INTERNATIONAL INSTITUTE FOR ENERGY CONSERVATION (IIEC)

Promoting Sustainable Energy and Environmental Solutions

Energy Conservation and Commercialization II (ECO-II): Support to the Bureau of Energy Efficiency (BEE) Action Plan

TASK B4

PROGRAM DESIGN REPORT

BESCOM EFFICIENT LIGHTING PROGRAM

Prepared for

United States Agency for International Development (USAID)

USAID | INDIA
FROM THE AMERICAN PEOPLE

Bureau of Energy Efficiency (BEE)

ENERGY IS LIFE
BEE
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LIST OF ABBREVIATIONS

BEE	Bureau of Energy Efficiency (India)
BELP	BESCOM Efficient Lighting Program
BESCOM	Bangalore Electricity Supply Company Limited
CFL	Compact Fluorescent Lamp
CO_2	Carbon Dioxide
DSM	Demand-Side Management
ECA	Energy Conservation Act 2001 (India)
ECO	Energy Conservation and Commercialization Project
EE	Energy Efficiency
ESCO	Energy Services Company
GHG	Greenhouse Gas
GOI	Government of India
GWh	Gigawatt Hour
KWh	Kilowatt Hour
LCC	Life Cycle Cost
M & E	Monitoring & Evaluation
MOP	Ministry of Power (India)
MU	Million Units (Electricity)
M & V	Monitoring & Verification
MW	Mega Watt
NGO	Non-Governmental Organization
NPV	Net Present Value
PF	Power Factor
USAID	United States Agency for International Development
WB	The World Bank

EXECUTIVE SUMMARY

Institution of the Energy Conservation Act 2001 by the Government of India and technical assistance extended by the United Sates Agency for International Development (USAID) India mission has resulted in the implementation of energy conservation measures in a combination of policy-based and market-driven efforts. Role of electricity utilities in the implementation of the market-based demand-side management and energy conservation measures targeted at the subsidized domestic sectors is obvious. Bangalore Electricity Supply Company (BESCOM) clearly was the first-ever utility in the public sector in India that took the progressive approach in developing lighting DSM.

Being the first large-scale attempt to promote efficient lighting in the domestic sector, the BESCOM Efficient Lighting Program (BELP) paved the way for other utilities to implement similar initiatives. Benefits of replacing conventional lamps with CFLs, as discussed in the report – complimented the utility-billing mechanism, placing lighting DSM at the forefront of market-based mechanisms. This encouraging initiative offering an otherwise high-end technology and premium lighting products to consumers belonging to a diverse socio-economic background received a great response from the customer. The success of this program is not only the savings achieved but also the appreciation from versatile personalities for its innovativeness.

BELP pilot scheme has enhanced the customer awareness related to using efficient lighting technologies in the country. This has also created interest among the manufacturers about participating in the utility-driven demand-side management schemes.

1 INTRODUCTION

USAID/India initiated the Energy Conservation and Commercialisation (ECO) project in 2000 aimed at promoting the widespread commercialisation of energy efficiency technologies and services in India, which would have a direct impact on the reduction in growth of greenhouse gas (GHG) emissions. In 2001, the Government of India passed the Energy Conservation Act and established a statutory coordinating body under the Central Government, the Bureau of Energy Efficiency (BEE). The BEE was officially established in March 2002, and the BEE Action Plan was subsequently approved and released in August 2002.

The Energy Conservation and Commercialization II (ECO II) project has been designed to promote widespread commercialization of energy efficiency technologies and services in India. The project supports the development of policy and market interventions that would enhance the capabilities of the private, financial, and government sectors for deploying market-based mechanisms for end-use efficiency investments. Demand-side Management (DSM) is one of the thrust areas of the BEE Action Plan and DSM case studies developed under ECO II Project will be used for national policy formulation.

IIEC is working with the Bangalore Electricity Supply Company Ltd (BESCOM) in implementing a series of Demand-Side Management (DSM) demonstration projects in the State of Karnataka under the ECO II Project. The aim of the demonstration projects is the development of a sustainable model for market driven DSM programs that would benefit the utility, customers and society as a whole.

1.1 Proposed Program and Rationale

BESCOM has a connected load of 7,360 MW and a customer base of 4,657,000. Over 60% of the customers are in the residential sector. It is reported that there was a peak capacity deficit in Karnataka in the range of 500 to 1000 MW in 2003. Under the current residential tariffs customers with monthly usage below 200 kWh are subsidized (ie. the average tariff is below the bulk supply tariff)

Research has shown that lighting is a major contributor to the system peak load especially in the evenings, predominantly by the residential and small commercial sectors. The use of energy efficient lighting would provide 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 proposed lighting program at BESCOM will include the design, implementation, monitoring, verification and reporting of a demonstration project using a model incorporating private sector participation.

1.2 Coordinating Agencies

1.2.1 US Agency for International Development (USAID)

The United States Agency for International Development (USAID) is a principal independent U.S. Federal government agency that receives overall foreign policy guidance from the Secretary of State. USAID/India initiated the Energy Conservation and Commercialization (ECO) project in 2000 aimed at promoting the widespread commercialization of energy efficiency technologies and services in India, which would have a direct impact on the reduction in growth of greenhouse gas (GHG) emissions. The project supports the development of policy and market interventions that would enhance the capabilities of the private, financial, and government sectors for deploying market-based mechanisms for end-use efficiency investments. In 2003, USAID initiated the second phase of ECO project. The purpose of the ECO-II Project is to provide the BEE with necessary technical assistance (TA) and training support.

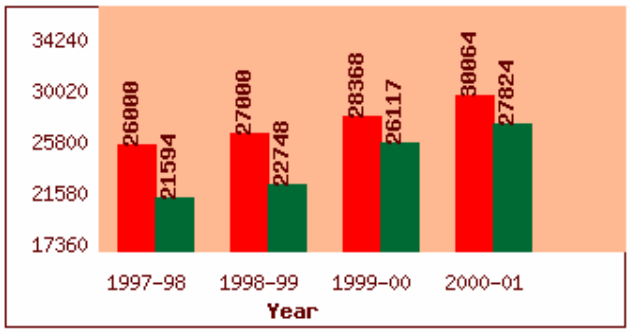
1.2.2 International Institute for Energy Conservation (IIEC)

IIEC is a non-governmental (NGO), not-for-profit organization with offices in Africa, Asia, Europe, Latin America, and North America. It was established in 1984, to foster the implementation of energy efficiency in developing countries and countries in transition. IIEC has full time local staff in each of its offices that are well placed to contribute to programs due to their extensive exposure to energy, transport and environmental activities in the region and their understanding of cultural issues relevant to the countries. As an organization with proven technical capabilities, IIEC designs policies, implements programs, and supports institutions that mainstream energy efficiency in the entire value chain of energy systems and use. IIEC' s approach focuses on implementation, resulting in policies developed in partnership with key policymakers and industry in our target countries as well as the bilateral and multilateral institutions that help to shape energy policy and investment priorities globally.

IIEC's mission is to accelerate the global adoption of energy efficiency, transport and environmental policies, technologies and practices to enable economic and environmentally sustainable development. The emphasis is finding local sustainable solutions to global energy, transport and environmental issues. IIEC assists in the scale-up and implementation of the solutions through the establishment of sustainable institutions.

1.2.3 Bangalore Electricity Supply Company (BESCOM)

Bangalore Electricity Supply Company (BESCOM) was formed in June 2002, with a mandate to distribute electricity. BESCOM service area includes six districts of Karnataka - Bangalore Urban and Bangalore Rural, Kolar Tumkur, Chitradurga and Devanagere. These comprise an area of 41092 Sq. Km and a customer base of over 49.6 lakhs as on January 2004.



The utility has a consumer base including residential, agriculture, industrial, municipal street lighting and waterworks, and lower income households.

The bar chart above gives the increase in demand and supply between 1997-98 and 2000-01. The green bar denotes the supply and the red bar denotes the demand for electricity. BESCOM purchases power from KPTCL through the regional load dispatch centers and also has a captive power generation capacity of 1702 MVA. BESCOM's connected load in the metropolitan zone is 3,550 MW and that in the rural zone is 3359 MW. Out of the metropolitan zone, approximately 1,200 MW load is contributed by Bangalore city alone. Urban sector load is contributed largely by the domestic (25%) and by HT (41%) connections.

Attachment 9.7 shows some of the program pictures during BELP.

2 PROGRAM OVERVIEW

2.1 Electricity Consumption Profile in Karnataka

Karnataka is the fifth largest state in the country. The power sector in Karnataka sees a peak demand in the range of 8,000 to 9,000 MW and a reported peak deficit in the range of 500 to 1000 MW[1]. Above figures are from the monthly data for June and July 2003. Electricity use by sectors is categorized as residential, HT, industrial, agriculture, commercial and residential.

The load growth in Karnataka during 90's was about 6% under restricted conditions as the State was experiencing severe power shortage since 1971. As against the unrestricted peak demand and energy requirements of 4845 MW and 28500 MU respectively for the year 1999-2000, the actual peak demand and energy consumption recorded in the State are 4066 MW and 26277 MU, respectively. Thus, the present shortage to meet the peak demand and energy requirement is to an extent of 16% and 8% respectively. The demand and energy requirement for the year 2009-10 are estimated to be about 9100 MW (with 15% spinning reserve) and 46,000 MU respectively. Taking into account the existing capacity of 5417 MW as on 31-03-2000 there is a need for further capacity addition of about 3500-4000 MW

In 1999, the Government of Karnataka took up reforms program in the power sector with the formation of the Karnataka Power Transmission Company Limited (KPTCL). The unbundling process continued till June 2002, when the government set up four distribution companies, namely Bangalore Electricity Supply Company (BESCOM), Mangalore Electricity Supply Company (MESCOM), Hubli Electricity Supply Company (HESCOM) and Gulbarga Electricity Supply Company (GESCOM). The utility has been successfully unbundled by KPTCL and the DISCOMS interact with each other through KPTCL management and the energy secretariat.

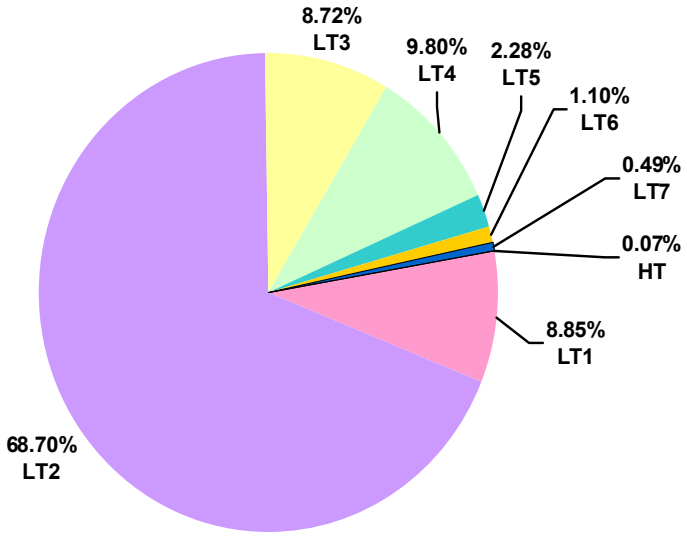
The BESCOM distribution network include six districts – Bangalore Urban, Bangalore Rural, Kolar, Tumkur, Chitradurga and Davangere as shown in Figure above:

2.1.1 Bangalore City

Bangalore Electricity Supply Company (BESCOM) was formed in June 2002, with a mandate to distribute electricity. BESCOM service area is depicted in blue in the Karnataka map above. Six districts of Karnataka are served by BESCOM - Bangalore Urban and Bangalore Rural, Kolar Tumkur, Chitradurga and Devanagere. These comprise an area of 41092 Sq.km., and a customer base of over 49.6 lakhs as on 1st Jan 2004. The utility has a consumer base including residential, agriculture, industrial, municipal street lighting and waterworks, and lower income households.

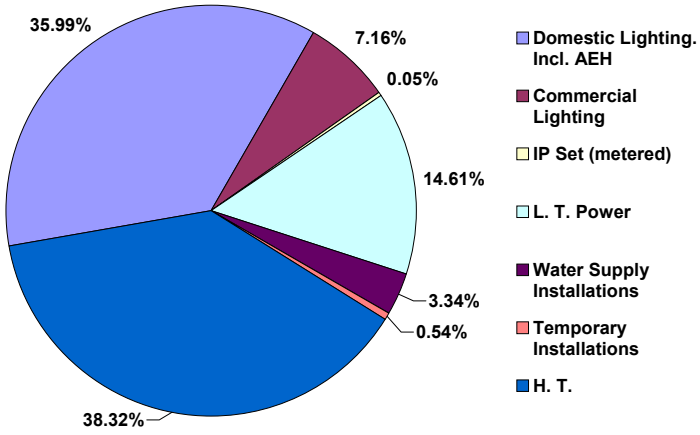
[1] Data from Karnataka Electricity Regulatory commission, accessed in August 2003

The figure below depicts the share of different sectors in the total consumer base. The following figure gives the share of different sectors in the total average electricity consumption.[2]



BESCOM purchases power from KPTCL through the regional load dispatch centres and also has a captive power generation capacity of 1702 MVA. BESCOM connected load in the metropolitan zone is 3550 MW and that in the rural zone is 3359 MW. Out of the metropolitan zone, approximately 1200 MW load is contributed by Bangalore city alone. Urban sector load is contributed largely by the domestic (25%) and by HT (41%) connections.

