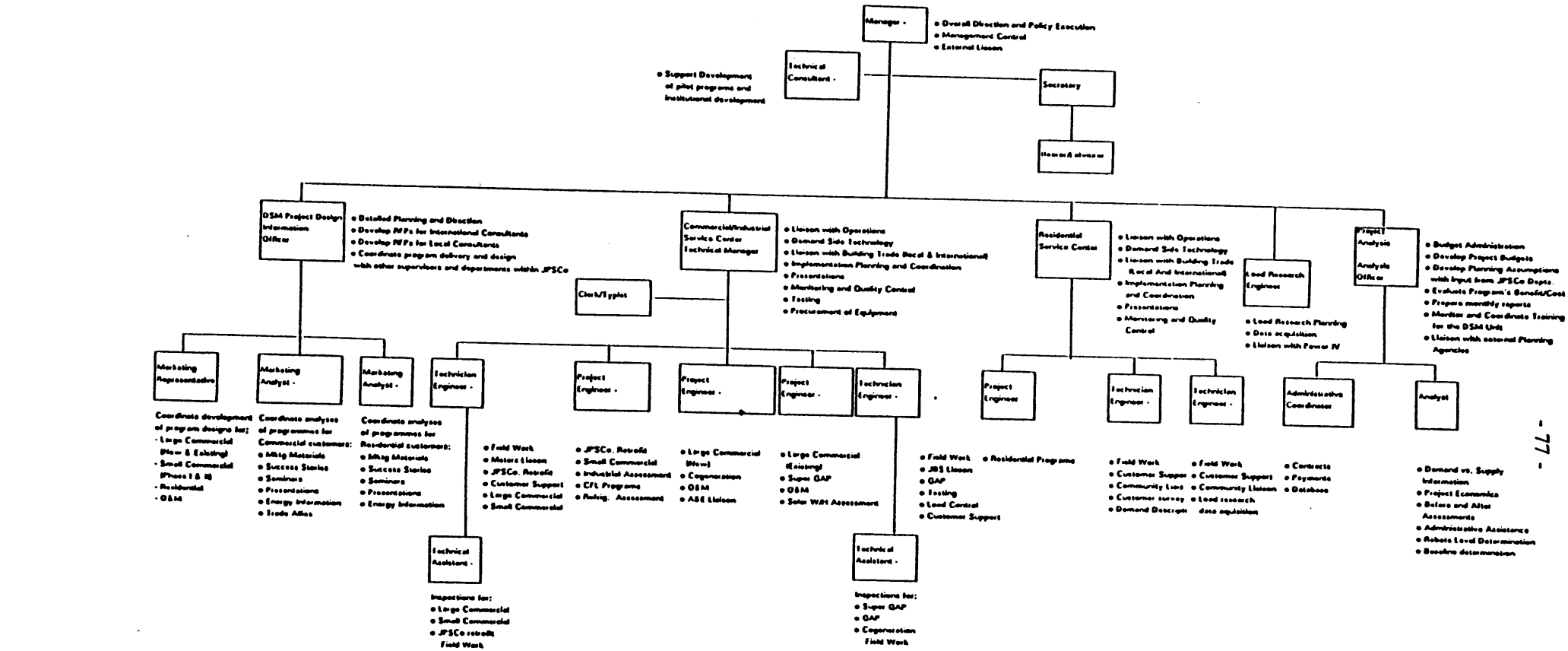
Program	Societal Test Benefit to Cost Ratio
Residential Lighting	1.33
Residential/Small Commercial Air Conditioning	1.55
Residential/Small Commercial Refrigeration & Freezers	2.44
Residential/Small Commercial Solar Water Heating	1.45
Small Commercial Lighting	1.27
Large Commercial Retrofit (Lighting, Air Conditioning, Motors	1.56
Large Commercial New Construction (Lighting, Air Conditioning, Motors)	2.84
Summary of all Plans	1.79

