Program Design

BESCOM EFFICIENT LIGHTING PROGRAM (BELP)

Prepared by:

Intenrational Institute for Energy Conservation (IIEC)

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Program under:

ECO II Initiative

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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. The International Institute for Energy Conservation (IIEC) was selected by USAID as the implementation contractor for ECO II.

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.

BESCOM is seeking expressions from lighting suppliers for participation in the lighting program.

1.1 Proposed Program and Rationale

Research has shown that lighting is a major contributor to the BESCOM 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.

2 **PROGRAM OVERVIEW**

The BESCOM distribution network include six districts – Bangalore Urban, Bangalore Rural, Kolar, Tumkur, Chitradurga and Davangere as shown in Figure 2.1 below:



Figure 2.1: BESCOM Distribution Network

2.1 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.
- 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-1 and LT-2 (Domestic only) 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.
- The customers will have two choices for the purchase of CFLs of approved brands – direct outright purchase or payment in installments through BESCOM's billing system. Only CFLs would be eligible for the installment scheme.
- Eligible customers (with no arrears on electricity bills) will acquire the CFLs from approved retailers and complete a sales voucher confirming purchase.
- For customers electing to purchase lamps on an installment basis, the distributors will send invoices at regular intervals to BESCOM's Program Administrators. Upon verification, BESCOM will include the lamp costs in the

customer's bills and allow for repayment in installments over the specified period of nine months.

- BESCOM will reimburse the suppliers in monthly installments following collections from customers.
- Program marketing will be managed by BESCOM.

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



2.2 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 CFL costs through customer bills; reimbursement of suppliers in installments from monthly collections; 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 BESCOM and disbursement of payments to retailers
Lighting Retailers	Sale of CFLs and 36W FTLs 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-1 and LT-2 (Domestic only) tariff classes as defined in the BESCOM Electric Power Tariff 2003. The customer numbers are as follows:

Division	LT-1 & LT-2
Bangalore South Circle	759,039
Bangalore North Circle	923,231
Total Eligible Customers	1,682,270#

[#] This number includes close to 300,000 connections from the low-income group, under the "Bhagya Jyoti – Kutir Jyoti" scheme. These customers would be ineligible for the program.

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

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 (FTLs)

Incandescent lamps and 40W fluorescent lamps are widely used in the residential sector. The aim of the program is the replacement of these lamps with CFLs and T8 lamps (36W FTLs) in areas of high usage (~ 4 hours/day).

3.3 Program Target and Duration

Cost/benefit analyse 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 installments through the electricity bills.

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.

3.4 Direct Sales Guidelines

The suppliers will offer a "special price" for those customers who prefer to purchase lamps (CFLs and 36W FTL) outright. Under the lighting program BESCOM will only endorse the products of the selected suppliers. The supplier obligations are as follows:

- 1. Offer a warranty on the CFLs purchased at least for the same duration as that offered in the installment scheme.
- 2. The lamps offered at the special price should only be available at the retail stores nominated by the supplier for the program.
- 3. All lamps sold shall have a unique bar code or seal for identification with the program and for warranty obligations.
- 4. The suppliers shall supply sales figures of all direct sales under the program to BESCOM.

3.5 Installment Scheme - Procedure for Issue of Lamps

The procedure for the issue of CFLs under the installment scheme will be as follows:

- 1. 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, the brands and prices of the CFLs.
- 2. The customer will choose one of the approved retail outlets for the "purchase" of the CFLs. There will be posters in the retail outlets participating in the program.
- 3. 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 CFLs and the limitation of the number of lamps will be five (5). The customer is not allowed to choose multiple brands due to practical problems in invoicing.
- 4. The customer and the authorized agent (retailer) will complete an Agreement for the purchase of lamps.
- 5. 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. For issue of lamps to tenants an authorization is required from the landlord.
- 6. The supplier shall provide a price for installment purchase that includes the supplier's cost of financing.

3.6 Procedures for Invoicing and Payment

The procedures for invoicing and payment for CFLs purchased under the installment scheme 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 BESCOM Program Administrator for verification and processing.
- 5. The BESCOM Program Administrator will also sort the purchase agreements by each BESCOM Sub-Division and submit these to each Sub-Division for inclusion in the electricity bills.
- 6. Monthly collections from each Sub-Division will be forwarded to the Central Accounting Division (CAD) who will then forward the installments to each supplier against the monthly invoices. The repayment period of the customer will be nine (9) months and the supplier reimbursement period will be the same.
- 7. The supplier reimbursements will start no later than sixty (60) days from the sale and the supplier reimbursement period will be over the following nine months.

