DSM Implementation Strategy and Load Research Program

Evaluation

of the

Compact Fluorescent Lighting Program

prepared for

DEMAND-SIDE MANAGEMENT BRANCH

CEYLON ELECTRICITY BOARD

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1. INTRODUCTION

In 1997, the World Bank, with the co-operation and co-funding from the Global Environmental Facility, launched the Sri Lanka Energy Services Delivery Project (ESD) to promote the provision by the private sector, NGOs and co-operatives of grid-connected and off-grid energy services using environmentally sustainable renewable energy technologies, to strengthen the capabilities for DSM planning and implementation, and to improve the public and private sector delivery of energy services including renewable energy and energy efficiency.

A key component of the ESD project is the DSM Implementation Strategy and Load Research Program initiated by the Ceylon Electricity Board (CEB) with the assistance of the World Bank. The DSM and Load Research Program will help CEB build its skills and capabilities to improve existing Programs, and to develop and implement a DSM Action Plan. It will also lead to the creation of a comprehensive database on the energy-using equipment in customer facilities and the patterns of use of such equipment.

The CEB has been undertaking DSM activities since 1995 through its DSM Unit which was subsequently upgraded to the DSM Branch (DSMB). The two key Programs undertaken by DSMB are the Compact Fluorescent Lighting (CFL) Program and the Energy Audit Program. One of the tasks, under the DSM Implementation Strategy and Load Research Program, is to evaluate the existing Programs and make recommendations for improvement in terms of cost effectiveness, marketing, implementation and administration.

This report details the evaluation of the Compact Fluorescent Lighting Program.

2. OVERVIEW OF THE CFL PROGRAM

2.1 Background

The Program was introduced in 1994 during a period of power shortages as a result of a drought that affected CEBs hydropower resources. The objective was to increase the efficiency in the use of electricity resulting in lower electricity bills for the customers, the mitigation of CEB energy deficits in the short term, and deferment of CEB investment in new capacity in the long term.

2.2 Participation

The Program is offered to Domestic and Religious Purpose customers coming under CEB's and Lanka Electric Company's (LECO's) tariff structure.

The Program is implemented by the CEB, LECO and the Energy Conservation Fund (ECF). The CEB implements the Program through its regional offices while its DSM Branch (DSMB) is responsible for the overall administration and management of the Program. LECO is responsible for the customers in its franchise area and receives funding from CEB for the loan scheme. The ECF, which is a division of the Ministry of Irrigation and Power, is responsible for the implementation of the Program in the public sector utilising its own funds.

The DSMB maintains an approved list of lamp suppliers who are eligible to participate in the Program. The supplier list and lamp costs are updated regularly. At the commencement of the full scale Program in 1997 there were ten approved suppliers and currently only five remain.

2.3 Description

A pilot project was launched in 1994 covering six hundred households, of varying electricity consumption levels, and implemented by a leading University with funding from the Energy Conservation Fund. Lamps were installed at no cost to the customer and performance monitored over a period of 1 year. The results of the pilot project indicated a high (90%) acceptance level of CFLs and the preference of electronic ballasts over magnetic ballasts.

Based on the success of the pilot project, a larger Program of 100,000 CFLs with electronic ballasts, was launched in June 1995 and completed in August 1996. The main feature of this Program was a subsidy provided by the CEB to include import taxes and other duties, advertising through brochures, seminars and electronic media and a 18-

month manufacturers warranty on the lamps. The lamps were imported by Lanka Transformer Ltd. (LTL), a subsidiary of CEB, and sold at a subsidised cost of Rs 480 through the CEB sales outlets with voluntary participation of the staff attached to these units. Hence, there were no incremental overhead expenses to CEB for implementing this Program.

In addition, successful lamp retrofit projects were undertaken in the sacred cities of Kataragama, Anuradhapura and Kandy and in the Parliamentary Complex. An interest-free loan scheme for CEB and LECO employees to purchase CFLs was also introduced.

In 1997, the CFL loan scheme was further extended to include CEB customers in Western Province (South), LECO customers, and public sector employees through the ECF. Customers were required to sign an agreement with the CEB to pay for the lamps (limit of 4 lamps per customer) in twelve monthly instalments. Upon signing the agreement the customers would collect the lamps from one of the participating dealer network that would be reimbursed by the CEB for the full cost of the lamps. All participating suppliers were required to provide a two-year warranty on the lamps. The ECF Program involved a service charge of 7% and cost recovery through participant's salary.

In 1998, the loan scheme was extended to include Colombo City, Western Province (North), Central, Southern and North Western Provinces. The Program in its current format has continued through 1998/99. In addition to the sales from the loan scheme, the direct sales from CEB listed CFL suppliers since 1997/98 has been monitored.

3. EVALUATION APPROACH

The overall goal of this evaluation was to conduct a review of the CEB Compact Fluorescent Lighting (CFL) Loan Program including an appraisal of the processes used in implementing the Program, the Program's impact on the energy use and demand patterns of participating customers, and the Program's impact on market conditions. Key evaluation goals and the methodologies used to achieve these objectives are outlined below.

3.1 Impact Evaluation

3.1.1 Objectives

Impact evaluation assesses energy and demand savings

The primary objectives of the impact evaluation were to:

- Determine the energy savings and demand reduction associated with Program participation,
- Estimate the cost of the energy and demand reductions delivered by the Program, and
- Assess the cost-effectiveness of the Program as a whole.

Specific objectives of the impact evaluation were to assess:

- How cost-effective is the Program for CEB, Program participants and the country? Could Program cost-effectiveness be improved? If so, how?
- How many CFLs have been installed as a ***direct*** consequence of the Program's intervention in the market? How many CFLs have been installed as an ***indirect*** consequence of the Program's intervention in the market (e.g., as a result of CEB's endorsement of the CFL technology?)
- How many of the Program participants would have installed a similar number of CFLs even if the Program had not been implemented?
- How have customers' lighting loads changed as a result of installing the CFLs?
- How have customers' use of lighting and total energy consumption for lighting changed as a result of installing the CFLs?
- Are the CFLs installed under the Program still in place? If not, why not?

- How much money has CEB spent on all aspects of the Program? How much has the suppliers spent as a direct result of their participation in the Program? How much has Program participants spent?

3.1.2 Approach

Net energy savings and demand reductions attributable to the Program were derived from engineering estimates of participants' pre- and post-installation electricity consumption.