FIGURE 1: END-USE BREAKDOWN FOR LARGE COMMERCIAL





JAMAICA PUBLIC SERVICE COMPANY LIMITED
DEMAND SIDE MANAGEMENT UNIT

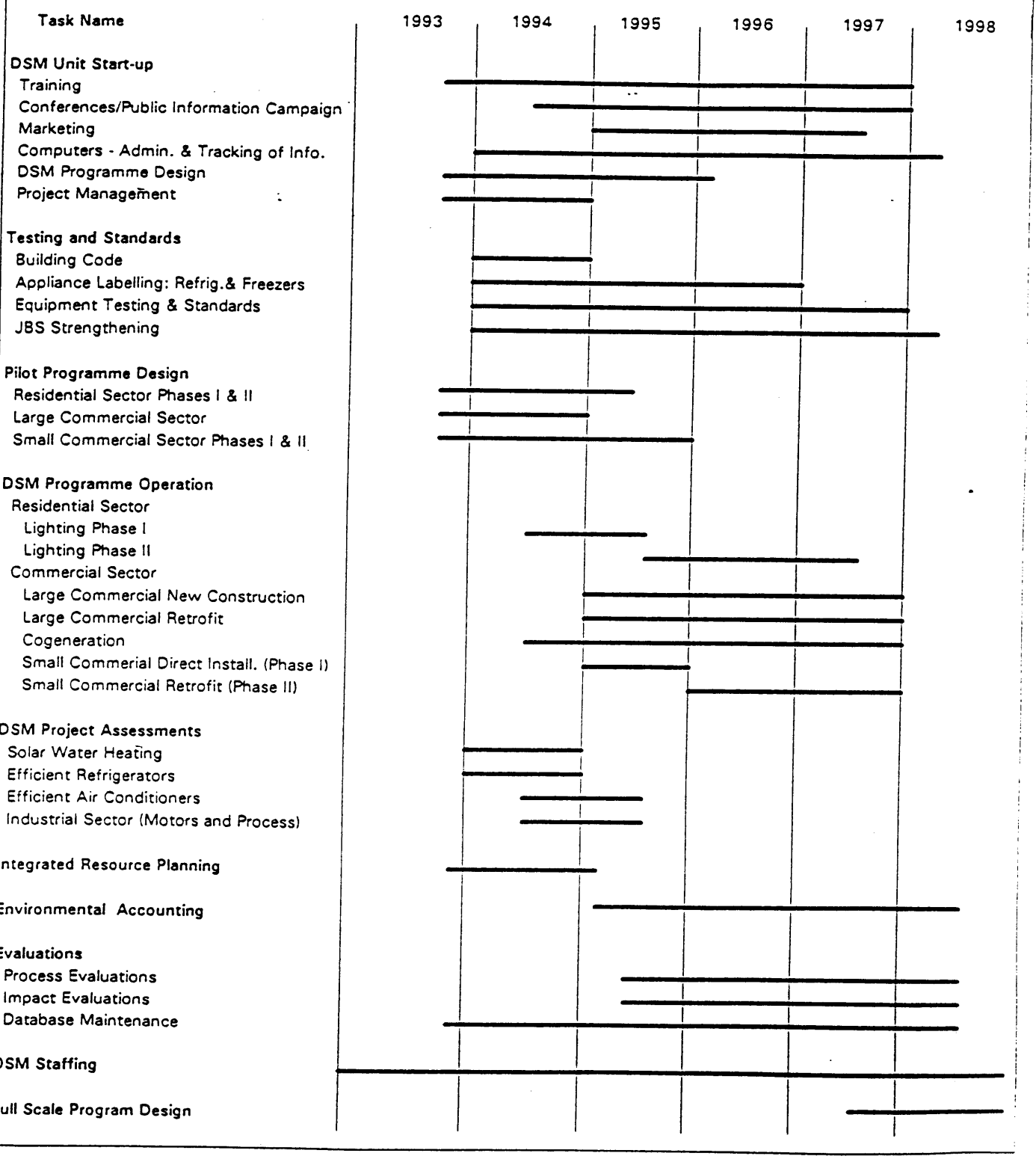


November 1, 1993

TECHNICAL ANNEX
FIGURE 2

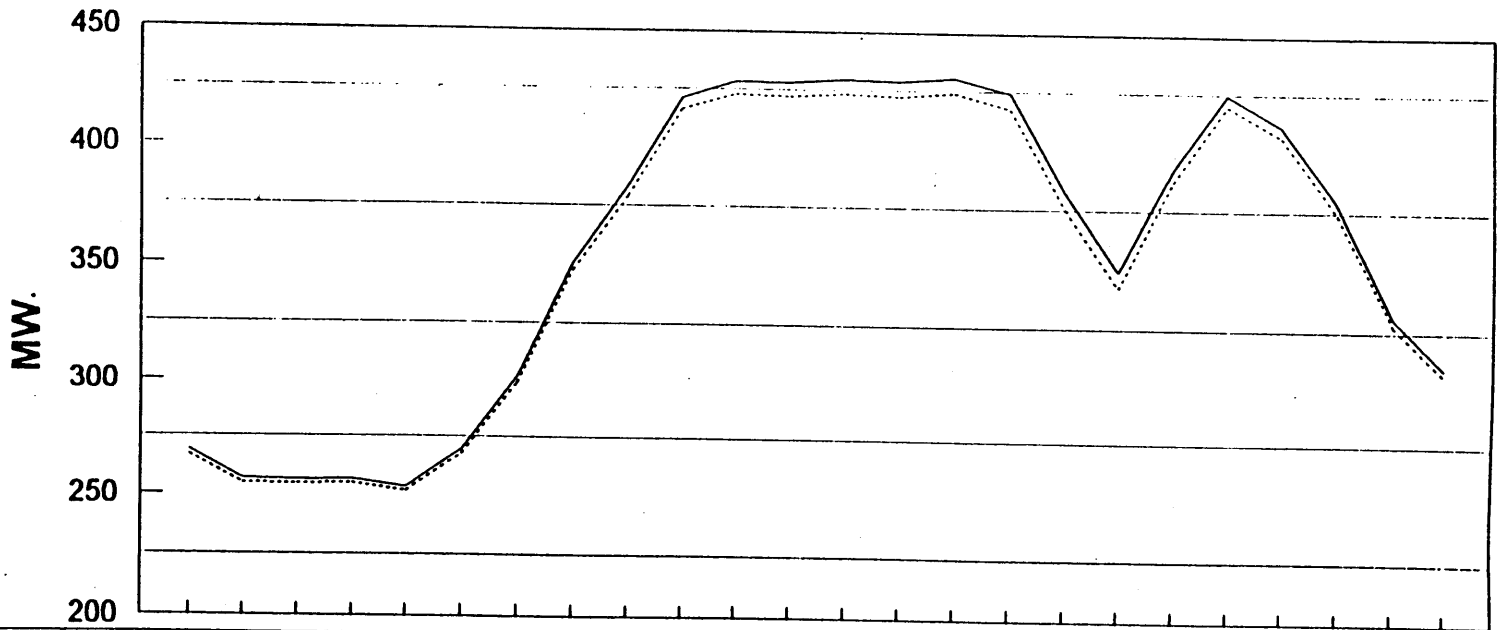
