UNIVERSITY OF PETROLEUM & ENERGY STUDIES

CENTRE FOR CONTINUING EDUCATION

UNDERSTANDING THE NEED FOR IMPROVING DEMAND SIDE MANAGEMENT TO BRING IN ENERGY EFFICIENCY IN INDIA-BRIDGING THE GAP BETWEEN DEMAND AND POTENTIAL

By

Shivanku Bhatt

50004106

Guided By

Mr. SUJITH P SURENDRAN

Mr. PRABHAT KISHORE DIMRI

LLM

(ENERGY LAWS)

A Dissertation Report submitted in partial fulfilment of the requirements for LLM (Energy Laws Specialization)

Post Graduate Center for Legal Studies

19/12/15 Subhash & Seth

19/12/15

Table of Contents

APPENDIX–I

Acknowledgement

This is to acknowledge with thanks the help, guidance and support that I have received during the Dissertation.

I have no words to express a deep sense of gratitude to the Staff of CCE, College of Legal Studies, University of Petroleum and Energy Studies for giving me an opportunity to pursue my Dissertation, and in particular Mr. Prabhat Kishore Dimri for his able guidance and support.

I must also thank Mr. Sujith Surendran for his valuable time and support throughout and for his valuable inputs.

I also place on record my appreciation of the support provided by faculty members of Administrative Staff College of India, Hydrabad. I also take pleasure to thank all other people who gave their valuable inputs and supported me while making the Dissertation.

Shivanku Bhatt

52, Mohini Road,
Dalanwala,
Dehradun.

+91780409025

lookShivank @gmail.com

29 /11/2015

निदेशक (तकनीकी)
Director (Technical)

उत्तराखण्ड
विद्युत नियामक आयोग
Uttarakhand
Electricity Regulatory Commission

Date: 08.12.2015

APPENDIX–II

A Declaration by the External Guide

This is to certify that Mr. Shivanku Bhatt, a student of LLM (Energy Law Specialization) with SAP Id. 50004106 of University of Petroleum and Energy Studies has successfully completed this dissertation report on *"Understanding The Need For Improving Demand Side Management To Bring In Energy Efficiency In India- Bridging The Gap Between Demand And Potential"* under my supervision.

Further I certify that the work is based on the investigation made, data collected and analyzed by him and it has not been submitted in any other University or Institution for award of any degree. In my opinion it is fully adequate, in scope and utility, as a dissertation towards partial fulfillment for the degree of LLM.

Prabhat Dimri
08.12.2015

(Prabhat Kishor Dimri)
Director (Technical)
Mob. 9760695217
e-mail: prabhat.dimri@gmail.com

APPENDIX–III

Declaration by the Internal Guide

his is to certify that **Mr. Shivanku Bhatt**, a student of **LL.M. (Energy Law Specialization) with** AP Id. 500084106 of University of Petroleum and Energy Studies has successfully completed this ssertation report on "***Understanding The Need For Improving Demand Side Management To ring In Energy Efficiency In India- Bridging The Gap Between Demand And Potential***" under y supervision.

urther I certify that the work is based on the investigation made, data collected and analyzed by him nd it has not been submitted in any other University or Institution for award of any degree. In my pinion it is fully adequate, in scope and utility, as a dissertation towards partial fulfillment for the egree of LL.M.

08/12/15

Ir. Sujith P Surendran

ssistant Professor (SS) (College of Legal Studies)

University of Petroleum & Energy Studies, Dehradun

8.12.2015

ehradun

1. ABBREVIATIONS

Abbreviations

1. ARR	Annual Revenue Requirement
2. BEE	Bureau of Energy Efficiency
3. BU	Billion Unit
4. BLY	Bachat Lamp Yojana
5. CFL	Compact Fluorescent Lamp
6. CDM	Clean Development Mechanism
7. DSM	Demand Side Management
8. DLC	Direct Load Control
9. DISCOM	Distribution Company
10. DC	Designated Consumer
11. DPR	Detailed Project Report
12. DR	Demand Response
13. EA	Electricity Act 2003
14. ECA	Energy Conservation Act
15. FERC	Federal Energy Regulatory Commission
16. FoR	Forum of Regulators
17. GHG	Green House Gas
18. HRD	Human Resource Development
19. HT	High Tension
20. IEPR	Integrated Energy Policy Report
21. IPP	Independent Power Producers
22. ISO	International Organization for Standardisation
23. ICL	Incandescent Lamp
24. IGA	Investment Grade Audits
25. IHD	In-home Display
26. ISI	Indian Standards Index
27. LED	Light Emitting Diode
28. LT	Low Tension
29. MW	Mega Watt
30. MTEE	Market Transformation of Energy Efficiency