Peak demand reduction …

The unitary peak demand reduction associated with each participant in the Program was derived as the difference in the power consumption for a conventional technology relative to that of the qualifying, energy efficient technology (i.e. Incandescent lamp vs CFL). The unitary demand impact so defined was then multiplied by the number of customers who had been influenced to participate in the Program and purchase the technology. The generalized algorithm used to determine the peak demand impact for each of the rebate measures was:

$$\text{Total Peak kW Reduction}_{Measure} = \sum_{\text{Participant } 1}^{\text{Participant } n} \left(kW_{Conventional} - kW_{Efficient}\right) \times \text{Diversity Factor}$$

…and energy savings…

Energy savings were based on the previously defined reductions in demand (undiversified) multiplied by hours of use. The generalized algorithm used to determine energy savings was:

$$\text{Total kWh Saving}_{Measure} = \sum_{\text{Participant 1}}^{\text{Participant } n} \left(\text{Total kW Reduction} \times \text{Hours of Use}\right)$$

Program Cost-Effectiveness

The overall net benefit/cost of the Program has been evaluated in terms of:

- **Total Resource Cost (TRC) benefit/cost ratio** — the net present value of the avoided cost of electricity supply achieved relative to the incremental costs of the technology plus the Program administration and marketing costs.
- **Utility (U) benefit/cost ratio** — the net present value of the avoided cost of electricity supply achieved relative to the Program administration and marketing costs.
- **Participant (P) benefit/cost ratio** — the net present value of the customer bill savings relative to the incremental cost of the technology.

where:

$$TRC_{Program} = \frac{\sum_{Measure1}^{Measuren} \text{Net Present Value of } Avoided\ Supply\ Cost(\text{Measure Life}, 12\%\text{ Discount Rate})}{\sum_{Measure1}^{Measuren} \text{Incremental Equipment Cost} + \text{Program Marketing \& Administration Cost}}$$

$$UB_{Program} = \frac{\sum_{Measure1}^{Measuren} \text{Net Present Value of } Avoided\ Supply\ Cost(\text{Measure Life}, 12\%\text{ Discount Rate})}{\sum_{Measure1}^{Measuren} \text{Rebate Cost} + \text{Program Marketing \& Administration Cost}}$$

and

$$PB_{Program} \frac{\sum_{Participant1}^{Participantn} \text{Net Present Value of } Avoided\ Supply\ Cost(\text{Measure Life}, 12\%\text{ Discount Rate})}{\sum_{Participant1}^{Participantn} \text{Incremental Equipment Cost}}$$

Free Ridership and Sales Impact

An important consideration in evaluating the impact of the CEB CFL Program is the estimation of free riders — customers who participate in the Program and use the interest free loan scheme, but who would have purchased CFLs in its absence. The value of loan received by free riders is considered to be a benefit from the perspective of the participant but this same benefit is a cost from the utility and non-participant perspectives.

A series of questions in the customer surveys was used to gain insights into these issues.

3.2 Process Evaluation

3.2.1 Objectives

Process evaluation focuses on participation, customer satisfaction and CEB's performance

The focus of the process evaluation was to understand three key elements: (1) the level of customers' participation in and satisfaction with the Program; (2) how well specific marketing strategies worked relative to others, and (3) how effectively CEB's internal procedures and systems performed.

Specific objectives of the process evaluation were to assess:

- The relative differences and similarities between participants and non-participants (including direct sales customers) — to ascertain if the Program has had broad market appeal rather than being limited to certain groups.

- The appropriateness of various marketing materials from the perspective of customers.

- The effectiveness of Program delivery mechanisms and an assessment of Program administration and implementation issues. How else can Program design and/or marketing be improved?

- How satisfied have customers been with the CFLs and with the Program overall? What are the barriers to increased participation in the Program, as expressed by customers?

- To what extent and how do retailers believe that the Program has influenced overall market take-up of CFLs? How do the retailers, LECO and CEB area office personnel, ECF and DSMB believe the Program could be improved.

3.2.2 Approach

In order to address the objectives outlined above, quantitative and qualitative methods were used to analyse the key characteristics and behaviours of the following groups:

- Participants - residential customers who purchased CFLs under the CEB Loan Scheme.

- Non Participants - subdivided into (1) residential customers who were eligible but did not participate in the Program and (2) residential customers who had purchased CFLs outright without using the loan scheme.

- Trade allies - suppliers and retailers approved by the CEB.

- Program Administrators - personnel responsible for Program implementation and management - ECF, LECO, CEB Area Office and DSMB staff.

DSMB staff conducted over 160 face-to-face surveys with the participating and non-participating customers in Western Province (South) and Colombo City. The number of surveys conducted for each customer category is summarised in Table 1. The questionnaire used for the survey is given in Appendix 1. The Trade Allies interviews were conducted with two lamp suppliers - Philips (Hayleys Electronics Ltd.) and Osram (Diesel & Motor Engineering Co. Ltd).

Table 1— Breakdown of Survey Respondents

Category	Survey Sample
Participant	84
Direct Sales Customer	35
Non Participant	43

To gain additional insights into the "process" component of the evaluation, interviews were conducted with relevant staff at ECF, LECO, CEB Colombo West Area Office and DSMB.

3.3 Market Evaluation

3.3.1 Objectives

Market evaluation examines broader issues

The market evaluation is an assessment of the continuing potential for the Program to affect the market in the future, and a re-assessment of the Program's design parameters in the light of post Program participation and changes in the market. The objectives of the market evaluation specifically concentrated on understanding:

- How successfully the Program penetrated its target markets.
- The need to re-evaluate Program eligibility criteria and incentive levels.

Specific objectives of the market evaluation were to assess:

- What is the current penetration of CFLs in the marketplace? What does this imply for refinement of the Program design?
- Has the Program achieved acceptance with a broad cross-section of customers, or is it more popular with specific sub-segments? What market segments are over- and under-represented in Program participation? What does this imply for refinement of the Program design?
- How much remaining market is there for the Program? Is this remaining market potential likely to be comprised of customers that are essentially similar to current participants, or very different from those participants?
- If different, what are the key benefits and criteria likely to be used by those customer segments representing the Program's remaining market potential?

3.3.2 Approach

The information sought for the market evaluation was obtained via:

- A series of questions in the surveys with participating, direct sales and non-participating customers.

- A series of questions during interviews with participating CFL suppliers.

4. INTERVIEWS WITH KEY PARTIES

4.1 Program Participants, Non-Participants and Direct Sales Customers

A series of customer surveys were conducted by DSMB staff in Western Province (South) and Colombo City. The questionnaire used for the survey is given in Appendix 1. The choice of the two areas was based on selecting one area where the Program was believed to have been successful (Western Province) and one area where the Program was considered to be a failure (Colombo City).