TECHNICAL ANNEX
FIGURE 3

JAMAICA
PROMOTION OF DEMAND SIDE MANAGEMENT DEMONSTRATION PROJECT



Jamaica Public Service Company

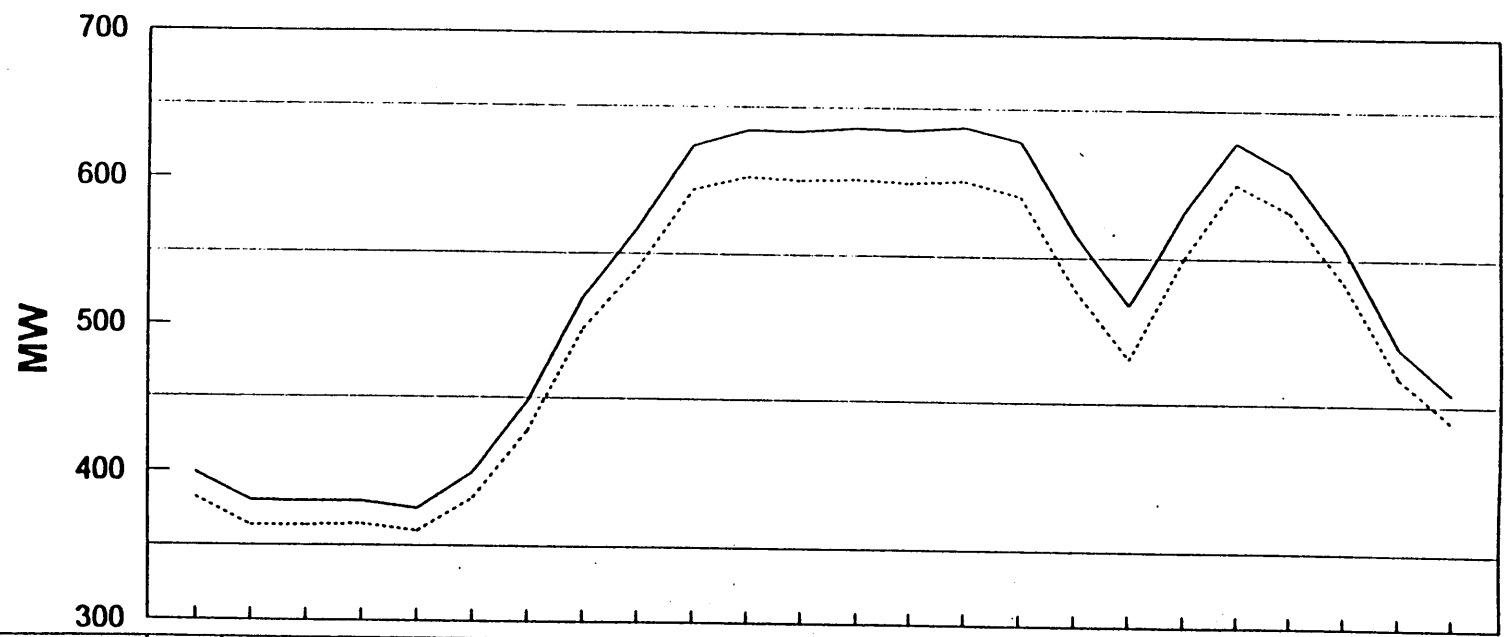
5 Year DSM Resource Plan - 1998 System Peak Impacts (MW)



Hour	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
— Before DSM	269	257	256	257	253	270	302	351	383	421	428	428	430	429	431	425	383	350	393	425	411	379	331	309
··· After DSM	267	255	255	255	252	268	299	348	379	416	423	422	423	423	424	418	376	343	387	420	407	374	328	307