31. NAPCC	National Action Plan for Climate Change
32. NMEE	National Mission on Enhanced Energy Efficiency
33. PAT	Perform Achieve & Trade
34. PRGF	Partial Risk Guarantee Fund
35. PoF	Programme of Activities
36. R&M	Renovation & Modernisation
37. SME	Small Medium Enterprise
38. SEEP	Supper Efficient Equipment Programme
39. S&L	Standard & Labeling
40. SEA	Supper Efficient Appliances
41. SMUD	Sacramento Municipal Utility District
42. SERC	State Electricity Regulatory Commission
43. SDA	State Designated Agencies
44. ULB	Urban Local Bodies

UNDERSTANDING THE NEED FOR IMPROVING DEMAND SIDE MANAGEMENT TO BRING IN ENERGY EFFICIENCY IN INDIA-BRIDGING THE GAP BETEEN DEMAND AND POTENTIAL[1]

2. INTRODUCTION

Indian Economy is moving with a fast pace. To match up with the growing needs of the country and the standard of development of the globe power plays a major role. Therefore, the need to have a sustainable quality power and uninterrupted supply and to meet the demand and availability, Indian power sector should come up with strategies and mechanism such as Demand Side Management so to utilise the energy and to provide a healthy power supply network across the country.

From developing to the developed State the dependency on power plays a crucial role. The realization of 1990's is now taking its shape. To be a developed country the countries need to ensure its power surplus and the same is not only achieved by generating more energy but also by focusing on power supply and demand management. Therefore, the need of the hour is to build a system with which the management of power can be smoothened and the gap between demand and availability can be shortened and also, efficiency in power supply and its consumption can be achieved.

The imperative to improve the present demand and supply of power is not only on the government *per se* but also on each individual consumer of electricity. It's the management by one and execution by all, though the policies are to be framed by the government and the regulators but the implication of those policies and regulations has to be applied at each individuals end. The whole process is an amalgamation of legal sanctions and awareness. Thus, paper touches all the aspects which relates to the management of power and its utilization in the most effective way.

To make a grip over the speedy development, new technologies have to be adopted, modification in the present system in required and updation of prevailing laws is needed.

---

[1] *The author is a professional in Power Sector and have chosen "**Understanding the Need for Improving demand Side Management To Bring In Energy Efficiency In India-Bridging the Gap Between Demand And Potential**" as a topic for my project in the capacity of a post graduation student pursuing LLM (Energy Law Specialization), SAP ID 50004106, from the University of Petroleum and Energy Studies after having Completed B.A.LLB (Hons.). The author can be contacted on look4shivanku@gmail.com.

Thus, the study concerns the mechanism for improving the energy efficiency in the country. It discusses the meaning, application and the prospects of Demand Side Management in the country. It discusses the policy and initiatives that government has taken in this regard and to what extent has the government been successful in doing so.

What the country is facing now is the biggest challenge to provide power to each corner of the country and in an uninterruptive way however, many policies and initiatives have been taken up at each level of authorities involved in its business. The issues pertaining to power prevails in every unit of power industry, from its generation to the actual consumption, power is not greeted as an expensive valuable commodity of the developing and developed country. Lack of technology and awareness, all accounts for the waste and loss of the power which is so precious for a country like India. Being a power sector professional, a insider view of the challenges has been incorporated in the study. Also, reports of various committees, conferences and NGO's have been analysed while preparing this dissertation which has helped and provided broader vision of how the country has been moving to achieve energy efficiency in this direction.