The overall results of the surveys were analysed and summarised into two categories, covering technical and Program aspects. Summaries of the technical aspects and program aspects are given in Table 2 and Table 3 respectively. These results are further analysed, discussed and evaluated in the Impact, Process and Market Evaluation sections in this report.

Table 2 - Survey Summary - Technical Aspects

		Kalutara	Dehiwala	Ratmalana	Horana	Colombo West	Colombo South	Colombo East
Total number of surveys		27	32	26	25	21	15	16
Participants	%	52	47	54	56	40	56	57
Direct Sales Customers	%	18	22	23	16	40	25	14
Non Participants	%	30	31	23	28	20	19	29
Participants								
Year of Participation - 1995/96	%	25	60	43	18	100	0	0
Year of Participation - 1997/98/99	%	75	40	57	82	0	100	100
Average No: of CLFs per customer	#	3.4	3.7	3.4	3.7	3.5	4.0	4.0
CFL used as incandescent replacement	%	100	100	100	100	100	100	100
Ave. Wattage of Incandescent replaced	W	62	63	56	69	57	50	65
Lamps still operating	%	86	73	86	86	83	100	83
Lamps failing in year 1	%	14	17	7	9	17	0	17
Lamps failing in year 2	%	0	0	7	0	0	0	0
Lamps failing after 2 years	%	0	0	0	5	0	0	0
Replacement of failed lamps	%	100	75	100	50	0	n/a	0
Satisfied with CFL Performance	%	86	93	100	93	83	89	100
Unsatisfied with CFL Performance	%	14	7	0	7	17	11	0
Light Quality	%	3.5	7	0	0	0	0	0
Looks	%	3.5	0	0	0	0	0	0
Level of Saving	%	7	0	0	0	0	11	0
Other	%	0	0	0	7	17	0	0
Direct Sales Customers								
Average No: of CLFs per customer	#	2.4	3.0	1.8	3.3	2.3	2.3	1.3
CFL used as incandescent replacement	%	100	100	100	100	83	100	100
Ave. Wattage of Incandescent replaced	W	67	52	53	53	63	55	60
Lamps still operating	%	80	67	67	100	100	100	100
Lamps failing in year 1	%	20	n/r	16.5	0	0	0	0
Lamps failing in year 2	%	0	n/r	16.5	0	0	0	0
Lamps failing after 2 years	%	0	n/r	0	0	0	0	0
Replacement of failed lamps	%	0	n/r	100	n/a	n/a	n/a	n/a

n/r - not recorded, n/a - not applicable

Table 3 - Survey Summary - Program Aspects

			Kalutara	Dehiwala	Ratmalana	Horana	Colombo West	Colombo South	Colombo East
PARTICIPANTS									
Information on CFL Program	Newspaper	%	13	13	36	0	33	0	37
	CEB Mail-Out	%	87	83	74	100	67	100	53
	Radio	%	0	0	0	0	0	0	0
	Other	%	0	6	0	0	0	0	9
Ease of Understanding Program Material	Easy	%	100	100	93	100	100	100	100
	Difficult	%	0	0	7	0	0	0	0
Reason for Participation	CEB sponsored	%	42	42	48	35	33	47	22
	Loan scheme	%	50	33	35	40	0	53	44
	Warranty	%	4	17	4	5	0	0	0
	Other	%	4	8	13	20	67	0	33
CEB Approval Process	Good / Fair	%	100	100	100	100	67	100	100
	Unsatisfactory	%	0	0	0	0	33	0	0
Choice of CFLs	Good / Fair	%	93	93	100	100	100	100	100
	Unsatisfactory	%	7	7	0	0	0	0	0
Location of Retail Outlets	Good / Fair	%	64	85	100	100	83	100	100
	Unsatisfactory	%	36	15	0	0	17	0	0
Repayment Period	Good / Fair	%	100	100	100	100	100	100	100
	Unsatisfactory	%	0	0	0	0	0	0	0
Length of Warranty	Good / Fair	%	100	93	92	100	100	100	100
	Unsatisfactory	%	0	7	8	0	0	0	0
DIRECT SALES CUSTOMERS									
Reason for Non-Participation	CEB Approval Process	%	40	0	33	0	0	0	0
	Short Repayment Period	%	0	0	0	0	0	0	0
	Prefer Outright Purchase	%	20	25	33	33	0	25	0
	Unaware of CEB Program	%	20	75	17	67	100	75	100
Importance of CEB Promotionn in decision to buy CFLs	Very Important	%	0	14	50	0	17	0	33
	Important	%	80	14	50	50	17	0	67
	Not Important	%	20	72	0	50	50	100	0
Interest in CEB Program	Yes	%	80	80	83	100	75	50	100
	No	%	20	20	17	0	25	50	0
NON PARTICIPANTS									
Awareness of the CEB Program	Yes	%	75	50	50	71	33	0	0
Reason for non-Participation	CEB Approval Process	%	44	0	50	43	50	n/a	n/a
	Short Repayment Period	%	0	0	0	0	0	n/a	n/a
	Initial Cost	%	0	40	17	0	50	n/a	n/a
	Looks	%	0	0	0	0	0	n/a	n/a
	Unsuitable for fittings	%	0	0	0	0	0	n/a	n/a
	Light Quality	%	0	20	17	0	0	n/a	n/a
	Do not believe savings	%	12	40	0	43	0	n/a	n/a
	Do not believe lamp life	%	0	0	17	0	0	n/a	n/a
	Other	%	44	0	0	14	0	n/a	n/a
CEB Material received	Yes	%	75	33	17	71	67	0	0
Material easy to understand	Yes	%	100	100	100	100	100	n/a	n/a

4.2 Implementing Agencies

4.2.1 CEB Colombo West Area Office

A summary of the meeting with Mr. K.K.S. Dassanayake (Area Engineer) is given below.

The processing of applications is co-ordinated by a trainee and the chief clerk at the Area office. The responses to the scheme have been poor with only around 70 applications processed in the preceding six months. This could be attributed to:

- domestic customers being more affluent in the area;
- high percentage of commercial customers;
- high percentage of tenants;
- reluctance to pay existing arrears (a requirement for Program participation); and
- the requirement for the applicant name to be the same as that in billing record

The voltage range in the service area was considered to be within "tolerable" limits. Some suggestions for improving participation included:

- Setting up of a CFL display centre at the Area Office;
- Pro-active marketing of customers with good payment records;
- Streamlining the approval process perhaps with supplier involvement;
- Increased marketing of product; and
- Organising "Open Days" at weekends

4.2.2 LECO Colombo Office

A summary of the meeting with Mr. Senarath Yapa from LECO is given below.