Jamaica Public Service Company

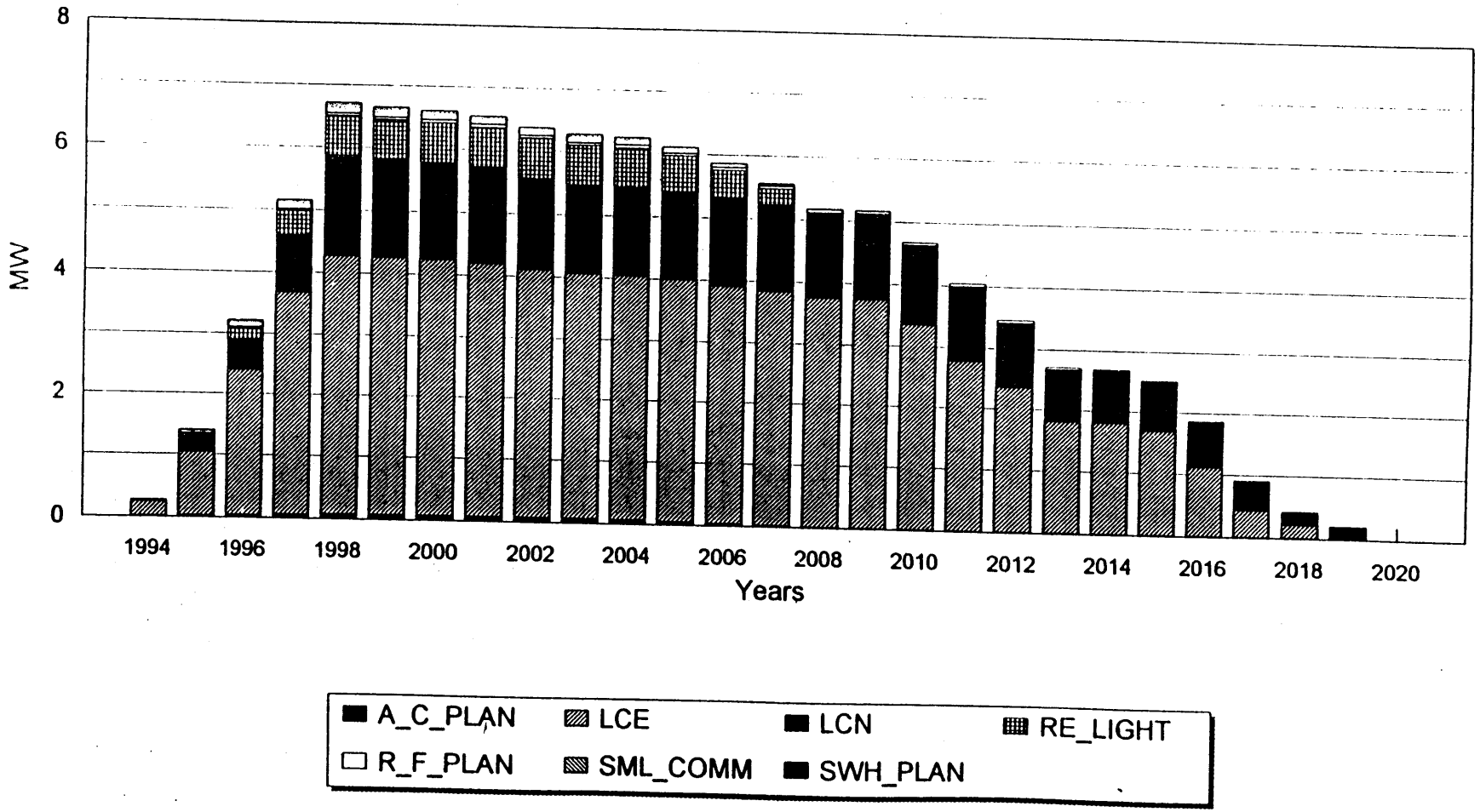
15 Year DSM Resource Plan - 2008 System Peak Impacts (MW)



Hour	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
— Before DSM	399	380	380	380	375	399	447	519	567	624	634	634	636	635	638	628	566	518	581	629	609	560	491	458
··· After DSM	382	364	364	365	360	382	427	498	540	594	603	601	601	599	601	591	528	481	551	600	582	535	469	439