Cost of supply of electricity in Karnataka is Rs. 3.62 at the last-mile. Most of the customers in the LT2 and LT 1 category are subsidized and BESCOM looses revenues in this sector, largely falling under the category of "All Electric Homes". DSM projects targeted at reducing the consumption in the LT1 and LT2 customers are beneficial to BESCOM.



2.2 Key Elements of Program

The key elements of the program are given below and described in detail in the following sections of this proposal:

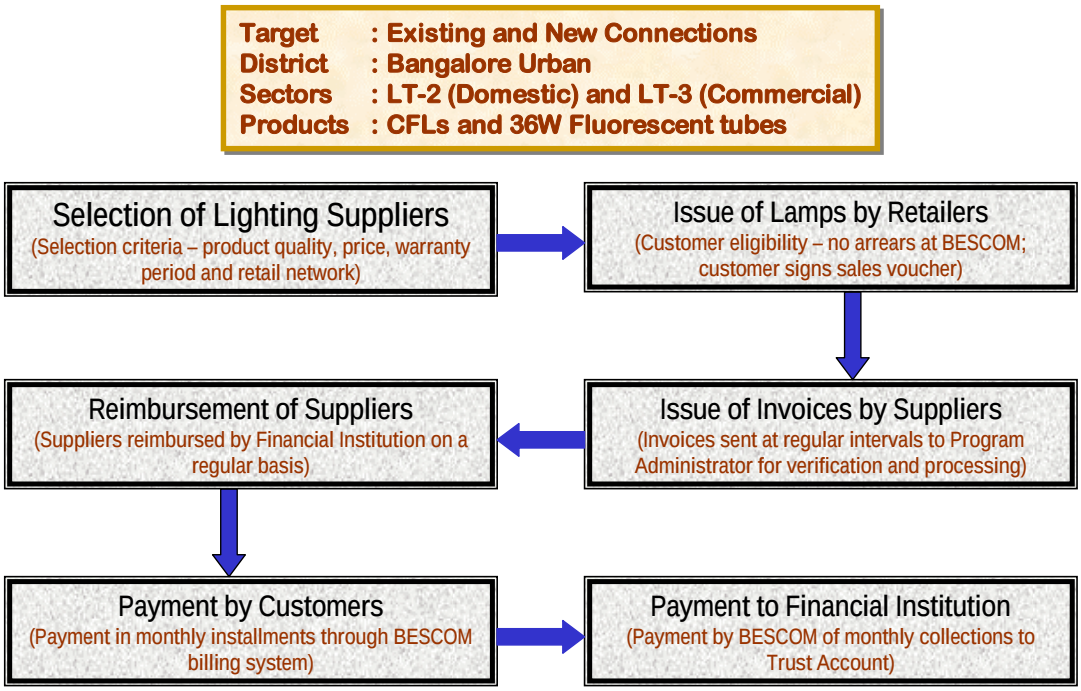
- The program will be called **"BESCOM EFFICIENT LIGHTING PROGRAM"** and will be implemented in the **Bangalore Urban** district.

[2] BESCOM

- This will be a demonstration program implemented initially for a period of six months with an option for extension on the recommendation of BESCOM.
- The program will be 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 will be Compact Fluorescent Lamps (CFLs) and Tri Phosphor 36W Fluorescent Tubes.
- The selection of lighting suppliers will be through a tender process and based on product quality, price, warranty and retail network.
- Eligible customers (with no arrears on electricity bills) will acquire the lamps from approved retailers and complete a sales voucher confirming purchase.
- The distributors will send invoices at regular intervals to the Program Administrators and upon verification will be reimbursed by the participating financial institution.
- BESCOM will include the lamp costs in the customer's bills and allow for repayment in instalments over a specified period.
- BESCOM will open a Trust and Retention Account with the financial institution and will deposit the monthly collections into this account.

The proposed process for the implementation of the program is outlined in Figure 2.2

Figure 2.2 – BESCOM Efficient Lighting Program



2.3 Stakeholders and Roles

The summary of the stakeholders and their respective roles is given below:

Stakeholder	Roles and Responsibilities
BESCOM	Overall responsibility for program; collection of lamp costs through customer bills; payment of monthly collections to Trust & Retention Account; program advertising and marketing
Lighting Product Suppliers/ Distributors	Provide lamps complying to specifications; provide required warranty; coordination with retailers on lamp sales; submission of invoices to IDECK and disbursement of payments to retailers
Lighting Retailers	"Sale" of lamps to eligible customers; providing sales documentation to Distributors.
IIEC	Overall program design and management; program monitoring and evaluation.

3 PROGRAM DESIGN

3.1 Customer Sectors

The eligible customer sectors for the program are LT-2 (a) and LT-3 tariff classes as defined in the BESCOM Electric Power Tariff 2003. This would be predominantly residential and small commercial customers. The customer numbers are as follows:

Division	LT-2 (a)	LT-3
Bangalore South Circle	759,039	119,235
Bangalore North Circle	923,231	161,827
Total Eligible Customers	1,682,270[#]	281,062

[#] This number includes close to 300,000 connections from the low-income group, under the "Bhagya Jyoti – Kutir Jyoti" scheme

3.2 Lighting Technologies

The lighting technologies promoted are as follows:

Current Technology	DSM Technology
Incandescent Lamps	Compact Fluorescent Lamps (CFLs)
40W Fluorescent Tubes	36W Fluorescent Tubes (T8)

Incandescent lamps and 40W fluorescent lamps are widely used in the residential and small commercial sectors. The aim of the program is the replacement of these lamps with CFLs and T8 lamps in areas of high usage (~ 4 hours/day).

3.3 Program Target

Cost/benefit analysis have shown that the replacement of incandescent lamps with CFLs to be cost effective in areas where the average usage is around 4 hours per day. In the residential sector the target areas would include porticos, living rooms, verandas, kitchen, lobbies and security lighting.

Market research has shown that the 40W fluorescents account for nearly 80% of the fluorescent tubing sold, even though the unit cost is marginally higher than a 36W fluorescent tube. It is possible that market transformation from 40W to 36W could be achieved primarily through customer education and without the need for payment by instalments through the electricity bills.

The program target will be 1,000,000 (1 Million) CFLs (or 750,000 CFLs and 250,000 T8s) achieved through the BESCOM instalment scheme and direct sales as a result of the program promotion.

3.4 Program Duration

The duration of the program will be a maximum of 6 months to enable program evaluation under the ECO II project. However, BESCOM has the option of extending the program beyond the six-month period.

In the event the program targets are met before six months, BESCOM has the option of closing the program early. The program will be marketed as a *"Special Offer for a Limited Period"* and thus giving the flexibility on the program duration.

3.5 Implementation Plan

3.5.1 Selection of Suppliers

The selection of suppliers will be made through a formal Expression of Interest (EOI) and clearly defined selection criteria. The selection will be made by IIEC in consultation with BESCOM and the selection criteria will be as follows:

- Company registration, core business, years of operation in India and financial stability (supported by recent financial statement and solvency certificate from the commercial bankers);
- Lighting products offered should be the own brand name of the company;
- Meeting the technical specifications for the lighting products (CFLs and 36W fluorescents);
- In-house testing protocols followed and quality assurance plans followed;
- Period of warranty offered;
- Proposed methodology of warranty serviced and guaranteed replacement time-period;
- Suppliers agreeing to bar-code the CFLs and T8s, supplied under this program for identifying should a warranty be raised;
- Retail price of the lighting products offered for the program;
- Well established distribution and retail network in the Bangalore Urban district; and
- Agreement to the payment procedure and provision of sales data for program monitoring

3.5.2 Expression of Interest

A formal notification of Expression of Interest (EOI) will be issued through BESCOM and published in selected daily newspapers in Bangalore. Interested suppliers will be requested to collect the documentation from BESCOM for a nominal fee. A period of two weeks will be allocated for receiving proposals. A draft EOI is given in ***Attachment 9.1***.

3.5.3 Supplier Obligations

The key supplier obligations are:

- Technical Specifications: The CFLs and T8s shall meet the Voluntary Technical Specifications of ***IFC/GEF Efficient Lighting Initiative (ELI).*** Copies of the specifications are given in ***Attachment 9.2***.
- Warranty Period: The minimum warranty period for the lamps shall be 1 year. However, the suppliers have the option of offering an extended warranty.
- Assigning separate serial numbers or unique bar-codes on the products kept at the retail stores.
- Price of Lamps: The suppliers are required to confirm the price at which CFLs (9W, 11W, 15W and 20W) and the T8s would be offered to BESCOM or its assigned financing intermediary and shall remain fixed for the duration of the program. This price, valid for the duration of program, will be used while raising invoices on BESCOM or assigned financing intermediary. It should be noted that price offered to customers would include finance costs and program administration cost. BESCOM and the assigned intermediary will be allowed to decide the cost to be recovered from its consumers.
- Retail Outlets: The suppliers need to ensure that they have retail outlets at close proximity to the 39 BESCOM Sub-Divisions in the Bangalore Urban district. The customers normally pay their electricity bills at the Sub-Divisions and are likely to purchase lamps immediately after paying the bill.

3.5.4 Eligible Customers

In the LT-2 (a) category there are approximately 1,700,000 customers and based on information from BESCOM about 300,000 customers are below the threshold of 30 units per month (i.e. average monthly bill less than Rs. 75 including fixed charge). These customers would be ineligible for the program.

The Table below outlines the guidelines for the number of lamps issued per customer.

Last Monthly Bill (Rs)	Maximum no: of CFLs	Maximum no: of T8 lamps
< 75	0	0
75 - 200	1	1
200 – 400	2	2
400 – 600	3	3
600 – 1,000	4	4
>1,000	5	5

The eligibility criteria for customers will be the proof of payment of the last BESCOM electricity bill and having no arrears.

3.5.5 Procedure for Issue of Lamps

The procedure for the issue of lamps under the program will be as follows:

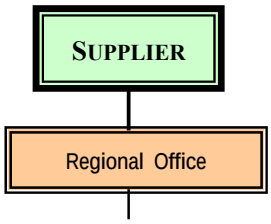
- The customer pays the last electricity bill at the BESCOM sub-division and is given a leaflet by the cashier giving details of the retail outlets in the area and the brands and

prices of the CFLs and T8s (see ***Attachment 9.3*** for sample). There will also be posters advertising the program in the BESCOM offices.

- The customer will choose one of the approved retail outlets for the "purchase" of the lamps. There will be posters in the retail outlets participating in the program.
- The customer will produce the last electricity bill and receipt of payment from BESCOM as proof of eligibility. The customer will be free to choose the brand of lamps and the limitation of the number of lamps will be based on the monthly bill, as outlined in Section 4.2. The customer is not allowed to choose multiple brands due to practical problems in invoicing.
- The customer and the authorized agent (retailer) will complete an Agreement for the purchase of lamps, a sample of which is given in ***Attachment 9.4***. The Agreement will be in triplicate – original to the distributor (for forwarding to BESCOM) and copies for the customer and the retailer.
- At the time of purchase the customer is required to provide proof of identity (driver's license or copy of passport or ration card or election card), which should correspond to the name in the electricity bill. If a customer wishes to delegate another person to come to the retail store to purchase the lamps on his/her behalf, the following documentation need to be produced – original electricity bill, customer's proof of identity (original) and a letter of authorization outlining the name of the person delegated. The person delegated would have to provide proof of identity at the time of purchase.
- The retailer will stamp the customer's electricity bill as proof of purchase under the lighting program.
- There may be a situation where a customer purchases lamps from a retailer in the first month of the program and then try to purchase more lamps in subsequent months from another retailer. In the agreement the customer is required to confirm that no lamps were purchased before under the program. In the event multiple purchases occur the customer would be ineligible for payment by installments and would have to pay the outstanding balance in full for all purchases (with a 10% penalty, if appropriate) in the subsequent electricity bill.

3.5.6 Procedures for Invoicing and Payment

It is expected that the participating manufacturers/suppliers would have a Regional Sales and Marketing Office in Bangalore. In turn, the manufacturer/suppliers would have ***Sole Distributors*** in different areas of Bangalore and the sole distributors will have a network of ***Retailers*** in its area of operation. The retailers would be selling more that one brand of lighting products (CFLs and T8s). The current distribution network is shown in Fig. 3.1.



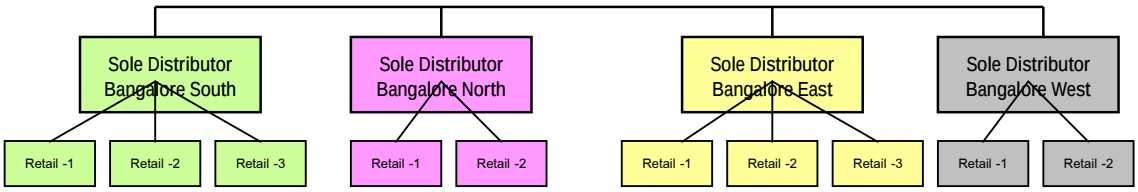


Figure 3.1: Lighting Products Distribution Network

The procedures for invoicing and payment are as follows:

1. Each Retailer will collate all the purchase agreements and forward these to the Sole Distributor for each Brand every two weeks.

2. Each Sole Distributor will collate the purchase agreements from all its Retailers and forward these to the Regional Sales and Marketing Office of the manufacturers/ suppliers.