LECO's Program targets specific towns and is not spread across its service area. LECO launched its Program in Kotte in March 1998 with advertisements at the payment centres. The customers have to make a written request to participate in the Program. From an initial 400 requests 260 customers were accepted to the Program. LECO had adopted a deliberate policy of selection of a cross-section of customers ranging from "good" to "not very good" (those who did not default in bill payments) customers. They have recently launched a similar Program in Moratuwa. They have an on-going survey with every customer accepted into the Program but the results are yet to be analysed.

Some of the barriers / issues identified by LECO are:

- Long delays (approx. 4 months) in receiving claims from suppliers, mainly due low customer participation and collection of forms from the retailers;
- Reluctance of customers to participate because of the requirement for prior payment of arrears;
- Need to ensure that the warranty cards bear the seal of the supplier/retailer;
- Increase in the price of CFLs as a result of the Goods & Services Tax (GST);

- Need to conduct training programs for retailers.

4.2.3 Energy Conservation Fund (ECF)

The ECF is responsible for implementation of the Program in the Public Sector utilising their own funds and imposing a service charge of 7% on purchases. The meeting with Mr. W.R.B. Rajakaruna (Chairman) and Mr. P.G. Joshep (General Manager) revealed that the Program has been stopped due to lack of resources, both administrative and financial, although there was big demand for participation in the Public Sector.

4.3 Suppliers

4.3.1 Diesel & Motor Engineering Co. Ltd. (OSRAM)

The meeting was attended by Mr. Sarath Ganegoda (Group Finance Director) and Mr. Harendra Jayasuriya (Sales Manager, Marketing & Distribution Division).

Osram indicated that their sales have increased significantly, since the CEB Program was launched, both from Program participants and direct sales. There were more direct sales in urban areas than in the Provinces and the retail outlets close to CEB offices experienced more sales.

Osram indicated that the CEB reimbursement procedures need to be more streamlined. They had experienced delays in payments particularly since the processing of applications was decentralised.

With regard to reducing the impact of foreign exchange fluctuations on the cost of lamps, Osram indicated that they would investigate different sources of supply. They have manufacturing plants in Belgium and Malaysia in addition to Germany. The company also market the "Neolux", which is about 15% cheaper that an equivalent Osram lamp. They have experienced a lamp failure rate of around 3% over the last two years.

They expressed their willingness to participate in a joint advertising campaign with CEB and other lamp suppliers.

4.3.2 Hayleys Electronics (Lighting) Ltd. (PHILIPS)

The meeting was attended by Mr. Peter Van der Vorst (Regional Manager, International Sales, Philips Lighting), Mr. Rahman Zubair (Manager, Consumer Products) and Mr. Fuard Saibukandu (Deputy General Manager). Philips expressed satisfaction with the current loan scheme, and stated that they have a co-operative relationship with DSMB staff.

The lamps used for the Program are sourced from The Netherlands and the CIF costs have risen periodically due to foreign exchange fluctuations. This together with a 12½% Goods and Services Tax (GST) introduced in 1998 was considered to be a major cause for concern. The need to investigate alternate sources of supply to control the CIF costs was discussed. Philips indicated that the last production of PLEC lamps in Holland will be in June/July 1999 and production will be discontinued in 2000. The manufacture of the new PLEU lamp will commence in August/September 1999 in China.

Some of the barriers / issues identified by Philips are:

- There is a need for tighter specifications for CFLs as there are many cheap, low quality imports from Asia that have a negative impact on customer acceptance of the technology.

- The power quality (voltage fluctuations) in the Provinces is very bad (e.g. Voltage of approx. 160V in Nuwara Eliya).

- There is a general lack of awareness of the benefits of CFLs in the Colombo area and a need to concentrate more on marketing efforts since the power quality is acceptable.

They expressed their willingness to participate in a joint advertising campaign with CEB and other lamp suppliers.

5. IMPACT EVALUATION

5.1 Participation

The breakdown of the participation in the CFL Loan Program since its initiation in November 1996 to end December 1998 is summarised in Table 4 below.

Table 4 - CFL Loan Program Statistics

Category	*Eligible Market size (# of customers)*	*Program Take-up (# of customers)*	*Percent Take-up (%)*	*Lamps sold (#)*	*Ave. # of Lamps per customer*
Western Province (South)	237,377	13,198	5.5	47,023	3.6
Colombo City	80,192	1,004	1.3	3,894	3.9
Western Province (North)	200,000	3,096	1.5	*7,400**	*2.4*
North Western Province	207,000	2,969	1.4	*8,800**	*3.0*
Central Province	246,877	11,529	4.7	*21,538**	*1.9*
Southern Province	*Not Available*	*Not Available*		*note 1*	
Total				88,655	
Program target @31/12/98				215,000	
% of target Achieved				41.2	

Direct Sales

Category	*Eligible Market size (# of customers)*	*Program Take-up (# of customers)*	*Percent Take-up (%)*	*Lamps sold (#)*	*Ave. # of Lamps per customer*
1997				137,385	
1998				373,353	
Total				510,738	
Program target @31/12/98				285,000	
% of target Achieved				179.20	

Public Sector and CEB Employees & LECO Customers

Category	*Eligible Market size (# of customers)*	*Program Take-up (# of customers)*	*Percent Take-up (%)*	*Lamps sold (#)*	*Ave. # of Lamps per customer*
CEB Employees	14,500	10,360	71.4	40,967	4.0
LECO Customers	*255,753*	*700*	*0.3*	*2,800**	*4.0*
Public Sector Employees	*Not Available*	*Not Available*		1,557	
Total				*45,324*	

** estimated figures*

note 1 : program commenced in 1999, approximately 2000 lamps sold

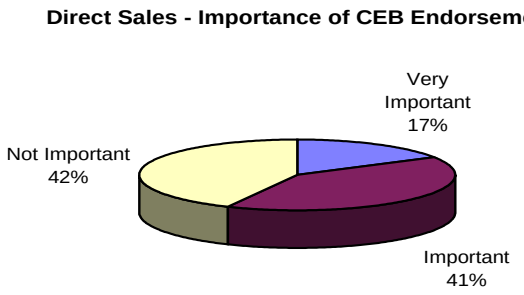
As expected, the CEB employee participation was the highest (71.4%). Relevant information for LECO and Public Service employees was unavailable for a similar comparison.

The participation rates in the Provinces and Colombo City varied from 1.3% to 5.5% which is considered to be low. One of the objectives of the loan scheme was to provide loans for 215,000 lamps by the end on 1998. Using best estimates only 41% of the target have been achieved.