Jamaica Public Service Company

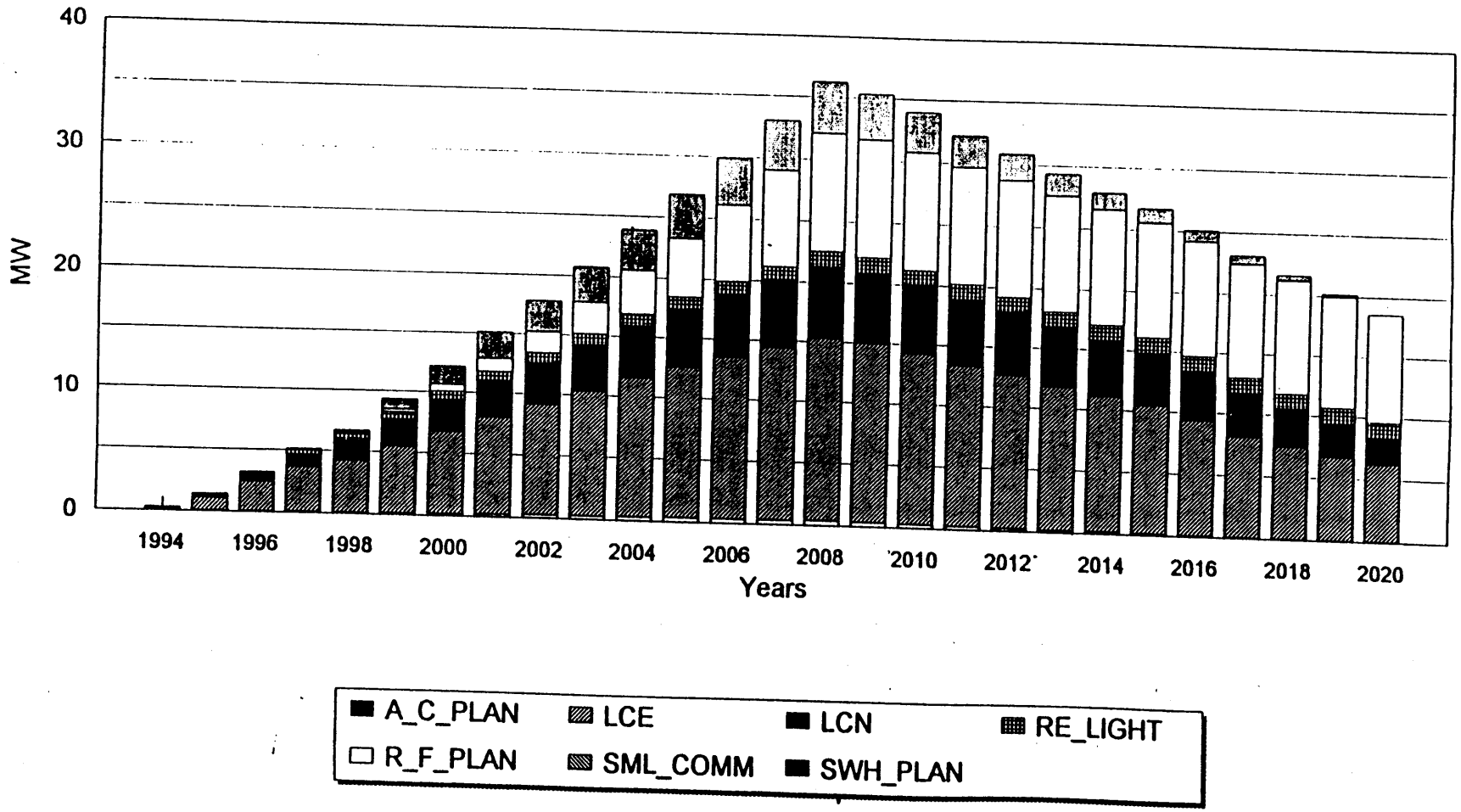
5 Year DSM Resource Plan (MW)