Form the first electric demonstration in Calcutta on July 24, 1879 till today there has been a tremendous growth in the business of generation, distribution and consumption of power which is quite obvious considering the population increase and simultaneously the ever growing dependency on power in India. The utility electricity sector in India had an installed capacity of 278.734 GW as of 30 September 2015.[2] [3]Renewable Power plants constituted 28% of total installed capacity and Non-Renewable Power Plants constituted the remaining 72%. The gross electricity generated by utilities is 1,106 TWh (1,106,000 GWh) and 166 TWh by captive power plants during the 2014–15 fiscal.[4] The gross electricity generation includes auxiliary power consumption of power generation plants. India became the world's third largest producer of electricity in the year 2013 with 4.8% global share in electricity generation surpassing Japan and Russia.

[5]The 17th electric power survey of India report claims:

- Over 2010–11, India's industrial demand accounted for 35% of electrical power requirement, domestic household use accounted for 28%, agriculture 21%,

[2] "All India Installed Capacity (In MW) Of Power Stations" (PDF). Retrieved 1 October 2015.
[3] "Power sector at glance". Retrieved 13 October 2015.
[4] Growth of Electricity Sector in India from 1947-2015.CEA, India. Retrieved 1 June 2015.
[5] "Report on 17th electric power survey of india" (PDF). Central Electricity Authority, Ministry of Power,2007.

commercial 9%, public lighting and other miscellaneous applications accounted for the rest.

- The electrical energy demand for 2016–17 is expected to be at least 1,392 Tera Watt Hours, with a peak electric demand of 218 GW.
- The electrical energy demand for 2021–22 is expected to be at least 1,915 Tera Watt Hours, with a peak electric demand of 298 GW.

If current average transmission and distribution average losses remain same (32%), India needs to add about 135 GW of power generation capacity, before 2017, to satisfy the projected demand after losses.

Considering the increasing demand and the availability of power, energy conservation has to be brought in the mainstream life. Mechanism has to be developed so as to trigger effective utilization and energy saving techniques in power sector in India. After the realization of demand and supply of power, Demand Side Management initiatives have been incorporated in the country for taping the habits of consumptions of electricity by consumer and managing minimum loss and maximum availability of power within the available limits.

The study focuses and will bring out the ways with which supply of power and its demand can be made swift and reliable in the country. It includes the challenges faced by different states relating power deficit, power shedding etc and highlights the mechanism which can be applied across the country. The study encompasses various dimensions of energy savings approach adopted by countries across the globe in generation, transmission and distribution of electricity.

A study of evolution and development of significance of Demand Side Management in the globe has been discussed, government past and future initiatives has been analysed in detail, a review of the Sate actions in implanting DSM has been conducted and application of Smart Grid Network in the country and the related challenges is highlighted in the study. The study will help to get an insight of the challenges faced in applying the energy efficiency measures and to what extent those challenges can be conquered.

The wholesome idea behind this dissertation is to bring out a very significant aspect of power sector and related mechanism of energy efficiency in India. The study throws light on all the dimensions of power sector and will dig out all the areas where possibilities of

power saving can be achieved. From the industrial units to the agricultural sector and then ultimately to the consumer, the flow of power is studied keeping in mind the power management and energy conservation techniques at various stations. Role of Government and Regulators have certain credentials in implementation of DSM schemes, which forms a very important segment of this study. The new technology which is floating in market, the issues, advantages and drawbacks relating the same is discussed in length and breath. Benefit of Consumer, Government, Generator and Distribution Company is contemplated in the work and for doing the same all prevailing laws and regulation and market compatibility is studied.

Chapter-II

3. GOVERNING LAWS

Electricity is a concurrent list subject and is at Entry 38 in List III of the seventh Schedule of the Constitution of India. In India's federal governance structure, this means that both the Central government as well as State governments are involved in establishing policy and laws for its electricity sector. This principle motivates Central government of India and individual State governments to enter into memorandum of understanding to help expedite projects and reform electricity sector in respective state.

