# Jamaica Residential Phase I Programme
# Demand Side Management Demonstration Project

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The Residential Phase I Power Saver Programme was developed and implemented by the Demand Side Management (DSM) Unit of Jamaica Public Service Company Limited (JPSCo) during the period March to December 1994. The programme was designed to provide energy-efficient equipment and measures at no cost to one hundred (100) participants and focused on testing and determining the technical issues involved in the installation and performance of the equipment. The information gathered as a result of the monitoring and evaluation will be used in the implementation of a second Residential program (Phase II), which envisions the provision of energy-efficient equipment to thirty-thousand (30,000) homes at a reduced cost. The Residential Phase I programme's goal was based on achieving electricity savings of 0.002MW and 18MWh annually.

Several public information/education efforts were initiated towards reducing the customers' demand for electricity. These efforts were aimed at sensitizing and educating various target groups including students, teachers, trade allies and residential customers, during the implementation of the Residential Phase I programme.

The group of 100 participants was selected by way of an islandwide essay competition, which was called the 'Power Writing' Essay Competition and conducted for students between the ages of 10 and 18. The homes of the winning students and their teachers were retrofitted with energy-efficient equipment and the winners also received additional promotional items.

JPSCo contracted an energy auditing firm to install energy-efficient compact fluorescent lamps, low-flow showerheads and other energy saving devices, as deemed appropriate, in the 100 home pilot program. The energy auditors were licensed electricians and selected through a local bidding process.

An independent programme evaluation was initiated in November, 1995. The impact evaluation indicated that the programme resulted in reduced annual energy use of 58,021 kWh and peak coincident demand reduction of 5.2 kW and that 835,965 gallons of water will be saved each year. Lessons learned from this programme have been used in enhancing the design and development of the second phase of the Residential programme.

The Residential programme was designed around the theme of ''building awareness and saving energy''. At a minimum, the marketing of the programme, through education and empowerment, has long-term benefits for consumers. The energy saving measures presented consumers with the opportunity to lower their electricity bills, upgrade their homes, and conserve energy and water. Energy knowledge and environmental awareness are of great importance to the development of sustainable energy programmes for the future.

# INTRODUCTION

Oil is the principal source of energy used in Jamaica's electric power sector. However, all of our oil requirements are imported with limited foreign exchange. The demand for electricity has been growing at an average annual compounded rate of 5% per year since the early 1980's. Jamaica's level of energy consumption is high compared to other countries at similar income levels, such as Tunisia, Thailand and the Dominican Republic. This project was designed as a result of the need for the implementation of additional energy sector and environmental policies, with a firm commitment to market transformation, while appreciating the cultural diversity within the country.

## Background

JPSCo currently serves approximately some 352, 000 residential customers and 44,000 commercial and industrial customers, with total generating capacity of 606 MW. The peak demand established in October 1995 reached 424 MW. The twenty four hour system demand profile indicates that the demand for electricity is driven by the commercial sector during the day and the residential sector during the late evening. JPSCo meets the demand through a mix of plant which include low speed steam/oil generators, medium speed diesels and gas turbines.Currently, there is an ongoing drive to diversify generating sources through the inclusion of independent power producers and cogeneration projects.

The Residential 'Power Saver' Programme is a component of a five year demonstration project which was designed by a global collaborative, which includes the Global Environmental Facility, administered by the World Bank, the United Nations Development Programme and the United Nations Environment Programme. The Project is being implemented by JPSCo and co-financed with additional loan and grant funds from the World Bank, Inter-American Development Bank, the Rockefeller Foundation and the Canadian Trust Facility.

## Scope

The Residential Phase I Power Saver Programme was developed and implemented by the Demand Side Management (DSM) Unit of Jamaica Public Service Company Limited (JPSCo) during the period March to December 1994. The programme was designed to provide energy-efficient measures to 100 households, to test and determine the technical criteria regarding equipment performance, customer response, installation issues and other factors. The programme's goal was based on achieving electricity savings of 0.002MW and 18MWh, annually.

