Leading for the Future

Puducherry initiative shows the way for **national LED adoption**

The ability to make policy investments in uncharted territory and to see future solutions enabled the seeding of a program in one Union Territory, which has now grown in to a significant national program and is having a major impact on the trajectory of energy consumed for lighting purposes in the country.

SHAKTI
SUSTAINABLE ENERGY
FOUNDATION

The Promise of LEDs

Starting in 2012, a lighting transformation started in Puducherry and has spread across the country, made possible by the increasing adoption of light-emitting diodes (LEDs). The Puducherry project was made possible due to the coming together of four partners – the Puducherry Electricity Department (PED), Energy Efficiency Service Limited (EESL) and International Institute for Energy Conservation (IIEC). The combined efforts resulted in an innovative demand aggregation arrangement that promoted economies of scale and addressed the high cost barrier of LEDs based on a contractual arrangement known as the Standard Offer Program, that was introduced in India for the first time.

The Standard Offer Program for energy efficient lighting was conceptualized by Shakti Sustainable Energy Foundation with the objective of bringing down the high cost of LEDs and to facilitate the adoption of LED based lighting systems through demand aggregation. The programme offered a compelling model for energy efficiency lighting in Puducherry, anticipating a host of benefits to consumers, distribution companies and society. It thus sowed the seeds for the nation-wide transformation of India's LED market.

As India experiences rapid urbanization and population increase, it has been recognized that energy efficient technologies are vital to help meet the growing energy demand. Adopting and deploying efficient lighting technologies to reduce carbon emissions is an important mitigation strategy for India, particularly in light of the recent pledge to reduce carbon emission intensity by 30-35% below 2005 levels by 2030.

There is persuasive evidence for LED lighting: lower electricity consumption, savings in money and energy, and reduced Green House Gas (GHG) emissions. However, the initial high cost of LEDs posed a barrier to their adoption. The first LED lamp, made in India in 2010, sold for INR 1200, [1] a price unaffordable for most consumers and far too expensive to be widely used.

The lighting sector matters. In 2012, lighting accounted for a substantial 28% of India's total electricity consumption from the residential sector. The potential of a national efficient lighting programme was enormous - a reduction of 20,000 MW load, energy savings of 100 billion KWh and GHG emissions savings of 80 million tonnes every year, amongst other benefits.[2] Energy efficient lighting offered an extraordinary opportunity to help achieve these benefits.

Despite the availability of efficient lighting technology, its adoption was fairly slow. In 2012, prevailing efforts focussed on promoting Compact Fluorescent Lamps (CFLs), which were a more efficient option than Incandescent Lamps (ICLs), without much additional cost. LEDs, however, were substantially more expensive notwithstanding their obvious benefits.(see Figure 1). An LED bulb uses only one-tenth as much energy as a normal incandescent bulb and half as much energy as a compact fluorescent lamp to produce the same amount of light.

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This gave an impetus to the case for the large-scale promotion of LED based lighting systems driven by an innovative business model – the testing ground for this concept was the Union Territory of Puducherry.

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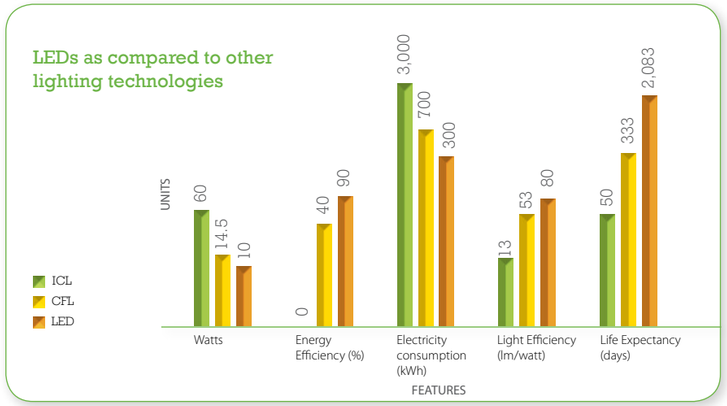
Figure 1: Benefits of LEDs vs other lighting technologies



[1] http://pib.nic.in/newsite/PrintRelease.aspx?relid=110348
[2] DELP-SOP: A case study for Puducherry: http://pib.nic.in/newsite/PrintRelease.aspx?relid=134669

The Puducherry Intervention

An Illuminating Business Model

With all its towns and villages 100% electrified as early as 1972 [3], Puducherry reached this landmark much earlier than other states and Union Territories. In the last few years, Puducherry had been taking concerted steps to address climate change, a very real issue for this Union Territory, given its geographical profile and coastline.