3.7 *Procedures for Lamp Replacement under Warranty*

Under the Agreement with BESCOM, the suppliers have an obligation to honour the warranty given on the CFLs purchased under this program both for direct purchases and purchases under the installment scheme. The procedures for lamp replacement are as follows:

- 1. The customer will be required to return the failed lamp to the retail store where the lamp was purchased and provide the original receipt as proof of purchase.
- 2. The retailer will supply a replacement lamp and will mark in the original receipt confirming the issue of the lamp and the date.
- 3. The retailer will keep a record of the replaced lamps and provide this information to the distributors and program administrator at regular intervals.

- 4. The obligation of the supplier is to replace failed lamps up to the limit of the warranty period from the date of the original purchase. For example, if a supplier offers a warranty of one year and a lamp fails after 9 months of purchase, then the replaced lamp will have a warranty of only 3 months.
- 5. The supplier will be required to provide a bank guarantee to BESCOM, to the value of Rs 50 Lakhs, as security against the warranty obligations.

4 SELECTION OF SUPPLIERS

4.1 Selection Criteria of Suppliers

The selection of suppliers will be made through this formal Request for Proposals (RFP) and clearly defined selection criteria, as outlined below:

- Company registration, core business, years of operation in India and financial stability (supported by recent financial statement and solvency certificate from the commercial bankers);
- The annual turnover of the Company a minimum of Rs 5 Cr.
- The CFLs and T8s (18W FTLs) offered should be the own brand name of the company;
- Meeting the technical specifications for the lighting products
- 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 supplied under this program for identifying should a warranty be raised;
- Retail price of the lighting products offered for the program for direct sales and for the installment purchase scheme;
- 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

4.2 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 6.1*.
- Warranty Period: The minimum warranty period for the lamps shall be one (1) year. Suppliers offering a warranty of less than one year would be ineligible. However, the suppliers have the option of offering an extended warranty.
- Sales Data: Provision of historical sales data for a period of 12 months prior to the commencement of the program and monthly sales data during the program implementation period.
- Agreement to make an equal contribution to an advertising budget to be established at BESCOM for program advertising. This would be limited to a

maximum contribution of Rs 500,000 per participating supplier. The exact amount will be determined based on the number of suppliers selected and the contributions from BESCOM and IIEC.

- Assigning separate serial numbers or unique bar codes or program seal on the products kept at the retail stores.
- Price of Lamps: The suppliers are required to provide equivalent CFLs for the replacement of 40W, 60W, 75W and 100W incandescent lamps. The suppliers are required to confirm the price at which CFLs would be offered to BESCOM 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. The suppliers are required to offer the following:
 - Prices for the range CFLs and 36W FTLs for direct sales;
 - Prices for the range of CFLs under the installment scheme.

It should be noted that price offered to customers, under the installment scheme, would include program administration costs of BESCOM. The administration costs per lamp will be a fixed component for all lamps and will be added to the retail price.

- 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.
- The suppliers are required to execute an agreement with BESCOM. A sample of the BESCOM / Supplier agreement is given in *Attachment 6.2*. The supplier will be required to provide a bank guarantee of Rs. 50 Lakhs as security against warranty obligations.

4.3 **Evaluation of Proposals**

4.3.1 Mandatory Requirements

The suppliers are required to meet the following minimum requirements in order to be considered for participation in the program. Proposals that do not meet **all** these requirements will not be considered.

- Proof of compliance with technical specifications given in Attachment 6.1;
- A minimum lamp warranty period of a minimum of 12 months;
- Contribution of a maximum of Rs 5 Lakhs towards program administration and marketing costs; and
- Provision of a bank guarantee of Rs 50 Lakhs as security for lamp warranty obligations.