TECHNICAL ANNEX
FIGURE 6

Jamaica Public Service Company

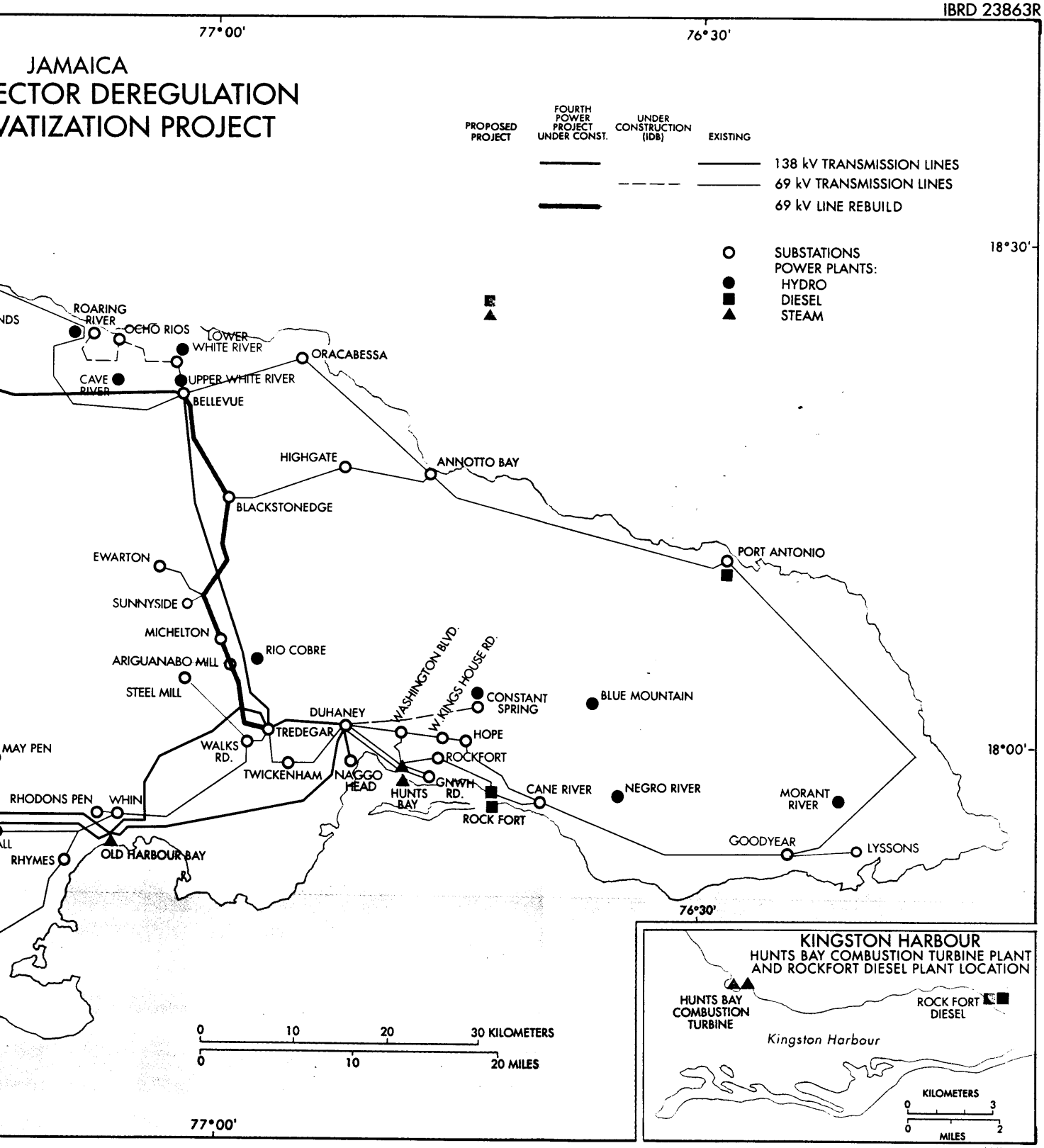
15 Year DSM Resource Plan (MW)