3. The Regional Sales and Marketing Office or its assigned representative (this could be the one of the sole distributor) will collate the purchase agreements from all its Sole Distributors and prepare a summary of customer details and purchases.

4. The Regional Sales and Marketing Office or its assigned representative will submit an invoice with the original of all the purchase agreements for the specified period to the Financial Institution (IDECK) for processing.

5. The Program Administrator (IIEC) will verify the invoices and certify to IDECK for payment.

6. The Program Administrator will also sort the purchase agreements by each BESCOM Sub-Division and submit these via IDECK to each Sub-Division for inclusion in the electricity bills.

7. Monthly collections from each Sub-Division will be forwarded to the Central Accounting Division (CAD) who will then forward one payment to IDECK.

A sketch of the Invoicing and Payment Process is given in Figure 3.2

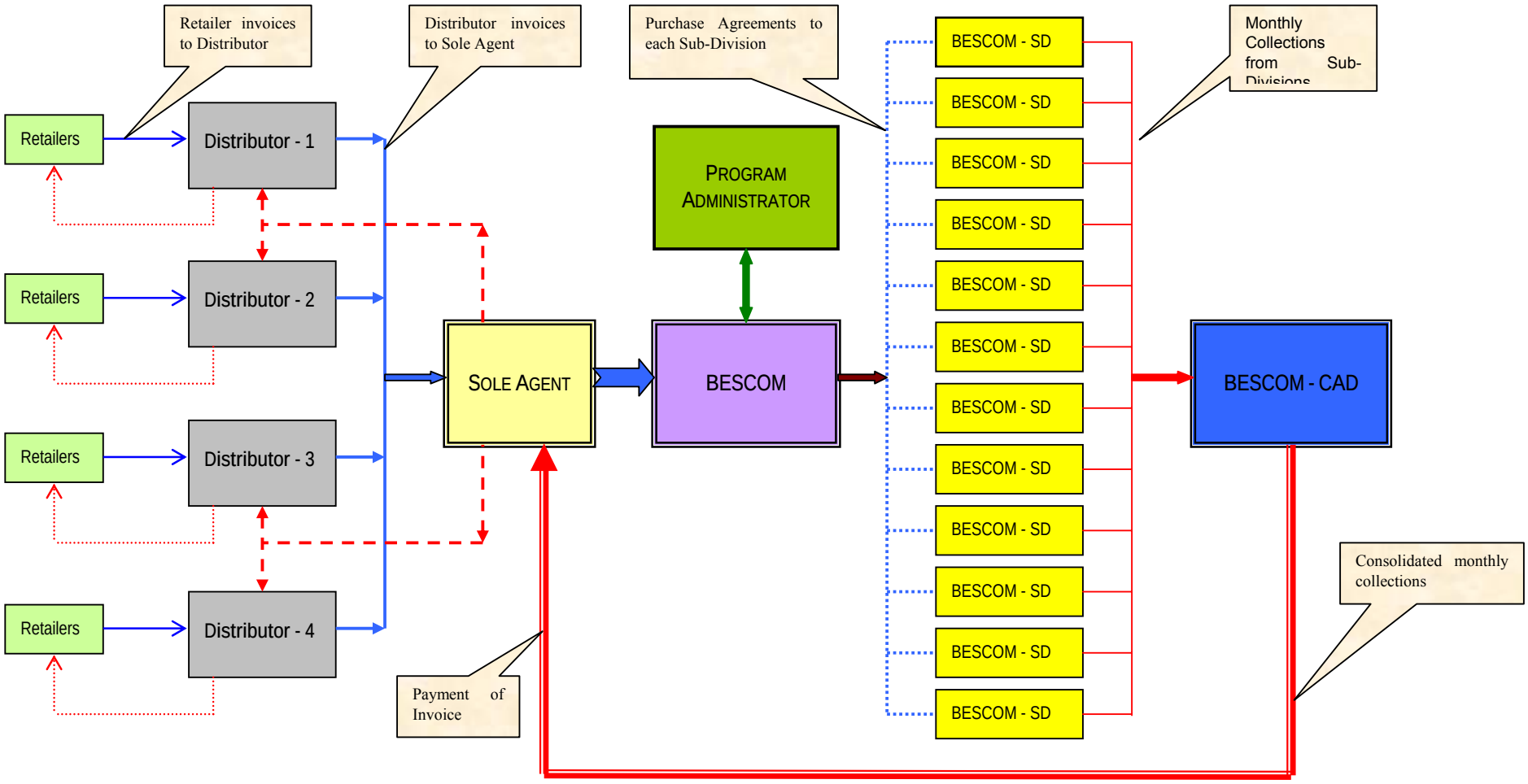


Figure 3.2: Invoicing and Payment Process

3.5.7 Agreements

3.5.7.1 Agreement between BESCOM and Suppliers

Following the selection of participating Suppliers, the obligations of the two parties (BESCOM and Suppliers) will be formalized through a Memorandum of Understanding (MOU). The key obligations of the Suppliers will include availability of adequate retail outlets in each of BESCOM's 39 Sub-Divisions, training of retailers and distributors, contribution towards program advertising, honoring of lamp warranties and the provision of sales data for program monitoring and evaluation. A sample MOU is given in ***Attachment 9.5***.

3.6 Marketing Plan

3.6.1 Bill Inserts

This would be the primary form of advertising the program. An insert will be prepared having the same dimensions as the electricity bill providing information of the program. The brochure will be in English and Kannada and will highlight "*BESCOM's Customer Service"* and *"Repayments from Savings".* The brochure will be in colour and on glossy paper and will fit the existing envelopes for billing.

The timing of the distribution will be based on the billing cycle and the commencement of the program.

3.6.2 Newspaper Advertisements

At the commencement of the program there will be frequent newspaper advertisements by BESCOM promoting the technologies. The frequency of the advertisements will be determined by the initial customer participation rate and advertising costs. The advertisements will be in both English and Kannada.

3.6.3 Posters

Colour posters in English and Kannada will be prepared for display in the BESCOM Sub-Divisions and retail stores.

3.6.4 Media Advertising

If budgets permit, advertising on radio programmes will be considered. There are no plans for TV advertising at this stage.

3.6.5 Road Shows

Road Shows will be organized at selected BESCOM Sub-Divisions. The participating Suppliers will set up booths at the BESCOM Sub-Divisions on a particular day to provide the facility for customers to purchase lamps immediately after paying the electricity bill. The Road Show days will be advertised in advance through leaflet distribution and displays at BESCOM Sub-Divisions.

3.6.6 BESCOM Staff Program

BESCOM staff will be informed of the program through an internal memo and will be encouraged to participate in the program.

3.7 Program Administration

IIEC will appoint a full-time Project Administrator for the duration of the program (approximately 9 months) and will be located at BESCOM. A staff member will be allocated by BESCOM to work with the Program Administrator as a part of training in program implementation, monitoring and evaluation, should BESCOM decide to continue at the end of the demonstration program.

The functions of the Program Administrator are:

- Coordination with Suppliers, Distributors, Retailers, BESCOM and IDECK
- 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
- Review of Supplier invoices and verification to IDECK for processing.
- Answering Customer queries
- Collecting information on the warranties honoured and time spent

4 MONITORING AND EVALUATION APPROACH

4.1 Objective

The objective is to conduct a detailed evaluation of all aspects of the Lighting 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.

4.2 Impact Evaluation

4.2.1 Objectives

The primary objectives of the impact evaluation are 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,
- Estimate the savings in the GHG emissions, specific to the generation mix in Karnataka, and
- Assess the cost-effectiveness of the Program as a whole.

Specific objectives of the impact evaluation will be to assess:

- How cost-effective is the Program for BESCOM, Program participants and the country? Could Program cost-effectiveness be improved? If so, how?
- How many lamps (CFLs and T8s have been installed as a ***direct*** consequence of the Program's intervention in the market? How many lamps have been installed as an ***indirect*** consequence of the Program's intervention in the market (e.g., as a result of BESCOM's endorsement of the lighting technologies)?
- How have customers' lighting loads changed as a result of installing of the lamps?
- How has customers' use of lighting and total energy consumption for lighting changed as a result of installing the CFLs?
- How much money has been 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?

4.2.2 Approach

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

The unitary peak demand reduction associated with each participant in the Program is 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 is 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 is:

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

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

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

The overall net benefit/cost of the Program is 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:

$$\mathrm{TRC}_{\mathrm{Program}} = \frac{\sum_{\mathrm{Measure\,1}}^{\mathrm{Measure\,n}} \mathrm{Net\,Present\,Value\,of}\ Avoided\ Supply\ Cost(\mathrm{Measure\,Life, 12\%\,Discount\,Rate})}{\sum_{Measure\,1}^{Measure\,n} \mathrm{Incremental\,Equipment\,Cost} + \mathrm{Program\,Marketing\,\&\,Administration\,Cost}}$$

$$\mathrm{UB}_{\mathrm{Program}} = \frac{\sum_{\mathrm{Measure\,1}}^{\mathrm{Measure\,n}} \mathrm{Net\,Present\,Value\,of}\ Avoided\ Supply\ Cost(\mathrm{Measure\,Life, 12\%\,Discount\,Rate})}{\sum_{Measure\,1}^{Measure\,n} \mathrm{Rebate\,Cost} + \mathrm{Program\,Marketing\,\&\,Administration\,Cost}}$$

and

$$\mathrm{PB}_{\mathrm{Program}} \frac{\sum_{\mathrm{Participant\,1}}^{\mathrm{Participant\,n}} \mathrm{Net\,Present\,Value\,of}\ Avoided\ Supply\ Cost(\mathrm{Measure\,Life, 12\%\,Discount\,Rate})}{\sum_{Participant\,1}^{Participant\,n} \mathrm{Incremental\,Equipment\,Cost}}$$

An important consideration in evaluating the impact of the 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 lamps (CFLs and T8s) 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 will be used to gain insights into these issues.

4.3 Process Evaluation

4.3.1 Objectives

The focus of the process evaluation is 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 BESCOM's internal procedures and systems performed.

Specific objectives of the process evaluation are 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 lamps 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 and T8s? How do the retailers, distributors and lighting suppliers, BESCOM and IDECK believe the Program could be improved.

4.3.2 Approach

In order to address the objectives outlined above, quantitative and qualitative methods will be used to analyze the key characteristics and behaviors of the following groups:

- Participants - residential customers who purchased lamps under the BESCOM 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 – participating suppliers, distributors and retailers.
- Program Administrators - personnel responsible for Program implementation and management – BESCOM, IDECK and IIEC.

Face-to-face surveys will be conducted with the relevant groups.

4.4 Market Evaluation

4.4.1 Objectives

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 concentrate 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 and T8s 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?

4.4.2 Approach

The information sought for the market evaluation will be 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.

4.5 Monitoring Procedure

Prior to the commencement of the program the participating suppliers will be required to provide historical sales data in the Bangalore Urban District, for 12 months prior to the program in order to establish the baselines.

Suppliers will submit monthly sales figures during the program classifying then ito two categories:- sales under the program and direct sales.

A series of customer surveys will be conducted during and immediately after the program.

5 PROGRAM RESULTS

5.1 Progress of BELP

5.1.1 Sales growth

During the BELP implementation, sales relevant to the participating suppliers was tracked monthly. ***Figure 5.1*** below shows the increasing sales volume during the tenure of the implementation comparing this with the same time-period during the last year.

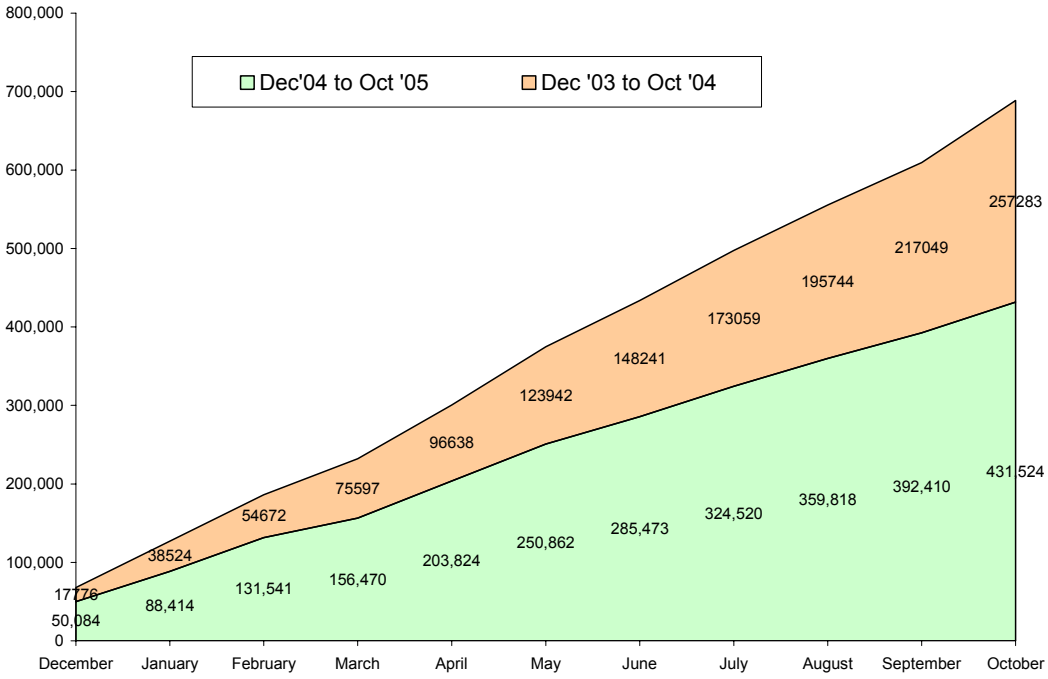


Figure 5.1 Monthly Sales - CFLs

CFL sale is seen increasing all through the program implementation tenure. Specifically, the important events and months where the CFL sale increased can clearly be attributed to key events during the program. A comparison of the sales during the program period and the corresponding period last year reveals an increase of more than 70%. Estimation of benefits to the utility and consumers made in this report is made on the basis of **175,000 CFL's (difference between the last and current year's sales)** and the total sale of **430,000 CFLs.** Sales data received from the suppliers is attached as ***Annexure 2***.

