

Promotion of Energy Efficiency through Standard Offer Program (SOP) Approach Case Study¹ of an Innovative and Replicable Project on Demand Side Management based Efficient Lighting Program (DELP) in Puducherry



Need for Energy Efficiency in the Lighting Sector

Lighting accounts for almost 28 per cent of the total electricity consumption in residential sector in India, and is a major contributor of peak load. India faces peak power shortage of more than 12 per cent as a result of the gap between demand and supply, leading to supply disruptions and power failures. The Electric Lamp and Component Manufacturers Association of India (ELCOMA) estimated that more than 75.8 crores (758 million) incandescent bulbs (ICLs) were sold in 2012 in India. ICL is an extremely energy inefficient form of lighting with just 5% of the electricity input converted to light. The table below depicts the state-wise annual sale of ICLs in 2012. The table also indicates the energy saving potential by replacement of ICLs with a more efficient light source like Light Emitting Diodes (LEDs), which uses 85% less electricity for delivering same light output.

States	ICL Sale in 2012 (Fig in crores)	Energy Savings Potential (mKWh)	Cost Savings (Fig in Rs crores)
AP	6.82	4530.526	2265.263
Assam	0.86	571.298	285.649
Bihar	6.2	4118.66	2059.33
Chattisgarh	1.8	1195.74	597.87
Delhi	5.1	3387.93	1693.965
Gujarat	4.21	2796.703	1398.3515
Haryana	1.91	1268.813	634.4065
HP	0.4	265.72	132.86
J & K	0.62	411.866	205.933
Jharkhand	1.56	1036.308	518.154
Karnataka	4.25	2823.275	1411.6375
Kerala	2.1	1395.03	697.515
Maharashtra	9.27	6158.061	3079.0305
Manipur	0.13	86.359	43.1795
Meghalaya	0.12	79.716	39.858
MP	3.6	2391.48	1195.74
Nagaland	0.12	79.716	39.858
Odisha	1.22	810.446	405.223
Punjab	1.81	1202.383	601.1915
Rajasthan	2.6	1727.18	863.59
TN	5.1	3387.93	1693.965
Tripura	0.2	132.86	66.43
UP	8.2	5447.26	2723.63
Uttarakhand	0.7	465.01	232.505
WB	6.2	4190.29	2095.15
Other states	0.7	465.01	232.505
Total quantity in Crore pieces	75.8	50365.57	25212.79

A national-level intervention to enhance the efficiency of the lighting sector has the potential to reduce the demand for electricity by over 50 billion KWh every year and would lead to reduction of over Rs. 25,000 crores at the consumer end taking the average retail tariff of Rs. 5 per KWh. This will be equivalent to an avoided capacity addition of about 19,000 MW.

National Mission for Enhanced Energy Efficiency (NMEEE) targets to unlock a market potential for energy savings across different sectors to the tune of Rs. 74,000 crores. The Bureau of Energy Efficiency (BEE) acts as the secretariat and nodal agency for the National Mission with Energy Efficiency Services Limited (EESL) set up to support BEE in the implementation activities.

¹ This Case Study has been compiled by the International Institute for Energy Conservation (IIEC - www.iiec.org) in support with EESL (www.eesl.co.in) under the project funded by the Shakti Sustainable Energy Foundation (www.shaktifoundation.in)



www.eesl.co.in

In order to develop a viable ESCO industry, Ministry of Power has set up Energy Efficiency Services Limited (EESL), a Joint Venture of NTPC Limited, PFC, REC and POWERGRID to facilitate implementation of energy efficiency projects. EESL work as ESCO, Consultancy Organization and Resource Centre to build the capacity of utilities, State Designated Agencies (SDA) and financial institutions. EESL was established in December 2009 under Companies Act 1956 to lead the market-related actions of the National Mission for Enhanced Energy Efficiency (NMEEE). EESL is the first such company registered exclusively for the implementation of energy efficiency in South Asia and amongst a very few such instances in the world. The Energy Efficiency Services Limited (EESL) is also involved in development of energy efficiency projects through advisory and consultancy services to utilities, urban local bodies, building owners, SDAs and state governments. EESL also supports the Bureau of Energy Efficiency (BEE) in implementation of national/state level programs.



SHAKTI
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FOUNDATION

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Shakti Sustainable Energy Foundation works to strengthen the energy security of India by aiding the design and implementation of policies that encourage energy efficiency as well as renewable energy. Shakti works in sectors with the maximum potential for

energy and carbon savings: Power, Transport, Energy Efficiency and Climate Policy. A Section 25 non-profit organisation under the Companies Act, Shakti is governed by a national board of directors, and supported by both Indian and international philanthropies. It convenes NGOs, universities, business, think tanks, and domestic and international experts to design and implement smart energy policies in India.

In the Demand Side Management (DSM) area, Shakti is making efforts to address implementation barriers by designing innovative commercial arrangements involving non utility service providers. Such models allow the utility management an option to significantly reduce the operational risks and programme management burden. This project was a step in that direction. Through intellectual and funding support, Shakti commissioned the International Institute for Energy Conservation (IIEC) to finalise a feasible implementation framework namely Standard Offer Program (SOP), which has the potential to bring in large scale DSM investments.



IIEC

International Institute for Energy Conservation

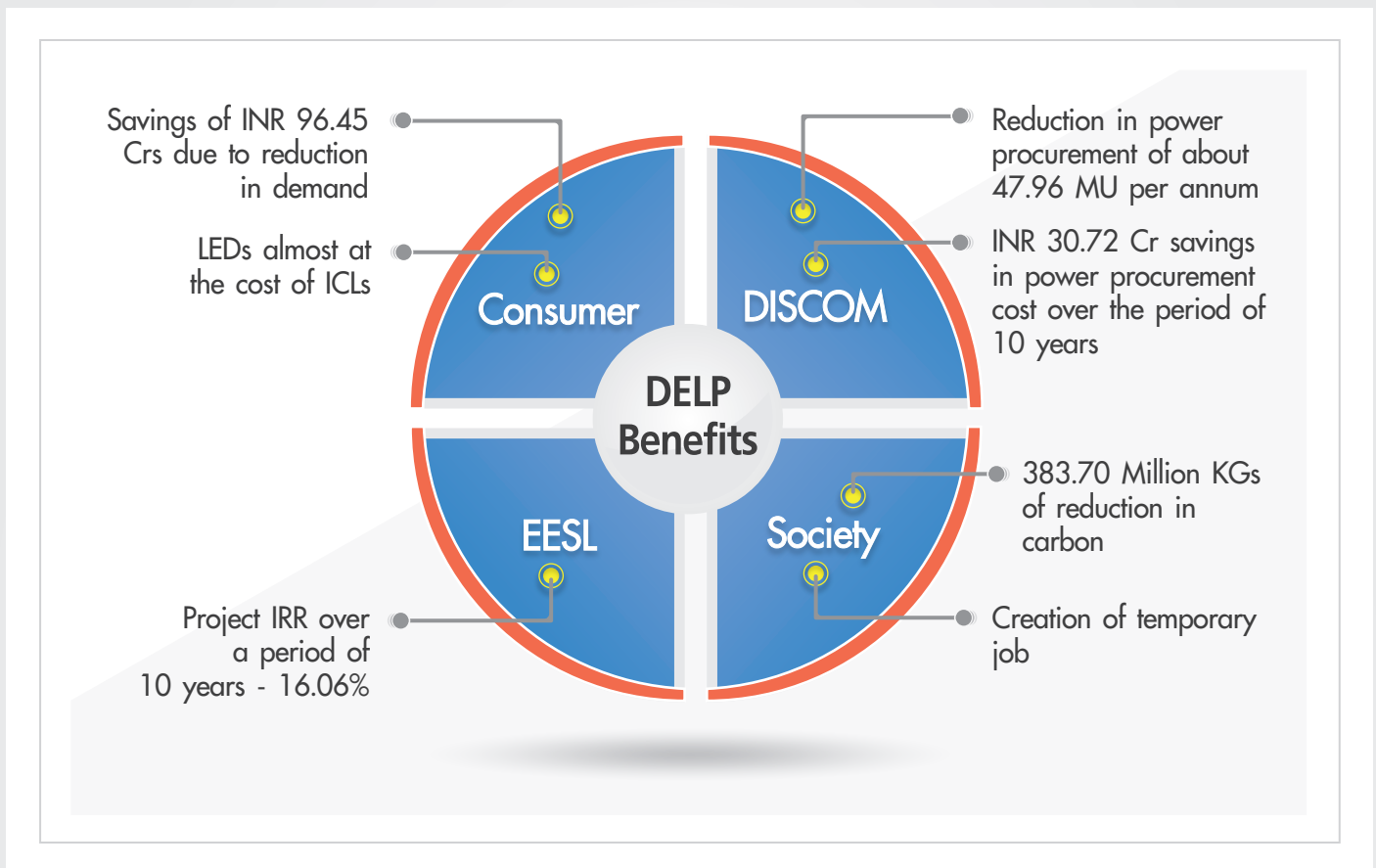
www.iiec.org

IIEC is a not-for-profit organization with offices in Asia (Thailand, India and the Philippines). 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 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 has worked closely with Shakti, EESL, JERC and Puducherry Government to jointly develop the case study of the DELP programme.

Benefits

As depicted in the figure below, the scheme could result in several environmental, economical, and social benefits for all stakeholders in Pondicherry.



Conclusion and the Way forward

The most promising and cost effective solution to energy shortages is embracing energy efficiency in a big way. In a large and populous country like India, even small measures like switch over to most energy efficient lighting in the residential sector can have big gains and large impact if implemented across the nation. The electricity regulatory process in India has identified DSM as one of the important vehicles to promote energy conservation programs at the state/UT levels. NMEEE also advocates EE project implementation amongst all the stakeholders. After carrying out a detailed situational analysis in Puducherry, EESL's first-of-a-kind project in India - DSM based Efficient Lighting Program (DELP), the Standard Offer Program (SOP) enunciates the policy shift of treating energy efficiency as a resource by DISCOMs and gives energy saving the same status as it gives to any other power procurement with maintaining the tariff neutral preposition.

The project has received substantial support from all the stakeholders--the Joint Electricity Regulatory Commission (JERC), Puducherry Government through the active involvement of both the BEE-State Designated Agency- Renewable Energy Agency of Puducherry (REAP) and Puducherry Electricity Department (PED). A successful implementation at Puducherry will lead to a policy mandate from the Bureau of Energy Efficiency (BEE) and the Ministry of Power and nationwide application of the DELP-SOP mechanism. Successful DELP-SOP projects will provide a tectonic shift to energy efficiency projects and markets in the country.

BEE's intervention in Domestic Lighting – Bachat Lamp Yojana (BLY) and the Emergence of LED in lighting industry

As part of the ongoing energy efficiency efforts, BEE conceived and implemented the “Bachat Lamp Yojana” (BLY) Scheme. The aim of the Scheme is to promote the penetration of energy saving Compact Florescent Lamps (CFLs) in the residential sector. Each household received four CFLs from the supplier/distributor under this scheme to replace four incandescent lamps (ICL) at a concessional price of Rs. 15.0 / CFL. The remaining cost of the CFL was realized by the supplier for the emissions reduction achieved from the savings within the framework of Clean Development Mechanism (CDM) of the Kyoto Protocol. Key impacts of the scheme include:

- Nationwide participation
- Decreased peak load to the utilities
- Reduction in GHG emissions,
- Reduced cost of latest lighting technology leading to its affordability without any discounts,
- Reduced monthly electricity bills of individual domestic households,
- Large scale manufacturing and marketing of CFL bulbs, and leapfrogging into latest technologies

Advantages of using LED

LEDs consume a fraction of energy used by ICLs to provide better light output. Also, LEDs do not use mercury and therefore are environmentally a better source of lighting. Their very long life makes them extremely cost effective as compared to ICLs and CFLs on life cycle cost effectiveness. The market trends show a slow phase down of ICLs and the increased growth of CFL and LED lamps. The 12th Five Year Plan of the Government of India targets sales and distribution of 33.96 million LED bulbs and energy savings around 3.4 billion units by 2016-17.

Box 1: Comparative analysis of lighting technologies (LEDs/CFLs/ICLs)

			
Lamp Equivalent	LEDs	CFL	Incandescent Bulbs
Life Expectancy	50,000 hrs.	8,000 hrs.	1,200 hrs.
Watt	10 watts	13-15 watts	60 watts
KWh of electricity used in 50,000 hrs.	300	700	3,000
Hazardous Materials	None	5 mg mercury/bulb	None
Color Rendition	Wide range of color	Restricted color option	Restricted color option
Dimmability	Yes	Restricted possibility	Yes
Robustness	Breakable	Sensitive	Sensitive
Start up Time	Instant	Delay	Almost instant
Cost of Ownership	Lowest	Low	High
Disposal	Via landfill	As per guidelines	Via landfill
Light Efficiency	620lm/10=80 lm/watt	620/15=53 lm/watt	620/60=13 lm/watt
Energy efficiency	90%	40%	5%

Barriers to large scale LED adoption



In spite of the known advantages, there are many challenges in adoption of LEDs on a large scale. High upfront cost as compared to available options acts as a major barrier. The cost of LED has to come down substantially if not equal to the cost of current CFL prices i.e. less than Rs.100 per piece and there will be a sudden surge in the sales of LED bulbs. While the awareness drives and concerted marketing are integral part of large-scale diffusion of any innovative and new technologies, well-conceived mass media messages in different major Indian languages are lacking. The Government procurement policies, projects and programs currently do not discourage any particular inefficient forms of lighting technology.

