SELF EVALUATION OF THE JAMAICA DSM DEMONSTRATION PROJECT

Hugh Harris and Norman Titus, Jamaica Public Service Company, Kingston, Jamaica

Introduction

Background

Jamaica is a relatively small island located in the Caribbean, approximately 600 miles from the North American mainland. The scenic topography, fine white sand beaches and salubrious climate have made the island a popular vacation spot for tourists. Tourism is thus the largest contributor of foreign exchange earnings, with earnings from bauxite, alumina, sugar, bananas and other agricultural products also of importance. The economy is a highly open one, and as such, the island has been severely affected over the years, by the vicissitudes of the international economic environment - falling international commodity prices, oil price shocks and an international debt overhang.

Since 1980, Jamaica has undertaken structural adjustment in cooperation with the International Monetary Fund (IMF) / World Bank.

Jamaica has a relatively high energy intensity compared to other economies at similar standards of living, such as Tunisia, Turkey, Columbia and Thailand. There has been negligible gain in the efficiency of energy use over the past 20 years. For example, in 1970, the energy intensity index (EII) for the non- bauxite energy sector stood at 105. It currently stands at 112. In comparison the EII for the high income countries averaged 99 during the seventies and currently is at level of 97. [1]

The Jamaica Public Service Company (JPSCo), the island's only electric utility, has developed a Demand Side Management Demonstration Pilot Project in collaboration with the Inter-American Development Bank, the Global Environment Trust Facility/World Bank, the Rockefeller Foundation, and the Canadian Trust Facility. The DSM Project, which is estimated to cost US$12.5 million, is designed to influence customers use of electricity in ways that will produce changes in the utility's load shape, reduce customer bills and reduce JPSCo's cost of producing electricity.

The Project is being executed by the Demand Side Management Unit, within the Corporate Services Division. Cooperation in the implementation and enhancement of individual DSM programme plans is provided by the Jamaica Environment Trust, the National Consumers' League, the United Consumers in Action, and the Natural Conservation Resource Authority. The Jamaica Bureau of Standards has been involved in the testing of energy efficiency lighting and in providing information on Solar Water Heating Standards and Energy Efficiency Building Codes and Standards, with a view to addressing the current void of enforced codes and standards.

The programmes falling under the umbrella of the Demand Side Management Demonstration Pilot Project with implementation dates are as follows:

- Residential Phase 1, 1994-1995
- Residential Phase II, 1996-1998
- Small Commercial Phase I, 1996-1998
- Large Commercial Retrofit, 1996-1998
- Large Commercial New Construction, 1996-1998
- Assessments of Solar Water Heating, Refrigeration
- and Air Conditioning systems, 1995-1998
- Cogeneration component targeted to hotels and
- industrial facilities, 1995-1998.

The primary purpose of the DSM project is to demonstrate the multifaceted benefits of upgrading the energy efficiency of residential and commercial buildings through energy efficiency cost sharing retrofits, technical assistance or direct installation. The potential facilities to be retrofitted under the JPSCo Demand Side Management Program include:

Programme	Number of Buildings	Targeted End Uses
Residential Phase I	100	Lighting, water heating, refrigeration and air-conditioning
Residential Phase II	30, 000	Lighting, water heating, refrigeration and air-conditioning
Cogeneration	10	Power Generation and Utilization of Waste Heat
Large Commercial Retrofit	13	Lighting, water heating, refrigeration and air-conditioning
Large Commercial New Construction	7	Lighting, water heating, refrigeration and air-conditioning
Small Commercial Direct- Installation	10	Lighting, water heating, refrigeration and air-conditioning
Small Commercial Phase II	20	Lighting, water heating, refrigeration and air-conditioning

[1] EII index calculation is based on the index of energy use by the economy divided by the index of GDP

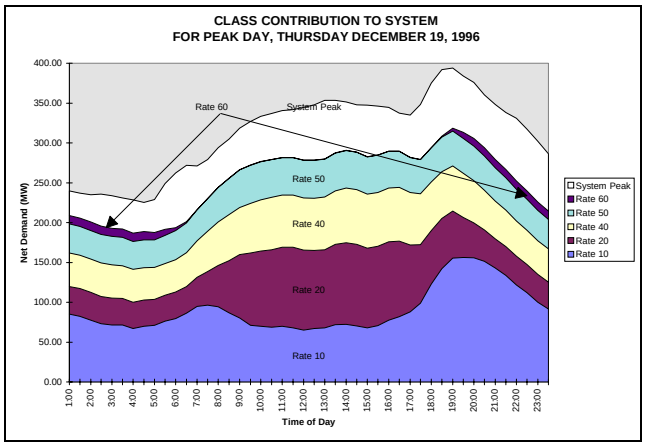

Figure 1

Demand Side Management is a complement to Supply-Side Management which seeks to maximize efficiency within the generation, transmission and distribution areas of the Company. The Demand Side Management Demonstration Pilot Project includes activities that intervene in the energy efficiency marketplace to increase the adoption of energy-efficiency measures and practices.

