

**CASE STUDY**  
**BESCOM EFFICIENT LIGHTING PROGRAM**

**TABLE OF CONTENTS**

PROGRAM HIGHLIGHTS .....	2
BACKGROUND AND RATIONALE .....	2
PROGRAM OBJECTIVES .....	3
PROGRAM DESIGN .....	4
<i>Baseline Survey</i> .....	4
<i>Market Characteristics</i> .....	4
<i>Barriers to CFL Adoption</i> .....	4
<i>Original Program Design</i> .....	4
<i>Modifications to Program Design</i> .....	5
PROGRAM IMPLEMENTATION .....	5
<i>CFL Procurement</i> .....	6
<i>Program Management</i> .....	7
MARKETING AND PROMOTION .....	8
POST-IMPLEMENTATION SURVEY .....	8
PROGRAM EVALUATION .....	9
MAJOR PROGRAM RESULTS .....	10
<i>Impact Evaluation</i> .....	10
<i>Process Evaluation</i> .....	11
<i>Market Evaluation</i> .....	11
LESSONS LEARNED .....	11
<i>Program Impacts</i> .....	11
<i>Market Transformation</i> .....	12
<i>Program Marketing</i> .....	12
<i>Product Range</i> .....	12
<i>Product Quality</i> .....	12
<i>Distribution and Sale</i> .....	12
LIST OF ANNEXES.....	12
<i>Annex 1 – BELP - Request for Proposal</i> .....	12
<i>Annex 2 – BELP Design, Implementation and Evaluation Document</i> .....	12

## **CASE STUDY**

# **BESCOM EFFICIENT LIGHTING PROGRAM**

<b>FIRST DRAFT</b>
--------------------

### **PROGRAM HIGHLIGHTS**

- [Bangalore Electricity Supply Company \(BESCOM\)](#), with technical assistance from the United States Agency for International Development, launched an efficient lighting program to create a market-based mechanism to promote Compact Fluorescent Lamps (CFL) and Fluorescent Tube-lights (FTLs)
- The Program was launched in December 2004 and the first phase was concluded in December 2005
- The program was implemented using a price determination mechanism similar to The World Bank quality and cost-based selection mechanism resulting in 430,000 CFLs sold during the program period.
- CFLs were distributed by the three suppliers selected during the competitive bidding process through existing retail network leveraging the marketing support from BESCOM
- The bulk procurement resulted in reduction of retail price by over 20% (\$3.125 against prevalent retail price of \$3.75 during 2004).
- The lamps were distributed by the participating suppliers using existing retail network.
- BESCOM used the technical specifications from the Efficient Lighting Initiative (ELI) to assure high CFL quality.
- The direct impacts of the program, based on a formal program evaluation, were peak demand reduction of 11 MW and energy savings of 10 GWH per year.
- The program evaluation pointed out that the BESCOM CFL program resulted in market transformation with non-participating suppliers too gaining from program implementation.
- The overall failure rate of the CFLs was insignificant and was moderated through supplier warranty..
- The post-implementation survey indicated a very high level (over 60%) of customer satisfaction with the program.

### **BACKGROUND AND RATIONALE**

Urban India has been facing power outages resulting from unprecedented economic growth since mid 1990s. Unbundled electricity utilities such as the Bangalore Electricity Supply Company (BESCOM) are struggling to meet the year on year 6% growth in residential and commercial sectors. In support of the Energy Conservation Act 2001, Government of India and the United States Agency for International Development (USAID) launched a bilateral technical assistance initiative in 2001. Under the Phase 2 of the technical assistance, USAID, through its Consultants,

supported implementation of demand-side management initiatives in two states – Maharashtra and Karnataka. Beneficiary organizations of the bilateral effort were the Bureau of Energy Efficiency (BEE) – a statutory body set up under the Ministry of Power, Government of India and distribution utilities/state nodal agencies in Maharashtra and Karnataka. Efforts in Karnataka were focused on demonstrating large-scale utility-driven market-based energy efficiency initiatives. The BESCOM Efficient Lighting Program (BELP) was identified as a key initiative in Karnataka targeted at implementing peak clipping efforts in the domestic sector. Domestic lighting, specifically the promotion of Compact Fluorescent Lamps (CFLs), was chosen as an important intervention to remove quality, availability and pricing barriers.