DELP – EESL's solution to overcome existing market barriers

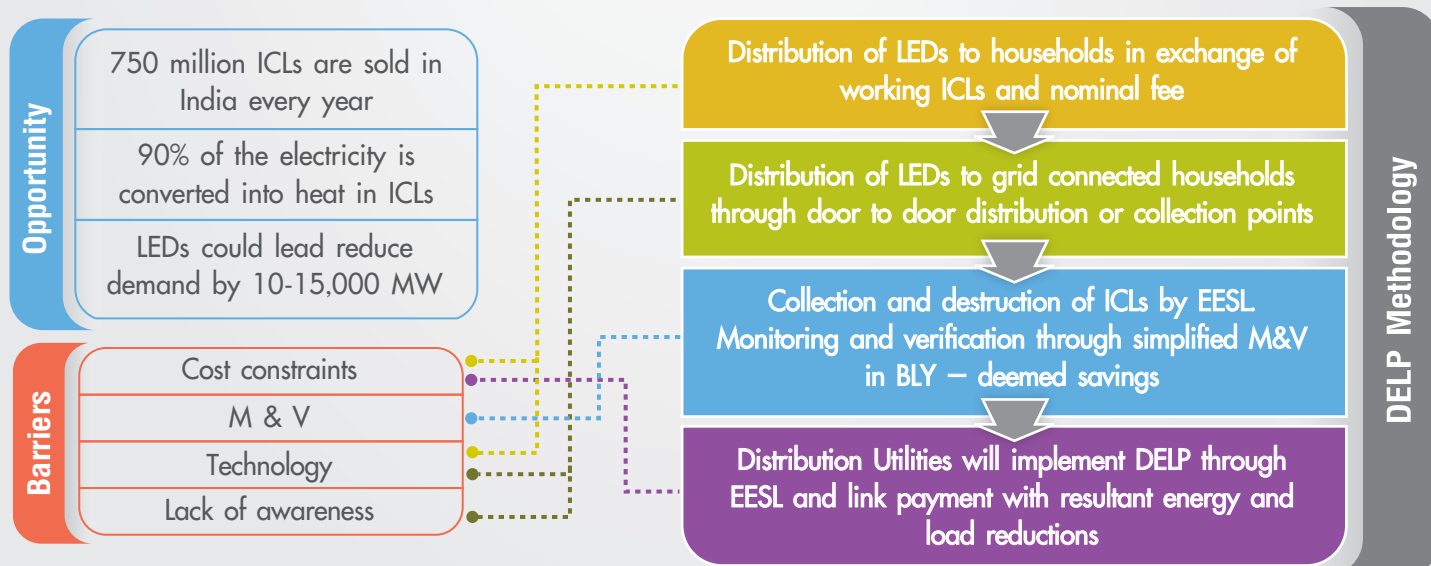
Energy Efficiency Services Limited (EESL) in order to stimulate investments in energy efficient lighting projects and to overcome barriers has launched the DSM based Efficient Lighting Program (DELP). DELP proposes to overcome the first cost barrier to promote LEDs by using the basic architecture of Bachat Lamp Yojana.

DELP aims at large-scale replacement of incandescent bulbs by providing LEDs to households at the price similar to that of incandescent bulbs. EESL, on its own or in collaboration with partners, will undertake project implementation and would take the financial risks and recover the balance cost over the project cycle.

EESL proposes to implement DELP as Standard Offer Program (SOP), an innovative approach to mainstream energy efficiency and DSM.

- 8 W Led (or less) to replace 60 W ICL; 5-6 years free replacement warrantee on lamps against technical defects;
- Distribution of 3 LEDs to each household on getting back the working ICLs;
- Awareness and outreach in the project area;
- Monitoring of project as per international standard methodology approved by CDM Executive Board for BLY.

The SOP is a mechanism for acquiring demand-side resources (energy efficiency and load management) under which the utility/Government purchases energy savings and/or demand reductions using predetermined rates. A Standard Offer Program (SOP) treats energy saving projects in a manner analogous to customer generation of electricity, and considers the energy or demand reductions as resources that the utility will pay for, in lieu of the avoided peak power procurement. SOP is comparable to the feed-in tariffs (FITs) utilized to promote increased implementation of renewable energy resources. The Expert Group on Low Carbon Strategies for Inclusive Growth of the Planning Commission has distinguished the determined effort and the aggressive effort for energy efficiency and DELP-SOP is an important mechanism for the aggressive effort for promotion of energy efficiency.



Case Study: DELP-SOP in Puducherry

Background



The Electricity Department of Government of Puducherry (PED) is a deemed licensee under Section 14 of Electricity Act, 2003 and is carrying on the business as an integrated utility. With all the towns and villages electrified in as early as 1972, the Puducherry is 100% electrified. Puducherry has an extensive network of Power Transmission and Distribution Systems spread along the breath and width of all the four regions of the UT.

The electricity consumers in Puducherry are divided into two large-scale categories, low tension (LT) and high tension (HT). The LT consumers are made of 5 categories, namely domestic, Commercial, agricultural, Street lighting and industrial. The largest number of consumers is in the domestic consumers. They comprise of 73% of the total numbers of consumers and consume around 25% of the total consumption. In spite of being the second largest consumers, domestic consumers account for 10% of the total revenue. The average cost of power purchase for PED is Rs. 3.18 whereas, the weighted average slabs tariff realization from domestic consumers is only Rs. 1.76 per unit.

It is evident from the sector wise power purchase trend of PED that the domestic sector is the fast growing sector at 4% followed by industry at 3% and others except agriculture, which has remained constant, is around 2%. In 2013-14, Puducherry has a daily power demand of 350 MW and a peak deficit of 7 MW. Hence, the inefficiencies in the domestic segment contribute to higher budget deficit. While rationalization of tariff would be necessary, there is also an urgent need to address energy efficiency for immediate returns.

EESL's DELP - SOP Methodology

Puducherry Electricity Department (PED) in cooperation with the EESL would launch a DELP-SOP project on LED lighting in the domestic sector targeting households with a view to overcome the peak deficit and also to service potential new connection load requests from higher tariff customers like Industry and commercial Sector.

The proposed initiative aims to reduce peak demand from households, provide energy savings, and thereby, reduce GHG emissions. These objectives are also in consistent with objectives set out by the Government of India as part of NMEEE for the country and National Electricity Policy of the County.

Energy Savings calculations for DELP-SOP in Puducherry

Key Parameter	Value
Number of Households.....	2,45,000
Number of LEDs.....	7,35,000
ICL Wattage.....	60W
LED Wattage.....	80W
Usages per day.....	3.5 Hrs
Operating days per year.....	300 Days

Impact on households and DISCOM	Yearly energy consumption	Yearly T&D losses
With ICLs	463,05,000 kWh	66,15,000 kWh
With LEDs	61,74,000 kWh	8,82,000 kWh
	87% reduction in consumption	57,33,000 kWh of reduction in T&D losses

Source: EESL DELP Scheme Document for Puducherry

Distribution Utilities implementing DSM projects through EESL, would consider the Energy Efficiency as resources at a predetermined SOP price measured on per unit of Energy saved. SOP price is based on the power procurement cost of DISCOM from open market.

In this particular project, the difference between SOP price and the power procurement of PED from open market may be taken as benefit to the PED and out of the total benefit PED will consider apportioning a certain % of the total benefit to the State Energy Conservation Fund. EESL will recover the investment over a period as specified in the DSM project from the payment made to them by PED duly approved by the Regulatory Commission. PED would provide payment to EESL on a periodic basis as per Energy Saving Agreement and appropriate ESCROW/payment security mechanism built to reduce the revenue risk to EESL. The figure below depicts EESL's DELP methodology:

MoU/ Letter of Intent	MoU/ Letter of intent between DISCOM & EESL
Sample Survey	Sample survey to ascertain population of ICLs and usage pattern
Technology Selection	To assess actual energy savings and finalising technical specifications of LED lamps
DSM-SOP Petition	Petition to be finalised for cost recovery for submission to ERC
Payment Mechanism	The Payment security mechanism to be finalized
Implementation	EESL will implement the project based on own resources
M & V	Deemed saving approach used