The Ministry of Power is India's apex central government body regulating the electrical energy sector in India. This ministry was created on 2 July 1992. It is responsible for planning, policy formulation, processing of projects for investment decisions, monitoring project implementation, training and manpower development, and the administration and enactment of legislation in regard to thermal, hydro power generation, transmission and distribution. It is also responsible for the administration of India's Electricity Act (2003), the Energy Conservation Act (2001) and to undertake such amendments to these Acts, as and when necessary, in conformity with the Indian government's policy objectives.[6]

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

i. Energy Conservation Act (2001)

The Energy Conservation Act (2001) is the most important multi-sectoral legislation in India and is intended to promote and encourage efficient use of energy in India. The Act specifies energy consumption norms and standards for designated consumers, prescribes energy conservation building code for efficient use of energy in commercial buildings and establishes a mechanism to comply with energy consumption norms and standards.

Government of India has enacted the Energy Conservation Act, 2001 to coordinate various activities associated with efficient use of energy and its conservation. The Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power and was

[6]"REFORM PROGRAMME OF GUJURAT". Ministry of Power, Government of India, January 2001

set up under Section 3 of the Act as the nodal agency to coordinate this activity with the assistance of the State Designated Agencies thus, keeps a check on DSM activity. The aim of this institutional framework is to stimulate market transformation and initiate other interventions in favour of DSM and energy efficiency in the country with the involvement of all stakeholders.

Under section 13 of the Energy Conservation Act 2001 the functions and powers of BEE has been specified and with those powers and function the BEE makes guidelines and various programmes for energy conservation hence, DSM.

The Bureau of Energy Efficiency has initiated many schemes for improving energy efficiency and many of them are DSM measures also. These flow from the provisions of the Energy Conservation Act, 2001. Some of the programmes, which BEE has undertaken in the area of DSM, are as follows:

1. Lighting DSM
2. Standard & Labelling Programme
3. Energy Conservation Building Code & Energy Efficiency in Existing Building Programme
4. Investment grade audits in buildings
5. Star rating of buildings
6. BEE-ECBC programmes under implementation
7. Municipal DSM
8. Agricultural DSM

Chapter V & Chapter VI of the Energy Conservation Act (2001) talks about the power and functions of the Central & State Government to facilitate and enforce efficient use of energy and its conservation. Section 15 to section 18 of the Act deals with the functions that the State government exercises in consultation with the Bureau. Following are the important provision of the Act w.r.t the powers and functions of State government given in the area of energy conservation.

- Under section 15 (d) the State government is to appoint a designated agency to coordinate, regulate and enforce provisions of this Act within the State.
- The State government under section 16 of the Act has to constitute a fund for the purpose of energy conservation scheme
- and under section 17 of the Act the designated agency is to appoint an inspecting officer for the purpose of ensuring compliance with the provisions of the Act.

Under section 26 whosoever fails to comply with the provisions as given under Section 14 and section 15 of the Act shall be adjudicated and penalised under this Act by the State Electricity Regulatory Commission. The appeal against the same will go to the Appellate Tribunal for energy conservation as given under Chapter IX of the Act.

On going through the provisions of the EC Act and having a practical exposure in power sector it is observed that, the Act mostly talks about the market transformation and not mentions anything in regard to the machinery which will execute it. Utilities and regulators are having a direct relation with the consumer but the Act has not efficiently used their power to bring in energy efficiency. Moreover, there is no reference of Demand Side Management and utility involvement in promoting energy efficiency in India. Although, BEE has come up with various policies and initiative to bring in energy efficiency but the same cannot be achieved without direct involvement of utilities and SERC's. Therefore, the SER's need to encourage the distribution licensee to undertake DSM activities.

ii. Electricity Act 2003

In regard to the energy efficiency the preamble of the Act says,

".... to consolidate the laws relating to generation, transmission, distribution, trading and use of electricity and generally for taking measures conducive to development of electricity industry, promoting competition therein, protecting interest of consumers and supply of electricity to all areas, rationalization of electricity tariff, ensuring transparent policies regarding subsidies, promotion of efficient and environmentally benign policies...."

Also, while determining the tariff for electricity under section 61 of the Electricity Act 2003, the appropriate Commission is guided by various factors, section 61 (h) of the Electricity Act is one of the guiding factor which provides for the Commission to determine the tariff in a way so to promote co-generation and generation of electricity from renewable energy sources the relevant extract of it is reproduced here under,

"The promotion of co-generation and generation of electricity from renewable sources of energy."