As BESCOM tariff in the domestic sector is cross-subsidized by the paying consumers from industrial and commercial segments, lighting technologies were recognized as important interventions. Initial interviews with the consumers and lighting manufacturers supported replacement of incandescent lamps in Bangalore households with CFLs. Removing barriers around higher first-costs of branded CFLs and lower quality (lifespan) of cheap imported CFLs available in the Bangalore retail sector and resulting awareness building among consumers were key program attributes.

## PROGRAM OBJECTIVES

The objectives of the CFL program were convergent with BESCOM and BEE goals related to DSM implementation. Research has shown that lighting is a major contributor to the BESCOM system peak load especially in the evenings where residential and small commercial sectors are predominant contributors. The use of energy efficient lighting provided significant benefits to BESCOM, including the following:

- Reduction of system peak demand
- Improvement of system load factor
- Improvement of power quality
- Improvement of customer relations

The lighting program at BESCOM will include the design, implementation, monitoring, verification and reporting of a demonstration project using a model incorporating private sector participation.

The primary strategies for achieving the above objectives were:

- to create a competitive CFL branding exercise endorsed by BESCOM
- attract Indian and multinational companies to supply high quality CFLs in BESCOM territory
- to develop internationally accepted technical benchmark for CFLs sold in India
- to promote market transformation towards the use of CFLs instead of incandescent lamps through utility-moderated awareness campaigns.

BELP targeted a quick gain 100,000 CFL uptake through the utility-moderated sales and distribution network. However, BELP resulted in over 430,000 CFLs distributed by the participating suppliers through a market-based, non-subsidized transaction mechanism. Moving beyond the USAID technical assistance, BESCOM was able to extend second phase of the initiative in peri-urban franchise areas..

## PROGRAM DESIGN

### *Baseline Survey*

No specific baseline survey effort was carried out during the program design stage,. However, interviews with BESCOM officials, few consumers, retail shop owners and suppliers revealed following facts:

- average use of incandescent lamps in the residential sector was for 6 hours
- BESCOM consumers used incandescent lamps in high-usage areas such as kitchens, living rooms and security lighting
- reputed suppliers were not aggressive in the Bangalore CFL market due to high-cost (INR 150 or \$ 3.75) barriers and availability of cheap (\$ 1.25) imported CFLs sold on roadside

### *Market Characteristics*

Before the launch of BELP, Indian CFL suppliers were not geared up to supply large quantities in the domestic sector. Emphasis of formal market was the institutional sales to commercial sector where lighting projects were driven by electrical contractors. However, formal and organized CFL suppliers/manufacturers had distribution capabilities through existing supply chain networks. Indian market had two products – pin-in types (used in commercial sectors) and integrated self-ballasted pin-in types directly to fit in to the existing holders. CFL specifications by the Bureau of Indian Standards were still evolving and market players were not following any specific technical standards for lumen output and power quality.

### *Barriers to CFL Adoption*

Indian market assessment pointed out the following barriers to the widespread adoption of CFLs:

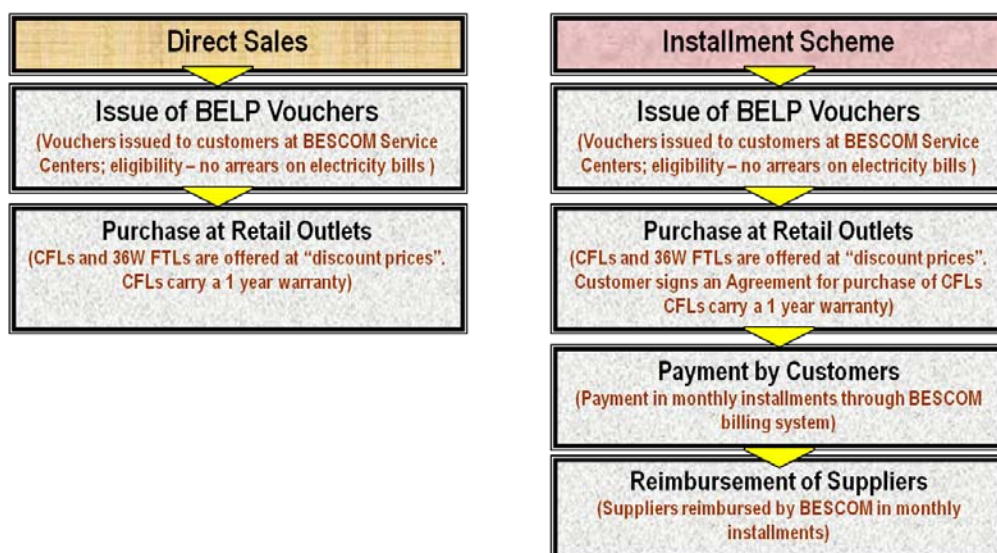
- lack of confidence in CFLs, especially in the domestic sector
- high first costs from organized players with cheaper versions available through imports
- lack of knowledge and awareness regarding benefits of CFL
- lack of branding and quality differentiation
- perceived risk of

### *Original Program Design*

The program was called “**BESCOM EFFICIENT LIGHTING PROGRAM**” and implemented in the **Bangalore Urban** district and was intended to be launched as a demonstration program implemented initially for a period of six months with an option for extension on the recommendation of BESCOM. The program was made open to BESCOM’s LT-2 (Residential and Institutions) and LT-3 (small Commercial) customer categories as detailed in the Electric Power Tariff 2003. The technologies promoted under the program are Compact Fluorescent Lamps (CFLs) and Tri Phosphor 36W Fluorescent Tubes. However, more emphasis was given to CFLs. The selection of lighting suppliers was through a tender process and based on product quality, price, warranty and retail network. Eligible customers (with no arrears on electricity bills) were allowed to acquire the lamps from approved retailers and complete a sales voucher confirming purchase. BESCOM allowed two transactions options – i) inclusion of lamp costs in

the customer's bills and allow for repayment in instalments over 9 months and ii) direct purchase from retailers without repayment through electricity bills.

Figure 1 - CFL Program Design



By design, BELP did not target subsidy and focused on market-based uptake mechanism using two options presented in Figure 1.

### *Modifications to Program Design*

Initial program development component envisaged creation of a Trust and Retention Account with a leading public finance institution in Karnataka. In this design, the suppliers would have received a credit a market rates to distribute the CFLs to BESCOM consumers with the reflows received through BESCOM. In this design, BESCOM would have had to provide a bank guarantee as a collateral. However, the billing pass-through paid directly by BESCOM was identified as a preferred implementation option as the suppliers and their distributors were able to leverage prevalent credit mechanism.

## PROGRAM IMPLEMENTATION

### *Implementation Plan*

A detailed implementation plan was prepared at the initiation of the program. The plan included specific steps listed below:

- short-listing of suppliers based CFL quality and organizational capabilities
- design of joint marketing campaigns by BESCOM and participating suppliers
- awareness building through customer support centers of BESCOM, leaflets, posters
- tracking of CFL uptake through the two proposed mechanisms (direct sales and billing pass-through)

### ***Program Training***

BESCOM and participating consultants launched specific training sessions for following stakeholders

- staff at the retail and wholesale distribution centers identified by participating suppliers
- BESCOM staff at the customer support and billing centers to issue the vouchers and to address any queries thereto
- BESCOM staff at the billing centers to create new field for entries to add 9 monthly installments in the consumer bills wherever applicable
- BESCOM sub-divisional and divisional officers to validate the invoices from participating consumers to complete payment obligations

### ***CFL Procurement***

A competitive tendering process was adopted by BESCOM similar to World Bank's International Competitive Bidding (ICB) approach comprising of short-listing based on quality and cost. BESCOM issued a Request for Proposal in June 2004 and held pre-bid meetings during June 2004. In order to get the quality of CFLs on par, BESCOM used the Efficient Lighting Initiative (ELI) specifications. ELI specifications were not till then used in India and the Bureau of Indian Standards (BIS) or the BEE did not have any specification issued in India. Key features of the ELI and other tender specifications used are as follows:

- Mandatory requirements
  - related to quality
    - guaranteed life of > 6000 hours
    - power factor of 0.5 or greater
  - minimum lamp warranty of 12 months
  - contribution to joint marketing campaign
  - provision of bank guarantee for warranty moderation
- Technical points for scoring
  - presence in Indian market
  - annual turnover
  - warranty of lamp (minimum 12 months)
  - distribution and retail network
- Financial/costing
  - price of CFLs to replace 40W, 60W, 75W and 100W

BESCOM bid was unique in nature where no CFLs were procured by BESCOM directly. Short-listed brands were offered to the market directly with warranty moderation carried out by BESCOM. Detailed Request for Proposal document is attached as Annexure 1.

Bidding process resulted in short-listing of two multinational and one Indian lighting supplier. All three suppliers offered a price point of INR 110 (\$2.75) to 125 (\$3.125), which shows a price reduction of over 25% in the prevalent market price, also backed by the warranty servicing mechanism.

### ***Lamp Distribution***

The CFLs were distributed through supplier-regulated channels involving 7 large-scale wholesale distributors and 200 retailers spread-over Bangalore city. In addition to retail sales, in order to bring about required boost to sales, BESCOM in coordination with the participating suppliers designed and implemented roadshows at the billing and collection centers and key public offices including offices of BESCOM and holding company the Karnataka Power Transmission Corporation Limited (KPTCL). During the roadshows, the suppliers, through their distributors, developed lamp distribution network using mobile vans. Out of three suppliers enrolled in the program, one supplier had very weak retail network. However, other two suppliers created their own branding and marketing campaigns also ensuring

### ***Targets for Lamp Sales***

There was a very modest sales target of 100,000 CFLs during inception of BELP. The target was set considering 2 CFLs procured under the installments and direct sales schemes by around 50,000 consumers. In reality, the sales of participating suppliers reached over 475,000 during the 9 months implementation period.

### ***Lamp Ordering and Selling***

Entire supply chain of lamp manufacturing to sales was managed by suppliers and their distributors. Non-availability of CFLs was not encountered as a barrier through the project implementation phase.

### ***Payment Collections***

Direct sales at the retail network resulted in across-the-counter payment. Installments collected by BESCOM were paid to the participating suppliers on validation of consumer numbers, collected installments and number of CFLs sold.

### ***Lamp Warranty***

During the project implementation period, BESCOM received as low as two complaints related to warranty issues. The complaints were addressed by participating suppliers within a week's time of logging the complaint. In order to ensure that true claims are made by the consumers, all the lamps sold during the initial 3 months were marked with a hologram specifically designed by USAID consultants and paid for by participating suppliers. However, the suppliers and retail channels used their own markings for warranty servicing at the time of actual transactions.

### ***Program Management***

BESCOM and USAID Consultants were responsible for the overall management of the CFL program. The program management was carried out by DSM Cell, under the directions of an officer of General Manager ranks within BESCOM system. Monthly review meetings were held during the program tenure – December 2004 through October 2005. Review meetings were participated by BESCOM key staff from headquarter and divisional offices, USAID consultants, suppliers and representatives of other government departments supporting BEE activities. BESCOM also appointed a Program Administrator whose functions were as follows.

- coordination with Suppliers, Distributors, Retailers, BESCOM and USAID

- issue of Expression of Interest and evaluation of responses
- selection of Suppliers in consultation with BESCOM and IIEC Project Staff
- preparation of Marketing Material – design and printing
- coordination of Distribution of marketing materials – bill inserts, posters
- media Advertising and Coordination of Road Shows
- coordination of program monitoring activities – collection of sales data
- answering Customer queries and collecting information on the warranties honoured and time spent

## MARKETING AND PROMOTION

BESCOM hired a branding and marketing consultanting agency to develop a marketing and promotion plan. The plan included overall marketing of the program through several media options including the following:

- newspaper advertisements
- leaflets and brochures circulated through monthly bills
- posters at the BESCOM billing centers and key government offices
- scrolling advertisements on local cable network
- hoardings near the billing centers during roadshows
- occasional mobile vans displaying BELP Mascot and CFL signs

BESCOM launched the BELP implementation through a public function on 10 December 2004 that was participated by key BESCOM and Government of Karnataka officials. BESCOM DSM Cell team also delivered specific dissemination lectures at divisional and sub-divisional offices.

