

Chapter 5

DEMAND SIDE MANAGEMENT ENERGY EFFICIENCY & ENERGY CONSERVATION

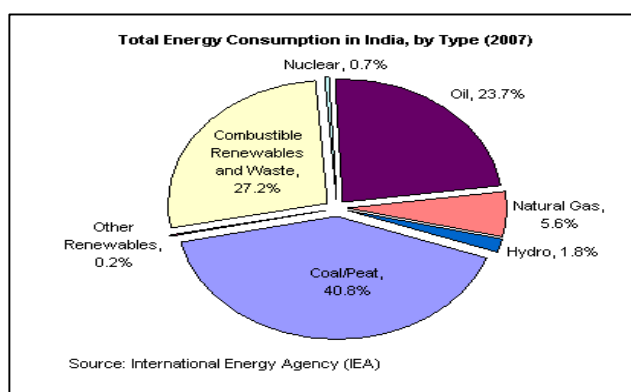
5.0 INTRODUCTION

Improving the efficiency with which energy is used to provide economic services meets the dual objectives of promoting sustainable development and of making the economy competitive. Energy Efficiency & Conservation has also assumed enhanced importance with a view to conserve depleting energy resources.

Over the past one decade energy efficiency in India has been increasing at a good trot, and energy intensity declined by about 20-25%. Yet there are places where energy efficiency opportunities continue to exist largely because of a range of market failures, information, risks and split incentives. This has led the Government of India through the Energy Conservation Act and the Bureau of Energy Efficiency to launch several programs.

The Energy Conservation Act (2001) is the most important multi-sectoral legislation in India and is intended to promote efficient use of energy in India. The Act specifies energy consumption standards for equipment and appliances, establishes and prescribes energy consumption norms and standards for designated consumers, prescribes energy conservation building code for efficient use of energy in commercial buildings, and establishes a compliance mechanism for energy consumption norms and standards. Large scale energy savings can be realized through strengthening of the existing policies, schemes as well as expanding and reaching out to new areas in the 12th Five Year Plan.

The primary energy consumption of India is 421 million tonnes of oil equivalent (mtoe) (2008; International Energy Agency 2009) which is about 3.5% of the world primary energy consumption in the year 2008. The per capita energy consumption is only 0.53 kilogram of oil equivalent (kgOE) whereas the world average is 1.82 kgOE (2008; International Energy Agency 2009). India lacks sufficient domestic energy resources and imports much of its growing energy requirements. According to the International Energy Agency (IEA), coal/peat account for nearly 40 percent of India's total energy consumption, followed by nearly 27 percent for combustible renewables and waste. Oil accounts for nearly 24 percent of total energy consumption, natural gas 6 percent, hydroelectric power almost 2 percent, nuclear nearly 1 percent, and other renewables less than 0.5 percent. About 30 percent of India's total energy needs are met through imports.



5.1 11TH FIVE YEAR PLAN – TARGETS & ACHIEVEMENTS

Bureau of Energy Efficiency (BEE) and Ministry of Power (MoP) had introduced a number of schemes during 11th Five Year Plan for promotion of energy efficiency in India. The schemes of BEE include Standards and Labeling (S&L), Energy Conservation Building Code (ECBC) & Energy Efficiency in Existing Buildings, Bachat Lamp Yojana (BLY), SDA strengthening, Energy Efficiency in Small and Medium Enterprises (SMEs), Agriculture & Municipal Demand Side Management (DSM) and Contribution to State Energy Conservation Fund (SECF).

The schemes of the Ministry of Power (MoP) include Energy Conservation Awareness, Energy Conservation Awards & Painting Competition on Energy Conservation for school students and National Mission for Enhanced Energy Efficiency (NMEEE). In the 11th Five Year Plan (2007–12), it was proposed to achieve the energy saving of 5% of the anticipated energy consumption level in the beginning of the 11th Five Year Plan.

The outcomes of these schemes are quite encouraging; various activities under different schemes of BEE and MoP have resulted in savings in avoided power capacity of 7,415 MW (verified; till Dec 2010) and 250 MW (unverified for 4th Quarter of year 2010 – 11) and 3409 MW avoided power capacity savings is projected during the last year of the 11th Five Year Plan (2011-12).

5.2 UTILITY BASED DEMAND SIDE MANAGEMENT IN THE 12TH PLAN

Demand-Side Management (DSM) is the selection, planning, and implementation of measures intended to have an influence on the demand or customer-side of the electric meter. DSM program can reduce energy costs for utilities, and in the long term, it can limit the requirement for further generation capacity augmentation and strengthening of transmission and distribution system. BEE would provide the technical assistance for establishment of DSM cells in the DISCOMs and capacity building of personnel of DSM cells for enabling them to undertake the following strategies and schemes of DSM in 12th Five Year plan:

(i) Load Survey

The questionnaire based surveys are the most commonly adopted tools to study the consumption pattern of the consumers by a utility. “Standard load survey techniques” need to be developed which may be adopted by the DISCOMs. Also it is envisaged that DISCOMs to develop utility/city level load profiles which may be uploaded on DISCOMs and BEE’s DSM website (<http://www.bee-dsm.in>) on a periodical basis which can be utilized for DSM plans and for further analysis.

(ii) Load Strategies

Load strategies are to be adopted by electricity utilities to modify customer load profiles and thereby reduce their peak demands. Following Load management strategies may be demonstrated by DISCOMs/Utilities:

* Demand Response

Demand Response is an effort to create additional capacity during the peak hours, by involving voluntary load curtailment by consumers during peak hours or when requested by the distribution companies. The load curtailment can be achieved through implementing load reduction by Energy Efficiency or by load shifting measures.

* Load Management Programmes

- Dynamic/Real Time Pricing: Based on real time system of supply & demand

- Time-of-Use Rates: Customers are offered different rates for electricity usage at different times of the day.
- Automated/Smart Metering: Implementing Dynamic/ Real Time Pricing or Time-of-use rate structure and billing accordingly.
- Web-based/Communication System: This is a tool used along with the above to convey to the customer about the prevailing demand, supply, prices on real time basis and the incentives and options for him, which are used by the customer to manage the demand.

(iii) Demonstration Studies

Direct installation programs that provide complete services to design, finance, and install a package of efficiency measures.

(iv) Advanced Metering

Advanced Meter has the capability of online communication, accurate measurements, local intelligence, load connect-disconnect facility and consumer friendly display unit. Adoption of this technology will help distribution companies in implementing Demand Side Management specially Demand Response Activities.

(v) DSM Financing

The strategic value of DSM measures and energy efficiency lies in their ability to improve the financial cash flow of Indian utilities.

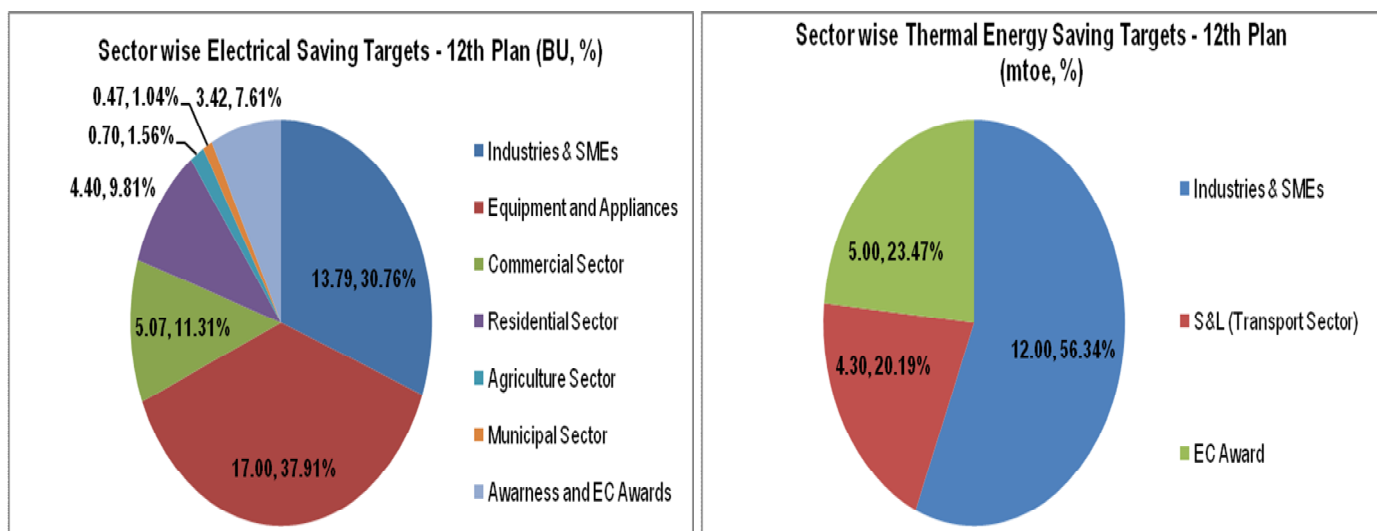
Moreover, DSM and Demand Response (DR) Activity are utilized to curtail the peak electricity demand. In other words, it helps to negate spending on generation, transmission and distribution infrastructure by curtailing the peak. Thus, it can be said that funds are freed up which would otherwise be utilized to meet the peak demand. At the National level, the load growth should be reviewed with and without DSM and the fund freed up because of lower peak growth should be used for DSM/DR activity. In other words, the DSM/DR should have a target (say 0.5% to 1%) of peak demand reduction and the net saving in infrastructure due to that should be used for DSM/DR activity.

The total funds required for providing technical assistance for capacity building of DSM cells established by DISCOMs under 12th Five Year Plan is Rs. 300 crore.

5.3 ENERGY CONSERVATION STRATEGY IN THE 12TH PLAN

The strategies adopted during the 11th Five Year Plan have started showing encouraging outcomes. It is necessary to carry forward the existing schemes as well as further strengthen the activities to accelerate the process of implementation of energy efficiency measures to achieve the desired energy savings.

Further, large scale energy savings can be realized through strengthening of the schemes in industrial, commercial, residential and agriculture sectors as well as expanding and reaching out to new areas. Projected electrical energy saving potential at the end of 12th Five Year Plan i.e during the year 2016-17 is 44.85 BU on the demand side (equivalent to 60.17 BU at Bus bar) and an additional energy saving equivalent of 21.3 mtoe in the industrial sector (including Thermal Power Stations (TPS) and Small and Medium Enterprises), Transport Sector and Energy Conservation (EC) award scheme. The share of target energy saving (Electrical & Thermal) for various proposed schemes under 12th Plan is given below:



Details of the above are furnished hereunder :-

5.3.1 Strengthening State Designated Agencies

State designated agencies (SDAs) in different states need to play a very important role in terms of carrying forward various energy efficiency initiatives at the state level. The thrust of the SDA program during the 12th Plan will be on strengthening the 32 SDAs which would enable them to implement various programs and activities initiated by BEE or SDAs themselves.

In the 11th Plan, BEE supported State designated agencies (SDAs) in preparation of action plan, building institutional capacity of SDAs, to perform their regulatory, developmental and promotional functions in their respective states, by way of technical assistance, guidance and funding etc. Each SDA has been supported to develop a five year Energy Conservation Action Plan, customized to local needs aiming at and delivery of the EC act mandates.

The proposed activities for the 12th Plan include sector specific interventions in areas like municipality (drinking water and sewage treatment), agriculture sector (pumping), street lighting, commercial buildings, government buildings and waste heat recovery in SMEs including demonstration projects. Following initiatives of SDA are proposed to be supported that would help in strengthening the capacities of SDAs and undertaking of various projects and programmes to promote energy efficiency in their respective states:

- Support for implementing state-wise sector specific energy saving plan by the SDAs
- Continued engagement of SDAs with energy efficiency professionals like energy auditors, energy managers and ESCOs
- Implement various EE demonstration projects in the states to showcase the effectiveness of the most advanced energy efficient technology and pursue state governments to replicate the project in other parts of the state.
- LED village campaign in the villages and pursue state governments to replicate the project in other parts of the state.
- Publicity /awareness on EE in the states
- Workshops/ training programmes for all the stakeholders
- Capacity building programmes for the SDAs

The total funds requirement for the above proposed activities is Rs. 140 crore.

The State Energy Conservation Funds (SECF) as mandated under the Energy Conservation Act, 2001, have already been constituted in 22 states and funds have been released to 21 states during the 11th

Plan to operationalize the SECF for various energy efficiency initiatives. The state governments of Andhra Pradesh, Rajasthan, Chhattisgarh, Karnataka, Haryana, Gujarat and Mizoram have also contributed a matching grant to the SECF.

In the 12th Plan, it is proposed to set up the SECF in all the states and

- Pursue with SDAs for constitution of SECF in the states and matching contribution by the state governments to the SECF.
- Coordinate with SDAs to implement various energy conservation activities and utilization of fund under SECF.

Contribution of Rs. 70 crore to state energy conservation fund is proposed under the 12th Plan.

Total fund required for strengthening of SDAs and SECF is Rs. 210 crore.

5.3.2 Industrial Sector

The total commercial energy consumed by the industries and SMEs together stands at about 40-50% of the total commercial energy consumption in the country. In view of continuing growth of industry sector, the proportion of commercial energy consumed by industry is envisaged to be around 40-45% in the next five-year plan also.

(a) Large Industries (Designated Consumers)

The projected energy saving potential in the 12th Plan is 11.43 mtoe which consists of a saving of 6.2 mtoe from the seven energy intensive industries (DCs) and 5.23 mtoe from thermal power stations sector. The total energy saving per year during 2011-12 to 2016-17 for 7 DC sectors is calculated on the basis of 1.2% p.a. of the total energy consumed and at 1% p.a. of the total energy consumed for the Thermal Power Plant sector during the 12th Plan period.

With the above assumptions, the extrapolation is also made further to see the expected energy saving in 2019-20 in 7 Industrial Sectors. The projected energy savings stand at 10.03 mtoe and 11.53 BU in thermal and electrical energy respectively in 2019-20.

The tabular and graphical representation of projected energy consumption trend (electrical and thermal) and saving targets in 7 industrial sectors (Designated Consumers) is given in below.

The details of projected energy consumption trend (electrical and thermal) and saving targets in 7 industrial sectors (Designated Consumers) are given in below.

Table 5.1

Energy consumption and saving projection in 7 Industrial Sectors (DCs)

<i>Particulars/Years</i>	<i>2012-13</i>	<i>2013-14</i>	<i>2014-15</i>	<i>2015-16</i>	<i>2016-17</i>	<i>2017-18</i>	<i>2018-19</i>	<i>2019-20</i>
Electrical Energy Consumption, BU	94.80	101.02	107.68	114.92	122.68	131.00	139.94	149.53
Thermal Energy Consumption, mtoe	82.44	87.84	93.63	99.93	106.68	113.91	121.69	130.02
Electrical Energy Saving, BU	1.14	2.35	3.64	5.02	6.50	8.07	9.74	11.53
Thermal Energy Saving, mtoe	0.99	2.05	3.17	4.37	5.65	7.02	8.47	10.03

The instruments to achieve the projected savings in 12th Plan in DCs and other industries are:

- **Continuation of on-going Schemes/Programs by Bureau of Energy Efficiency and Ministry of Power**
 - **National Energy Conservation Award** - Many industries have taken up a number of energy saving initiatives through voluntary energy audits. In the national EC awards, it has been

observed that energy saving to the tune of 1 % per annum has been achieved by participating units during the last 4 years. The scheme is proposed to be continued in the 12th Plan and its base will be widened. The anticipated savings in the year 2016-17 of the 12th Plan (for non PAT sector) are 3.42 BU and 5 mtoe as electricity and thermal energy respectively.

- **Notification of Energy Intensive Sectors as Designated Consumers (DC)**- After the notification of Designated Consumers (DC) among selected industrial sectors, more concerted efforts have been put forward in achieving energy savings through adoption of exclusive energy management policies, creation of a separate EC cell and improvement in energy monitoring and accounting system. All the sectors covered in the Schedule to EC Act are proposed to be covered as Designated Consumers.
- **Enhanced Capacity Building of Energy Management Professionals (National Certification Examination for EA/EM)** - Enrolment & success in National certification examination for Energy Managers / Auditors from industries has been growing at a healthy rate. BEE has taken a pro-active role in establishing a proper energy management system in the country. In this context, BEE has successfully conducted 11 National Certification Examinations across the country till 2010-11. After 11th Examination, 8525 persons have qualified as energy managers out of which 6091 have also qualified as energy auditors. The National Certification of EA & EM will continue in the 12th Plan and refresher training courses for qualified candidates will be taken up to further strengthen their knowledge base.
- **Implementation of Perform, Achieve & Trade (PAT) Scheme** - As per the EC act, 2001, the central government in consultation with BEE has identified a list of energy intensive industries and other establishments. The Perform, Achieve & Trade (PAT) mechanism is a market based mechanism to enhance cost effectiveness of improvements in energy efficiency in 8 energy intensive industries (including TPS) through certification of energy saving which can be traded. The scheme is expecting an energy saving of 3.5 million tons of oil equivalent (mtoe) in seven selective industrial sectors and 3.1 million tons of oil equivalents in Thermal Power Stations by 2014-15.

The following points describe the vision for PAT scheme during 2012-2017.

- *Implementation of 1st Cycle of PAT to achieve the set target of 6.6 mtoe by 2014-15*
- *Widening and Deepening the Scope of PAT during the 2nd Cycle of PAT by including other energy intensive sectors like Refineries, Chemicals, Petrochemicals, Automobile manufacturing, Sugar, Glass etc. in the scheme and reducing the threshold energy consumption limit of existing sectors to bring in additional industries.*
- *Accelerate the Implementation of ISO 50001 to promote benchmarking of Energy Management system in Industries and facilities*
- **Implementation of Frame work for Energy Efficient Economic Development** - Fiscal instruments like Partial Risk Guarantee Fund (PRGF) and Venture Capital Fund for Energy Efficiency (VCFEE) have already been proposed in NMEEE for successful implementation of PAT scheme.
- **Getting support from National Clean Energy Fund (NCEF)** - In order to achieve the target in PAT scheme, the industry has to look for newer technology, Renovation & Modernization (R&M), adoption of clean energy and efficient energy management systems. BEE proposes a 3% interest subsidy scheme for adoption of energy efficient technologies by Designated Consumers in 7 sectors under PAT scheme.
- **Facilitation for Need for R&D in NMEEE / PAT Scheme** - Major R&D program may be initiated in selective areas and selective sectors for developing new customized energy efficient technology through indigenous development of applications of already available energy efficient technologies/concepts. It is proposed that a need based framework for research in industrial

energy efficiency may be undertaken, centres of excellence may be established and improving the industry-institute-interaction at state level.

The total projected saving in the year 2016-17 i.e. end of 12th Five Year Plan is of the tune of 11.43 mtoe in which 10.41 mtoe is contributed by thermal energy. The rest, which is equivalent to 11.96 BU of electricity saving is estimated at bus-bar in 2016-17. The fund requirement is Rs. 190 crore to support the proposed PAT schemes.

The total funds requirement for Industrial Sector (excluding SMEs) under the 12th Five year plan is Rs. 3767 Crore.

(b) Small & Medium Enterprises

The MSME sector is an important constituent of the Indian economy, contributing significantly in GDP, manufacturing output and export. Similarly this sector also plays a significant role in energy consumption which is about 25% of the total energy consumption by industrial sector. In the 12th Five Year Plan, BEE would target the SME sector for reduction in energy consumption by 5.75% of the energy used in the energy intensive manufacturing SMEs which is equivalent to 1.75 mtoe. The targeted goal is proposed to be achieved by introducing innovative business models and financial instruments (like Venture Capital Fund/Revolving Fund, Partial Risk Guarantee Fund). The proposed schemes/activities to be undertaken in 12th Plan are as mentioned below:

- Sector specific approach for energy efficiency and technology upgradation through facilitation of implementation of DPRs
- Energy mapping of the targeted SME Sector on all India basis
- Undertaking of Innovative Financial Schemes for adoption of EE Technologies in the SMEs
- Technical assistance and capacity building
- SMEs Product Labelling Promotion Scheme

The approach would be based on the replication of results and findings from the 11th Plan. This would include implementation of DPRs on energy efficient technologies and development of Local /technologies Service Providers for SMEs, capacity building of stakeholders including bankers /FIs and strategic approach for dissemination of results. The strategy will be to move from cluster based approach to sector based approach to enable large degree implementation in the sectors selected under the 11th Five Year Plan. The details of projected energy consumption trend (electrical and thermal) and saving targets in energy intensive SMEs are given in below.

Table: 5.2

Energy consumption and saving projection in energy intensive SMEs

Particulars/Years	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Electrical Energy Consumption, BU	41.2	44.0	47.0	50.1	53.5	57.2	61.1	65.2
Thermal Energy Consumption, mtoe	20.06	21.42	22.88	24.44	26.10	27.87	29.76	31.78
Thermal Energy Saving, mtoe	0.06	0.24	0.63	1.06	1.59	2.16	2.76	3.40
Electrical Energy Saving, BU	0.07	0.27	0.72	1.22	1.83	2.48	3.18	3.91

The projected saving in the year 2016-7 of 12th Five Year Plan is 1.75 mtoe in which 1.59 mtoe is thermal energy and rest is equivalent to the 1.83 BU of electricity with the financial budget

requirement of Rs. 55 crore. In addition to this, Rs. 400 crore is also proposed for setting-up of Revolving fund and partial risk guarantee fund.

The total funds requirement for SMEs under the 12th plan is Rs. 455 Crore.

5.3.3 Equipment and Appliances

(a) Standard & Labeling (S&L) Programme

During the 11th Plan, under this scheme, a large number of appliances were covered initially under the voluntary labeling categories, out of which four appliances/equipment are under the mandatory labeling program. The S&L Program was quite successful during the 11th Plan period and has contributed to the savings in avoided capacity addition of 4,898 MW upto 31st March 2011. It is anticipated that by the end of the 11th plan, total savings in avoided capacity addition would be 7,315 MW.

The 11th Plan has already envisaged completion of 21 appliances under S&L programme and the 12th Plan also envisage similar numbers. However, data on some of the appliances/equipments such as chillers, pumps, data centres, furnaces, boilers, desert coolers, laptop chargers, deep freezers etc. is not available and is planned to be collected through baseline survey.

The proposed activities in 12th Five Year Plan under S&L for equipments and appliances include:

- Inclusion of at least 5 selected new equipment and appliances (selection is to be made from the list provided in the table given below). Standby power loss reduction in few of the electrical appliances will also be focussed in the 12th Plan.
- Awareness creation among all the stakeholders,
- Undertaking of check testing, label verification, market impact assessment for appliances/equipments covered under S&L scheme and
- Up-gradation of energy performance standards for equipment/ appliances covered during 11th Plan.

The equipments/appliances which are to be undertaken for up-gradation of energy performance standards covered during 11th Plan and inclusion of selected new appliances in 12th Five Year Plan is given in table below;

Table: 5.3

List of the Equipment & Appliances under S&L during 12th Plan

No. of Individual Appliances	Appliances	Appliances Category
1	Room Air Conditioner	
2	Refrigerator (Direct cool & Frost Free)	
3	Ceiling Fan	Fans
4	Exhaust / Table Fan	
5	Colour TV	Entertainments Gadgets
6	Set-top Box	
7	Music System	
8	Distribution Transformer	
9	Storage water heaters	
10-15	Office Automation Products (Printer, Scanner, Fax Machine, Photocopier, MFD)	
16	Laptop	Computer and Accessories
17	Desktop Computer	

No. of Individual Appliances	Appliances	Appliances Category
18	Computer Monitors	
19	Server / Data centres	
20-22	Power Back-up Systems (Inverter, UPS, Inverter Battery)	
23	Router /Modem	
24	Fluorescent tube light	Lighting
25	Ballast	
26	LED	
27	Voltage Stabilizer	
28	Drinking Water Coolers	
29	Microwave Ovens	
30	Tea / Coffee Vending Machine	

The energy saving projection in 12th Five Year Plan for the refrigerator and room air conditioner which dominate the electricity consumption in the domestic and commercial sectors is represented in the table and figure that follow:

Table: 5.4

Sales and energy saving targets for Refrigerator and Air-conditioners

Appliances	Refrigerators (FF & DC)			Room Air-Conditioners		
	Total Sales, MU/Year	Sales of S&L Refrigerators, MU/Years	Energy Saving, BU	Total Sales, MU/Year	Sales of S&L RAC, MU/Years	Energy Saving, BU
Year						
2012-13	11.02	11.02	0.19	4.93	4.93	0.44
2013-14	11.69	11.69	0.39	5.52	5.52	0.93
2014-15	12.39	12.39	0.60	6.18	6.18	1.48
2015-16	13.13	13.13	0.83	6.92	6.92	2.09
2016-17	13.92	13.92	1.07	7.75	7.75	2.78
2017-18	14.75	14.75	1.32	8.68	8.68	3.55
2018-19	15.64	15.64	1.59	9.73	9.73	4.42
2019-20	16.58	16.58	1.88	10.89	10.89	5.38

S&L for Transport Sector

There are total 13.3 million passenger cars (2010 – 11) in India which consume about 9 mtoe. The average annual sales of new passenger cars in the country are about 1.1 million. Under the labeling scheme, the following activities are proposed

- Introduction of fuel economy norms effective from 1st year of 12th Plan,
- Technical study for 2 & 3 wheelers and commercial vehicles (Truck & Buses) to finalise S&L programme

The targeted energy saving by the end of the 12th Five Year Plan is 4.3 mtoe.

Based on the above proposed schemes, fund requirement of Rs. 183 crores have been envisaged for the Standard & Labeling programme for the 12th Plan. Based on the above investment, the likely saving from the S&L scheme in the year 2016-17 is estimated to be 10.4 BU of electrical energy and

4.3 mtoe of thermal energy. The proposed savings are based on the baseline data of 2006-07 on which basis the energy savings have been assessed.

(b) Super Efficient Equipment Program (SEEP)

SEEP is a part of Market Transformation for Energy Efficiency (MTEE) initiative, one of the four initiatives of the National Mission on Enhanced Energy Efficiency (NMEEE). The primary objective of MTEE is to accelerate the shift to energy efficient appliances through innovative measures to make the products more affordable. NMEEE seeks to achieve annual savings of 19,598 MW of power and 23 million tonnes of fuel and greenhouse gas emissions reduction of 98.55 million tonnes. The mission is one of the eight mission under the Prime Minister's National Action Plan on Climate Change (NAPCC). BEE is the mission implementing agency for NMEEE.

This programme proposes to deal directly with the manufacturers of select key appliances. Usually, only a handful of manufacturers account for 70 to 90% of the market share of these appliances. SEEP would compensate the manufacturers for a major part of the incremental cost of producing Super Efficient Appliances (SEAs), and encourage them to not just produce but also sell SEAs at an affordable price to common consumers. The need for incentive is expected to reduce very fast as volumes pick up.

In this manner, the programme would help to introduce appliances that are far more efficient than the ones currently available in India thus, narrowing the massive gap between the efficiency of the average purchase and that of the most efficient technology available internationally.

Super efficient appliances (SEA) may consume 30 to 50 percentages less energy than the five star rated equipments of BEE. SEAs will have their high first cost which can be decreased by large scale production facilities, but due to uncertainty of market demand, manufacturers feel reluctant to make the initial investment to change production lines for super efficient appliances. This barrier needs to be removed by innovative policy interventions.

BEE has already announced the SEEP for ceiling fans, and has initiated a dialogue with manufacturers on setting the technical specification, monitoring process etc. SEEP would also be extended to LED Tube lights & LED bulbs. Financial incentives of Rs 244 crore per year would be required (depending on the market situation and technical preparation).

The ceiling fan market will undergo a significant transformation because of the SEEP intervention. It is expected that 26.86 million SEA ceiling fans will be sold in 12th Plan which will provide savings of 2.2 billion units in the year 2016-17 of 12th five year Plan.

Estimated market of Tube Fluorescent Lamp (TFL) in terms of lighting points shall be about 270 million in 2016-17. With an incentive pattern under SEEP, it is assumed that about 33.96 million lighting points would get converted from conventional lighting to LEDs lighting points giving a saving of around 10 -12 Watt per lighting point. The savings the year 2016-17 of 12th five year Plan from sales of 33.96 million LED TL would be around 0.91 billion units.

Further, currently both in the S&L and SEEP programme, no intervention in the bulb market was envisaged, although, BLY scheme considers the replacement of inefficient incandescent lamps (bulb) by CFL. The new emergent technology under SEEP through LEDs bulb (replacement of 60 W incandescent bulbs with 8-12 Watt LED bulb) would give large savings about 70-80%. The saving in the year 2016-17 of 12th five year Plan from sales of 33.96 million LED bulbs would be around 3.42 billion units.

The details of sales (total sales of appliances and sales of SEAs) and energy saving is given in the table that follows (base year 2012-13):

Table: 5.5

Sales and energy saving targets for SEEP Appliances

Appliances	Ceiling Fans			Tube Light			Bulb		
	Total Sales, MU/Year	Sales of SEA (Fan), MU/Years	Energy Saving, BU (TWh)	Total Sales ¹ , MU/Year	Sales of SEA (LED TL), MU/Years	Energy Saving BU (TWh)	Sales, MU/Year	Sales of SEA (LED Bulb), MU/Years	Energy Saving BU (TWh)
2012-13	36.75	0.00	0.00	41.0	0	0.00	665.0	0.000	0.00
2013-14	38.59	2.32	0.19	49.6	0	0.00	678.3	0.000	0.00
2014-15	40.52	4.86	0.59	54.6	5.46	0.15	691.9	5.460	0.55
2015-16	42.54	8.51	1.30	60.0	12	0.47	705.7	12.000	1.76
2016-17	44.67	11.17	2.22	66.0	16.5	0.91	719.9	16.500	3.42
2017-18	46.90	23.45	4.17	72.6	29.04	1.69	734.3	29.040	6.35
2018-19	49.25	24.62	6.20	79.9	39.95	2.77	748.9	39.950	10.38
2019-20	51.71	25.86	8.34	87.9	52.74	4.18	763.9	52.740	15.69

The energy saved from appliances under SEEP is about 6.6 BU in the year 2016-17. The financial support required for the proposed activities is Rs. 1470 crores which includes Rs. 250 crore for capacity building and creating awareness regarding S&L and SEEP.