Impact of CEB Endorsement of CFLs on Direct Sales

The CEB endorsement of the CFL Program has had a significant influence in the decision of direct sales customers. Fifty eight percent (58%) of the customers surveyed indicated that CEB endorsement was either very important or important in their decision to purchase CFLs. See Figure 1 for summary of customer responses to this aspect.

Figure 1 - Importance of CEB endorsement on Direct Sales

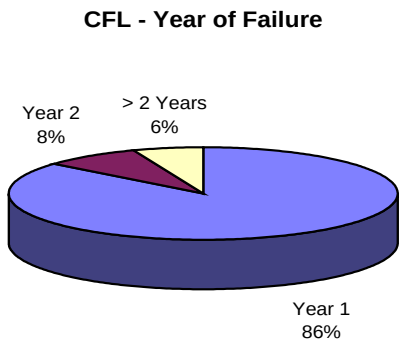


5.2 Lamp Performance Impacts

Lamp failures

Eighty Five percent (85%) of the program participants who responded to the survey indicated that all of the lamps purchased are still operating. The Figure 2 shows a summary of the responses for the year in which the Clefs failed, which indicates 86% failure rate in the first year of the 15% of the participants whose lamps had failed.

Figure 2 - Year of Failure of Lamps



5.3 Program Cost Effectiveness

A cost effectiveness analysis of the program requires detailed information on participant numbers, administrative costs of all the implementing agencies. This information was unavailable at the time of preparation of this report.

A technology cost effectiveness analysis was conducted using the following information and assumptions:

Base Technology		:	60W Incandescent lamp
DSM Technology		:	11W CFL
CFL Lamp life		:	6 years (6000 hours)
Incandescent Lamp Life		:	1 year (1000 hours)
Operation		:	3 hours/day, 365 days per year
Lamp Cost	- CFL	:	600 Rs
	- Incandescent:		25 Rs
Average Domestic Tariff		:	4.40 Rs/kWh
CEB Avoided Costs		:	*3.06 Rs/kWh (Energy)*
		:	*1200 Rs/kW per year (Demand)*
Average System Loss		:	*17%*
Discount Rate		:	12%

Details of the calculation are given in Appendix 2 and the results are summarised in Table 5 below.

Economic Perspective	***Participant***	***Rate Impact Measure***	***Total Resource Cost***
PV Benefits (Rs)	*971*	*1164*	*1164*
PV Costs (Rs)	*497*	*971*	*497*
NPV (Rs)	*473*	*193*	*666*
Benefit/Cost Ratio	*1.95*	*1.20*	*2.34*

Table 5 - Technology Economic Summary

Another analysis was conducted for the Block 1 & 2 customers (<90kWh per month) using an average tariff of Rs 2.40/kWh and the current approved lamp cost of Rs 650.00. The analysis showed that the Program was not cost effective to the participant, as summarised in Table 6 below

Economic Perspective	***Participant***	***Rate Impact Measure***	***Total Resource Cost***
PV Benefits (Rs)	*529*	*1164*	*1164*
PV Costs (Rs)	*547*	*529*	*547*
NPV (Rs)	*-18*	*634*	*616*
Benefit/Cost Ratio	*0.97*	*2.20*	*2.13*

Table 6 - Technology Economic Summary for Block 1&2 Customers

5.4 Program Benefits

The benefits to the CEB system in 1997 and 1998 was evaluated based on the total participation (Loan scheme and direct sales) and the program costs including cost of incentives (interest free loan). The results are summarised in Table 7 below.

Table 7 – CEB Program Benefits

System Impacts	*Program Target*	*1997*	*1998*
Energy Saving (GWh/yr)	*37.5*	*14.2*	*46.4*
Demand saving (MW)	*25.0*	*10.4*	*33.9*
Cost Effectiveness			
Reduced Supply Costs (Rs.M)		*55.92*	*182.66*
Customer Bill Savings (Rs M)		*46.90*	*153.18*
Net Benefit (Rs M)		*9.02*	*29.48*
Program Costs (Rs M)		*1.50*	*0.25*
Incentives (Rs M)		*4.32*	*5.33*
Total Costs (Rs M)		*5.82*	*5.58*
Benefit / Cost Ratio		*1.55*	*5.29*

5.5 Summary of Findings

1. Some important program statistics are not available. This information is required if proper program evaluations are to be conducted in the future.

2. The details of costs associated with program implementation are not available. These include advertising and program administration costs of all agencies responsible for program implementation.

3. From the information that is available it appears that around 41% of the program target for the loan scheme was achieved at the end of 1998. However, the target set for direct sales exceeded by 79%.

4. The endorsement of the CEB of the program has had a major impact on customer participation.

5. Of the 15% of the survey respondents who experience lamp failure, most failures (86%) occurred during the first year.

6. Recent increases in the cost of CFLs as a result of foreign exchange fluctuations and introduction of GST have made the

program economically unattractive for the customers on Block 1 and 2 tariffs.

6. PROCESS EVALUATION

6.1 Customer Satisfaction

The survey indicated an overwhelming majority (92%) were satisfied with the performance of the CFLs. The survey also determined the reasons for dissatisfaction from the 8% of the respondents and the results are summarised in Figure 3 below.

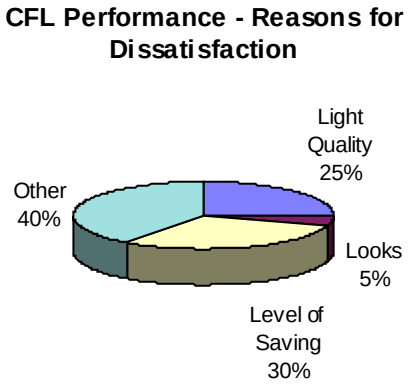


Figure 3 - Reasons for Dissatisfaction with CFL Performance from the 8% of respondents

The extent of satisfaction on the following key Program aspects were targeted in the surveys - CEB approval process, choice of clefs, location of retail outlets, loan repayment period and the length of warranty offered by the suppliers. The summary of the responses is given in Table 8 below.