Several implementation strategies evolved during the program implementation have also clearly had an impact over the CFL sales. ***Figure 5.2*** identifies some of these events and resulting changes in the CFL sales. While the launch of the program, road-shows in key sub-

divisions had a positive impact on the sales, the introduction of Value Added Tax (VAT) in the state of Karnataka has had negative impacts.

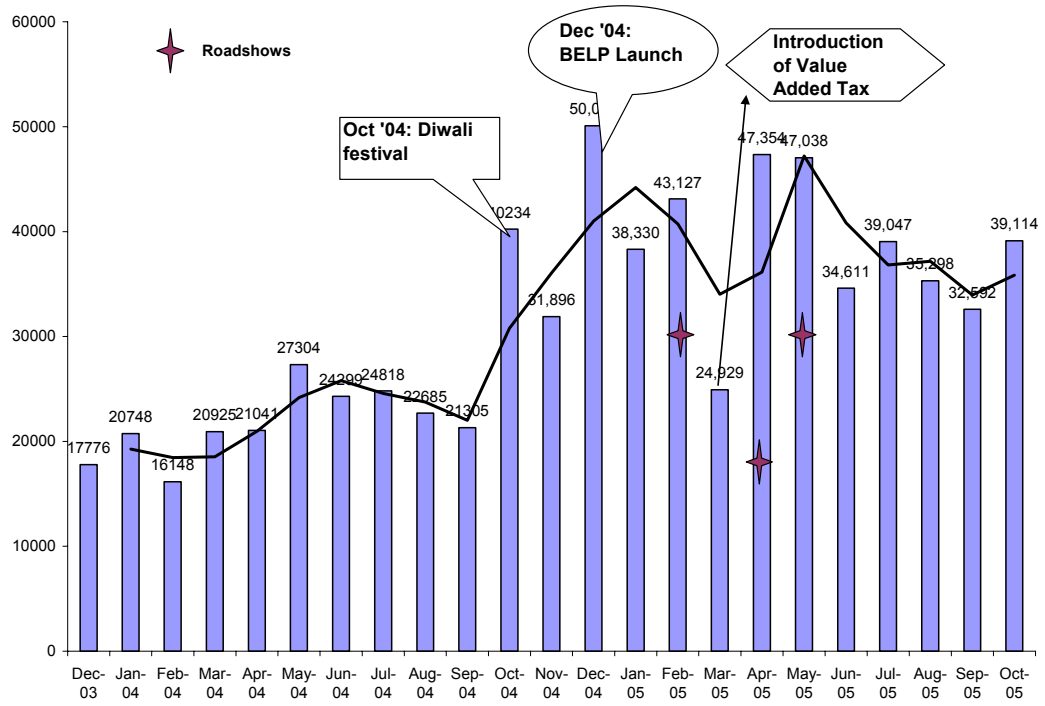


Figure 5.2 Pre and Post-implementation Sales Progression and Events

Note on sales of non-participating suppliers

Participating suppliers enjoy a market-share of close to 50%. Though data from at least 10 other suppliers active in the Bangalore market is not available, total CFL sales in Bangalore market is estimated to be at least 860,000.

5.1.2 Pricing benefits

Benefits of the competitive bidding process in utility-sponsored DSM initiatives are evident from ***Table 5.1***.

Table 5.1 Changes in pricing and warranty of participating and non-participating suppliers

	Before BELP	After BELP
Pricing		
Average cost of 11 Watt CFL, Rs.	150	125
Average cost of 14 Watt CFL, Rs.	170	145
Warranty		
Warranty by participating suppliers, months	6	12
Warranty by non-participating suppliers, months	0	12

As the price dynamics under the competitive domestic market is very high, IIEC and BELP evaluation committee recommends periodic revision of prices offered to the customers.

5.2 Domestic sector consumption in BESCOM

BESCOM domestic customer base is increasing. With an assumption of average connected load of 3 KW, domestic sector is expected to contribute at least 60% peak demand and load. ***Figure 5.3*** shows the domestic-sector growth and ***Figure 5.4*** shows the domestic sector load-growth.

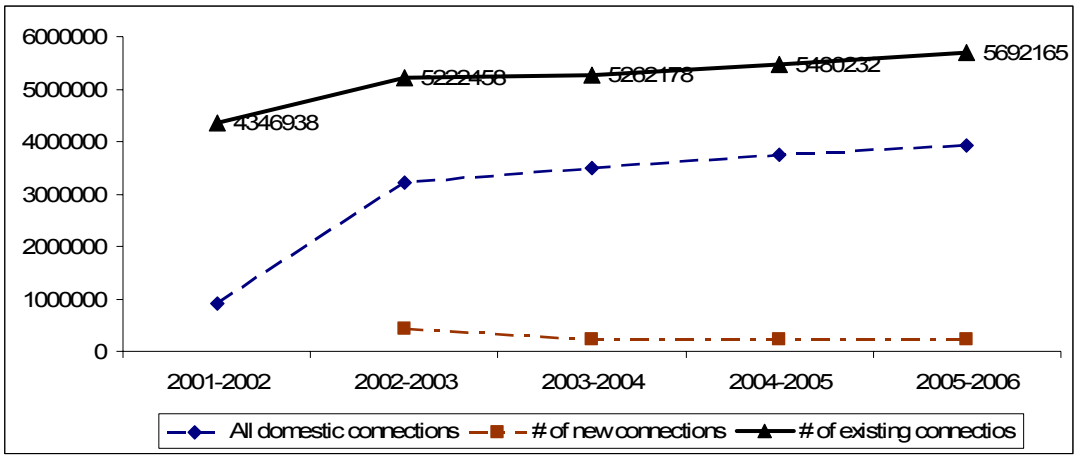


Figure 5.3 Growth – domestic sector in BESCOM

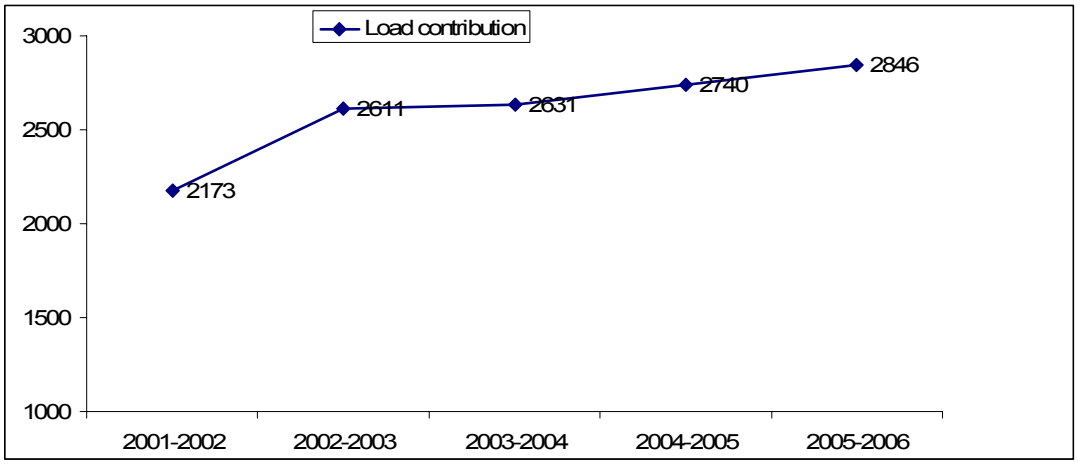


Figure 5.4 Load growth – domestic sector

6 EVALUATION RESULTS

6.1 Benefits to utility

BESCOM load-shape captured at different times before and after the program design represents an evening peak, primarily contributed by the domestic lighting. Market survey during the inception stage of this initiative concluded that the lighting sector contributes to the evening peak and current technologies used included incandescent lamps (40, 60, 100 Watts) and fluorescent tube-lights (typically 40 Watts). However, despite BELP, because of the additional lighting load from the commercial sector and additions in domestic sectors, the current load-shape does not reflect the reducing peak as the BESCOM system is still faces challenges of evening peak. ***Figure 6.1*** shows a typical system load shape.

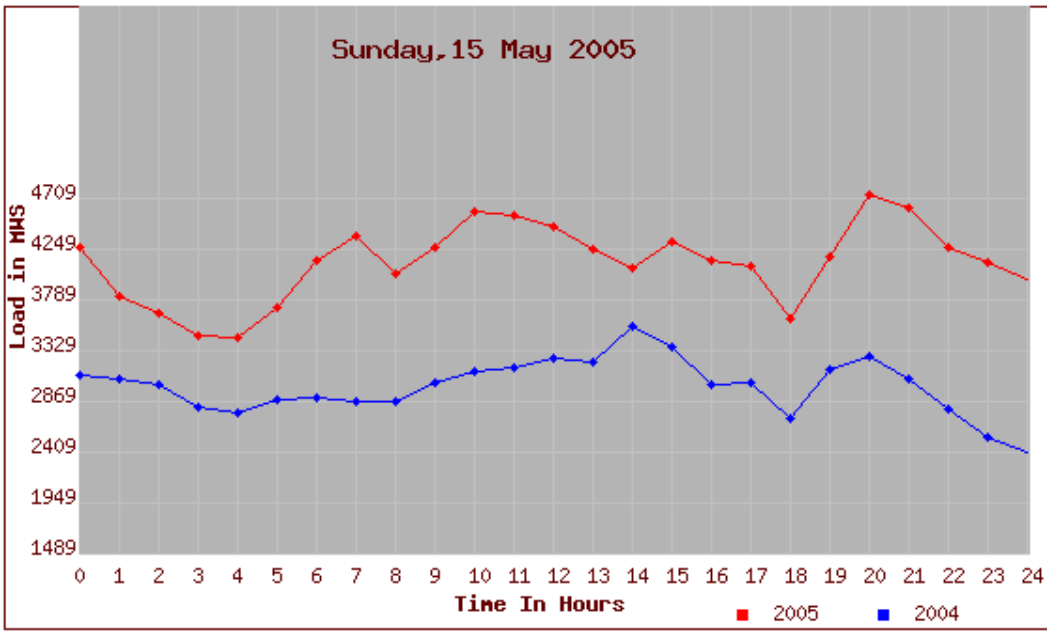


Figure 6.1 BESCOM Load Shape

As common feeders cater to all kind of load under the BESCOM system (consistent with all other utilities in India), impact of efficient lighting products is extremely difficult to implement. Based on the engineering analysis, however, reduced load and annual consumption are projected as in ***Table 6.1***.

Table 6.1 Peak demand and energy consumption reduction benefits of CFLs

Total peak demand reductions, MW		
	Conventional	Efficient
Technologies	Incandescent Lamps (A)	Compact Fluorescent Lamps (B)
Average rating, Watts	60	11
Number of CFLs sold		
# of CFLs sold (C)	430000	
Diversity factor[3]	100%	
Coincidence factor[4]	100%	
T&D losses (D)	18%	
Total peak reduction		
Peak demand savings (MW) (E) ((A-B)*C)/((1-D)*1000000)	**25.695**	
Number of hours per day, Hrs (F)	4	
Number of days (G)	365	
Annual energy savings – utility (MU) (H) (E*F*G/1000)	**37.5147**	
Cost of power purchase (Rs./Unit) (I)	2.2	
Reduced cost of power purchase (Rs. Lakhs) (H*I/10)	825	
Cost of setting up new generation capacity (Rs. Crores/MW) (J)	4	
Avoided cost of generation, Rs. Crores (E*J)	**102.78**	
Benefits with BELP impact alone (considering 175,000 CFLs)		
Peak demand savings (MW)	**10.46**	
Annual energy savings (MU)	**15.267**	
Reduced cost of power purchase (Rs. Lahks)	**335**	

Reduced energy consumption also results in the greenhouse gas emission reduction (reduction of CO_2). Based on an emission factor of 1 Kg CO_2 per kWh electricity, annual greenhouse gas emission reduction for the 175,000 additional CFLs sold in the system is approximately 15267 Mtons of CO_2.

[3] **Diversity Factor** is the ratio of the sum of coincident maximum demands of two or more loads during a period to their non-coincident maximum demands during the same period.

[4] **Peak Coincidence Factor** is defined as the ratio between maximum power demand and installed total power during peak hours for a given apparatus. This considers the simultaneity of operation of different equipment within the category.