# METHODOLOGY

## Promotion and Public Information/Education

In an attempt to capitalise on the natural enthusiasm of children to educate their families on Energy conservation matters as well as to capture the attention of students an Essay Competition was used. This delivery mechanism was suggested by the Jamaica Environment Trust, a non-governmental agency, which was contracted by JPSCo to assist in public education activities. The competition was also perceived to be a transparent method of selecting households.

The island wide essay competition, which was called the 'Power Writing' Essay Competition, was conducted for students between the ages of 10 and 18. Both the winning students and their teachers received the direct installation of energy conservation measures along with additional promotional prizes. A Public Relations/Communications agency was identified to assist with the development of the competition.

The medium of an Essay Competition was used for two reasons:

(1) In an attempt to bring about long term attitudinal change within the society, given that students represent the future generation of energy-users.

(2) The competition presented an effective public education tool by utilizing the innate enthusiasm of children to sensitize their families on conservation issues. Teachers were targeted because of their influential role in educating an increasing number of children about the importance of the programme's objectives.

The topics for the Power-Writing Essay Competition were:—

(1) What Energy Management means to me; Age Group—10–12

(2) Energy Management—The Key to a better environment; Age Group 13–15

(3) Energy Management, a necessary measure for developing countries; Age Group—16–18

The DSM Demonstration project and the Power-Writing Essay Competition were officially launched on March 15, 1994 by the Jamaican Minister of Public Utilities, Mining

and Energy. This was attended by the representatives of the project funding agencies, government and non-government agencies, senior managers of the utility, as well as students and teachers.

Members of the DSM Unit then commenced visits to various schools and colleges islandwide to inform students about the competition, the role of the DSM Unit and the importance of energy management. Posters and entry forms were distributed to students and schools by JPSCo personnel who visited or from the various Customer Service offices. Letters (Figure 3) were also sent to over 900 schools inviting their committment to and participation in the Power-Writing Essay Competition. The essays were judged on content, clarity of expression, grammar and innovative recommendations. (See Figures 1, 2, and 3). Students were invited to call, write or visit the Unit or the library at the Ministry of Public Utilities, Mining and Energy for information.

***Figure 1.*** *Brief on the Power-Writing Essay Competition*

The Jamaica Public Service Company's Power Saver Demonstration Programme was designed to assist participating residential customers in reducing their overall levels of energy consumption by increasing their efficiency of energy use. JPSCo launched an essay competition on March 14, 1994 for students between the ages of 10–18, as a vehicle for the selection of 100 homes to participate in the Power Saver Programme.

The essay competition, which was titled the ''Power Writing'' essay competition was jointly planned by the Jamaica Public Service Company, the Ministry of Public Utilities, Mining and Energy and the Jamaica Environment Trust. The selection of homes will be decided based on the following breakdown.

1. Three categories of first, second and third prize winners will be awarded for ages 10–12, 13–15 and 16–18. (9 prize winners).

2. The next six top essays in each age range will receive consolation prizes and be included in the Power Saver Programme (18 prize winners).

3. The teachers identified by student winners in categories (1) and (2) above will be included in the Power Saver Programme (27 prize winners).

4. 46 teachers with the highest number of entries will also be selected to receive energy efficient lamps and energy management assistance through the Power Saver programme. (46 prize winners).

The total number of participants targeted is (9 + 18 + 27 + 46 = 100) one hundred.

Other Public education efforts included the sensitization of various target groups during the implementation of the Residential Phase I programme. The strategies utilized reflect the diversity of the target audience as each group is peculiar. By way of direct contact, Jamaican lighting suppliers were briefed on the programme at a breakfast meeting. They were also informed of compact fluroscent lamp test results by the Jamaica Bureau of Standards as well as updated on the Energy-Efficiency Building Code. The increasing significance of the role of the private sector in providing the public with information on energy matters and energy-efficient equipment was heavily emphasized and their committment to assist in the DSM effort was solicited.