Aspect	*Good*	*Fair*	*Unsatisfactory*
CEB Approval Process	88%	10%	2%
Choice of CFLs	72%	26%	2%
Location of Retail Outlets	64%	26%	10%
Repayment Period	83%	17%	0%
Length of Warranty	84%	14%	2%

Table 8 – Customer satisfaction on key program aspects

6.2 Marketing Strategies

The CEB and lamp suppliers adopted several marketing strategies to promote the program. The CEB did a mail out to the customers in the participating Provinces, which included program information, brochures of participating suppliers and an application form. The CEB

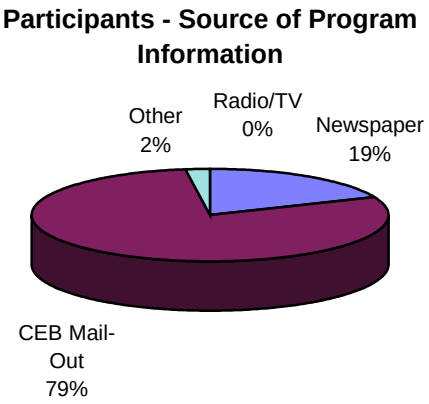
also placed several newspaper advertisements outlining the key benefits and program participation details.

The suppliers had their own marketing plan, which included billboard advertising, newspaper advertising and TV commercials.

Participant Responses

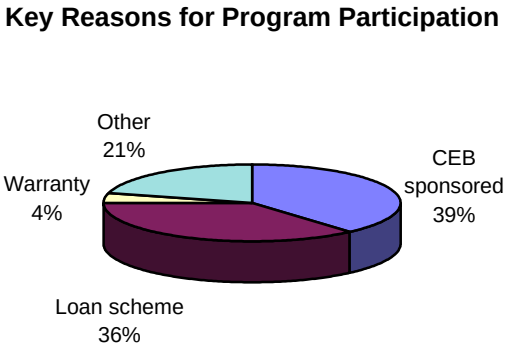
A summary of the responses from program participants regarding where they heard about the CFL program is given in Figure 4 below. The CEB mail-out appears to be the most effective and all respondents indicated that the program material sent by the CEB was easy to understand.

Figure 4 - Source of CFL Program Information



CEB sponsorship and loan facilities offered under the program appear to be the key factors affecting the customer's decision to participate in the program. The summary of the responses for main reason for participation is given in Figure 5 below. It is interesting to note that the length of the warranty (currently 2 years) has had little impact. In the "others" category the primary response was to reduce electricity bills,

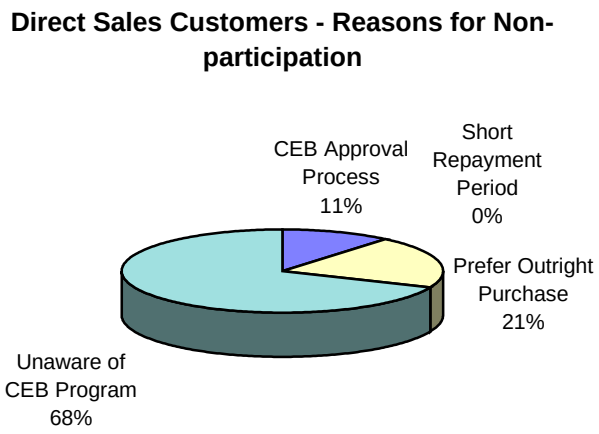
Figure 5 - Key Reasons for Program Participation



Direct Sales Customer Responses

The primary reason for customers opting to purchase CFLs outside the CEB program appears to be the lack of awareness of the existence of the program. The summary of the customer responses on reasons for non-participation in the CEB program is given Figure 6 below.

Figure 6 - Reasons for Non-participation in CEB Program

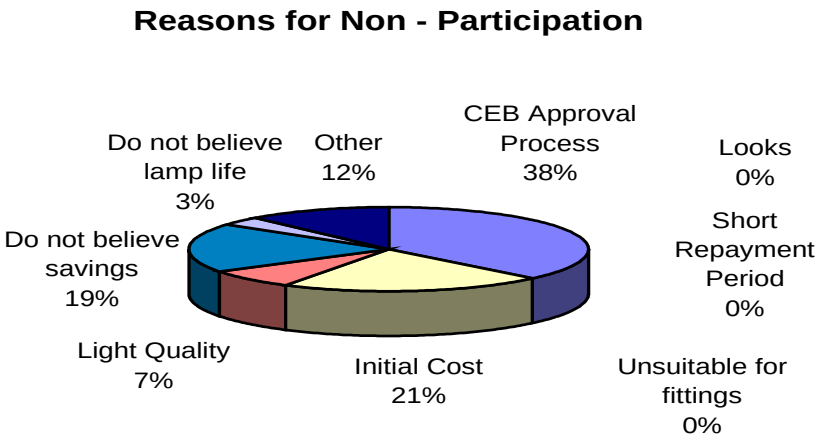


It should be noted that 81% of the customers expressed interest in the CEB Program.

Non-Participant Responses

The responses from the non-participants indicated that only 38% remember receiving the CEB material in the post. Their reasons for non-participation are summarised in Figure 7 below. The CEB approval process and lamp costs appear to be the key factors affecting their decision. The responses to the "other" category included – not interested in CFLs do not like to get loans and no time to visit the CEB area office.

Figure 7 - Key Reasons for Non-Participation in CEB Program



6.3 Performance of Agencies

The Public Sector Program, which is managed by the ECF, has been suspended due to lack of resources. The information in relation to the progress since program commencement is unavailable.

The CEB appear to have allocated sufficient resources at their Area offices to process applications for the purchase of CFLs. However, there have been delays in making payments to suppliers primarily due to the decentralisation of the payment process.

LECO have adopted a somewhat different approach to program implementation than that of the CEB. They have focused on specific areas and have put the onus on customers to formally express interest in the scheme. This has resulted in slow progress in program take up.

6.4 Summary of Findings

1. An overwhelming majority of participants are satisfied with the performance of the CFLs. This could be attributed to the high standards and specifications adopted by the CEB for CFL suppliers.

2. Majority of the direct sales customers and non-participants were unaware of the CEB Program.

3. The CEB approval process, high lamp costs and doubts about achievable savings are considered to be the main reasons for non-participation.

4. The length of the warranty is not an issue (only 4% thought it was) with the program participants.

5. Direct customer mail-outs and newspaper advertising appear to be the best sources of marketing under the adopted marketing strategies.

6. The Public Sector currently does not have access to the program (unless they reside in areas where the program is run) due to the suspension of administrative responsibilities by the ECF.

7. MARKET EVALUATION

7.1 Market Penetration

The total CFL sales data since the initiation of the Program in June 1995 to end December 1998 is summarised in Table 9 below.