Under section 86 of the Electricity Act the functions of the State Commission's and section 86(1) (e) of which stipulates that,

"promote cogeneration and generation of electricity from renewable sources of energy by providing suitable measures for connectivity with the grid and sale of electricity to any person, and also specify, for purchase of electricity from such sources, a percentage of the total consumption of electricity in the area of a distribution licence; "

Also, under section 181 of the Electricity Act the State Commission's have made regulations on the Demand Side Management. The framework under which the State Commission's have developed their regulations are,

Section 23 of the Electricity Act which provides, *"if the Appropriate Commission is of the opinion that it is necessary or expedient so to do for maintaining the efficient supply, securing the equitable distribution of electricity and promoting competition, it may, by order, provide for regulating supply, distribution, consumption or use thereof "*

Section 86 (2) of the Electricity Act provides *that "State Commission shall advise the State Government on all or any of the following matters, namely:- "Clause (i) " promotion of competition, efficiency and economy in activities of the electricity industry;"*

From reading the provisions as given above it is observed that, the Act does not mandate any institution to take any step in regard to energy efficiency or DSM measure. There is no dedicated provision which ensures the application of DSM measures or energy efficiency measures in the country. Also, Section 86 of the Act which talks about the functions of the Regulatory Commissions nowhere talks about the energy efficiency or DSM measures. However, it should also be noted that some of these issues have been addressed by the *Government of India* in National Electricity Policy (NEP) as discussed below:-

Clause 5.9.2 of the National Electricity Policy provides that *"The potential number of installations where demand side management and energy conservation measures are to be carried out is very large. Bureau of Energy Efficiency (BEE) shall initiate action in this regard. BEE would also made available the estimated conservation and DSM potential, its staged implementation along with the cost estimates for consideration in the planning process for National Electricity Plan."*

Clause 5.9.4 of the National Electricity Policy provides that *"In the field of energy conservation initial approach would be voluntary and self-regulating with emphasis on*

labelling of appliances. Gradually as awareness increases, a more regulatory approach of setting standards would be followed."

Clause 5.9.6 of the National Electricity Policy provides that *"In order to reduce the requirements for capacity additions, the difference between electrical power demand during peak periods and off-peak periods would have to be reduced. Suitable load management techniques should be adopted for this purpose. Differential tariff structure for peak and off peak supply and metering arrangements (Time of Day metering) should be conducive to load management objectives. Regulatory Commissions should ensure adherence to energy efficiency standards by utilities; "*

The National Electricity Policy identifies the role of BEE in the field of Demand Side Management and also recognises the role of BEE in preparation of National Electricity Plan and it further recognises the role of Regulator in promotion of energy efficiency. However, the National Electricity Policy has not made any institution responsible for initiating any activity in the field of DSM. Further, there is no institutional framekwork which gives an idea as to who will implement the DSM activity in the country. The policy and the legislations does not have a bone to support the idea of energy efficiency and DSM, as it does not identify the institutional structure required to implement DSM projects in the country. In short, while NEP brings more clarity on role of BEE, it does not provide institutional structures that may be required to ensure design, development and implementation of DSM in the country.

In the Tariff Policy [7]also initiatives with regard to DSM and EE has been taken which provides for Time of Day tariffs, but it does not have any specific provisions related 'Demand Side Management' or 'Energy Efficiency'.

Further, the Integrated Energy Policy Report (IEPR) released by the Planning Commission of India also says that the SERC's can include the expenditure done in the EE & DSM activity in the tariff and that the utility/company should have a DSM cell.

National Action Plan for Climate Change (NAPCC) also talks about some of the initiatives on the Energy efficiency mechanism.

[7] Extraordinary Gazette of India, Part-I, Section-1, Published by Ministry of Power vide Resolution No. 23/2/2005- R&R (Vol.III) dated 6th January, 2006

iii. Lacuna in the present legal framework

Some of the lacuna in this framework that emerges from the analysis are enumerated below:

- There are no specific provisions related to DSM implementation in two major Acts (EC Act & EA 2003) governing the power sector;

- The National Electricity Policy, a statutory policy under EA 2003 refers to DSM but fails to provide clear guidelines on the institutional framework or process of deployment;

- Tariff Policy, another statutory policy provides for ToD tariffs and other tariff related measures without referring anything in regard to DSM;

- Other policies such as IEPR & NAPCC, though have specific provisions but are not statutory in nature and therefore not binding on key institutional players.

Chapter-III

4. NEED FOR CONSERVATION OF ENERGY

India has approximately 17% of world's population, but less than 1% of the world's energy resources. This is a huge variation in the demand and availability of energy. The real challenge for India is to shrink the gap between demand and availability. The gap between demand & supply of electric energy is widening day by day. Bridging this gap by setup of new power plant is very difficult & expensive proposition. This situation is not likely to improve in immediate future. As we know that electricity is an important input in all the sectors of any country's economy, hence we need to find alternate methods to reduce peak demand and to save electricity. This could be done by increasing the installed capacity, which has its own limitations. Hence, going by the dictum Energy saved is Energy Generated. It's a big challenge for the Power Sector to save the energy to narrow the gap between demand and supply. There is a huge potential to save energy in various sectors of economy-industrial, agricultural and domestic, in each of them and which accounts for a huge contribution. To utilise that potential and run the network effectively through what is available is what concerns this study. As mentioned above investing in making in expensive power plants is not a logical option but correcting the network available and by strengthening the system the gap between availability and demand can be narrowed. Although, we have a dedicated legislation but we need to identify as to why the legislation is failing to achieve its motive. Having a practical exposure as being a professional in power sector, the issues and challenges that are highlighted are addressed in the study.

i. Electricity Generation Performance (Ministry of Power)

The electricity generation target for the year 2015-2016 was fixed as 1137.5 Billion Unit (BU). i.e. growth of around 8.47% over actual generation of 1048.673 for the previous year (2014-2015). The generation during (2014-15) was 1048.673 BU as compared to 967.150 BU generated during April- March 2014, representing a growth of about 8.43%.

The electricity generation target for the year 2014-15 has been fixed at 1137.5 BU comprising of 966.700 BU thermal; 128.000 BU hydro; 38.000 nuclear; and 4.800 BU import from Bhutan. [8]

[8] http://powermin.nic.in/power-sector-glance-all-india last visited on 28.11.2015 at 3:42pm.

The Ministry of Power India in its website has purported sign of growth in the generation of power. However, considering the growing population of the country and the ambition of the government to connect to extreme villages in India the numbers and data is incompetent. Inspite of the fact that energy in India is being generated on a much better pace than ever before, the question rises as to whether it matches the demand of the country. It is observed that with the passing years investment in the generation and increasing number of power plants is not a solution instead what is available has to be utilised efficiently inorder to meet the demand. The energy generated has to be conserved and utilised efficiently, for which different mechanisms are adopted even by various countries. Those mechanisms and measures are discussed in details in the study. Demand Side Management is one of the most effective mechanism to save power specially in a country like India.

ii. Basic's of DSM

Demand-side management (DSM) has been traditionally seen as a measure of reducing peak electricity demand so that utilities can delay building further capacity.[9] In fact, by reducing the overall load on an electricity network, DSM has various beneficial effects, including mitigating electrical system emergencies, reducing the number of blackouts and increasing system reliability and saving power. Possible benefits can also involve reducing dependency on expensive imports of fuel, reducing energy prices, and reducing harmful emissions to the environment. Finally, DSM has a major role to play in reducing high investments in generation, transmission and distribution networks. Thus, DSM applied to electricity systems provides significant economic, reliability and environmental benefits. When DSM is applied at the consumers end in general, not just electricity but fuels of all types, it can also bring significant cost benefits to energy users (and corresponding reductions in emissions). Opportunities for reducing energy demand are numerous in all sectors, there are various ways with which energy saving can be achieved and many are low-cost, or even no cost, items that most enterprises or individuals could adopt in the short term basis, if good energy management is practised which is the key agenda for this research, there islot that we can save and supply. The next chapter of the study will examine the types of DSM measures that can reduce energy demand for the end-user, that can manage and control loads from the utility side, and that

[9] http://www.unido.org/fileadmin/import/83268_Module15.pdf

can convert unsustainable energy practices into better efficiency and sustainable energy use.