In 2012, domestic households were the largest category of consumers in Puducherry (comprising around 73% of the total consumers), using around 25% of the total electricity. Incandescent bulbs were the norm in homes. Therefore, we saw a fertile opportunity to demonstrate an energy efficiency intervention in the lighting sector, which could potentially be scaled to other regions.

It was recognized that innovative demand aggregation strategies could drive economies of scale and address the high first cost barrier of LEDs, thereby creating an opportunity to transform the LED market. A demand aggregation approach works best through institutional anchors. Therefore, we chose distribution companies as the institutional anchor to demonstrate demand aggregation for LED lighting under an innovative Standard Offer Programme (SOP) mechanism (see box).

While this mechanism has been quite successful abroad, it had not made much headway in India. Recognizing its potential to scale up energy efficiency, Shakti engaged with the International Institute for Energy Conservation, to develop the design for India's first ever Standard Offer Programme for LED lights.

The model was presented to the Puducherry Electricity Department (PED), who expressed an interest in it and consented to pilot it in the Union Territory. Towards the end of 2013, the PED agreed to implement the model to advance the large-scale replacement of incandescent bulbs with LEDs.

Since the scale of the project was large, Energy Efficiency Services Limited (EESL), a prominent ESCo, was approached for support. EESL agreed to invest and implement the project under a third party contractual agreement. Following this, we engaged again with the International Institute for Energy Conservation to survey and assess the LED replacement opportunity in Puducherry. It was estimated that 88% of the residential consumers still used incandescent bulbs at an average of three bulbs per household. The replacement opportunity was projected to be between 700,000-750,000 bulbs.

Following this estimation, EESL agreed to integrate their existing DSM based Efficient Lighting Programme (DELP) with the SOP. The integrated version, called DELP-SOP, was launched in Puducherry to replace incandescent bulbs with LEDs in households.

EESL replaced around 735,000 ICLs with 7 watt LEDs, priced at INR 310 (USD 5) per bulb. This replacement is expected to reduce the demand by 48 million units per annum over a period of 10 years. The PED agreed to procure energy efficiency as a resource at a cost ranging from INR 1.23/kWh in the first year to INR 0.67/kWh in the tenth year (USD 0.042/kWh to USD 0.01/kWh), [4] to be paid to EESL for every unit of energy saved.

By October 2014, Puducherry had achieved the unique feat of lighting almost every home with LED bulbs. The programme is expected to yield numerous benefits for Puducherry: savings of USD 15 million due to reduction in demand; LED's distributed almost at the cost of CFLs and approximately 383.7 million KGs of CO_2 reduction.

The story does not end there. In fact, it had just begun.

Q&A

What is a Standard Offer Program?

The Standard Offer Program is an innovative approach to promote energy efficiency. It treats energy efficiency as a commodity, similarly to renewable energy or conventional resources.

Under this approach, an energy efficiency resource acquirer purchases deemed energy savings from third party energy efficiency implementation agencies (such as ESCOs) at a pre-determined price. The SOP is comparable to Feed-in-Tariffs used to support renewable energy.

[3] DELP-SOP: A case study for Puducherry: http://shaktifoundation.in/wp-content/uploads/2014/02/DELP-SOP-Case-Study.pdf
[4] Government of Puducherry Electricity Department, http://jercuts.gov.in/writereaddata/Files/delp2.pdf

Switching on

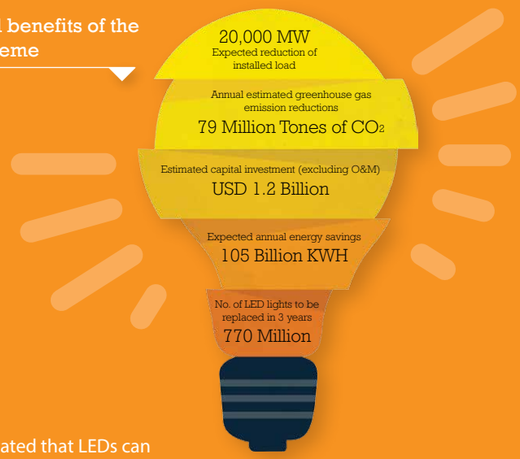
The Nationwide Market

The Puducherry project marked a new chapter in scaling up lighting efficiency in India and is expected to yield significant results. Following the Puducherry experience, EESL implemented the model in Andhra Pradesh, where too, the rapid price reduction as a result of demand aggregation augured well for revolutionising the LED market. Gradually, EESL expanded the project to Delhi, Rajasthan, Himachal Pradesh and Uttar Pradesh and other states.