6.2 Benefits to consumers – billing analysis

One of the interventions during BELP was to ensure proper use of the CFLs at appropriate locations. Marketing campaigns ensured this aspect of the consumer education. ***Figure 6.2*** reports the reduction in the energy consumption relevant to only 6 consumers in BESSCOM. During the course of this monitoring and evaluation, billing analysis relevant to a wider range of consumers was carried out. A sample size of 100 consumers was chosen based on the following methodology:

- 100 consumers represented those who purchased CFLs during BELP from the sub-division offices (road-shows and otherwise)
- Sample chosen represented consumers from two different sub-divisions, thus providing geographical spread

Box below reports the billing numbers, maximum and minimum variations and some analysis of the reduced bills (also see Attachment 9.6).

Box – billing analysis

- 7-monthly (January to July 2005) consumption for a sample of 100 BESCOM consumers shows a reduction from 94072 units (January-July 2004) to 86932 units (7140 units). A similar reduction was also observed when compared with consumption from July-Dec 2004. Figure 3.2 shows the consumption of 7 consumers representing two different consumer classes.
- Average reduction in bills of All Electric Homes (AEH) is 400 units spread-over 7 months. Average increase in the bills of AEH is close to 500 units.
- Increasing consumption is easily attributed to increasing use of appliances and equipment.

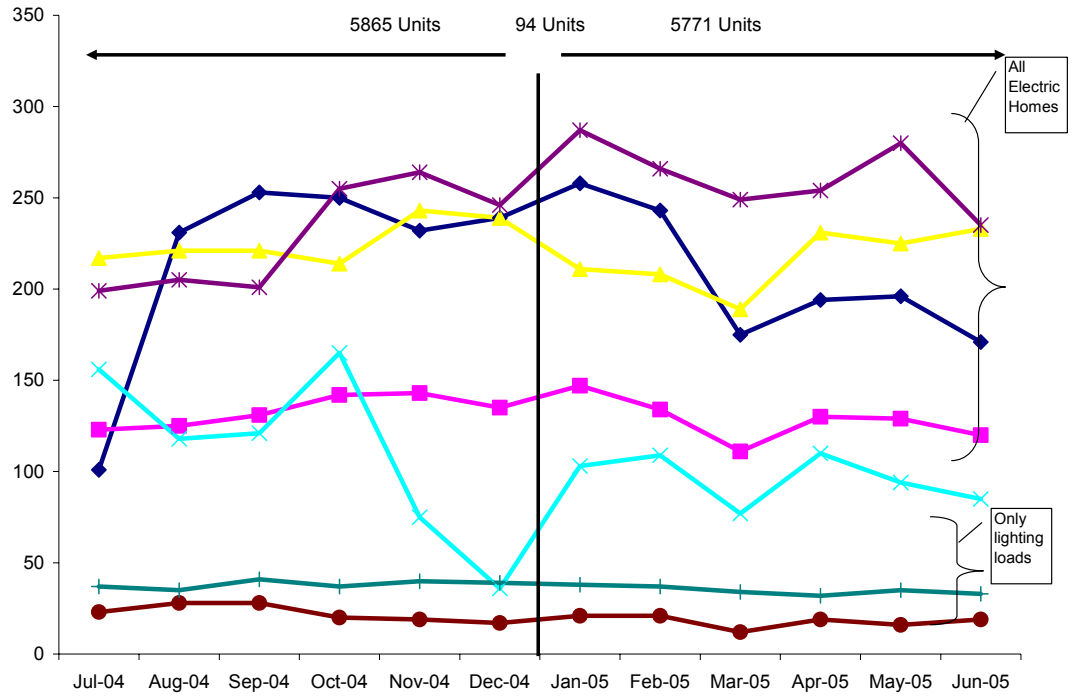


Figure 6.2 Consumer billing Analysis

6.3 Contribution of Load Curtailment

Comparing with the total load, the peak load reduction is not substantial but significant with respect to domestic lighting load. It is very difficult to accrue the benefits on bills in the view of increasing connections/ consumers. The load reduction calculations are done based on certain assumptions mentioned in Table 6.1. The evening peak load estimated to be reduced by 10.26MW while the minimum annual energy savings viewed is around 15.267MU.

6.4 Power quality issues with CFLs

6.4.1 Importance of power quality in use of CFLs

Power factor of CFLs has been debated in the Indian energy sector at various levels. During the initiation stage of BELP, IIEC and BESCOM compared international power factor standards relevant to the use of CFLs and equipments alike. ***Table 6.2*** shows a comparison among available standards.

Table 6.2 Comparison of CFL standards

Country	Serial number of standards	Comment on the power factor > or =
Sri Lanka	SLS 1231: Part 1: 2002	0.5
India	IS	0.5
Australia/New Zealand	AS/NZS 60969:2001	0.5
	IEC 60969	
ELI	IEC 60969	0.5

In addition to the above, according to the article published by the International Association for Energy-Efficient Lighting (IAEEL), on the power quality of the CFLs and other household products of less than 25 Watts rating, power factor and harmonic distortions in the domestic sector are not relevant. IEC specifications for appliances/equipment less than 25 Watts do not have power factor recommendations. Similar products used in the household include domestic TV and computers. Proposed Energy Conservation Building Codes recommend power factor correction at an aggregate level (incomer of the individual buildings).

6.4.2 Power factor and total harmonics distortion with CFLs

While a 100 W IL draws 0.454 RMS current at 220 V, Unity power factor, the 25 W CFL will draw 0.227 RMS current at 0.5 power factor (NEEMA working paper – LSD 8-1999).

It can be seen that even the low PF CFL draws much less RMS current than the Incandescent Lamp (IL). The power factor will pose problems only when we compare equivalent voltage IL and CFL. Though the total harmonic distortion of the CFL is higher than IL, the total wattage of CFL in a house is very small as compared to other loads of the house of the consumer. Presently, our country is not fully geared up for harmonic control of the LT domestic sector, as even for HT consumer harmonic control is not implemented. This issue may not be of great importance in the incentive programs.

6.5 Awareness among BESCOM consumers

6.5.1 Consumers' perspectives

A preliminary survey was carried out by IIEC during the project period which reveals that close to 55% of the respondents purchasing directly from the retailers and 70% of the respondents purchasing under instalments valued BESCOM branding as "important" (***Figure 6.3***).

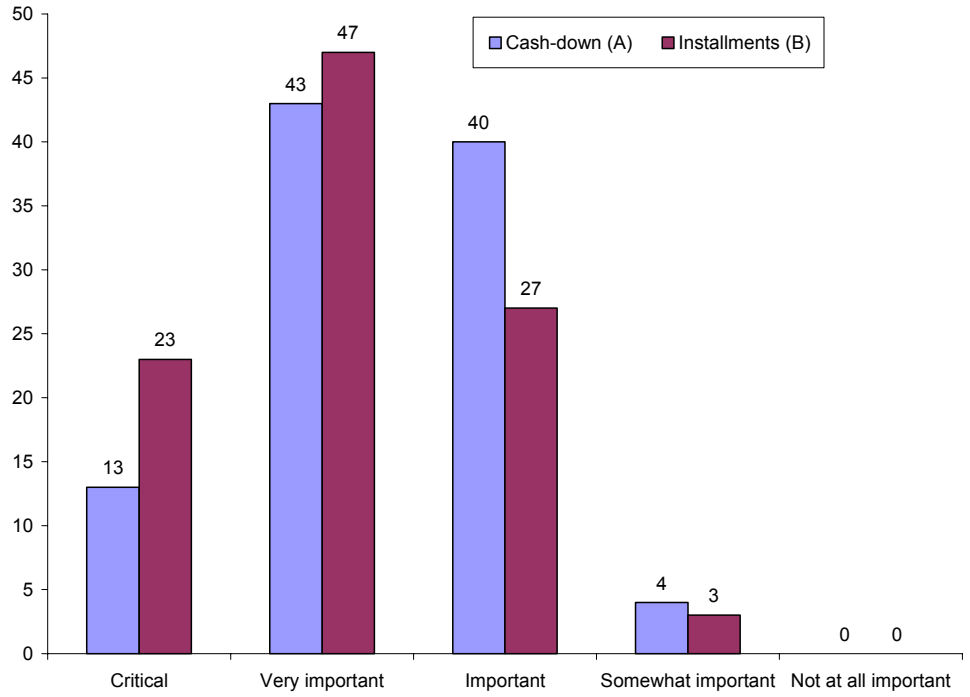


Figure 6.3 Importance of BESCOM Branding

As a part of the market evaluation, response from the non-participants was also captured. Perceptions of some of the non-participating consumers are explained in ***Figure 6.4***. Please refer to sum-up meeting presentation for description of terminology in Figure 6.4.

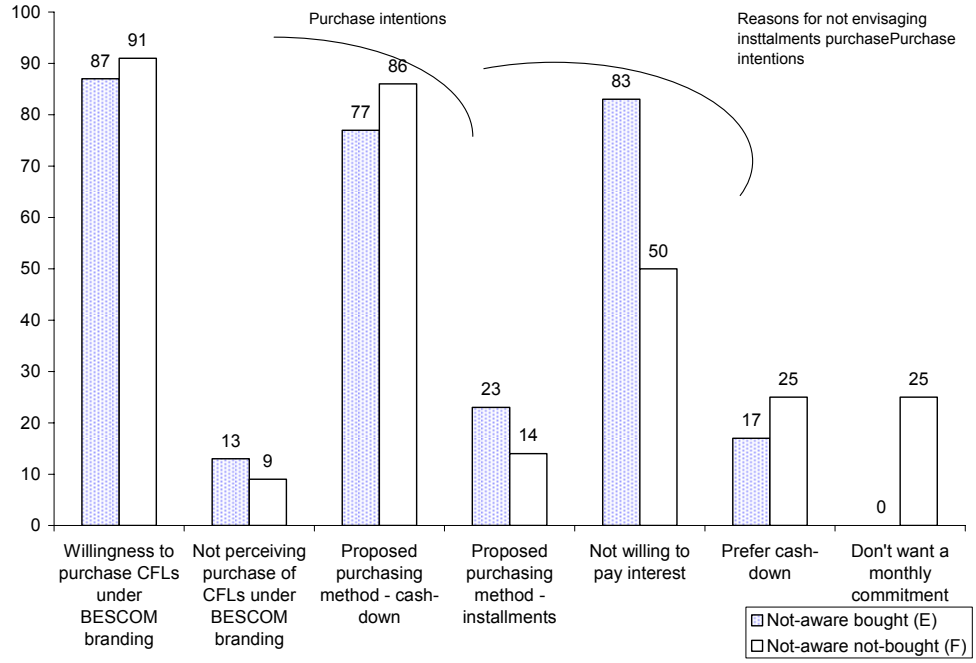


Figure 6.4 Willingness and Drivers of Non-participants in Next BELP Phase

7 BELP INDEPENDENT EVALUATION

BESCOM and IIEC organized a sum-up meeting on 17 December 2005 that was attended by the top management from the Bureau of Energy Efficiency, USAID, BESCOM, KPTCL and IIEC. Based on specific suggestions made during the meeting by Mr. V. S. Verma, Director General, Bureau of Energy Efficiency, a committee was constituted with the mandate to address some of the issues related to BELP. Constitution of the committee was as follows:
Chairman of the Committee: **Mr. B. R. Vasanth Kumar**, Director (Technical), Bangalore Electricity Supply Company
Convener: **Mr. B. T. Prakash Kumar**, Technical Assistant to Director (Technical), Bangalore Electricity Supply Company
Members:
Mr. B. N. Satyapremkumar, Communications and Reforms Coordinating Officer, Bangalore Electricity Supply Company
Mr. Alok Gupta, Director, Central Electricity Authority
Mr. S. K. Tyagi, Sr. Manager, Bureau of Energy Efficiency
Mr. S. Vishwanatha Prasad, Chief General Manager – BMAZ, Bangalore Electricity Supply Company
Mr. Govindraju, Executive Engineer, Karnataka Power Transmission Corporation Limited
Mahesh Patankar, Sr. Project Manager, International Institute for Energy Conservation
Invitees:
Mr. V. A. Rodrigues, Manager, Bangalore Electricity Supply Company
Mr. H. S. Gururaja, Consultant, International Institute for Energy Conservation

7.1 Terms of reference for the committee

Committee was given the following clear mandate.

a. Evaluate peak demand reduction and energy savings from sales of Compact Fluorescent Lamps (CFLs) under BELP – *data on the sales of CFLs from the three suppliers and non-participating suppliers will be generated by IIEC and BESCOM*
b. Evaluate contribution of above savings in the overall planning of power distribution in Bangalore city considering new connections in the domestic and other sectors – *data on power development to be provided by BESCOM*
c. Evaluate power quality issues related with the use of CFLs. Following steps are envisaged in completing this task
    - Review of national and international CFL specifications (power factor, harmonics, voltage fluctuations)
    - Review of manufacturing of CFLs in the domestic and international market and the prevalent technical specifications
    - Review of power factor correction techniques relevant to CFLs
    - Suggestions on power factor correction techniques related to the use of CFLs considering technical and commercial viability
d. Suggest technical measures to be taken up during the next phase of BELP and CFL programs in other utilities

7.2 Committee meetings

The Committee met twice (30 January 2006 in Bangalore and 20 February 2006 in Mumbai) before finalizing this report. During the two meeting of the committee (30 January 2006 and 20 February 2006), the committee reviewed the program design documents and BELP Sum-up meeting presentations (***Attachment 9.2***). Some of the next steps identified by the committee are as follows:

- The comparison of the load curve of the BESCOM system must be made for the two similar days
- All the supporting documents for the sale of the CFL under the project need to be enclosed with the project report – *this data was obtained as emails from the suppliers and being a commercially sensitive sales data, it is difficult to obtain the documentation*
- The effect of VAT on sales also needs to be brought in the report
- Increase in sales of CFL along with growth of consumers may also be shown for the period considered
- Sale of other suppliers may also be shown – *this is still being obtained*
- Customer satisfaction reports may be obtained from the customers/RWA – *an independent survey agency made this observation*
- Billing analysis comparison should be made for the same period of 2004 and 2005. The sample supporting documents may also be enclosed - *this is still being obtained*
- The survey report from the customer that they are benefited with the scheme may also to be enclosed.