The Ashe Caribbean Performing Arts Ensemble, the creative arm of the Jamaica Environment Trust, revised their theatrical performance to include information about compact fluorescent lamps (cfls). The group performed at 25 schools islandwide as well as to adult audiences, highlighting environmental and energy issues facing Jamaica and potential solutions. Attendees from 14 schools were sponsored by the DSM Unit and during these performances the Power-Writing Essay competition and the role of the DSM Unit were promoted.

Four regional meetings were also conducted with members of the Jamaican parliament to sensitize and educate government officials and area business people about the DSM demonstration project.The Manager of the DSM Unit spoke on the Residential programme and energy management tips were provided.

JPSCo employees were briefed on the Residential Power Saver Programme at Senior Management, Area Managers and Customer Service Manager meetings. A high level of interest was displayed and some managers were of tremendous assistance in promoting the contest particularly in the rural areas. Residential Customers were also briefed by the JPSCo customers in community outreach meetings islandwide.

Mass media advertising was used to target residential customers via press, television and radio. Radio interviews, press advertising and television advertising during children's programmes were the main areas of focus.

An Awards Ceremony for the winners of the Essay Competition was held in July, 1994. Prizewinners, their teachers, parents and representatives of the funding, government and non-government agencies and JPSCO employees attended. The Government Minister responsible for Energy was the key-note speaker.

***Figure 2.*** *JPSCO Essay Competition Grading Sheet*

TOPIC: WHAT ENERGY MANAGEMENT MEANS TO ME?

NAME: _____ AGE: _____

ADDRESS: _____ SCHOOL: _____

CRITERIA FOR JUDGING

CONTENT (50)
- Definition (2)
- General Information on Energy Management (3)
- Information on Jamaica's situation (5)
- Facts on JPSCo (5)
- Facts on other energy organisations (5)
- Energy Management tips (10)
  - None (0) Few (3) (two or less) Varied (6) (three-four) Many (10) (more than five)
- Effect of energy management on the environment (5)
  - No ideas (0) Slight mention of the environment (3) Specific ideas mentioned (5)
- Personal comments on Energy management (5)
- Benefits of Energy managment to individuals and nation (10)
  - No mention (0) Few benefits (5) Three or more (10)

CLARITY OF EXPRESSION
- Not clear (0) Somewhat clear (10) Clear (15) Very clear (20)

GRAMMAR
- Very Poor (0) Poor (10) Good (15) Very good (20)

INNOVATIVE RECOMMENDATIONS
- None Few (Less than 3) Some (3–5) Many (More than 5)

OTHER (i.e any other comments note worthy)

FINAL GRADE

## Installation of measures

JPSCo contracted Econergy Engineering Services Ltd., an energy auditing firm, to coordinate the installation of energy efficient compact fluorescent lamps and other energy saving devices, as deemed appropriate, in the 100 home pilot during the months of September through November 1994. This contractor hired to install the devices was a licensed electrician, selected through local bidding. Homeowners received energy efficient compact fluorescent lamps, low-flow showerhead, kitchen and bathroom faucet aerators, refrigerator gaskets, photo-electric light controls and water heater timers, as appropriate Additionally, the contractor performed minor maintenance work on refrigerators and air conditioners. An on-site energy-use survey was conducted to identify characteristics of the participants' households as well as the types and patterns of their electrical appliances. Householders were provided with tips and further information as to how they could conserve energy and reduce their energy bills. Preliminary engineering estimates were calculated for each of the 100 homes in the pilot.

## Results

At the closure of the competition, a total of 1,090 essays were submitted from students attending 269 schools islandwide. Essays were received from all fourteen parishes. Xenergy Inc.a U.S. based consulting firm was contracted to conduct

***Figure 3.*** *Letter to Principals*

**March, 1994**

Dear Principal,

In a concert effort to highlight the importance of Energy Management and recognizing that habits cultivated in our youth often become lifelong practices, the Jamaica Public Service Company is launching the ''POWER WRITING'' Essay Competition. The competition is open to students aged 10–18 years and will be launched on Monday, March 14, 1994. Essays should be based on the following topics:

*Age Group 10–12 years*
''What Energy Management Means to Me?''