## POST-IMPLEMENTATION SURVEY

BESCOM, through USAID Consultants, appointed an agency to carry out post-implementation survey. The sample size for this survey was 180 consumers from following categories:

- aware of BELP – bought CFL cash-down
- aware of BELP – bought CFL in installments
- aware of BELP – bought CFL from retailer
- aware of BELP – did not buy CFL
- not aware of BELP – bought CFL



- not aware of BELP – did not buy CFL

The survey captured following points:

- demographic profile of respondents (age, education, occupation, monthly income)
- media habits radio, television, newspapers, magazines, internet exposure)
- program participation (program awareness, brands purchased, number of CFLs purchased before and after BELP launch, purchase influencer, decision-making attributes – look, price, brightness, life of CFL, warranty, where used, hours of usage, sources of awareness and relative impacts, impact of message conveyed, suggestions for improvement)
- long-term technology buy-in (recommendations to others, satisfaction level)

## PROGRAM EVALUATION

A formal program evaluation of the CFL program was conducted by BESCOM, USAID Consultant and a committee constituted by the BEE. EVN. A consulting firm was selected by EVN to conduct the program evaluation using a competitive bidding procedure. The [Terms of Reference for the evaluation \(see Annex 5\)](#) required the program evaluation to include impact evaluation, process evaluation and market evaluation. The key elements of the evaluation are shown in Table 1 below:

**Table 1 - Key Elements of Program Evaluation**

<i>Evaluation Objective</i>	<i>Type of Evaluation</i>	<i>Evaluation Method</i>
<u>Energy and Peak Savings</u> - Determine energy (MWH) and peak demand (kVA) savings associated with the program. Peak demand savings are defined as the average savings during the hours of 6pm to 10pm.	Impact	Engineering Calculations using manufacturer lamp data and engineering estimates for other factors such as operating hours
<u>Environmental benefits</u> – determine reduced pollutant emissions - such as GHG emissions	Impact	Engineering estimates – pending availability of valid data
<u>Program is cost effective</u> - Evaluate cost effectiveness of program	Financial Analysis	Participant and Utility Test – pending availability of data
<u>Raise awareness of CFLs</u> – evaluate change in consumer awareness and satisfaction with CFLs	Process	Surveys of customers
<u>Improve customer service</u> - evaluate how consumers have responded to the CFL program and their satisfaction with the program	Process	Surveys of customers
<u>Assist poor communities</u> – evaluate benefits to poor customers	Process	Surveys and participant test analysis
<u>Build market for CFLs</u> - evaluate how CFL manufacturers, distributors and retailers responded to the program and possibly changed	Market	Surveys of manufacturers, distributors and retailers

<i>their way of selling CFLs</i>		
<i>Prepare recommendations on how could the program be improved</i>	All	Analysis of overall evaluation results

The detailed [Final Report of the Program Evaluation](#) is provided in Annex 2.

## MAJOR PROGRAM RESULTS

The major program results, based on the program evaluation, are summarized below. A detailed program design, implementation and evaluation document created by BESCOM is attached as Annexure 2.

### *Impact Evaluation*

A summary of the direct program impacts of BELP are given in Table 2 below. During the pilot implementation stage, increased sales of CFLs were estimated to be 175,000 and absolute sales figure for the participating suppliers is 430,000. Load reduction and energy savings benefits have been calculated using 4 hours of CFL use for 330 days in a year.

**Table 2 - Direct Program Impacts**

Program phases (No of CFLs)	Load reduction, MW	Units saved annually, MU
Pilot stage (~175,000 / 430,000)	<b>11.3 / 27.77</b>	<b>9.66 / 23.74</b>
BESCOM-wide potential (~2.6 Million)	<b>117</b>	<b>210</b>
State-wide (~10.0 Million)	<b>450</b>	<b>810</b>

Reduced energy consumption also results in the greenhouse gas emission reduction (reduction of CO<sub>2</sub>). Based on an emission factor of 1 Kg CO<sub>2</sub> per kWh electricity, annual greenhouse gas emission reduction for the 175,000 additional CFLs sold in the system is approximately 15267 Mtons of CO<sub>2</sub>.