4.3.2 Technical Proposal

The following shall apply:

Criteria	Points
Company Registration and years of operation in India; and core business	20
Annual Turnover	25
Period of lamp warranty offered	20
Distribution and retail network in Bangalore	20
Previous experience in utility lighting programs	15

The proposed scale for each of the above criteria is given in the Table below:

Criteria	Points	Proposed scale	
Company Registration and years of operation in India; and core business	20	{More than 20 years in India, core business in lighting for 20 years = 20 points } {More than 10 years in India, core business in lighting for 10 years =16 points } {More than 10 years in India, business in lighting for < 10 years = 12 points } {Less than 10 years in India, business in lighting for < 10 years = 8 points } {Less than 10 years in India, business in lighting for < 5 years = 4 points }	
Annual Turnover	25	{Turn-over > 25 Crores from Lighting Products = 25 points } {Turn-over < 25 Crores > 15Crores from Lighting Products = 20 points } {Turn-over < 15 Crores > 10Crores from Lighting Products = 15 points } {Turn-over < 10 Crores > 5Crores from Lighting Products = 10 points } {Turn-over < 5 Crores from Lighting Products = 5 points }	
Period of lamp warranty offered	20	{Warranty > or = 24 months = 20 Points } {Warranty > or = 18 months = 15 Points } {Warranty = 12 months = 1 0 Points }	
Distribution and retail network in Bangalore	20	<pre>{> 5 large distributors = 20 Points} {> 3 and <5 large distributors = 15 Points} {> 1 and <3 large distributors = 10 Points} {1 large distributors = 5 Points}</pre>	
Experience in utility lighting programs	15	{Local and International experience of company or its subsidiaries = 15 points } {Local experience of company = 10 points } {International experience of company or its subsidiaries = 5 points } {No local or international experience = 0 points }	

A minimum technical score of 60 will be required for consideration for participating in the program.

4.3.3 Cost Proposal

The Cost Proposal of the suppliers meeting the technical criteria (60 points) will be considered for the cost evaluation.

Only the cost of the CFLs for the installment scheme will be considered in the evaluation. The average cost of the range of CFLs offered as replacement for 40W, 60W, 75W and 100W incandescent lamps will be determined and used in the following formula:

Sf = $100 \times Fm/F$

Sf = financial score,

Fm = lowest average price

F = average price of the proposal under consideration

In the case of a supplier not offering the full range of CFLs, the average price will be determined by taking the highest price (from the prices by other suppliers) for the product that is not been offered.

4.3.4 Overall Ranking

The weight given to the Technical Proposal T = 0.7 and the weight given to the Financial Proposal P = 0.3; T + P = 1

4.3.5 Final Selection

BESCOM will select 3 to 5 suppliers with the highest overall weighted scores (Technical plus Financial) for the program. There will be a limit to the number of suppliers participating in the program, and the exact number will be determined by BESCOM.

5 INFORMATION FROM SUPPLIERS

The suppliers are required to submit a detailed proposal addressing the criteria outlined in Section 4.1. The proposal shall include, but not be limited, to the following:

- Company registration information including recent financial statement and solvency certificate from a commercial bank;
- Detailed listing of the lighting products offered and confirmation of compliance of the specified technical standards. Copies of certified technical specifications of each product shall be provided;
- The proposed retail prices (direct sales and installment scheme) of each lighting product for the initial period of the program (6 months). The prices shall remain fixed for the period of the program. The selected suppliers will have the option of applying for a reduction of the original retail prices once during the program period. However, request for increase in the prices will not be entertained.
- The period of warranty offered for each product and the proposed process for servicing the warranty.
- Details of the retail and distribution network in the Bangalore Urban District;
- Agreement to make an equal contribution contribute to a common pool of funds, not exceeding Rs 500,000, for joint program advertising.
- Agreement to the cost reimbursement procedure (i.e. 9 installments after collection from customers) offered by BESCOM.
- The suppliers shall review the draft agreement with BESCOM (Attachment 6.2) and provide comments and revisions for consideration by BESCOM.

5.1 Submission of Proposals

The Technical and Financial Proposals shall be submitted separately

The original and two copies of the Technical Proposal shall be placed in a sealed envelope clearly marked "Technical Proposal". The original and two copies of the Financial Proposal shall be placed in a sealed envelope clearly marked "Financial Proposal" and warning: "Do Not Open with Technical Proposal". Both envelopes shall be placed in an outer envelope and sealed. This outer envelope shall bear the submission address specified in the Invitation for Bids.