*Age Group 13–15 years*
''Energy Management—The Key to a Better Environment''

*Age Group 16–18 years*
''Energy Management—A Necessary Measure for Developing Countries''

We would like to have your students participate and ask that you encourage them to enter this competition which will not only afford them a wonderful opportunity to be involved in a project of vital importance to their future, but also the chance to win prizes for their School, their Teacher and themselves.

The Prizes are as follows:

**First Prize:**
A trip for 2 to Epcot Centre at Disney World, Orlando, Florida
For all Age Groups

**Second Prize:**
A BMX or 10-speed Bicycle for all Age Groups.

**Third Prize:**
A Walkman with Educational Cassettes for all Age Groups.

**18 Consolation Prizes:**
Packages of Exercise Books, T-Shirts and Caps.

**JAMAICA PUBLIC SERVICE COMPANY LIMITED**

**School Prize** of a 20″ Colour Television Set and VCR for the First Prize Winner's School in each Age Group.

**Plus**. . . .the 9 Prize Winners, the 18 Consolation Prize Winners and their 27 Teachers will all win the free supply and installation of 5 Energy Efficient Compact Fluorescent Lamps in their homes. . . . to save energy and lower their electricity bills.

**Plus**. . . .46 Teachers whose schools send in the highest number of entries will also have the 5 Energy Efficient Compact Fluorescent Lamps installed in their homes.

If you are interested in helping the Jamaica Public Service Company to promote Energy Management, we ask that you indicate your interest by returning the attached Entry Form, to your JPS Commercial Office. Posters for your notice-board will be available at all JPS Commercial Offices.

The closing date for entries is Tuesday, May 31, 1994, and each essay sent in by a student must have a completed Entry Form attached. For your convenience we have enclosed several of these forms, but additional ones may be obtained from any JPS Commercial Office.

We look forward to receiving many entries from your students, and know that they will find this a challenging experience.

Sincerely,

**Denise A. Tulloch**
Manager, Demand Side Management Unit (DSM)
Jamaica Public Service Company Ltd.

a formal evaluation of the program between December 1995 and April 1996. Interviews of forty participants were undertaken by Xenergy and eighty (80) lighting loggers were installed in twenty of these homes.

The Engineering estimates indicated that the programme resulted in reduced annual energy use of 58,021 kWh and peak coincident demand reduction of 5.2 kW and that 835,965 gallons of water will be saved each year. *Collectively, the one-hundred customers can save up to J$278,500 or US$6,962.00 per year in electricity and water costs. An impact analysis has been conducted to determine the net savings by drawing a comparison group to estimate what participants would have done in the absence of a programme.* A survey of forty-one (41) households which participated in the program was conducted.

## Persistence

Persistence of CFLS installed—Of the two hundred and ten (210) lamps installed (based on the survey) one hundred and seventy-five (175) or (83%) were found to be still in service. Failed lamps accounted for over ten percent (10%) of all lamps installed through the programme. Of the failed lamps, five (5) had been thrown away, two (2) had been given to other households, four (4) were not accounted for and the rest had been kept by customers. Two (2) of the defective CFLs had been replaced by customers at their cost, with other CFLs.The impact analysis also estimated a 5.2 kW demand savings associated with the installation of CFLs and assumed a 23% diversity.This diversity calculated from the logger data is consistent with residential lighting diversity findings from evaluations of similar programs in the USA. For example, in a recent evaluation of direct installation and rebate programs operated by New England Electric System, Xenergy found winter evening diversity factors of 21.6 and 27.5% respectively.*

## Water energy savings

Estimates of water and energy savings from the installation of low-flow showerheads and faucet aerators were based on documentation of the technical performance of showerheads from US literature and information gathered through the evaluation survey.