The term Demand Side Management was first coined after the energy crisis in USA in the year 1973, since then, DSM is also known as Energy Side Management, the ultimate aim of which is to reduce the peak demand of power plant and to flatten the load curve as DMS has different means for different categories of people. For the generating company, Distribution Company and the consumers DMS has different meaning. For utilities DMS means avoiding or delaying the need to establish new generating capacity by reduction or shift of consumer's energy used period and for consumers DSM means to have an opportunity to save money by reducing their electricity bill by taking advantage of the financial incentives provided by the utility.

For Industrial consumers, DSM is to translate to lower the production cost and more competitive product. In different words DSM means the steps taken by the utility and consumer on meter side to change the amount or timing of power consumption.

iii. Needs of having Demand Side Management

The Indian power sector has multiplied its installed capacity, from 30,000 MW in 1981 to over 2, 28,722 MW at present. Despite this growth in supply, its power system network is struggling to overcome chronic power shortages and poor power quality. With high demand exceeding supply, severe peak (around 18%) and energy (around 10%) shortage continue to weaken the sector. In 1991, IPP proposal exceeds 150,000 MW, while in 2001, just 3,500 MW of IPP power was actually operational. Even if captive market capacity addition of 1500-2000 MW per year is included, a total capacity addition of not more than 6,000 MW a year over the next 4-5 years is only expected. This translated into US$6 billion of investment and several million tons of additional pollutants but would still not close enough to meet the targeted capacity increases. [10]As mentioned before, the ever increasing demand for electrical energy has become a notable feature of modern civilization for quite some time now, we find them in situation, where the gap between the demand and supply of electrical energy is continuously widening. We have failed and have not been able to meet the energy demand.

According to the Central Electricity Authority of India in the year 2012, total generation shortfall during 2011-12 was 8.5% with demand touching 9, 37,199 million

[10] Electricity Demand Side Management: Various Concept and Prospects, International Journal of Recent Technology and Engineering, ISSN: 2277-3878, Volume-I, Issue-I, April 2012, Praveen Dabur.

units and generation lagging at 8,57,886 million units. The absolute shortfall was 79,313 million units during the year. This also indicates the volume of power that the country needs so to meet its ambitions.[11]

Electricity shortages are exacerbated by inefficiencies mainly in end-use system. The inefficiencies in the end use system is due to irrational tariffs, technology obsolescence of industrial processes and equipment, lack of awareness, nascent energy services industry and inadequate policy drivers. The only possible way in handling these crises is to overcome these inefficiencies in end uses is with the Demand Side Management Strategy. Numerous studies in China and other countries have found that cost effective DSM programs can reduces the electricity use and peak demand by 20-40%[12]. In India, great opportunities for reducing energy demand using DSM are available in all the sectors, many are low cost, or even individual can adopt them that help to reduce the electricity demand and per unit generation cost, improving reliability and environment and social improvement.

iv. How did DSM evolved?

The energy shocks of 1970s had a huge impact on the electricity and gas utility industries, these impact have helped give rise to the use of DSM strategies. Sharp increase in the fuel process was accompanied by high inflation and interest rate. Consequently, the cost of building, financing and operating power plants greatly increased. The resulting rate increases were met with unprecedented customer reaction in the form of vocal outcry and changes in energy use patterns. After years of operating in a stable environment, utilities and other energy suppliers were suddenly presented with high levels of uncertainty concerning two crucial elements of the planning process: projections of costs and customer demand. As resource planning for energy suppliers became more difficult, the consequences of making inaccurate projections became so immense that default and bankruptcy became real possibilities for the first time in the utility industry since Great Depression.

[11] http://www.alstom.com/press-centre/2014/9/alstom-td-india-to-supply-power-transformers-in-bhutan last visited on 10.11.2015 at 11:30 am.
[12] www.upm.ro/proiecte/EEE/Conference/papers/s335.pdf.

The rise in electricity process prompted customers to reduce consumption. The abrupt changes in global energy industry were manifested in several ways:

- Planning energy infrastructure was plagued by the uncertainty of future demand for energy.
- Energy conservation measures became more attractive to consumers as electricity costs rose.
- Promoting DSM measures became less expensive to the governments and utilities than the generational alternatives in many cases.
- Utilities and governments sought ways to alleviate customer and citizen dissatisfaction by providing service options that offered the opportunity to gain control over electricity bills.