Demand Side Management is particularly suited to JPSCo due to the ambitious construction required over the next ten years to meet growing demand, the high marginal costs of supplying electricity, and the high rate of losses currently being experienced by the Company (Figure I). Jamaica imports all of its fuel and therefore the foreign exchange element of the utility's operations is significant. Jamaica's fuel imports consume 30% of merchandise export earnings, with 25% of these imports being used by JPSCo for power generation. Given the involvement of the Global Environmental Trust Facility, the Jamaica DSM Project also focuses on concerns of environmental stewardship. This is particularly of significance to JPSCo where Bunker C - fuel generators account for 83 per cent of generating capacity, Diesel, 13 per cent and Hydroelectric plant, 4 per cent. This demonstration project is targeted to save 88,950 tons of CO_2 by the end of 1998.

A national energy policy was also promulgated in 1995, which include stipulations relating to the fostering of energy efficiency. Jamaica is also a signatory to the Montreal Accord on chlorofluorocarbons and the Rio Agreement on greenhouse gas emissions.

Objectives of the Jamaica DSM Project

The Demand Side Management Demonstration Pilot Project seeks to test and demonstrate the marketing, technical, financial and economic feasibility of implementing cost-effective energy conservation measures in both the commercial and residential sectors. The information acquired through evaluation of demonstration activities will be used to design full scale sustainable long term energy efficiency programmes. The goal is to create financially sustainable conservation programmes within the Jamaican economy. The project aims to:

- Reduce fossil fuel consumption;
- Avoid generation capacity expansion;
- Reduce emissions of greenhouse gases;
- Build institutional capability in the Jamaica electric power sector and the energy-related private sector
- Support the ongoing efforts in testing and adopting energy efficient equipment;
- Increase public awareness;
- Demonstrate the potential gains to utilities of other developing countries;
- Provide cost savings to JPSCo and participating customers; and ,
- Expand the use of new technologies in Jamaica.

The project has a demand savings target of about 7 peak MW and an energy savings target of 30,000 MWh by 1998. Additionally, the project includes institutional strengthening for the JPSCo DSM Unit, and other institutions, such as the Jamaica Bureau of Standards (JBS), National Resource Conservation Authority (NRCA), Jamaica Environment Trust (JET) and other Non-Governmental Organizations (NGOs).

The Project faces several risks to the realization of these benefits. There are technical, institutional and market risks. The technical risks relate to the unique characteristics of the power in Jamaica which is supplied at 110V, 50Hz. The institutional risks relate to the ability to adequately staff the DSM Unit, and supporting operations. The market risks relate to the possibility of weak interest or participation in DSM programs, which would affect penetration and savings targets.

Analytical Framework

A conceptual view of the market transformation process for DSM in Jamaica[2] is presented in Figure 2 below.

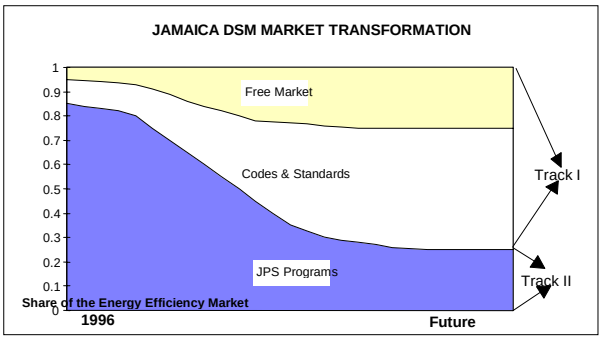

Figure 2

[2] Adapted from Regulatory Framework for DSM in Jamaica 1996 Study by Ahmad Faruqui.

The objective of Track I is to create customer value, by reducing energy bills and enhancing comfort, quality of life and worker productivity. It is envisaged that with the market transformation process, this track will be self-sustaining and serviced by energy service companies (ESCOs) that possess detailed knowledge about customer energy needs, access to funds and project management capabilities for technology purchase, leasing, installation and maintenance.