5.3.4 Commercial Sector

Energy Conservation Building Code & Energy Efficiency in Existing Buildings

To set the minimum energy performance standards for new commercial buildings, having connected load of 100 kW and above, as well as to promote energy efficiency in the existing buildings through retrofitting, Energy Conservation Building Code (ECBC) was launched during the 11th Plan. Rajasthan and Orissa have notified ECBC and three other states (, Kerala and Uttrakhand) are in the process of notification. Star labelling programme (Voluntary) for day use office buildings, BPOs and Shopping complexes have been developed and 123 buildings have been awarded energy star ratings label.

The draft report on "Low Carbon Strategies for Inclusive Growth" indicates that by mandating ECBC for new commercial complexes and energy audits in existing buildings, 75 % of new commercial buildings constructed during the 12th Plan would be compliant to the ECBC. Similarly, 20% of existing buildings would reduce their present energy consumption by 20% through energy audits & retrofits. Consequently, the estimated savings in energy use in new and existing buildings over the Business As Usual (BAU) scenario is likely to be 5.07 BU.

BEE would assist both central and state government agencies in undertaking energy audits and promoting implementation of energy efficient measures. For the performance contracting route, BEE would assist in the development of standard documents for performance contracting and monitoring & verification protocols for carrying out retrofits through ESCO mode.

The projected energy saving at the end of the 12th Five Year Plan i.e. 2016-17 is 5.07 BU with the financial budget requirements of Rs. 65 crore.

¹ Projected from the sales figure of BEE star labeled TFLs of 2009-10

5.3.5 Residential Sector

Bachat Lamp Yojana

The residential sector accounts for 25.87 percent of the electricity demand in the country. The lighting load comprises of 28% of this electricity demand in the residential sector and contributes almost fully to the peak load as well. To promote the penetration of energy saving CFLs in the residential sector, BEE has developed the “Bachat Lamp Yojana” (BLY) Scheme. Under the BLY scheme, a maximum of 4 nos. long-life, quality CFL would be distributed by the CFL supplier to the grid-connected residential households in exchange of equivalent no. of incandescent lamp (ICL) and Rs. 15 per CFL. The savings in electricity that would mitigate GHG emissions will be leveraged in the international market by the CFL supplier under the Clean Development Mechanism (CDM) of the Kyoto Protocol.

Three types of ICL lamp wattages commonly in use viz. 40 W, 60 W and 100 W are likely for replacement under the BLY scheme. This Bachat lamp Yojana Scheme is registered as Programme of Activities (PoA) with the CDM executive board to reduce the transaction cost associated with CDM. The project brings together the three key players, namely BEE, the Electricity Distribution Companies (DISCOMs) and investors to supply the households with CFLs. To bridge the cost differential between the market price of the CFLs and the price at which they are distributed to households, the Clean Development Mechanism (CDM) is harnessed. The CFL supplier (Investor) would cover the project cost through the sale of greenhouse gas (GHG) emission reductions achieved in their respective project areas.

BEE, the Coordinating and Managing Entity (CME) will have to keep a functionary to handle the various documentation and protocols required by the UNFCCC (United Nations framework Convention for Climate Change) and the PoA. Further to facilitate the implementation of BLY projects and CFL distribution, this functionary will have to continuously engage with the State Electricity Distribution Companies and CFL suppliers. The database management of the BLY projects and Capacity building of State Electricity Distribution Companies and CFL suppliers along with BEE functionary will be the key focus areas in 12th Plan.

In 12th Five Year Plan, activities proposed to be undertaken are: strengthen the on-going BLY scheme by continued engagement with the state electricity distribution companies and streamlining and sustaining operations-mainly database management, data security, BLY system audit, PoA updation & re-validation, and CDM Project Activities (CPA).

The projected electricity saving at the end of 12th Plan is i.e. 2016-17 about 4.4 BU with the financial budget requirement of Rs. 6 crore.

5.3.6 Agriculture Sector

Agriculture DSM (Ag DSM)

Electricity consumption in agriculture sector has been increasing mainly due to the subsidized electricity rates and meeting the growing irrigation need of agricultural land. To tap the energy saving potential in the agriculture sector, which is estimated to be 20.75% (2007-08) of the total energy consumption, the activities planned to be undertaken in the 12th Plan would focus on development of innovative financial mechanisms like Venture Capital Fund (VCF) and Partial Risk Guarantee Fund (PRGF) for the large-scale implementation of AgDSM projects on Public Private Partnership (PPP) mode, in the states for which DPRs have been prepared in the 11th Five Year Plan. The major impacts of the Ag DSM scheme during the 11th Five Year Plan includes 97 MU of annual energy saving potential assessed across eight different states covering about 20,885 pump sets.

Based on the results achieved during the 11th Plan, the targeted reduction in electricity consumption at the end of 12th Plan is 0.7 billion units (BU) which would be about 0.57% of the electricity consumption in the agriculture pumping system. The following instruments are proposed to meet the proposed target:

- Financing mechanism for promoting investments in Ag DSM projects (Target – 0.25 million pump sets, 0.7 BU of energy savings, Total Budgetary Provision: Rs. 352 crore).
 - Placement of partial risk guarantee fund for risk mitigation of Manufacturer/Implementer/ESCOs/FIs.
 - Placement of capital subsidy fund/venture capital fund for providing incentive to Manufacturer/Implementer/ESCOs.
 - Monitoring and verification protocol under the AgDSM scheme (Total Budgetary Provision: 25 crore)
- Monitoring and verification protocol under the AgDSM scheme (Total Budgetary Provision: 25 crore)
- Integrated water and energy conservation scheme – 100 Joint Demo projects implementation (Total Budgetary Provision: Rs. 10 crore)
- Technical assistance & capacity development of all stakeholders (Total Budgetary provision – Rs. 6 crores)

At the end of the 12th Five Year Plan, it is forecasted that through market transformation of agriculture pump sets, major manufacturer of agriculture pumps in the organized SME sector would transform into manufacturing of energy efficient star labelled pumps through the various initiatives of BEE schemes/programmes.

Wider involvement of stakeholders like DISCOMs, state regulatory commissions, State Designated Agencies, State Governments, pump manufacturers, energy saving companies, farmers/ consumers etc. is one of the key initiatives under the scheme.

The projected electricity saving at the end of 12th Plan i.e. 2016-17 is about 0.7 BU with the financial budget requirement of Rs. 393 crore.

5.3.7 Municipal and Public Utility Sector

Municipal DSM (Mu DSM)

The basic objective of the Municipal Demand Side Management (MuDSM) programme is to improve the overall energy efficiency of the Urban Local Bodies (ULBs) which could lead to substantial savings in the electricity consumption, thereby resulting in cost reduction/savings for the ULBs.

The situation analysis was carried out in the Municipal sector in 2007 covering 23 States/UTs. The finding across all the 171 cities spread in 23 states points out that only 9 cities have exclusive energy cell. Other Municipal's region neither had energy cells nor having any medium for collection of data for improvement of energy efficiency.

• Energy Efficiency in ULBs

As low as only 38 cities out of 171 have separate allocation in their budget for any energy efficiency initiative. Notably out of total budget allocation of Rs. 12,123 crore across these 171 cities, only Rs 128.5 crore (1.06%) was allocated exclusively for energy efficiency initiatives in the year 2006-07. This subsequently went down to 0.88% in 2007-08 with the allocation of Rs 161.8 crores out of total budget provision of Rs 18,430 crore. Based on the data collected in the situation analysis survey, the energy saving potential for 12th Plan has been estimated as 257 million units (MU) in the urban local bodies.

• **Energy Efficiency in Water pumping**

During the course of initial Investment Grade Audits (IGAs) of ULBs, it was found that over a period of time, many of the water pumping bodies (Jal Nigam/ Jal Sansthan/ Water Department) have separated out from the scope of ULBs and therefore, a separate situation analysis of these bodies was carried out.

The representative water bodies, encompassing total of 3520.65 lakh of population in 1896 Sq.km spread across 105 cities, were covered during this sample based survey for situation analysis covering 19 states. In this study, the overall estimated electricity consumption in the pumping was 1040 MU with an estimated electricity saving potential of 208 MU.

Based on the above survey, funding requirement of Rs. 45 crores is assessed for the MuDSM Scheme as this scheme would create an institutional mechanism for implementation of the MuDSM in the country. The above budget is meant for undertaking investment grade energy audits in both ULBs and Jal-Nigams. It is envisaged that implementation of the proposed IGAs can be achieved through funding under JNNURM and linking the same through development fund of MoUD to realize the savings. Any implementation programme under BEE scheme is to be considered for separately funded.

The projected electricity saving at the end of 12th Plan i.e. 2016-17 is about 0.47 BU with the financial budget requirement of Rs. 45 crore.

5.3.8 Energy conservation awareness, awards and painting competition

Many activities to promote awareness on energy conservation amongst the targeted sectors and general public and also for school children were undertaken during the 11th Plan which include National Energy Conservation Award for industries, buildings and railways and Painting Competition on energy conservation for school children.

Painting competition is being organized since 2005 for students at School, State and National levels. In the year 2010, about 15.63 lakh students participated in the competition in comparison to 3.43 lakh in the year 2005. The National Energy Conservation Award Scheme of Ministry of Power covers about 34 sectors of industry, thermal power stations, office buildings, hotels and hospitals, zonal railways, state designated agencies, municipalities and manufacturers of BEE Star labelled appliances. The avoided capacity saving achieved in the first four years of 11th Plan was 1441 MW.

It is proposed to strengthen all ongoing activities during the 12th Plan and introduce the following specific activities:

- Creation of data base and its analysis EC Award participating units
- Compilation and dissemination of best-practices in industry and building sector
- Continuation of EC Awards and paintings competition on energy conservation
- Awareness creation on energy conservation through print, electronic and other media for general public

The projected saving in the year 2016-17 of 12th Plan is about 3.42 BU of electrical energy and 5 mtoe of thermal fuel saving with the financial budget requirement of Rs. 100 crore.

5.4 HUMAN RESOURCE DEVELOPMENT PROGRAMMES

Human Resource Development (HRD) activities are required to meet the challenges of energy efficiency and sustainability together. A sound policy for creation, retention and up-gradation of skills of Human Resources is very crucial for penetration of energy efficient technologies and practices in the various sectors. Access to information and training is considered to be one of the most important barriers limiting the transfer of energy efficient technologies. BEE and SDAs have

played a major role for stimulating a major change in the energy efficiency practices in the various sector of economy. BEE will continue the capacity building of energy professionals through national certification programme for Energy Manager/Energy Auditors. In addition to the HRD activities undertaken in each of the scheme of BEE and MoP, the following initiatives are also proposed to be undertaken in the 12th Five Year Plan:

- Student awareness programs
- Training, skill up gradation and refresher training of energy managers and energy auditors
- Training, skill upgradation and refresher training of operators handling fuel fired furnaces and boilers.
- Inter-institutional networking in energy efficiency training
- Training of Power plant personals

The HRD plan is developed with both widths through general public awareness and student groups as well as depth through special training packages for sector specific energy efficiency of operators, energy auditors and managers. It meets the need of most of the sectors such as the power sector, SME, North East, agricultural, buildings, etc.

The total budget proposed is Rs. 288 crores in the 12th Plan.

5.5 OTHER TECHNOLOGIES/AREAS FOR ENERGY CONSERVATION

5.5.1 Award for manufacturer offering the most energy efficient appliance models

Appliances manufacturing companies may have started producing energy efficient, star rated models. However, they also produce a wide range of models that are cheaper and popular but energy inefficient. An award will incentivize the manufacturing companies to offer more energy efficient models and will act as recognition of their commitment to energy efficiency.

The Ministry of Power already has the National Energy Conservation Award (NECA) scheme to recognize the innovation and achievements in energy conservation & efficiency by the industry, and the above proposed award can be a part of the scheme.

5.5.2 Energy Efficiency Research Centers

Setting up of 10 energy efficiency research centers for selected energy consuming sectors may be considered in collaboration with the Department of Science & Technology (DST). Based on a model appropriate for India, BEE may invite offers from academic institutions, manufacturing associations & ESCOs and offer funding for initial set up, partial running and maintenance cost for the first 5 year period.

The financial budget requirement for this activity is Rs. 200 crore in 12th Five Year Plan.

5.5.3 Other Strategies and Initiatives

5.5.3.1 Other strategies

Encourage planners and regulators related to energy and technology up gradation sector to adopt integrated resource planning in the entire value chain of activities, right from extraction or procurement, and conversion to final end use.

5.5.3.2 New areas/initiatives

- **Railways**

The Indian Railways in past has undertaken many initiatives to conserve energy. However, still many opportunities may exist for improving the energy efficiency in the railway sector as a whole. Given the energy saving potential that may exist in this sector, it is proposed to initiate studies and various schemes in coordination with the Ministry of Railways.

- **Additional sectors**

A few additional sectors are proposed under the 12th Plan, where possibilities to reduce energy consumption exist, which are not presently/ adequately covered under the existing BEE schemes. These include the defence establishments like ordinance factories (purely on a voluntary basis), Public Sector Units (PSUs) township and large engineering/ manufacturing industries.

5.5.3.3 Lighting Center of Excellence

Creating a demonstration centre on lighting technologies (Lighting Centre of Excellence) to showcase energy efficient lighting technologies, may be considered in the 12th Plan.

5.6 CONCLUSION AND RECOMMENDATIONS

The target of energy saving which may be achieved in the terminal year 2016-17 of 12th Five year Plan as a consequence of Demand Side Management (DSM), Energy Efficiency and Energy Conservation schemes as proposed in the plan is expected to be 44.85 BU (at consumer side) which is equivalent to 60.17 BU at the Bus bar side. The equivalent avoided peaking capacity is estimated to be 12,350 MW at the end of the 12th five year plan. In addition to the electricity saving, total thermal energy saving equivalent to 21.30 million tonne of oil equivalent (mtoe) in the Industries & SME, Transport sector and Energy Conservation (EC) award is also expected to be achieved in the terminal year of 12th Plan.

The details of target of energy saving during 12th Plan as well as corresponding fund requirement for various programmes initiated by BEE are summarized in following table.

Table: 5.6

Energy Saving Targets for 12th Plan

Sr No	Sectors	Schemes	Total Fund requirement in schemes (Rs. In Crore)	Total Fund requirement in sector (Rs. In Crore)	Targeted Electricity Saving, BU	Targeted Thermal Fuel Saving, mtoe
1	Utility Based DSM	DSM Programme for Utilities	300	300	-	-
2	Industries	Industries	3767	4222	11.96	10.41
		SMEs	455		1.83	1.59
3	Residential Sector	Bachat Lamp Yojana	6	6	4.40	-
4	Equipment & Appliances	Standards & Labeling (S & L)	183	1653	10.40	4.30
		SEEP	1470		6.60	-
5	Agriculture Sector	Agricultural Demand Side Management	393	393	0.70	-

Sr No	Sectors	Schemes	Total Fund requirement in schemes (Rs. In Crore)	Total Fund requirement in sector (Rs. In Crore)	Targeted Electricity Saving, BU	Targeted Thermal Fuel Saving, mtoe
6	Commercial Sector	ECBC & Energy Efficiency in Existing Buildings	65	65	5.07	-
7	Municipal Sector	Municipal Demand Side Management	45	45	0.47	-
8	State Designated Agencies	SDA Strengthening	140	210	-	-
		State Energy Conservation Fund	70		-	-
9	National Awards, Painting & Awareness	National Awards, Painting & Awareness	100	100	3.42	5.00
10	Innovative Technologies/Areas	Energy Efficiency Research Centre	200	200	-	-
11	HRD	HRD	288	288	-	-
Total				7482	44.85	21.30
Total electricity saving at demand side, BU					44.85	
Total electricity saving at Bus bars, BU					60.17	

Following recommendations/new initiatives are suggested for 12th Plan.

- Continuation of on-going Schemes/Programs by Bureau of Energy Efficiency and Ministry of Power
- State designated agencies (SDAs) in different states need to play a very important role in terms of carrying forward various energy efficiency initiatives at the state level. The thrust of the SDA program during the 12th Plan will be on strengthening the 32 SDAs which would enable them to implement various programs and activities initiated by BEE or SDAs themselves.
- In the 12th Plan, it is proposed to set up State Energy Conservation Fund (SECF) in all the States and pursue with SDAs for constitution of SECF in the states to implement various energy conservation activities and utilization of fund under SECF. Matching contribution may be made by the state governments to the SECF.

The proposed activities in 12th Five Year Plan under Standard & Labelling Programme (S&L) for equipments and appliances include:

- Inclusion of at least 5 selected new equipment and appliances. Standby power loss reduction in few of the electrical appliances will also be focussed in the 12th Plan.
- Awareness creation among all the stakeholders,
- Undertaking of check testing, label verification, market impact assessment for appliances/equipments covered under S&L scheme and
- Up-gradation of energy performance standards for equipment/ appliances covered during 11th Plan.

Under the labelling scheme, the following activities are proposed

- Introduction of fuel economy norms effective from 1st year of 12th Plan,
- Technical study for 2 & 3 wheelers and commercial vehicles (Truck & Buses) to finalise S&L programme