Period	Details	No: of Lamps
June '95 - August'97	*Program with CEB subsidy*	*100,000*
November'96 - December'98	*CFL Loan Scheme*	*122,222*
January '97 - December'97	*CFL Direct Sales*	*137,385*
January '98 - December '98	*CFL Direct Sales*	*373,353*
Total Sales		***732,960***

Table 9 -CFL Sales Statistics

The analysis of the sales data show that, since the launch of the CEB loan scheme, only 19% of the sales (122,222 lamps) were through the scheme while the rest were direct sales. It should be noted that the direct sales figures are those obtained only from suppliers participating in the Program and the overall sales are considerably higher.

In 1998, the direct sales increased by around 270% compared to the previous year. An annual breakdown of the sales figures under the loan scheme was unavailable for a similar comparison.

7.2 Program Acceptance

There are technological considerations associated with the extent of program participation. Voltage fluctuations are of major concern to lamp suppliers and their ability to give two-year warranty on the lamps.

One of the requirements for eligibility for the Program is that all arrears have to be paid prior to approval. This in turn would exclude customers with an acceptable payment record but unable meet the eligibility criteria.

7.3 Summary of Findings

1. The sales statistics are only available from suppliers participating in the program. There are other numerous retailers in the country whose sales data are unavailable.
2. Technological considerations, such as, impact of voltage fluctuations would need to be considered.

3. Colombo City, where the power quality is the best, is the area with the greatest potential but so far shown the least participation.

8. PROGRAM REFINEMENTS

8.1 Program Delivery

8.1.1 Lamp Costs

Investigate cheaper sources of supply, GST exemption and extension of repayment period.

The cost of the CFLs have increased 10 to 20% since the commencement of the Program, primarily as a result of weakening of the Rupee against major European currencies. The two major brands of CFLs in the market (Philips and Osram) are imported from Holland and Germany. Philips and Osram have manufacturing plants in China and Malaysia respectively, and the feasibility and benefits of these alternate sources of supply should be investigated.

The GST, which was imposed since 1998 has also compounded this problem. The feasibility of seeking an exemption or the CEB absorbing these costs should be evaluated. The option of extending the current repayment period of 12 months to 18 months should also be investigated.

8.1.2 Power Quality

Power quality to be considered in future extensions

The lamps function effectively in a voltage range of 180V to 240V. However, according to the retailers, the voltage is frequently outside this range in some of the Provinces where the Program is implemented. Therefore, they are concerned about the impact on lamp life and hence, their warranty. Colombo City is the only area where the voltage is considered acceptable. Any future extension of the Program should consider the extent of voltage fluctuations in the Provinces targeted.

8.1.3 Target Customer Segments

Consider a rebate for Block 1 & 2 customers

Economic analysis has shown that the Program is not cost effective for the Domestic Block 1 and 2 customers at the current retail value of Rs 650. Considering that CEB's avoided cost of energy (Rs 3.06/kWh) is greater than the average tariff (Rs 2.40/kWh), the feasibility of offering a rebate on the CFLs for these customers (<90units/mth) should be investigated. If this is not practical, the customers in these categories should be dissuaded from participating in the program.

In contrast, Colombo City has a high percentage of Block 3 and 4 customers and an acceptable supply voltage. However, the customer take up so far has been very low (1.3%). A different marketing strategy should be adopted for attracting these customers. One of the problems to be addressed is the high percentage of tenants and in most instances the CEB account is in the landlord's name.

8.1.4 Warranty Period

Reduce warranty period in exchange for lower cost

The surveys have shown that in the majority of the lamps that failed, the failure occurred in the first year. In addition, only a small percentage (4%) of participants considered the length of the warranty to be important in their decision to participate in the Program. Consideration should be given to a one-year warranty with an equivalent reduction in lamp costs.

8.1.5 Sales Outlet at CEB

Establish sales outlet at DSMB

The time taken for the approval of applications and purchase of lamps is considered to be one of the major barriers in the Program. Although some minor refinements to the approval process could be made, an establishment of a sales outlet would reduce the time significantly. The DSMB and the CEB Colombo West Area office is now located in the same building. This presents a good opportunity for a pilot sales outlet to be established and operated by DSMB.

8.2 Program Promotion

8.2.1 Advertising

Consider joint advertising with suppliers

At present there is no co-ordinated approach to advertising, with the CEB and suppliers doing their own advertising. The suppliers who were interviewed during the evaluation indicated their willingness for a joint advertising program headed by the CEB. The feasibility of this should be investigated together with other modes of advertising such as Television and radio.

8.2.2 Brochures

Design new brochures

A new set of brochures, based on the joint advertising concept, should be prepared using an advertising or marketing organisation.

8.2.3 New Promotion

Initiate new marketing approach

A new approach to marketing the Program should be adopted. One of the approaches maybe to target customers with a good payment record. Letters of recognition could be sent to the customers and advising them of the Program that would assist them in reducing their electricity bills. The CEB Colombo West Area office could initially adopt this approach.

8.2.4 Special Events

Organise special events for program promotion

One of the barriers in the current program is that the customers have to visit the CEB Area office during normal working hours for the approval of applications. One way of addressing this is to organise "special events" during a weekend with participation from suppliers

where a customer could get approval and purchase lamps at the same venue.

8.3 Program Administration

8.3.1 Application Approvals

The process and conditions adopted for approval of applications need to be reviewed to determine if there is scope to eliminate unnecessary steps and expedite processing.

Review application approval procedures

8.3.2 Revival of Public Service Program

The Public Service program, which was administered by the ECF, was suspended due to lack of resources. The Public Sector is by far the largest employer with approximately 565,000 employees and offer significant scope for participation in the program. Considering the success of a similar program with CEB employees, the DSMB should initiate discussions with the ECF and formulate a joint proposal to re-commence the program.

Revive Public Sector program

8.4 Program Monitoring

8.4.1 Monitoring Procedures

Proper program monitoring procedures need to be established for the program. These should include gathering information of key program parameters - total and program sales data, participation statistics, lamp failures, program administration costs, advertising costs, and other incidentals.

Establish monitoring procedures

APPENDIX 1

CUSTOMER SURVEY FORM

Interview Number: _____

Interviewer : _____

Date of Interview : _____

Time : _____

Compact Fluorescent Lighting Program

Customer Survey

Customer Details

Customer Name _____

Address _____

_____

Province _____

Electricity Supplier CEB / LECO *(circle)*

Utility Account No. _____

Customer Code

Participant..... 1

Non - Participant 2

Direct Sales..... 3

Introduction

My name is..... and I am from the Demand Side Management Branch of the Ceylon Electricity Board and I am here to conduct a survey on a lighting program.

Overview of the survey

The Ceylon Electricity Board introduced a Compact Fluorescent Lighting Program in 1995 to assist Domestic customers to save money on their electricity bills. This program was supported by the government of Sri Lanka through the Ministry of Irrigation and Power.