Given the fact that the DSM industry in Jamaica is in its early stages, it is premature to rely on Track I to produce an optimal level of DSM in Jamaica. It is likely that a substantial portion of the cost-effective DSM potential will remain untapped if it is left to Track I. Consequently the environmental and foreign exchange benefits of DSM will also fail to materialize. Thus there is need for publicly supported DSM activities in the transition period, (Track II) until such time that Track I has matured and is producing DSM benefits commensurate with the economic needs of Jamaica.

Market Dynamics

The introduction of energy efficient technologies in the Jamaican marketplace requires a substantial change in buying habits, financial expenditure and customer perception. The more complex the technology and the higher the price, the more factors influence the decision to purchase or participate. This decision requires the interplay of the input of information, processing of information, product brand evaluations, general motivating influences,-economics, technical performance-, and adaptive environmental influences. Insufficient information about energy efficiency, lack of financing options, the inability of low income customers to purchase energy efficiency measures and the differing motivations of landlords and tenants were all viewed as major marketing barriers.

Many of these issues were also underscored by a 1994 Standard Practice and Incremental Cost survey, commissioned by JPSCo , which indicated that the market for the promulgation of energy-efficiency equipment and practices was very immature. Few customers seriously considered energy-efficiency in equipment purchase, and stated their belief that there was limited information on equipment reliability or applicability, and limited individual experience with energy-efficiency products identified in a random sample of buildings constructed over the five years prior to the study.

Against this background, JPSCo can act as a catalyst in stimulating market transformation efforts towards Track I as discussed above, that create long-term changes and reap continuous energy savings at low cost such as private industry or regulatory initiatives that foster new tech-nologies and upgrade building codes and standards. National energy efficiency programs normally require base level support for a minimum of 10 years[3]. With the establishment of the required institutional and market conditions, programme efforts in Track II, can be gradually reduced and energy efficiency will be sustained primarily by market forces. Track II efforts will thus largely seek to create awareness and acceptance of the benefits of improved energy efficiency, to build up the requisite local skills and capabilities and to stimulate the market for sustained availability of energy efficiency tools and services.

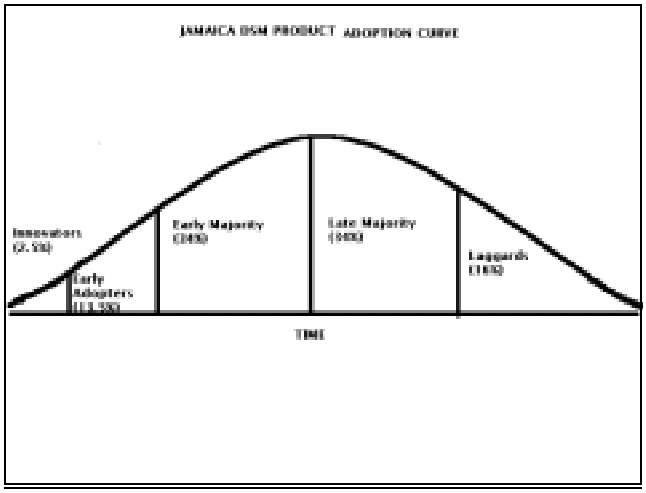

Figure 3

As Figure 3 illustrates all product introductions follow what is called the Product Adoption Curve. Innovators initially are willing to take a perceived risk on new technology, for instance those individuals who believe they should be active in preserving the environment, followed by the Early Adopters. For this group based on a local focus group study, there is a positive role for promotion and publicity, the need to conduct their own product information search, beliefs about the appropriateness of energy conservation measures and perceptions about costs and efficiencies. Following the Early Adopters are the Early Majority, who essentially require prior demonstration and consumption patterns before they make a decision to purchase. It is with the participation of the Early Majority that a real market begins to develop with its associated multiplier effects in stimulating product development. The Late Majority purchasers who are the next participants to join the bandwagon are not risk takers but follow market trends. Last to enter are the Laggards who are very conservative. Current available data suggests, that under this DSM Project, market development is approaching the Early Majority Stage for the Residential Programme.

Evaluation Methodology

The Jamaica DSM project is in any early stage of implementation. To date, only one component - the Resi-

[3] Establishing Energy Efficiency in a Developing World, 1996 Report prepared for the United Kingdom Overseas Development Administration.

dential Phase I Program - has been completed. The evaluation framework must reflect the stage of development in the program's life cycle. For the Jamaica DSM project, the program life cycle may be viewed in three stages.:

1. The Formative Stage
2. The Early Maturity / Growth Stage
3. The Mature Stage

It is further posited that the Jamaica DSM Project is at the early maturity stage or at the initial stage of a stabilized program, having completed the formative stage, as discussed earlier in relation to the Product Adoption Curve.