**Minutes per shower:** The assumption of 5 minutes per shower was viewed as reasonable in light of published research such as the Schuldt et al. (1995) report and Kooney et al. (1994) which assumed shower usage equal to 5 minutes per day.*

**Flow reduction showerheads.** This was based on Warwicks Study (1995) and Kooney et al. (1994) which assumed delivery of 3.4 gpm. This value was reported to be approximately equal to the flow rate found by Brown and Caldwell (1984) and Warwick (1993). Given these findings, the flow reduction due to shower head retrofit of 1.6 gpm (3.4 gpm for standard fixtures—1.8 gpm for low-flow fixtures) was deemed to be reasonable.*

**Flow reduction: faucet aerators.** Similar studies were used to determine assumptions of flow reduction rate.

**Temperature differential.** Fifteen of the 100 participants had electric water heaters. Schuldt et al. (1995) reported measured shower temperatures equal to 105 °F. Based on these findings, the same assumptions were used.*

## Refrigerator savings

**Refrigerator assumptions.** Xenergy was unable to find any support data for the usage reduction assumptions. The only large scale study of the energy effects of repairs to old refrigerators was conducted by Rochester Gas and Electric between 1988 and 1990. Of the 70 refrigerators monitored, only 3 units showed a clear decline. A similar project conducted by Philadelphia Electric, but with only five refrigerators, found that average daily consumption fell by 5 percent after coil cleaning. Energy use was monitored two weeks before and after repair. In light of these findings, the assumption of 5% estimated savings was used.*

Lessons learned from this programme have been used in enhancing the design and development of the second phase of the Residential programme. These are summarised below.

- Methodology
  The first phase of the program was designed to be a technical study focusing on testing and establishing the criteria regarding equipment performance, customer response, installation issues and other factors. 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 from the utility's database.

- Package options
  The information gleaned from the survey undertaken by the installation contractor, was used to justify the equipment package options under the Residential Phase II programme. Customers will be offered three packages.
  Package I—Three compact fluorescent lamps
  Package II—Three compact fluorescent lamps and a low-flow showerhead
  Package III—A home-energy audit and direct installation of energy-efficient equipment.

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

- Equipment Characteristics and Performance
  Approximately forty percent (40%) of all the incandescent lamps in use are 40 watts or less. If this distribution is typical of the Jamaican residential customer base, it could limit the cost-effectiveness of CFL measures.

- Installation
  Approximately (30%) thirty percent of homes could not not accommodate installation of showerheads. The direct installation approach was well received by householders. Most of the recepients commented that they were much more aware of energy management issues subsequent to the visit of the installation contractor.

## CONCLUSION

The programme was based on a small sample of customers island wide, whose energy use ranged from that of the average customers to that likely to be found in the high-income group. The results of the programme are an indicator of energy use trends and the potential for conservation in the residential sector. The impact evaluation conducted by US based consulting firm, Xenergy Inc. revealed that the estimated savings exceeded the projected goals of the program. However, fifteen percent (15%) of the 100 participants possessed electric waterheaters. This is actually a higher proportion than the estimated 6% penetration of electric water heaters in the wider population. As a result the additional energy savings derived from this source assisted in boosting the overall savings. This information will have pertinent implications for the second phase of the programme.

During the next three years (1996–1998), the second phase of the Residential Programme will seek to increase the saturation of high-efficiency electrical equipment, boost consumer demand and the commercial viability of energy-efficient equipment in the residential sector. The Residential Phase II Programme will provide 30,000 randomly selected customers with rebates towards the purchase of preselected energy-efficient products. JPSCo will also continue to develop programmes for the commercial sector and work towards the establishment of building codes and standards for energy-efficiency.

## ACKNOWLEDGEMENTS

The authors wish to acknowledge the assistance provided by the other members of the Demand Side Management (DSM) Unit.

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