TECHNICAL ANNEX
FIGURE 7

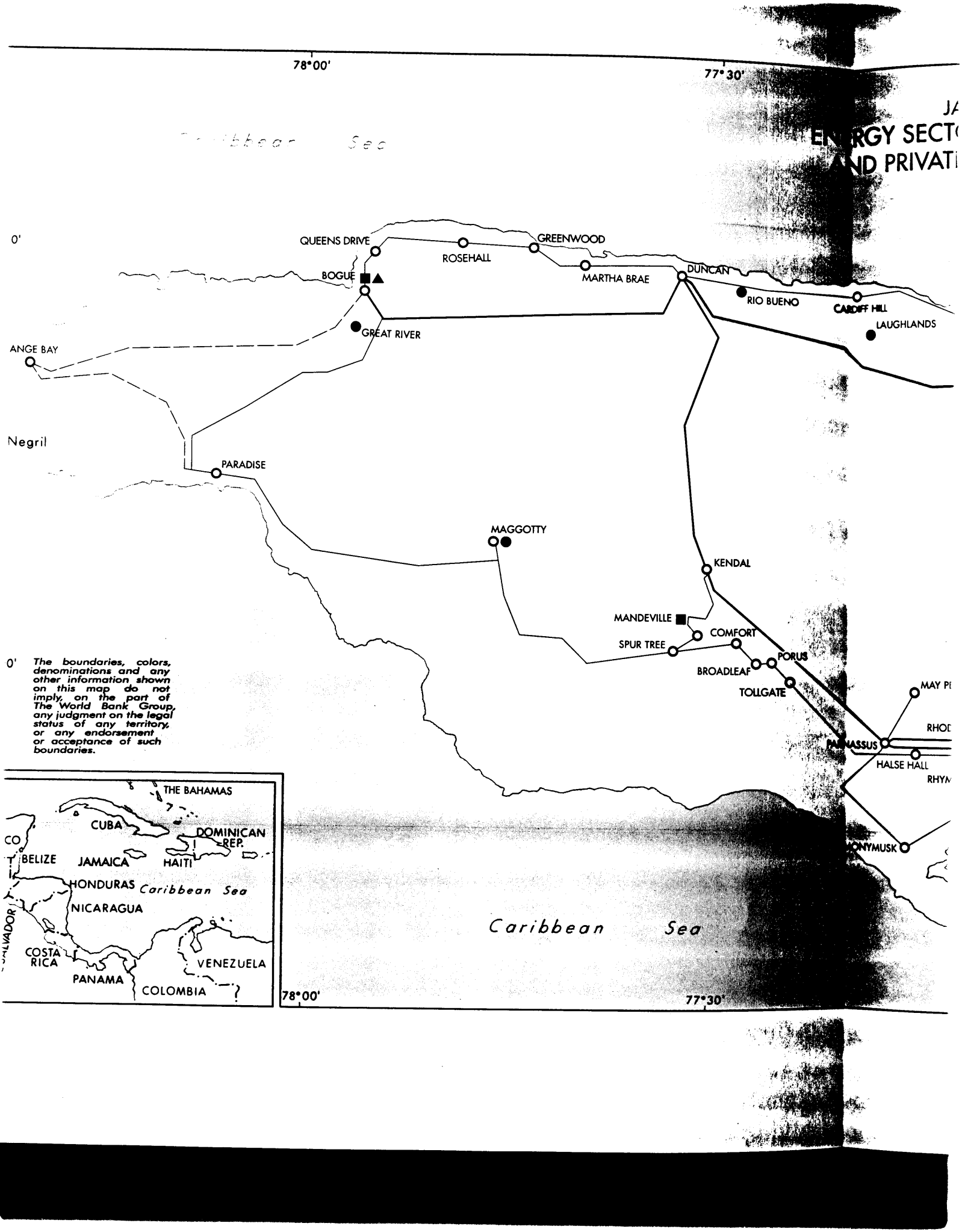
IBRD 23863R

JAMAICA
ECTOR DEREGULATION
VATIZATION PROJECT



KINGSTON HARBOUR
HUNTS BAY COMBUSTION TURBINE PLANT AND ROCKFORT DIESEL PLANT LOCATION

MAY 1994



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