The nature of the program purpose determines the evaluation design. The proposed methodology is one of self assessment/ feedback evaluation , which in essence involves a quick but comprehensive assessment of program performance to date in relation to program objectives and performance criteria, buttressed by the results from interviews of stakeholders, customers and trade allies. This assessment aims to provide information that enable program decision makers to glean the effects of one or more components of the current program(e.g. its design, implementation or marketing) in order to make recommendations for increasing the effectiveness of the program. This self monitoring role is even more critical for requirements of the multilateral development banks associated with this DSM Project.

A self-evaluation assessment of progress towards the objectives of the Jamaica DSM project was performed by the JPSCo DSM Unit, over the period, December 1996 to April 1997. The assessment documented the project's accomplishments, revised the original impact goals, presented details concerning lessons learned and recommended corrective actions as deemed necessary. In other words flexibility in future actions rather than "staying the course" is the fundamental thrust of this self assessment approach, to help achieve programme objectives.

Self-Evaluation Findings

The Residential Phase 1 Program has achieved several of its overall objectives and is realizing benefits in a number of areas.

Residential Phase I Program

Programme Description

Provision of compact fluorescent lamps (CFLs) and other energy efficient devices at no cost to 100 participants. The objective was to establish the technical criteria regarding equipment performance, customer response and installation problems.

Implementation Procedure

Direct installation of 5 CFLs, low flow shower heads, faucet/sink aerators & refrigerator gaskets, by local contractor.

Selection of participants

The group of 100 participants was selected via an Essay Competition conducted for students between the ages of 10 and 18. Both winning students and their teachers were selected.

Objectives of the evaluation

The principal objectives of the Residential Phase 1 evaluation were to:

- Assess the technical performance of energy efficiency measures in the field.
- Estimate the energy and water savings associated with the installation of measures supported by the program;
- Support analysis of the cost-effectiveness of the Phase 2 program;
- Assess customer response to the energy efficiency measures and to the program;
- Assess conditions in the market for energy efficiency measures among Jamaican manufacturers, distributors, and retailers (Market Evaluation); and
- Identify the strengths and weaknesses of the program's delivery system and organizational support (Process Evaluation).

Results

- A USA-based consulting firm, was contracted to conduct a formal process and impact evaluation of the Phase I Programme between December 1995 and August 1996.
- Interviews of 40 participants, installation of 80 lighting loggers in 20 participant homes
- Engineering estimates exceeded the original targets of 2kW peak reduction and 18,000 kWh energy savings. The programme resulted in reduced annual energy use of 58,021 kWh and peak coincident demand reduction of 5.2 kW. Further 840,000 gallons of water will be saved each year.

A simple engineering algorithm was used to calculate the energy savings from the installation of the CFLs as follows:

kWh Savings = No. of lamps* In Service rate * average watts displaced * Average hours per year the CFLs are in use.

Based on the above the annual average kWh savings per lamp installed was estimated at 31kWh. Extrapolating the results for the total program, energy savings from lighting would amount to 3100 MWh per annum. .

The evaluation analysis also yielded the following results:

- **Persistence of CFLs installed** - Of 210 lamps installed (based on the survey) one hundred and seventy-five (175) or 83% were found to be still in service one year after installation.
- **The importance of customer education** - JPSCo's school based publicity strategy generated a great deal of press coverage as well as contact with students, teachers, and parents, concerning changes in appliance usage patterns and purchasing habits.
- **High levels of customer satisfaction** - Pilot participants expressed a high level of satisfaction with the products and services received.

Generally, the evaluation indicated that the planning and administration of the program were very sound. Program Marketing Operations were energetic and well directed. Staff and contractors had a good technical command of the skills needed to carry out their roles in the program. Records keeping system were adequate to support the pilot level of operation. However, they were of a somewhat improvise nature and would not be sufficient to support full-scale operation. To this end, the DSM Unit is currently developing a comprehensive database tracking system which is scheduled to be completed by September 1997.

The evaluation also recommended the following activities for the operation and management of the Residential Phase II Program.

- Educate customers on proper installation and use of CFLs.
- Encourage customers to use CFLs for exterior and security lighting.
- Promote Package 2 in the Phase 2 Program.
- Identify a larger commercial role for trade allies in the Phase 2 Program.
- Move quickly to design and implement a program tracking system
- Use billing data analysis to estimate energy savings associated with the program.

Lessons Learnt from Evaluation

Feedback from customers was used to enhance the design and development of the Residential Phase II Programme.

- Methodology

In terms of sensitizing schools, this effort will be continued in the second phase, through the targeting of 140 schools by a consumer advocate group, which has been contracted by JPSCo. The second phase will rely on the random selection of thirty-thousand customers.

- Package Options

  The information gleaned from the survey by the installation contractor, was used to justify the equipment package options under the Residential Phase II Programme. Customers are being offered a choice among three packages.

  Package I - Three CFLs.

  Package II - Three CFLs and a low-flow shower head.

  Package III -A home-energy audit and direct installation of energy-efficient equipment, including up to 5 CFLs, and the energy efficiency measures included in the Phase I Programme.

- Promotion

  A mix of promotional tools is desirable. This includes direct contact, direct mail, and mass media. In Jamaica radio has the widest reach to audience.

Residential Phase II Power Saver Program

Programme Description

The second phase of the residential power saver programme, seeks to increase the saturation of high-efficiency electrical equipment, boost consumer demand, and the commercial viability of the equipment in the residential market. This programme involves the provision of energy efficiency measures to 30,000 randomly selected customers island wide at a discounted price. The cost of the energy efficiency measures is shared between JPSCo and the customer with the discount to the customer being 50% of the incremental cost of the measures.

Implementation will be carried out over a three-year period, 1996-98.The programme was launched on February 8, 1996. Subsequently, Power Saver coupons were mailed to 12,750 consumers, including JPSCo employees offering energy saving devices at a discount. As of December 1996,exactly 1992 coupons had been approved.

Lessons Learnt from Self Assessment

Prior to receiving brochures and coupons in the first mailing, customers were sensitized via a media campaign. Based on several telephone queries and other contact, many customers expressed a general disinterest in mail outs. Instead, there was a propensity towards more direct contact, i.e., (speaking with JPSCo personnel who could provide more details and answer additional questions). In

some cases in the rural areas, some customers were illiterate and hesitant in requesting assistance to complete the coupons. Consequently, the participation rate was lower than anticipated.

It is fair to assume, based on the results, that the 12 % participation rate obtained from the direct-mail approach will not increase by any meaningful amount.

Having tested and established the potential for this effort, the DSM Unit decided that it was timely to initiate another delivery strategy: namely **direct contact.**

Recommended Action

In preparation for more wide-scale implementation, the DSM Unit carried out a pilot effort at one of JPSCo's Customer Service Offices during October 1996. The aim was to see how many customers would opt for participating in the programme over a two hour period. This test was executed on two separate days (four hours in total), and the results were certainly encouraging. A total of 63 customers joined the programme and another 14 left a contact number for definite follow-up.

By extension, these findings suggest that JPSCo's Customer Service Offices island wide could be fertile contact points for garnering customers.

Based on this consistently positive feedback, the DSM Unit developed the following plan to implement the direct-contact mechanism at the commercial offices. The key to this method is the opening up of the offer to all customers who visit JPSCo customer service offices island wide. Customers will therefore have the opportunity to interact directly with JPSCo employees and obtain the energy efficient products being offered. Since implementing the direct contact strategy on January 20, 1997, the total number of participants has increased from 1992 to 8,132 as of April 30, 1997. In other words since initiating the direct contact strategy 6,140 additional customers have joined the Power Saving Plan. The DSM Unit has also set a target of 10,000 participants by May 31,1997, and based on the current trend it is projected that the target of 30,000 customers should be achieved by March 1998.The participation levels will be closely monitored and further marketing strategies adopted as required.

Currently, both process and impact evaluations are being undertaken for the residential phase II program, by a US consulting firm, working in association with local subcontractors. The process evaluation is scheduled to be completed by September of this year, and the impact evaluation including billing analysis by the end of December 1997.

Commercial Programs

Program Description

The commercial programs which are being marketed under the slogan "Power Plus Program", has two components: the retrofitting of existing commercial buildings and the implementation of energy efficient measures in new construction sites. Selected customers will be provided with financial incentives to assist in the procurement of energy - efficient equipment at reduced cost. The DSM Unit of JPSCo will arrange with selected facilities to conduct a pre-installation audit or building simulation to identify those energy conservation measures which are cost-effective and can therefore be implemented. The Commercial program components were launched in October 1996, after much preparation and the dissemination and review of programme plans. These programmes are more complex than the residential programmes because they are hinged on the Energy Efficiency Building Code which only became available in January 1996.