An impactful revolution in energy efficiency was now underway on a much larger scale. In January 2015, India launched a nation-wide programme on LEDs for home and street lighting systems. This has been dubbed as the largest energy efficiency programme in the world– ten million streetlights to be replaced with LEDs and 200 million LED bulbs to be distributed across 100 cities over a period of two years. [5] Recently, Andhra Pradesh set a landmark record, after it distributed 10 million LEDs in a year under the DELP scheme.

Such high procurement volumes have begun to transform the LED market. With the demand for LEDs shooting up, the LED wholesale price (for a 7W bulb) dropped significantly, by around 75% from INR 310 (USD 5) in 2014 to INR 73 (USD 1.24) in June 2015. [6] LEDs have become competitive with CFLs, which made them a much more affordable option for consumers.

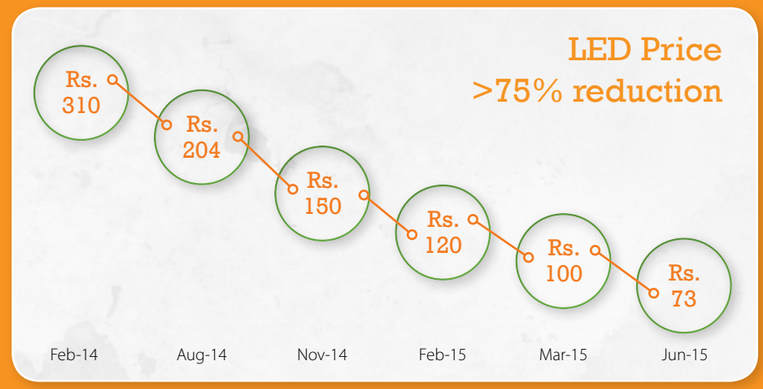
Projected benefits of the DELP scheme



It is anticipated that LEDs can gradually light up our power starved nation. This is particularly encouraging in the wake of India's ambitious goal to provide 24x7 electricity for all by 2019. The LED revolution may well take us closer to meeting this goal, by controlling peak power demand and reducing the threat of power outages.

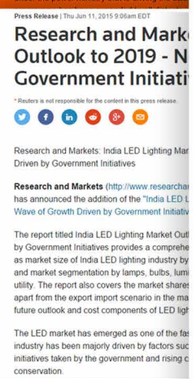
For updates on EESL's progress in extending the LED program, visit http://www.delp.in/

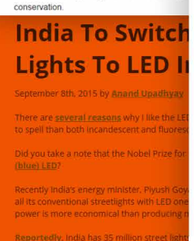
Source: Ministry of power



Andhra Pradesh set a landmark record of distributing 10 million LEDs in a year under the DELP scheme.

[5] SARMA, G, 'Centre to light up 100 cities with LEDs' The Hindu;http://www.thehindu.com/news/cities/Visakhapatnam/centre-to-light-up-100-cities-with-leds/article6867127.ece | [6] 'Led There Be Light' Power Today, Vol Volume 7, 2015. pp.36 - 49





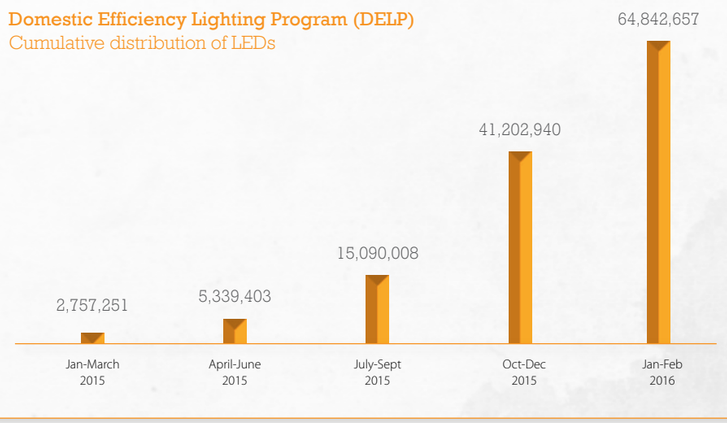
A Well-LED National Effort to Deploy LEDs

By early March 2016, more than 70 million LEDs had been distributed across the country. Notably, the government plans to replace all 770 million incandescent bulbs sold in India with LED bulbs. This would result in a reduction of 20,000 MW load, energy savings of 105 billion units and reduce greenhouse gas emission equivalent to 79 million tonnes of CO_2 every year. The annual saving in electricity bills is estimated at USD 5.9 billion, considering an average tariff of INR 4 per unit.

The LED market has witnessed a Cumulative Annual Growth Rate (CAGR) of 40-45% in recent years, and is currently sized at USD 483 million.[7] It is expected to reach USD 2.2 billion by 2021.[8] Government actions such as retrofitting streetlights in public places with LEDs are playing a major role in scaling up the LED market. The street light retrofitting programmes, accounting for 60% of the total LED demand, are expected to provide energy savings of 4 billion kWh.[9]

This upsurge in demand has resulted in the creation of domestic manufacturing capacity with several manufacturers now establishing domestic production capacity for a product that was previously largely imported. Recently, EESL closed the single largest tender to procure 50 million LED bulbs. These lamps, worth USD 62 million, will be supplied by companies like Philips, Osram, Bajaj Electricals, and Crompton Greaves. The lamps will be sold to households in various states through local distribution companies.

Domestic Efficiency Lighting Program (DELP)
Cumulative distribution of LEDs



A Bright Revolution

The project seeded in Puducherry has borne much fruit. The wave of acceleration that followed was unprecedented. The LED lamp also holds great promise for people seeking to gain access to electricity, by reducing the load required for lighting.

The significance of efficient lighting resonated at COP21 in Paris, where the Global Lighting Challenge was announced, which committed to the deployment of 10 billion high–efficiency, high quality and affordable lighting products. [10] India is contributing to the goal of this challenge through the Domestic Efficient Lighting Programme and the LED based Street light Programme, launched in 2015 with a goal of 770 million LED bulbs and 35 million street lights using energy efficient LED bulbs in three years' time. With the successful implementation of the Standard Offer / demand aggregation model for LEDs, we look forward to extending it to other energy consuming products in widespread use such as ceiling fans and agricultural pump sets.

[7] 'Led There Be Light' Power Today, Vol Volume 7, 2015. pp.36 - 49 | [8] Research and Markets: India LED Lighting Market (2015 - 2021): Market Forecast By Lighting Types, By Applications and Regions' Business Wire; http://www.businesswire.com/news/home/20150219005769/en/Research-Markets-India-LED-Lighting-Market-2015#.Vhukzvmqqkp
[9] 'LED Lighting Scenario in India', PowerPoint presentation, http://www.elcomaindia.com/wp-content/uploads/ELCOMA-Mumbai-Jan-05-2012-Nirupam-Sahay-LED-Lighting-scena.pdf
[10] Clean Energy Ministerial, 'CEM Global Lighting Challenge launched at COP21 to deploy 10 billion LED Bulbs' http://www.cleanenergyministerial.org/News/cem-global-lighting-challenge-launched-at-cop21-to-deploy-10-billion-led-bulbs-57426

The implementation of DELP-SOP in the country:

A Timeline

Nov '12 — International Institute for Energy Conservation starts to develop the first-ever SOP design for EE resource procurement.

Jan '13 — Energy Efficiency Services Limited agrees to be the third party implementer for SOP.

Apr '13 — International Institute for Energy Conservation organizes workshop to inform the Puducherry State Government of the SOP opportunity.

Nov '13 — Puducherry Electricity department agrees to pilot SOP for LED lighting.

Dec '13 — International Institute for Energy Conservation conducts an LED replacement potential survey in Puducherry and designs a customised SOP for lighting in Puducherry.

Feb '14 — PED and EESL enter into a contract to replace 735,000 ICLs with LEDs; LEDs are procured at USD 5/bulb.

Mar '14 — EESL rolls out DELP to other states including Delhi, Andhra Pradesh, Rajasthan etc.

Jan '15 — A nationwide DELP programme is launched.

Jun '15 — LED wholesale price is now USD 1.24/bulb.

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About:

Shakti Sustainable Energy Foundation seeks to facilitate India's transition to a sustainable energy future by promoting policies that encourage energy efficiency, renewable energy and sustainable transport solutions.

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Additional Resources:

http://www.delp.in/
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