We are currently doing an evaluation of the program to see if it could be improved to help more customers benefit from the program. I would appreciate your assistance in answering a few questions about the program.

During the interview I will be taking notes but when we analyse the results all the customers participating in the survey will remain anonymous.

1. PROGRAM PARTICIPATION

I'd like to begin our survey by finding out if you participated in the program.

The CEB introduced the CFL Program in 1995 where Domestic Customers were entitled to purchase up to 4 lamps from approved retailers and pay for them in twelve monthly instalments through the electricity bills.

Q 1-1 Did you participate in this program?

Yes	1	goto	Q 2-1
No	2	goto	Q 1-2

Q 1-2 Have you purchased any CFLs directly from the retailers over the last 3 years?

Yes	1	goto	Q 3-1
No	2	goto	Q 4-1

2. PROGRAM PARTICIPANTS

I would now like to ask you more details about your participation in this program

Q 2-1 In which year did you participate in this program?

1995 / 1996	1		
1997 / 1998 / 1999	2		

Q 2-2 How many lamps did you purchase?

One	1		
Two	2		
Three	3		
Four	4		

Q 2-3 Where were the lamp(s) installed?

Verandah / Lounge/Dining area	1		
Kitchen	2		
Bedrooms	3		
Outside	4		
Other (specify)	5		

Q 2-4 Were the CFLs used as replacement of existing incandescent lamps or in new installations?

Replacement of Incandescent lamps ..	1	goto	Q 2-5
New fittings	2	goto	Q 2-6
Both	3	goto	Q 2-5

Q 2-5 What was the wattage of the incandescent lamps replaced?

40W	1		
60W	2		
75W	3		
100W	4		

Q 2-6 Are the lamps still operating?

All operating	1	goto	Q 2-10
Some Operating	2	goto	Q 2-7
None operating	3	goto	Q 2-7

Q 2-7 After how long did the lamp(s) fail?

Within 1 year		goto	Q 2-8
Between 1st and 2nd years		goto	Q 2-8
After 2 years		goto	Q 2-10

Q 2-8 Were the lamps replaced by the supplier during the warranty period?

Yes	1	goto	Q 2-10
No	2	goto	Q 2-9

Q 2-9 Why was it not replaced?

Reason:

Q 2-10 Have you changed your usage pattern of lighting (i.e. no: of hours/day) since participating in the CFL program?

No	1
Increased no: of hours	2
Decreased no: of hours	3

Q 2-11 Where did you hear about the CFL Program?

Newspaper	1
CEB program mail-out	2
Radio	3
Other (specify)	4

Q 2-12 Were the advertisements / CEB literature easy to understand?

Yes	1	goto	Q 2-14
No	2	goto	Q 2-13

Q 2- 139 Why was it difficult to understand?

Reasons:

Q 2-14 Why did you decide to participate in the CFL Program? *Multiple responses allowed*

Sponsored by CEB	1
Instalment Scheme	2
Manufacturers Warranty	3
Other (specify)	4

Q 2-15 Are you satisfied with the performance of the CFLs?

Yes	1	goto	Q 2-17
No	2	goto	Q 2-16

Q 2- 16 What aspects were you not satisfied with?

Quality of light	1
Looks	2
Level of saving	3
Other (specify)	4

Q 2-17 How do you rate the following aspects of the program?

	Good	Fair	Unsatis-factory
CEB approval process			
Choice of CFLs			
Location of retail outlets			
Repayment period			
Length of warranty			

Q 2- 18 Do you have any suggestions for improving the program?

Suggestions:

3. Direct Sales Participants

Q 3-1 What do you consider to be the main reasons why you have not purchased CFLs under the loan scheme? *Do not prompt*, *multiple responses allowed*

Procedures for obtaining CFLs ……	1
Short Repayment Period ……..	2
Prefer to purchase outright …….	3
Was not aware of program ……..	4
Other (specify)……	
……..	

Q 3-2 How important was the fact that the CEB was promoting CFLs in your decision to purchase CFLs?

Very important ……..	1
Important ……	2
Not important ……	3

Q 3-3 How many lamps did you purchase?

One ……..…… …….	1
Two …….....	2
Three ……..	3
Four or more……	4

Q 3-4 Where were the lamp(s) installed?

Verandah / Lounge/Dining area ……	1
Kitchen ……..	2
Bedrooms ……..	3
Outside ……..	4
Other (specify) ……	5

Q 3-5 Were the CFLs used as replacement of existing incandescent lamps or in new installations?

Replacement of Incandescent lamps ..	1	goto	Q 3-6
New fittings	2	goto	Q 3-7
Both	3	goto	Q 3-6

Q 3-6 What was the wattage of the incandescent lamps replaced?

40W	1
60W	2
75W	3
100W	4

Q 3-7 Are the lamps still operating?

All operating	1	goto	Q 3- 11
Some Operating	2	goto	Q 3 - 8
None operating	3	goto	Q 3 - 8

Q 3-8 After how long did the lamp(s) fail?

Within 1 year		goto	Q 3- 9
Between 1st and 2nd years		goto	Q 3- 9
After 2 years		goto	Q 3-11

Q 3-9 Were the lamps replaced by the supplier during the warranty period?

Yes	1	goto	Q 3- 11
No	2	goto	Q 3-10

Q 3-10 Why was it not replaced?

Reason:

Q 3-11 Have you changed your usage pattern of lighting (i.e. no: of hours/day) since participating in the CFL program?

No	1
Increased no: of hours	2
Decreased no: of hours	3

Q 3-12 Would you like to participate in the CEB CFL Loan Scheme?

Yes 1

No 2

If not, why? 3

Reason:

4. Non - Participants

Q 4-1 Were you aware of the CFL Program sponsored by the CEB?

Yes	1	goto	Q 4-2
No	2	goto	Q 4-3

Q 4-2 What do you consider to be the main reasons why you have not purchased CFLs under the loan scheme or directly from retailers? *Do not prompt, multiple responses allowed*

Procedures for obtaining CFLs	1
Short Repayment Period	2
Cost.....	3
Looks.....	4
Not suitable for fittings.....	5
Quality of light.....	6
Do not believe the savings	7
Do not believe lamp life.....	8
Other (specify).....	7
.....	
.....	

Q 4-3 Did you receive CFL program material from CEB in the mail?

Yes	1	goto	Q 4-4
No	2		

Q 4-4 Were the material easy to understand

Yes	1
No	2

APPENDIX 2

TECHNOLOGY COST EFFECTIVENESS ANALYSIS