Observations made by the committee and its recommendations are highlighted in the next section. The following observations were discussed with Mr. V. S. Verma and Dr. Archana Walia during the concluding meeting of this program

7.3 Observations of BELP evaluation committee

This section of the report summarizes the findings of this committee.

a) Evaluation of peak demand from BELP
   Peak reduction with the BESCOM system is in the range of 25.70 MW and annual savings is close to 37.515 MU. In monetary terms, the capacity offset benefit is in the range of 102.78 Crores (@ Rs. 4 Crores per MW) and avoided purchase of energy is in the range of Rs. 8.25 Crores.

b) Benefits to overall BESCOM power development plans
   Savings accruing from the saved energy to individual customers is at an average of 8% when compared with the 7-month period of last year. With an average of 125 units consumed in a month by All Electric Homes – a classification of domestic sector, annual savings of 37.515 MUs resulting from BELP will result in avoided power development for at least 25,000 new connections in BESCOM with an average 125 units per month consumption.

c) Relevance of power quality issues
   Power factor and total harmonic distortions relevant to CFLs are not too large as other loads in the domestic sector are more than the average CFL rating. Also, international power quality standards call for 0.5 and above power factor for CFLs. As the CFL costs would go up with the increased power factor and would also lead to higher heating of the lamps, in order to protect the warranty-issues of CFLs, no specific efforts are envisaged to improve the power factor of CFLs at this stage. On

the other hand, as in case of other utilities in India (Reliance and Calcutta Electricity Supply Company), power quality correction at the Low-Tension side of the distribution transformers is recommended, which will be helpful in correcting the THD and PF of inductive loads (e.g. domestic pumping).

d) Suggestions on technical issues for the other utilities

BELP evaluation committee recommends following steps to capture better date on the utility benefits.

- Promote changing all the incandescent lamps with CFLs on a representative domestic feeder. Installation of energy meters to capture the energy savings data
- Utilities may capture the electricity use data through surveys on the same feeder to strengthen the arguments around the benefits of CFLs, either keeping other load constant or accounting for other domestic load (additional load with fans, ACs, refrigerators, TVs, VCD/DVD players, water heating elements and computers) Utilities can take support from CEA and BEE to complete the above study

8 BELP SPIN-OFF EFFECTS

8.1 Energy efficient lighting initiative in other states

Inspired with the success of BESCOM efficient lighting program, at least two utilities in Maharashtra state have taken initiative to implement similar kind of programs. The Maharashtra State Electricity Board is proceeding with a program identical to BELP for Nasik city while Tata Power is following same lines for Mumbai city.

8.2 Extension of BELP

The enthusiastic response to the efficient lighting program of BESCOM from the consumers and also from the manufacturers forced the utility to extend it for four more cities under its territory. The extension of program is not only because of the response to it but also accrued reduction in the peak load.

9 ATTACHMENTS

9.1 Expression of Interest from Suppliers

INVITATION

Expression of Interest for

BESCOM EFFICIENT LIGHTING PROGRAM

As a part of its Mission to provide quality customer service, BESCOM is initiating a pilot efficient lighting program for its residential and small commercial customers in the Bangalore Urban District. Technical assistance for this program is provided by the International Institute for Energy Conservation, which is implementing agency for the United States Agency for International Development (USAID) sponsored Energy Conservation and Commercialization II (ECO II) initiative.

The program involves the promotion of Compact Fluorescent Lamps (CFLs) and high efficiency 36W fluorescent tubes. BESCOM assistance includes an interest free loan for purchase of the lamps payable in instalments through the electricity bills.

BESCOM invites reputable lighting Suppliers and Manufacturers to register their interest for participation in the program. Interested applicants are requested to collect the program documentation from the address below.

For more information contact:

Forward written applications to: ……..
Bangalore Electricity Supply Company Limited
14/3 CFC Building, 4th Floor,
Nrupathunga Road,
Bangalore 560 001

Closing date for Applications:

Lighting up your life

Bangalore Electricity Supply Company Limited
14/3 CFC Building, 4th Floor,
Nrupathunga Road, Bangalore 560 001
Ph: 080-2276366 Fax: 080-2296529

9.2 Technical Specifications for CFLs and T8s

IFC/GEF Efficient Lighting Initiative

Voluntary Technical Specification

Compact Fluorescent Lamps

Background

Developing countries often share common market barriers to the use of energy-efficient lighting. Barriers include inadequate information about the energy, economic and environmental benefits of efficient lighting, and a lack of credible sources of such information.

To address these barriers, ELI develops and promotes voluntary technical specifications that include rigorous technical and quality criteria. ELI has a labeling system that helps consumers identify energy efficient lighting products that meet the ELI specifications. ELI programs include marketing, educational, market building, and financing activities. Each participating country tailors its activities to meet the needs of the local market. These activities are supported by US$15 million in Global Environment Facility funding, and by additional local and international funding. Lighting manufacturers whose products meet the ELI specifications are invited to launch product promotions and advertising campaigns in cooperation with ELI's local marketing programs.

Manufacturers interested in ELI should review the ELI voluntary technical specifications to determine whether or not their products could comply. They should then review the ELI qualification protocol for guidance on how their lighting products could receive the ELI label.

Compact Fluorescent Lamps

Compact fluorescent lamps (CFLs) are an important energy efficient lighting technology that is promoted through ELI. ELI-labeled CFLs are available in a wide variety of lamp dimensions, with various wattages, lumen outputs, efficiency levels and prices. For a current list of ELI-labeled products, see <www.efficientlighting.net>

Definitions for this Specification

Ballast

Refers to an electrical device used with an electric-discharge lamp to obtain the necessary circuit conditions (voltage, current and waveform) for starting and operating the lamp.

Compact Fluorescent Lamp (CFL)

Refers to any compact fluorescent lamp/ballast combination designed for applications furnished with a socket originally intended to operate standard incandescent bulbs. CFLs may be either unitary (a single, non-separable unit containing lamp and ballast, also often referred to as self-ballasted), or, modular (designed so that the lamp may be removed from the ballast and replaced by the consumer).

Dimmability

Unless otherwise indicated, the requirements set forth in this specification apply to non-dimmable CFLs, and also to dimmable CFLs that are operating at maximum power.

Efficiency

Calculated as initial lumens measured with the CFL in optimal operating position divided by the measured input power and expressed as lumens per watt (lm/W).

Fluorescent Lamp

Refers to an electric discharge lamp that generates visible light through fluorescence when attached to and operated by an appropriate ballast.

Input Power

Power drawn by the CFL in stable operation after an initial burn-in period of 100 hours. Input power shall be the power drawn measured in watts (W) by the specific lamp and ballast combination being tested during stable operation at maximum power.

Luminous Flux

Lumens generated by the CFL in stable operation after an initial aging period of 100 hours. Luminous flux shall be measured as the lumens generated by the specific lamp and ballast combination included in the CFL being tested during stable operation at maximum power in the vertical base up (VBU) position.

Normal Operation

These specifications require that measurements be taken from CFLs operating at rated voltage and temperature. Measurements shall be taken from CFLs in the vertical base up (VBU) position after an initial burn-in period of 100 hours, with stable light output and power supply, unless otherwise noted.

Standard References

IEC -International Electrotechnical Commission

EN -European Norm (European Union Standard)
IESNA - Illuminating Engineering Society of North America

CIE -Commission Internationale d'Eclairage (International Illumination Commission)

ANSI - American National Standards Institute

ISO - International Standards Organization

Compact Fluorescent Lamp (CFL) shall meet the following ELI performance specifications. *Items that must be clearly indicated on the CFL product package are indicated in italics.*

Laboratory and Test Requirements	Performance Specifications
Laboratory Facility	Must be accredited according to ISO 17025, or equivalent standard. Accreditation document must be provided to ELI.
Testing Conditions	Performed at 25 C in an atmosphere with maximum relative humidity of 65%.
Position and Initial Burn-in	Measurements should be recorded from products in the VBU position, after an initial burn-in period of 100 hours at stabilized light output and current.
Test Data and Sample Size	Test data must be from the model for which qualification is sought. Values indicated on the application form shall be calculated as the average of the data from all the units tested. Measurements of electrical characteristics must be submitted for at least 10 units of the same CFL model. Measurements of photometric characteristics must be submitted for at least three units of the same CFL model.
Longevity of Test Results	Test results must be less than two years old, unless manufacturer can document to ELI's satisfaction that older test results accurately portray the performance of the present model.

Efficiency Specifications

The CFL package must clearly state the performance of the following characteristics, as defined in IEC 60969:
Rated input power in watts, and
Light output in lumens.

Efficiency shall be calculated from luminous flux and input power for the specific lamp and ballast combination in the CFL measured at 25 ^{o}C and 220 V. To qualify, CFLs of any tube configuration shall meet the following minimums.

If CFL has either an integral or a separate ballast
At input power of < 15 W: ≥ 45 lm/W
At input power of ≥ 15 W: ≥ 60 lm/W

If CFL has a translucent cover
At input power of ≤ 14 W: ≥ 40 lm/W
At input power of 15 to 19 W: ≥ 48 lm/W
At input power of 20 to 24 W: ≥ 50 lm/W
At input power of ≥ 25 W: ≥ 55 lm/W

If CFL has a reflector
At input power of ≤ 19 W: ≥ 33 lm/W
At input power of > 19 W: ≥ 40 lm/W

Power Characteristics	Performance Specifications
Electromagnetic and Radio Frequency Interference	Comply with CISPR 15 or relevant local regulations.
Power Factor	Measured in vertical base up position, and as defined in IEC 61000. CFLs for inclusion in ELI programs in Latvia, Hungary and the Czech Republic must comply with power quality limits set by IEC 61000-3-2. CFLs for other ELI countries must have a power factor of 0.5 or greater at maximum power as defined by IEC 61000.
Tolerance of Voltage Variation	Manufacturers must state in the application that CFL will perform within specified parameters at a range of nominal voltages ± 10% of rated operating voltage without reduction in the rated life.
Transient Protection	CFLs must comply with IEC 61547.

Operating Characteristics	Performance Specifications
Lamp Start	CFL must continuously illuminate within 1.5 seconds of being switched on at minimum rated starting temperature and maximum power. Prior to measurement CFL must be switched off for at least 30 minutes.
Starting Temperature	*CFL package must declare the minimum starting temperature and any other conditions (such as installation in an enclosed luminaire) that would affect either reliable starting or the starting time.*
Lifetime	CFLs must have a minimum rated lifetime of 6,000 hours as defined in IEC 60969. *Lifetime shall be clearly indicated in hours on product packaging.*
Safety	CFLs must meet all local safety requirements and the requirements of IEC 60968 for unitary CFLs and applicable parts of IEC 61199 and 60598 for modular CFLs.

Light Characteristics	Performance Specifications
Correlated Color Temperature	*Correlated lamp color temperature of CFL must appear on product packaging* (as defined in IEC 60969 and measured in accordance with IES LM-16-1984, "Colorimetry of Light Source" and the *1993 IESNA Lighting Handbook*).
Color Rendering	Color Rendering Index (CRI) of at least 80 for fluorescent lamps with a diameter less than 2.0 cm. CRI of at least 70 for all other lamps (as defined in IEC 60969, measured in accordance with CIE 29/2).
Lumen Maintenance	After 2000 hours of operation the luminous flux of CFLs must be ≥ 80% of initial levels (measured in accordance with IES LM-66-1991 or IEC 60969 for unitary CFLs, IEC 60901 for modular CFLs).
Stabilized Light Output	The time to 75% of stabilized light output after switch-on shall not exceed 100 seconds, or, the time to 80% of stabilized light output after switch-on shall not exceed 120 seconds (measured in accordance with IEC 60969).

<table>
<tr><th>Other</th><th>Performance Specifications</th></tr>
<tr><td>Comparison of CFL to GLS on Label**</td><td>Lumen output noted on package must be the luminous flux as reported to ELI for the specific lamp and ballast combination in the package. Where the packaging or other literature claims that the rated luminous flux of the CFL is equivalent to, or exceeds that, of an equivalent GLS filament lamp the lamp rating must comply with the following requirements:
<table>
<tr><th>CFL
Luminous Flux
Claim (lm)</th><th>Rated Wattage(s) of equivalent GLS filament lamp</th></tr>
<tr><td>≥ 214</td><td>≤ 25 W</td></tr>
<tr><td>≥ 386</td><td>≤ 40 W</td></tr>
<tr><td>≥ 660</td><td>≤ 60 W</td></tr>
<tr><td>≥ 874</td><td>≤ 75 W</td></tr>
<tr><td>≥ 1246</td><td>≤ 100 W</td></tr>
<tr><td>≥ 2009</td><td>≤ 150 W</td></tr>
</table>
In addition, manufacturers must notify ELI if the CFL exhibits ≥ 10% light output degradation due to:
Operation outside of rated temperature range or,
Operation in other than VBU position or,
Any other factors.</td></tr>
<tr><td>Warranty</td><td>Purchaser may return the CFL to point of purchase with no explanation necessary within 12 months from the date of purchase for a full refund. Written warranty in at least one applicable local language must be included with CFL when purchased. Manufacturer shall provide a local address for customer contacts and complaints.</td></tr>
<tr><td>Quality of Production</td><td>CFLs must be manufactured under a Quality Assurance System in accordance with ISO 9000-2000 or equivalent (equivalency to be determined by ELI).</td></tr>
</table>

Reference Specifications

IEC - 61547 Equipment for General Lighting Purposes - EMC Immunity Requirements.

IEC – 60969 Self-Ballasted Lamps for General Lighting Service: Performance Requirements.

IEC – 61199 Single-Capped Fluorescent Lamps: Safety Requirements.

IEC – 60968 Self-Ballasted Lamps for General Lighting Service: Safety Requirements.

IEC – 60901 Single-capped Fluorescent Lamps: Performance Requirements.

IEC - 61000-3-2 Electromagnetic Compatibility - Limits - Limits for Harmonic Current Emissions (equipment input current ≤ 16A per phase).

EU Ecolabel Criteria for Single-Ended Lightbulbs.

Propuesta De Norma De Eficiencia Energética Para Lamparas Fluorescentes Compactas - LFC's, Peru May 1999.

ANSI C78.5-1997 Specifications for Performance of Self-Ballasted Compacted Fluorescent Lamps U.S.A., 1997.

Minimum Specifications for Promotional CFLs: IFC/GEF Poland Efficient Lighting Project, Poland 1997.

Pacific Northwest National Laboratories Subcompact Fluorescent Lamp: Bulk purchase program features and specifications. U.S.A. 1998.

ENERGY STAR® Compact Fluorescent Lamp Specification. U.S.A. 1999.

European Wide Initiative for the Promotion of Efficient Lighting in the Residential Sector: Campaign CFLs Quality Charter.

Inquiries

Please address all questions or comments regarding this specification to:

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IFC/GEF Efficient Lighting Initiative

Lamp Ballast Circuits for Linear Fluorescent Lighting

Voluntary Technical Specification

Background

Developing countries often share common market barriers to the use of energy-efficient lighting. Barriers include inadequate information about the energy, economic and environmental benefits of efficient lighting, and a lack of credible sources of such information.

To address these barriers, ELI develops and promotes voluntary technical specifications that include rigorous technical and quality criteria. ELI has a labeling system that helps consumers identify energy efficient lighting products that meet the ELI specifications. ELI programs include marketing, educational, market building, and financing activities. Each participating country tailors its activities to meet the needs of the local market. These activities are supported by US$15 million in Global Environment Facility funding, and by additional local and international funding. Lighting manufacturers whose products meet the ELI specifications are invited to launch product promotions and advertising campaigns in cooperation with ELI's local marketing programs.

Manufacturers interested in ELI should review the ELI voluntary technical specifications to determine whether or not their products could comply. They should then review the ELI qualification protocol for guidance on how their lighting products could receive the ELI label.

Linear Fluorescent Systems

Fluorescent lamps and ballasts are interdependent components of a complete lighting system. Different lamps and ballasts are combined to create systems that generate light at different levels of efficiency. High frequency electronic ballasts paired with triphosphor T8 lamps can reach efficiencies approaching 100 lumens per watt, as compared to older fluorescent technologies that may yield less than 65 lumens per watt.

The diversity of lighting customers and markets in ELI countries poses a challenge to the design of a common specification for linear fluorescent lighting that is relevant across all ELI countries. As a result, this specification recognizes that different technologies may be appropriate for market transformation activities in different sectors. For new commercial and industrial applications, this specification requires high frequency electronic ballasts and triphosphor T8 or T5 lamps. New residential installations may use low-loss electromagnetic ballasts, due to their relatively lower costs. Low-loss electromagnetic ballasts may also be used to replace failed ballasts in existing luminaires. ELI offers no general specification for lamps; ELI country program managers must decide what is appropriate for lamps in each country.

The specifications do not address the issue of product reliability because linear fluorescent lighting systems are familiar and have well-established markets in each ELI country. The one exception is for linear fluorescent electronic ballasts which are relatively new and which have had problems with high failure rates in some countries. This specification relies on broadly accepted technical parameters for

electronic ballasts. These parameters are further supported by a requirement that manufacturer product warranties cover not only the material costs of replacing faulty electronic ballasts, but also labor costs.

ELI assumes that high quality electronic ballasts will be available at cost-effective prices in all ELI country commercial and industrial new construction markets by the end of ELI (in the year 2002). In fact, in many ELI countries this goal has already been reached. The market transformation task for ELI in the commercial and industrial new construction market is to help the penetration of electronic ballast technology by increasing product quality and driving down prices through competition and higher sales volumes.

The residential market for linear fluorescent lighting in most countries is very price-sensitive, and in ELI countries tends to be dominated by low-efficiency, electromagnetic ballasts. Therefore, low-loss electromagnetic ballasts represent a significant improvement over the status quo.

The replacement ballast specification allows ELI to promote low-loss electromagnetic replacement ballasts that compete in the same general price category as inefficient electromagnetic ballasts that are the current market leaders in ELI countries. Of course, ELI encourages electronic replacement ballasts where possible.

Definitions

Electronic Fluorescent Ballast

A device used with a linear fluorescent lamp to obtain the necessary circuit conditions (voltage, current and waveform) for starting and operating. Electronic ballasts are made of solid-state electronic components and operate at higher frequencies than AC mains.

Electromagnetic Fluorescent Ballast

A device used with a linear fluorescent lamp to obtain the necessary circuit conditions (voltage, current and waveform) for starting and operating. Electromagnetic ballasts operate at the same frequency as AC mains (50 or 60 Hz).

Linear Fluorescent Lamp

A linear fluorescent lamp is an electric discharge lamp that generates light from a phosphor-coated tube. Linear fluorescent lamps come in a wide range of lengths and a number of different diameters. The older "T12", or 1.5 inch (38 mm) diameter tube is being globally supplanted by the "T8", or 1 inch (26 mm) diameter tube or the even thinner "T5" tube. Halo-phosphor technology is also being replaced by more efficient triphosphors. In some countries, the use of halo-phosphor lamps has been restricted as an energy efficiency measure.

Linear Fluorescent Lighting System

For the purposes of this specification, the linear fluorescent lighting system consists of a fluorescent ballast or ballasts and a linear fluorescent lamp or lamps that are designed to operate together in a luminaire. This specification considers only the efficiency of the lamp-ballast circuit, and not the efficiency of the luminaire.

Luminous flux

Luminous flux is the generated by the linear fluorescent system after an initial burn-in period of 100 hours. Luminous flux shall be the lumens generated by the specific linear fluorescent lighting system in question under stable operation at maximum power.

Input Power

Power drawn by the linear fluorescent system after an initial burn-in period of 100 hours. Input Power shall be the power drawn measured in watts (W) by the specific linear fluorescent lighting system in question under stable operation at maximum power.

System Efficiency

Luminous flux generated by a linear fluorescent lighting system divided by Input Power in units of lumens per watt lm/W.

Ballast Factor

The ratio of a fluorescent lamp's light output on a specific ballast compared to the fluorescent lamp's output as measured on a reference ballast.

Residential

For the purposes of this specification, residential linear fluorescent products are sold through retail shops to consumers and may be installed in dwellings, small commercial and other buildings.

Commercial/Industrial/Institutional (C/I/I)

For the purpose of this specification, C/I/I linear fluorescent ballasts and lamps are sold in bulk through commercial distributors to builders or electrical contractors.

New Construction & Significant Renovation

For the purpose of this specification, new construction or significant renovation applications for linear fluorescent lighting are applications involving the total replacement of the linear fluorescent luminaire and possibly the rewiring of a building's lighting.

Replacement

For the purpose of this specification, replacement applications for linear fluorescent lighting are applications involving the replacement of only the linear fluorescent lamp and or ballast.

Standard References

IEC - International Electrotechnical Commission

CIE - Commission International d'Eclairage (International Illumination Commission)

ISO - International Standards Organization

Linear fluorescent Lighting Systems sold for new applications in commercial, institutional and industrial buildings should use electronic ballasts that meet the following efficiency criteria for ELI:

Table 1: New C/I/I – Linear Fluorescent Systems	
Lamp Power (High Frequency)	Max. Circuit Power Draw
13.5 W	≤18 W
16 W	≤21 W
24 W	≤33 W
32 W	≤38 W
50 W	≤59 W
60 W	≤72 W
Fluorescent lamps shall have a color rendering index (CRI) ≥ 70.	
These maximum power draw limits shall be measured as defined by the Association of European Luminaire Manufacturers (CELMA) and are equivalent to the CELMA "A3" level classification for fluorescent ballasts.	

Electronic Ballasts that are promoted through ELI should meet the following requirements.

Table 2: Electronic Ballasts	
Frequency	> 20 kHz
Power Factor	≥ 0.90
Total Harmonic Distortion	≤ 32 %
In-rush Current	≤ 20 A for < 3 ms
Current Crest Factor	≤ 1.7
Voltage variation	Must operate within specified parameters at a range of nominal voltages up to 15% higher or lower than rated operating voltage without reduction in rated life (as by IEC 60929)
Safety	Ballast shall comply with applicable parts of IEC – 60920, 61547, 60928 and all local requirements.
Warranty	Minimum 3-year replacement warranty including a labor allowance for electronic ballasts that fail early due to manufacturer defect. Manufacturer shall apply a label with basic warranty terms and a local telephone number to each ballast, written in at least one applicable local language.

Linear fluorescent Lighting Systems for new applications in residential buildings should meet the following efficiency criteria for ELI:

Table 3: New Residential Linear Fluorescent Systems	
Lamp Power (50- 60 Hz)	Max. Circuit Power Draw
15 W	≤21 W
18W	≤24 W
30 W	≤36 W
36 W	≤41 W
38 W	≤43 W
58 W	≤64 W
70 W	≤77 W
These maximum power draw limits shall be measured as defined by the Association of European Luminaire Manufacturers (C.E.L.M.A) and are equivalent to the CELMA "B1" level classification for fluorescent ballasts.	

Note: These efficiency levels should allow new residential linear fluorescent systems to use low-loss electromagnetic ballasts. Electronic ballasts used for new residential applications should meet the same criteria specified for electronic ballasts in C/I/I linear fluorescent systems (Table 2 above).

Linear Fluorescent Ballasts for Replacement Applications sold separately from fluorescent lamps and luminaires must meet the following performance specifications for ELI:

Table 4: Linear Fluorescent Ballasts for Replacement Applications
At a minimum, linear fluorescent ballasts intended for replacement applications must meet the efficiency criteria described in Table 3 above, corresponding to CELMA classification B1. All electronic ballasts used in replacement applications must meet the performance criteria further described in Table 2.

Note: The specification allows ELI qualified low-loss electromagnetic ballasts to compete in the local ballast replacement markets against the inefficient electromagnetic ballasts that currently dominate those markets. The specification also ensures that purchasers who make the cost and efficiency leap to an ELI-qualified electronic ballast will get the savings and reliability that they expect.

Linear Fluorescent Lamps for Replacement Applications that are sold separately from ballasts and luminaires for installation in retrofit applications must meet the following performance specifications for ELI:

Table 5: Linear Fluorescent Lamps for Replacement Applications
Due to the different levels of penetration of different linear fluorescent tube and ballast technologies into the different ELI country markets, individual specifications will be determined on a country by country basis by IFC in concert with country implementation staff.

Reference Specifications

IEC – 60920 Linear fluorescent ballast safety

IEC – 61547 Equipment for general lighting purposes - EMC immunity requirements

IEC – 60928 High frequency ballast safety

IEC – 60929 High frequency ballast performance

National Lighting Product Information Program, *Guide to Fluorescent Lamp-Ballast Compatibility*, Lighting Research Center, Rensselaer Polytechnic Institute, Troy, NY USA

National Lighting Product Information Program, *Guide to Specifying High Frequency Electronic Ballasts*, Lighting Research Center, Rensselaer Polytechnic Institute, Troy, NY USA

Classification of Lamp-Ballast Circuits for Energy Efficiency in Lighting, C.E.L.M.A.

Inquiries

Please address all questions or comments regarding this specification to:

Ms. Kathryn Conway
Technical Consultant, Efficient Lighting Initiative
P.O. Box 510
Nassau, NY 12123-0510 USA
email eli@kateconway.cc

9.3 Price List and Retail Stores

BESCOM Efficient Lighting Program
Price List and Supplier Details

BESCOM SUB-DIVISION: S5

Price List

Brand	Lamps	Price (Rs)	Warranty Period (Months)	Monthly Instalment (Rs)				
				1 lamp	2 lamps	3 lamps	4 lamps	5 lamps
Brand 1	CFL – 9W							
	CFL – 11W							
	CFL – 15W							
	CFL – 20W							
	T8 Tube - 36W							
Brand 2	CFL – 9W							
	CFL – 11W							
	CFL – 15W							
	CFL – 20W							
	T8 Tube - 36W							
Brand 3	CFL – 9W							
	CFL – 11W							
	CFL – 15W							
	CFL – 20W							
	T8 Tube - 36W							
Brand 4	CFL – 9W							
	CFL – 11W							
	CFL – 15W							
	CFL – 20W							
	T8 Tube - 36W							

Retail Stores

Mahesh Enterprises 42, Fourth Street Bangalore Ph: 080 4257360 Products: Brand 1, Brand 2, Brand 4		

9.4 Customer Purchase Agreement

Bangalore Electricity Supply Company Limited

EFFICIENT LIGHTING PROGRAM

AGREEMENT FOR THE PURCHASE OF CFLS AND FLUORESCENT TUBES (T8S)

(Translation in Kannada)

SECTION 1: TO BE COMPLETED BY THE APPLICANT

Applicant's Name *(Translation in Kannada)*	
Address *(Translation in Kannada)*	
Location Code *(Translation in Kannada)*	
RR. No: *(Translation in Kannada)*	
Ledger / Folio No: *(Translation in Kannada)*	

I agree to purchase ..... (.....Nos.) CFLs and ..... (..... Nos:) T8 Fluorescent tubes under the BESCOM Efficient Lighting Program and pay the total cost of the lamps in twelve equal monthly instalments commencing after one month of the date of receipt of the lamps with my monthly electricity bills.

I hereby give my consent to BESCOM to include the lamp loan recovery in the monthly electricity bills in respect of the above account number.

I confirm that I have not purchased lamps under this program before this date.

.....

Date: ..... Signature of Applicant

(Translation in Kannada)

SECTION 2: TO BE COMPLETED BY THE AUTHORIZED RETAILER *(TRANSLATION IN KANNADA)*

DETAILS OF LAMPS SOLD

BRAND	TYPE (CFL / T8)	NO: PURCHASED	BATCH NO:S	COST (RS)

TOTAL COST (RS)		INVOICE NO:	

Issued ..... Nos. CFLs and ..... Nos T8 Tubes

Date: ....

Signature of Authorized Agent and Seal

SECTION 3: TO BE COMPLETED BY THE APPLICANT *(TRANSLATION IN KANNADA)*

I CONFIRM THAT I RECEIVED THE FOLLOWING LAMPS IN GOOD CONDITION

LAMP TYPE	NUMBER OF LAMPS
CFLS	
FLUORESCENT TUBES (T8)	

Date: ....

Signature of Applicant

9.5 Agreement between BESCOM and Lighting Suppliers

MEMORANDUM OF UNDERSTANDING

between

BANGALORE ELECTRICITY SUPPLY COMPANY LIMITED

and

ABC LIGHTING COMPANY, BANGALORE

Energy Conservation and Commercialization II (ECO-II) Project: Support to the Bureau of Energy Efficiency (BEE) Action Plan

BESCOM EFFICIENT LIGHTING PROGRAM

This Memorandum of Understanding (MOU) is made and entered into on this day of 2004, between:

- Bangalore Electricity Supply Company Limited (hereinafter referred to as *BESCOM*), having its registered office at K.R.Circle, Bangalore-560 001, India, in this matter represented by the Managing Director,
- ABC Lighting Company (hereinafter referred to as "Lighting Supplier") having its registered office at ……, in this matter represented by the Regional Director.

The ECO II – Support to the BEE Action Plan is hereinafter referred to as the *ECO II Project*.

1. Introduction and Background

1.1 USAID/India initiated the Energy Conservation and Commercialisation (ECO) project in 2000 aimed at promoting the widespread commercialisation of energy efficiency technologies and services in India, which would have a direct impact on the reduction in growth of greenhouse gas (GHG) emissions.

1.2 In 2001, the Government of India passed the Energy Conservation Act and established a statutory coordinating body under the Central Government, the Bureau of Energy Efficiency (BEE). The BEE was officially established in March 2002, and the BEE Action Plan was subsequently approved and released in August 2002. Many of the areas addressed under ECO, as well as the contributions of other donors, are helping the BEE to implement their Action Plan.

1.3 The Energy Conservation and Commercialization (ECO) project has been designed to promote widespread commercialization of energy efficiency technologies and services in India. The project supports the development of policy and market interventions that would enhance the capabilities of the private, financial, and government sectors for deploying market-based mechanisms for end-use efficiency investments.

1.4 In 2003, USAID initiated the second phase of ECO project. The purpose of the *ECO-II Project* is to provide the BEE with necessary technical assistance (TA) and training support to implement two major Thrust Areas of its Action Plan as summarised below:

ECO-II Project Activities	BEE Action Plan Thrust Areas
1. Implementation of Utility Demand Side Management (DSM) in Selected Indian States	Demand Side Management
2. Development and Dissemination of a DSM Best Practices Guide	Demand Side Management
3. Energy Efficiency Building Codes for Six Climatic Regions	Energy Conservation Building Codes

1.5 The BEE and USAID has selected a consultant team, led by the International Institute for Energy Conservation (IIEC), as the technical assistance contractor for this project. The project team includes senior international and local consultants.

1.6 IIEC is a not for profit NGO with a mission to promote sustainable energy solutions in developing countries and countries in transition. BESCOM is a power distribution company in the State of Karnataka and nominated by the Karnataka Power Transmission Corporation Limited (KPTCL) to be the host utility for the *ECO II Project*.

2 Scope of DSM Activities in ECO II Project

There are two DSM related activities in the *ECO II Project* and their objectives are given below:

2.1.1 Activity 1 - DSM implementation in State Utilities

1. DSM capacity building within the state electric utility (including training, technical assistance and provision of hardware and software);
2. Development of approaches to obtain management commitment and qualified and dedicated staff resources;
3. Development and implementation on a set of “demonstration projects”;
4. Effective utilization of the private sector (including ESCOs, equipment vendors and private financial institutions);
5. Development and identification of appropriate regulatory mechanisms, including incentives to utilities, for increasing the attractiveness of DSM; and
6. Training and capacity building of the regulatory commissioners and their staff relative to DSM.

2.1.2 Activity 2 – DSM Best Practices Guide

The DSM Best practices Guide will be designed as a solutions provider and organized so that the different practices will be organized by the context in which they are applied successfully. The Guide will:

1. Include both market-based and policy-driven DSM mechanisms;
2. Cover programs from developed countries, developing countries in Asia and Indian States;
3. Address key elements of each program selected for the Guide including target markets, implementing mechanisms, regulatory considerations/incentives, utility actions, funding sources, results achieved, and benefits/costs;
4. Highlight the role of manufacturers, utilities, financing institutions, ESCOs, and regulators; and

5. Define the potential implications of the programs for Indian Utilities.

2.2 Activity 1 involves DSM implementation in two state utilities. The selection of the two utilities was made in consultation with the BEE and USAID based on established selection criteria. Maharashtra State Electricity Board (MSEB) and a State utility in Karnataka – Bangalore Electricity Supply Company (BESCOM) were selected. On the recommendation of MSEB, MEDA was appointed as the agency for coordination of activities under the *ECO II Project.*

3.0 Scope of Energy Efficient Lighting Program

a) Lighting in the Residential and Commercial sectors has a significant contribution to the system peak demand in the state of Karnataka.

b) BESCOM, in coordination with IIEC, is implementing an Efficient Lighting Program in the Bangalore Urban District for customers in the LT-2 (a) and LT-3 tariff classes.

c) This will be a demonstration project with an initial duration of six months followed by a detailed program evaluation. Based on the impacts of the demonstration project a decision will be made by BESCOM on the merits of extending the program to the customers in Bangalore Urban District and expanding the program to the other districts.

d) The lighting products promoted under the program are Compact Fluorescent Lamps (CFLs) and 36W Fluorescent tube lights.

e) BESCOM will collect the cost of the lamps in equal monthly instalments through the electricity bills. The Suppliers will be reimbursed in full through a financial institution.

4.0 Obligations of BESCOM

4.1 Make staff available, in partnership with IIEC, for program administration.

4.2 Advertise the program through an insert distribute with the customer's electricity bills.

4.3 Advertise the program in the newspapers and through posters displayed in each of its 39 Sub Divisions.

4.4 Distribute information of lamp costs and location of participating retail stores in each Sub-Division.

4.5 Incorporate the cost of lamp purchases in the customers account and collect in equal monthly instalments over a period specified in the program.

4.6 Make monthly payments of collections from the lighting program in to the Trust and Retention Account maintained by IDECK.

4.7 In coordination with IIEC, publish the benefits of the program after monitoring and evaluation.

5.0 Obligations of Lighting Supplier

5.1 Provide a warranty for all lamps sold under the program for a period of ___ months from the date of purchase

5.2 Provide lighting retailers in the vicinity of the 39 BESCOM Sub-Divisions.

5.3 Provide adequate training for the retailers and distributors to ensure that the program guidelines are followed.

5.4 Contribute a specified sum to a common budget of all participating Lighting Suppliers for program advertising.

5.5 Provide information of all sales data for a twelve-month period prior to the commencement of the program.

5.6 Provide information on sales data (both for the program and direct sales) during the demonstration program.

5.7 Provide information on failures for lamps purchased under the program.

5.8 Provide other assistance, as required, to the Program Administrator during the program

6.0 Timing

6.1 The demonstration program will commence on _____ 2004 initially for a period of six months.

Agreed to on this …….. day of ……, 2004

Mr. Bharat Lal Meena

Managing Director

Bangalore Electricity Supply Company Limited, Signature: _____
Bangalore, India

Date: _____

Regional Director

ABC Lighting Company Signature: _____

Bangalore, India Date: _____

9.6 Billing Analysis Data – Representative 100 Consumers

Billing data – BESCOM Consumers

	Period 1	Period 2	Difference
EH3218	907	750	157
N1AEH15371	479	405	74
N1EH10306A	949	918	31
N1EH10943	954	1178	-224
N1EH11037	688	760	-72
N1EH11218	940	983	-43
N1EH11542	1165	1238	-73
N1EH12512	935	710	225
N1EH12849	904	914	-10
N1EH13102	585	487	98
N1EH14347	41	125	-84
N1EH14491	463	538	-75
N1EH15071	546	603	-57
N1EH15245	1355	1297	58
N1EH15546	1751	1608	143
N1EH15903	1529	1696	-167
N1EH16170	654	610	44
N1EH16203	464	494	-30
N1EH16683	1018	1007	11
N1EH17188	614	763	-149
N1EH17870	1152	508	644
N1EH2463	1180	1467	-287
N1EH28664	665	573	92
N1EH3051A	264	361	-97
N1EH3497	1116	1211	-95
N1EH4242	1075	2116	-1041

N1EH4569	1975	2225	-250
N1EH5115	1491	1578	-87
N1EH6260	992	884	108
N1EH6509	251	730	-479
N1EH6537	1441	1810	-369
N1EH6827	541	656	-115
N1EH6883	689	640	49
N1EH6935	945	1142	-197
N1EH7511	934	1074	-140
N1EH8551	923	721	202
N1EH9027A	1586	1428	158
N1EH9274	1531	1525	6
N1EH9445	1709	1574	135
N1EH9662	843	669	174
N1EH9892	514	582	-68
N1LG1640	97	157	-60
N1LG30754	433	759	-326
N1LG6548	448	543	-95
N1LG7529	128	132	-4
N1LG8292	15	55	-40
N1LG9290	634	849	-215
N2CP6094	593	690	-97
N2EH10032	651	891	-240
N2EH1005A	622	591	31
N2EH10061A	1483	1640	-157
N2EH10149	1405	1312	93
N2EH10150A	910	947	-37
N2EH10263	1611	1360	251

N2EH10345	450	471	-21
N2EH1048	904	879	25
N2EH1090	1301	667	634
N2EH11057A	8634	599	8035
N2EH11128	108	134	-26
N2EH1129	575	455	120
N2EH1138B	1015	365	650
N2EH11486A	417	532	-115
N2EH11494	1321	1643	-322
N2EH11617	2421	2195	226
N2EH11767	691	939	-248
N2EH12179A	1295	1454	-159
N2EH1233A	1614	1670	-56
N2EH12398	492	428	64
N2EH12529	772	704	68
N2EH12670	691	674	17
N2EH12904	991	1000	-9
N2EH13438	1444	1054	390
N2EH13564	344	397	-53
N2EH14254A	172	183	-11
N2EH14268	1072	792	280
N2EH14606	341	439	-98
N2EH14607	317	336	-19
N2EH14934	1327	1400	-73
N2EH15058	363	245	118
N2EH15290	214	327	-113
N2EH15294A	1053	1070	-17
N2EH15295	134	155	-21

N2EH15413	497	501	-4
N2EH15924	1238	1264	-26
N2EH16145	619	961	-342
N2EH16180	594	728	-134
N2EH16181	664	769	-105
N2EH16182	2031	1388	643
N2EH16507	394	312	82
N2EH16847A	798	640	158
N2EH17387	283	272	11
N2EH17461A	835	676	159
N2EH17527	797	823	-26
N2EH17552	278	254	24
N2EH17576	1055	1134	-79
N2EH18068	660	691	-31
N2EH18141	1329	845	484
N2EH1872	1142	1029	113
N2EH18750	1254	1353	-99
N2EH18786	638	669	-31
N2EH18979	705	932	-227
TOTAL	**94072**	**86932**	**7140**

9.7 BELP Program Photographs

BELP Strategy Meetings

BELP Launch – 10 December 2004

BELP Sum-up Meeting
17 December 2005

BELP Roadshows