Implementation Procedure

- Energy audit and identification of EEMs that have favorable economic promise.
- Discussion with client, selection of measures to be installed and installation schedule.
- Selection of contractor (involves identification of qualified bidders, issuance of bidding documents, and award of contract by the Client)
- Installation of Energy efficient measures, with inspections of work being performed, witnessing operational tests, and other oversight by owner as well as by DSM Unit staff. Oversight includes: (a) documenting observed deficiencies in work performed, and (b) seeking remedies to these deficiencies.
- Final acceptance of work performed.

Selection of Participants

- Facilities were selected based on a review of applications and ranking against the following criteria, high potential for energy savings, visibility, facility type, occupancy type and an existing maintenance program.

Current Status

A total of 29 participants have been approved, 18 Large Retrofit, 9 Small Retrofit, and 4 New Construction customers. Audits have been completed for 17 existing buildings and design assistance for 2 new construction facilities. Based on the energy conservation measures identified the demand and energy savings targets are currently being revised.

Prior to implementing the Large Commercial Retrofit Pilot Programme, it was decided that it would be useful for the DSM Unit to become familiar with the process involved in a large building retrofit project by managing the retrofit of JPSCo's Head Office in Kingston. This demonstration project involved installing energy efficiency

measures (EEMs) in a 4-story, 78,000 sq.ft. building complex:

Lessons Learnt

Although numerous problems have occurred during the project, the aggravations can be mitigated if the lessons they teach are heeded and procedures adopted to make future projects flow more smoothly. These "lessons learnt" include:

- The DSM Unit should avoid being responsible for the work performed by contractors. The proper role of the DSM Unit's Engineer who is assigned to oversee a given project should be to: ensure that the energy audit is in full compliance with the Terms of reference for that task, that the audit and audit report are timely and meet professional standards, that the auditor clearly explains to the building owner the benefits of installing the recommended EEMs, and that the owner understands the low-interest financing that is offered via the programme.
- Subsequently, the Engineer and the auditor should maintain frequent contact with the owner, to facilitate the decision to proceed with EEM installation. At that point, the Engineer must promptly process the necessary paperwork for the loan and internal records of EEMs and expected savings. Selection of the organization to prepare the TOR and secure bids from qualified contractors should be the owner's task. The DSM Unit's participation in this task is to help ensure that the owner's intentions are being implemented, and do not replace the owner's primary responsibility in this regard.
- The owner should be informed that oversight of EEM installation is primarily his responsibility, but that the DSM Unit's Engineer will assist in this task. Dispute resolution is the owner's (or owner's agent's) responsibility.

The lessons learnt from this pilot retrofit, will guide the procedures for the remaining retrofit activities of the DSM project.

Conclusion

The DSM Unit is currently in the process of establishing contracts for the formal evaluation of the Residential and Commercial Programmes with assistance from external consultants. These evaluations will conclude at the end of the program life cycle in December 1998.With regards to the Residential Phase II Program a contract is already in place for the monitoring and evaluation of this program. The evaluation will be carried out as an integrated process and impact evaluation in two phases spanning 1997 and 1998. Phase I of the evaluation will focus on the history, operation, and impacts of the program during the first year of the Program, involving comprehensive process analysis, and engineering/ metering-based impact assessment. A training seminar on evaluation techniques will also be held on site in Jamaica to foster institutional strengthening and technology transfer. Phase II will consist of a simple process evaluation and a comprehensive billing analysis- based impact evaluation.

For the commercial Programmes, Requests for Proposals will be issued shortly for the monit5oring and evaluation of these programmes. The evaluation will involve both process and impact assessments.. The process evaluation will focus on the effectiveness and efficiency of the program delivery system. The impact evaluation will estimate energy and peak demand savings for individual measures, individual facilities, and both gross and net for the entire program. These estimates will take into account free riders, snapback, and measure persistence. 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.

The DSM Unit will continue to assess program performance vis a vis program objectives, in order to determine how the mix of activities should be adjusted based on the feedback from self assessment. Marketing strategies, delivery mechanisms, incentive structures will be reviewed based on information garnered during the course of the project. At the end of the Demonstration Project, the results obtained from the evaluation of the Residential and Commercial Programmes and of the entire Project, will be used to design a full-scale sustainable energy service management programme.

Acknowledgments

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