5.2 **Contact for Further Information**

Clarifications may be requested at least 10 days before the submission date. The address for requesting clarifications is:

General Manager – Electrical (Procurement), Bangalore Electricity Supply Company Limited,

K.R. Circle, Bangalore 560 001

6 ATTACHMENTS

6.1 Lighting Specifications



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 labelling 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-labelled 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-labelled products, see <<u>www.efficientlighting.net</u>>

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 <u>unitary</u> (a single, non-separable unit containing lamp and ballast, also often referred to as <u>self-ballasted</u>), or, <u>modular</u> (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 °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: $\ge 45 \text{ lm/W}$ At input power of $\geq 15 \text{ W}$: $\geq 60 \text{ lm/W}$

If CFL has a translucent cover At input power of $\leq 14 \text{ W}$: $\geq 40 \text{ lm/W}$ At input power of 15 to 19 W: \geq 48 lm/W At input power of 20 to 24 W: \geq 50 lm/W At input power of $\geq 25 \text{ W}$: $\geq 55 \text{ lm/W}$

If CFL has a reflector At input power of $\leq 19 \text{ W}$: $\geq 33 \text{ lm/W}$ At input power of > 19 W: \geq 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 $\pm 10\%$ of rated operating voltage without reduction in the rated life.
Transient Protection	CELs 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. <i>Lifetime shall be clearly indicated in hours on product packaging.</i>
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	<i>Correlated lamp color temperature of CFL must appear on product packaging</i> (as defined in IEC 60969 and measured in accordance with IES LM-16-1984, "Colorimetry of Light Source" and the <i>1993 IESNA Lighting Handbook</i>).	
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 $\geq 80\%$ 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).	

Other	Performance Specifications	
Comparison of CFL to GLS on Label**	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:	
	CFL	Rated Wattage(s) of equivalent GLS filament
	Luminous Flux	lamp
	Claim (lm)	
	≥ 214	≤ 25 W
	≥ 386	$\leq 40 \text{ W}$
	≥ 660	$\leq 60 \text{ W}$
	≥ 874	≤ 75 W
	≥ 1246	$\leq 100 \text{ W}$
	≥ 2009	≤ 150 W
	In addition, manufacturers must notify ELI if the CFL exhibits $\geq 10\%$ light output degradation due to: Operation outside of rated temperature range or, Operation in other than VBU position or, Any other factors.	
Warranty	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. <i>Written warranty in at least one applicable local language must be included with CFL when purchased.</i> Manufacturer shall provide a local address for customer contacts and complaints.	
Quality of Production	CFLs must be manufactured under a Quality Assurance System in accordance with ISO 9000-2000 or equivalent (equivalency to be determined by ELI).	

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:

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



IFC/GEF Efficient Lighting Initiative

Lamp Ballast Circuits for Linear Fluorescent Lighting Voluntary Technical Specification

Background

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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 luminaries. 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

<u>Linear fluorescent Lighting Systems</u> 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) \geq 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.

Table 2: Electronic Ballasts			
Frequency	> 20 kHz		
Power Factor	≥ 0.90		
Total Harmonic Distortion	≤ 32 %		
In-rush Current	$\leq 20 \text{ A for} < 3 \text{ ms}$		
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.		

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

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	Max. Circuit	
(50- 60 Hz)	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 <u>eli@kateconway.cc</u>

6.2 Sample BESCOM and Supplier Agreement

DRAFT AGREEMENT

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 Agreement 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;
- 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 nine (9) equal monthly installments through the electricity bills. The Suppliers will be reimbursed by BESCOM in corresponding monthly installments after collections from customers.

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 distributed 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 **using funds provided by the suppliers**.
- 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 under the installment scheme in the customers account and collect in equal monthly installments over a period specified in the program.
- 4.6 Make monthly payments of collections from the lighting program to the suppliers against the relevant invoices.
- 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 Promptly replace any lamps that fail during the warranty period.
- 5.3 Provide a Bank Guarantee to the value of Rs 50 Lakhs as security against lamp warranty obligations.
- 5.4 Provide lighting retailers in the vicinity of the 39 BESCOM Sub-Divisions.
- 5.5 Provide adequate training for the retailers and distributors to ensure that the program guidelines are followed.
- 5.6 Contribute a specified sum, up to a maximum of Rs 5 Lakhs, to a common budget of all participating Lighting Suppliers for program administration and advertising.
- 5.7 Provide information of all sales data for a twelve-month period prior to the commencement of the program.
- 5.8 Provide information on sales data (both for the installments program and direct sales) during the demonstration program.
- 5.9 Provide information on failures for lamps purchased under the program.
- 5.10 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.

7.0 Both the parties shall have the right to terminate the contract in case of failure of the other party to perform the obligations undertake.

Mr. Bharat Lal Meena

Managing Director

Bangalore Electricity Supply Company Limited, Bangalore, India Signature:

Date:

Regional Director	
ABC Lighting Company	Signature:
Bangalore, India	Date: