IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 2 Issue 4, April 2015.
www.ijiset.com
ISSN 2348 – 7968

DELP (Domestic Energy Efficient Lighting Program)- A DSM Initiative in New Delhi

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Abstract*:*

Government of India has initiated a Project for the capacity Building of DSM in all DISCOM of Country through BEE.BEE (Bureau of Energy Efficiency has assigned this project to EESL (Energy Efficiency Services Limited). This paper is discussing an energy efficient (1)solution that has been promoted in New Delhi to all domestic consumers so that there will be a huge reduction in demand. As per the load Research Activity that has been carried in one of the DISCOM in Delhi it has been observed that Domestic Consumers are mostly using CFL (Compact Fluorescent Lamp) of 15 Watt and 60Watt Incandescent bulbs are still in use. In Delhi there are almost 80 lakh Domestic Consumers as per the records of DISCOM. In the Load research it has been further observed that consumers are not going for Energy Efficient Lighting like LED due to its high initial cost, so a DSM (2) plan has been formulated that if LED will be sold at a cost of CFL with a warranty of 3 years over CFL. The agenda behind this plan is to bring down the peak load and to bring down the cost of LED in open market. As per that A DSM (Demand Side Management) plan has been initiated to replace all CFL and Incandescent bulbs via LED Bulbs. A LED Bulb of 7 Watt is an exact replacement of 15 Watt CFL and 60 Watt Incandescent Bulbs. As per the technical calculation it has been calculated if 1 Million CFL will be replaced via LED there will be a demand reduction of 9MW and in 3 years lifetime (Warranty period of LED Bulb) there will be a saving of 39.42 MU which will further save 32,324 ton of CO_2 and 484 ton of coal.

Keywords- DISCOM, DSM, LR, Lumen, Lux, kWh, MU, EESL, LED, CFL, Incandescent Bulbs, ROI.

1 INTRODUCTION

The next generation DSM technologies will enable customers to make more informed decisions about their energy consumption, adjusting both when they use electricity and how much they use.

The electrical infrastructure installed to meet the required demand must be adequate within the generation, transmission and distribution systems to supply the requirements in a safe, secure and economical manner. In many regions around the world, the electric power system is becoming over-stressed. Peak demand(3) is approaching generation system capacity, boosting electricity costs and increasing the risk of supply shortages.

Simultaneously there is a significant increase of renewable intermittent generation due to the need to curb carbon emissions, several countries mainly in Europe are achieving or will achieve in the near future large penetration of intermittent generation as wind. New operation practices are required to keep system security whilst keeping an acceptable economic performance of the power system. Such systems will require a different approach to system flexibility and control where the demand side will be fully integrated into system operation as a source of flexibility to support the system operator in dealing with intermittency and keeping the system in balance.

While in the past the terminology dealing with demand side activity was referred to as Demand Side Management (DSM) and Demand Response (DR)(4), the newer term Demand Side Integration (DSI) reflects the new approaches to integrating demand flexibility and controllability into the power system.

2 LEVERS OF DSM

Energy conservation programs encourage consumers to give up some energy use in return for saving money, such as turning up the thermostat a few degrees to reduce air conditioning. Energy Efficiency(5) program allows consumers to use less energy while receiving the same level of end service, such as when they replace old refrigerator with a more energy efficient model.

ISSN 2348 – 7968

HOW DSM WORKS?

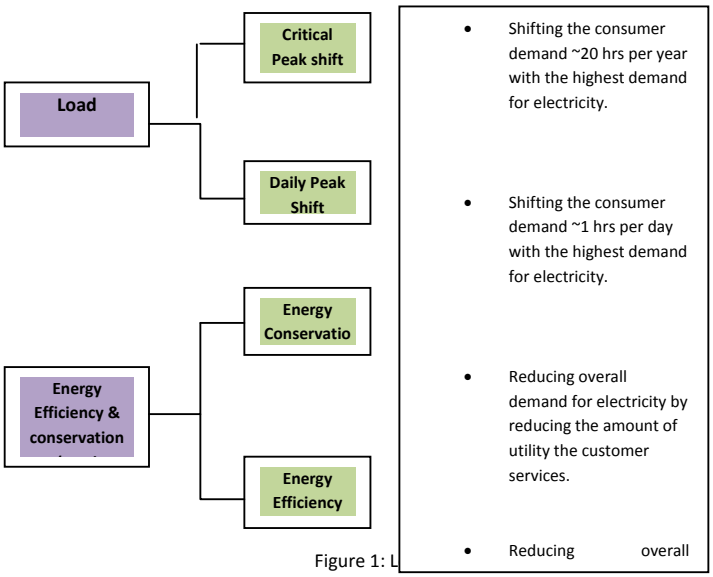

Figure 1: L

Based on the work of utilities six key levers of successful DSM initiatives are: rates, incentive, access to information, technology & controls, education & marketing, customer insight & verification(6). Each lever has a distinct impact on consumer behavior& depending upon the circumstance of particular utility, such as its customer base & geography, certain combinations of actions, within and across levers, will produce greater results.

Rate: Utility tariffs are already designed to achieve a range of objectives; from making electricity more affordable for lower income consumers to make electricity prices better reflect the cost of generation. Utilities will need to tailor their tariff design, including opt-in or opt-out participations, to yield the desired behavior. Utility(7) (& their regulatory partners) must also account for winners and losers in any rate design, and ensure that particular segments, such as socio-economic classes, do not bear any unnecessary cost.

Incentives: To encourage participation in demand side management programs, utilities have found that rebate checks, compensation for participating in a pilot, or freetechnology such as in home display can increase consumer adoption.

Access to information: When consumers have access to real time information they become much more aggressive about managing their usage. The utility can then provide recommendation how to reduce their energy usage.

Utility Controls: Direct load control programs are used to curb demand, such as air-conditioning, during critical peak periods. The smart grid will enable consumer to manage their own demand (and distributed generation resources) based on price or other signals from the utility. These controls could be integrated with programmable communicating thermostats, home energy controllers, or other automation tools to meet consumer preference.

Education & Marketing: Customer education on the benefits and the technology of DSM programs can be targeted to different market segments, different education goals or segments.

Customer insight &verification: To drive improvements it is essential to verify DSM program results and feedback, regardless of whether the targets are broad or narrow.

3 METHODOLOGY

Initially the plan was to sell the LED at the cost of CFL with a 3 year warranty. In the retails market the average cost of LED bulb is above Rs 350 per bulb but due to the aggregation in demand because of DSM activity vendor has given a first price of Rs 160 for each bulb. So initially the scheme has been designed that each consumer will pay an upfront payment of Rs 130 at the same cost he is procuring CFL and rest Rs 30 which will be subsidized through the energy savings.

Energy Saving Calculation of LED over CFL is as follows:

Parameter	CFL	LED
Power consumption (watt)	16.5	7.5
Luminous efficacy (lumen/watt)	53	80
Warranty (years)	1	3
Hazardous material	Mercury	None
Dimming	Restricted	Available
Start up time	Delay	Instant
Aesthetics	Normal	Attractive
Increased Lifetime in LED vs CFL	**6 times increased lifetime of LED**	
Energy saving (@3.5hr/day/year)	**13.14**	

Table 1: LEDvs CFL

Initially this program was designed for only domestic consumers that are having a consumption less than 200 kWh/Month as there is a loss of sale in power(8) for that particular domestic category. There are three beneficiaries of this scheme which are as follows:

- Consumer
- DISCOM
- Government

So it was designed that the benefit of DISCOM and government via Energy saving will be used for filling the gap

of amount.For consumers below 200kWh/month there tariff structure is as follows:

Parameter	Value (Rs/kWh)
Energy charge as per tariff	3.9
Consumer share	2.7
Government subsidy	1.2

Table 2: Tariff Structure

So for each unit saving government can also save his subsidy amount that can be used to bring down the high costs of Energy Efficient appliances.

Further to this there is a loss of sale for DISCOM to that particular consumer category. Details are as follows:

Parameter	Value	Unit
Power Procurement cost	5.3	Rs/kWh
Cost Borne By DISCOM (including 10% loses)	5.83	Rs/kWh
Tariff price for Target Category	3.9	Rs/kWh
Loss of Sale	**1.93**	**Rs/kWh**

Table 3: Loss on sale

So by implementing this program further to a huge load reduction this DSM plan will be profitable to all its three players: consumer, Government and DISCOM.

Beneficiary	Energy Savings (kWh/year)	Energy Savings (Rs/unit)	Monetary Savings (in Rs.)	Monetary Savings in 3 years (in Rs.)
Term	**A**	**B**	**C=(A*B)**	**(D=3*C)**
Consumers	**13.14**	**2.70**	**41.66**[1]	**124.98**
BSES	**13.14**	**1.93**	**25.36**	**76.08**
Government	**13.14**	**1.20**	**15.77**	**47.30**

Table 4: Beneficiaries through Energy Saving

So the total cooling load because of the solar transmission from walls and roof is:

So the biggest hurdle for this program is how the funding mechanism will take place. As per the quote of vendor the price of LED was Rs 160 per bulb and Rs 15 has been taken as the overhead cost including marketing, promotion and distribution costs. So the final price which was landing is Rs 175 for each bulb and as per the tag line of program it has to be sold at the cost of CFL i.e. Rs 130 which means that Rs 45 has to be funded for each bulb. So it was designed in this manner that the savings earned of government over subsidy and DISOM due to energy savings will be used for funding the gap of Rs 45. Initial LED pricing structure was as follows:

Parameter	Value	Unit
LED cost by vendor	160	Rs/lamp
Overhead cost (marketing, promotion & distribution)	15	Rs/lamp
Total cost of LED	175	Rs/lamp
Upfront cost by eligible Consumer	130	Rs/lamp
Gap	45	Rs/lamp

Table 5: Cost Gap Filling

So for eligible consumers the priced offered was Rs 130 per lamp and for other consumers Rs 175 per lamp.

Later on this program has been taken to Ministry of Power and for this attractive scheme MOP (Ministry of Power) has granted the subsidy as EESL has offered that for such program and for that large volume the price will surely fall below Rs 130 for each lamp. So the model has been submitted that Domestic Consumer will pay an upfront payment of Rs 10 for a lamp and the rest of Rs 120will be taken via installment of Rs 10 for a year via their electricity bills and also the facility of upfront payment has been also offered to consumers. DERC has also approved that if the price of LED bulb after the Tender process falls below Rs 130 then that profit will be surpassed to consumer. So after the approval the initial pricing structure of DELP Program was as follows:

Parameter	Value	Unit
LED cost by vendor	130	Rs/lamp
Overhead cost (marketing, promotion & distribution)	20	Rs/lamp
Total cost of LED	150	Rs/lamp
Upfront cost by eligible Consumer	130	Rs/lamp
Gap	20	Rs/lamp

Table 6: New cost structure

So the power ministry has granted a subsidy that Rs 20 for each bulb and interest amount for entire year will be given to EESL via government and rest Rs 130 per lamp cost will be taken from consumer. After the bidding the price was offered is Rs 104 for each lamp, so it has been designed that Rs 10 will be taken as upfront payment and rest Rs 94 will be taken via on bill EMI of Rs 10 for 9 months and Rs 4 for 10th month also consumer can avail this scheme via paying Rs 104 as upfront payment.

4 CONCLUSION

DSM (Demand Side Management) Programs are very important as they can make in impact in energy efficiency and also can play a vital role in the optimization of load curve.

ISSN 2348 – 7968

DELP (Domestic Energy Efficient Lighting Program) can be very useful as this measure not only reduces the demand(9) but also makes an opportunity that energy efficient products will be promoted and the biggest barrier is cost which can be easily managed by DSM(10) measures. As per the technical calculations this program for each 1 Million LED bulbs over CFL the benefits are as follows:

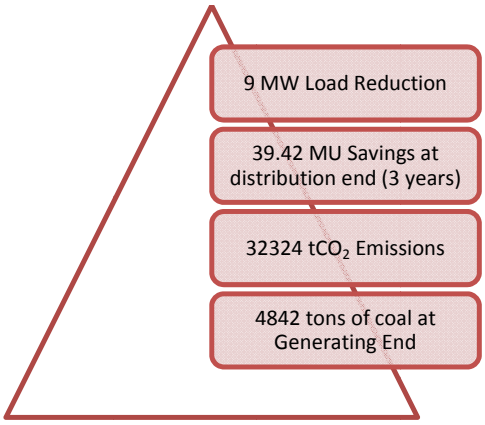

Figure 2: Saving Potential of Scheme

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