The following is a summary of the major conclusions from the Impact Evaluation:

- The program was found to be cost effective to both BESCOM and its consumers
- BESCOM benefits were high as the program was implemented in subsidized residential sector resulting in avoided cost of supply
- The average wattage of the replaced lamps was 60W. Uptake of branded multinational brands was higher than Indian brand
- Perceived reduction in the monthly electricity bills was single-most important factor to purchase the CFLs for new buyers.

- The direct impact, based on engineering calculations, of the BERP was 11.33 MW and 27.77 MW for incremental and absolute sales respectively.
- Other suppliers, who were not a part of the CFL design, also reduced the selling price of CFLs in the market substantially bring the program participant and non-participant prices at par. This reduction resulted in increased sales of non-participating suppliers substantially. Exact numbers were not documented.

### *Process Evaluation*

The following is a summary of findings from the Process Evaluation:

- Average 2 CFLs were purchased by program participants. As high as 87% and 93% of purchasers were first-time buyers in the cash-down and installments purchase categories respectively.
- Price, warranty and reduction in bills were key messages that appealed to the program participants
- Cash-down purchase was most preferred route resulting from consumers' choice to avoid filling out vouchers/agreements for repayment and to avoid queues at the bill collection centers. Retailers too encouraged purchasing the CFLs cash-down to avoid extension of credit to consumers and suppliers/distributors
- Posters at BESCOM billing centers and other offices offered key marketing tool. Roadshows at BESCOM billing offices during the bill payment cycles was effective marketing/campaigning strategy
- Aggressive television campaigns were suggested by program participants as suggestions for future campaigns
- The overall failure rate of the CFLs was less than 0.5% and the failed lamps were replaced by participating suppliers within a week.
- Approximately 60% of the purchasers used the CFLs in bedrooms, verandahs, kitchens (locations with higher daily use)

### *Market Evaluation*

The market evaluation was carried out through interviewing participating and non-participating suppliers. Though data for other suppliers in Bangalore distribution territory as well as other parts of India are not available, CFL sales in India increased after BERP implementation substantially according to the suppliers. In addition to BERP, similar models were tried out in other cities in India as pilot programs.

## LESSONS LEARNED

The major lessons learned are summarized below:

### *Program Impacts*

The CFL program achieved peak demand savings of up to 28 MW based on engineering calculations. Documentation of retirement of used incandescent lamps resulting avoidance of leakage should be made a part of future programs.

### *Market Transformation*

The results of the BELP support the fact that utility interventions in lighting program designs are a useful tool. BESCOM branding also resulted in creation of first-ever utility-EE appliances interface.

### *Program Marketing*

Overall, the marketing activities undertaken by BESCOM proved to be effective in promoting the use of CFLs. There is strong evidence that the awareness levels of CFLs increased in India post-BELP implementation as several other utilities and BEE, at a national level, initiated lighting DSM initiatives. However, use of CFLs in should be promoted in places where high usage is evident to create quicker consumer and utility paybacks.

### *Product Range*

BELP offered appropriate ratings of CFLs to replace 40, 60 and 75 Watts incandescent lamps. This is an important consideration in program success.

### *Product Quality*

BELP used internationally accepted ELI technical specifications and created a baseline for further CFL programs in India. Very low failure rate (only 2 documented warranty claims at BESCOM) substantiates this statement. Barriers related to perception of low-quality of CFLs was removed the BELP implementation.

### *Distribution and Sale*

BELP involved distribution and sale of CFLs via existing market mechanisms and supply chain. This proves to be an important factor in support of promoting new efficient lighting technologies where subsidies may not be essential in case of CFL uptake. Similar mechanism was used by BESCOM in next phase of BELP where even the rural markets CFL distribution was carried out using existing supply chain.

## LIST OF ANNEXES

[\*Annex 1 – BELP - Request for Proposal\*](#)

[\*Annex 2 – BELP Design, Implementation and Evaluation Document\*](#)