Load management programme was the 1st step taken by the utilities and government in this direction. Load-management programs focus on reducing customer use strategically at the time of high utility-system loads. The goal is to avoid construction of generation, production, and delivery facilities that would be operated for relatively few hours per year and/or costly wholesale purchases when customer loads can be shifted or displaced at a lesser cost. In many ways, this is the most mature part of DSM activity to date; many utilities have well-developed and significant load management programs.

There are several important components of load management activities, including direct load control (DLC), pricing-based options (interruptible/curtailable rates or seasonal rates), and thermal energy storage. The initial program efforts were hardware-centered and did not sufficiently consider customer needs. The objectives were to identify technologies that worked in peak clipping, valley filling and load shifting and push then into the marketplace. These load management efforts were followed closely by the early interest in "conservation." Again, technology was the driving force of these early conservation programs. Utilities and governments maintained an inventory of energy-saving actions, and they would test hardware options and provide information to customers about possible energy savings from technology adoption.

Instead of using technology or hardware as the driving force behind programs, DSM was the first marketing strategy that specifically promoted a customer focus. Instead of conducting "what- if" studies on individual technologies, DSM allowed an integrated look at technology options, customer needs, and utility considerations.

The DSM framework was initially brought for two reasons. First, it responded to the need for a logical process to help energy planners optimize the supply–demand interface.

Second, it presented a unique marketing tool. The DSM framework was structured to convince supply-side planners that "demand need not to be considered as was apparent. In practice, DSM became an umbrella for increased efficiency, load management and conservation, all with an emphasis on reducing the need for energy.

Demand Side Management involves co-operatvie action by the utility and the consumer both to modify the consumer load curve resulting in savings to the consumer, utility and society at large. This can meet the load objectives of the utility and can include energy efficiency and load shifting. A well designed DSM programme needs to have low transaction costs, should not effect the utility revenues, should have significant potential for savings and should have high consumer participation/ interest.

Chapter IV

5. DEMAND SIDE MANAGEMENT IN POWER SECTOR

This section of the research will include the applicability of Demand Side Management in generation, transmission and distribution, what technologies are required, what have been implemented and what is the outcome of the application of DMS measures. As has been discussed before in the study DSM program can reduce energy costs for utilities, and in the long term, the same can limit the requirement for further generation capacity augmentation and strengthening of transmission and distribution system. There are different ways with which the energy can be conserved which are given as follows:-

Supply Side

- Improving existing thermal power station performance
- Grid management
- Improvement in transmission and distribution system

Demand Side

- Industrial Sector
- Domestic Sector
- Commercial Sector
- Agricultural sector

This section of the study will cover the analysis of what the government proposes in its 12th Five Year Plan w.r.t the DSM activities. [13]

i. 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. All that is said in the plan is in a very positive tone and does not address the particle

[13] India, Energy Policy, Laws And Regulations Handbook, Volume-I, Strategic Information And Basic Laws.

challenges to its implementation. There is no mention as to how the implantation will be done, who will ensure the implementation and through what channel will it be commenced. Further it is said that 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:

a. Load Survey

Vision -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 can be adopted by the DISCOMs. Also it is envisaged that DISCOMs to develop utility/city level load profiles which can be uploaded on DISCOMs and BEE's DSM website on a periodical basis which can be utilized for DSM plans and for further analysis.

Comments- there is no mandatory provision which pushes the DISCOM to conduct such activities. Already there is a humongous dearth in the manpower of the organizations, this probably will not add to their enthusiasm for sure.

b. Load Strategies

Vision- 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.

Comment- All that is mentioned above is in a good spirit but lacks particle approach. There are many places in the country where system management is very poor. In the rural area the networks are old and withered. Moreover, in the industrial areas too load shedding takes place very often and without intimation which injures the equipments of the utility. This all is due to the lethargic approach and environment in the utilities. The present system is very poor to adopt the new technology which can only be implemented if a dedicated institution is set up in every state.

c. Demonstration Studies

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

Comment- this can be effective but gain the question is who will do it ?

d. Advanced Metering

Vision- 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.

Comment- this can be a lucrative option in the metro-cities but there are various states in the

country where 100% metering has not been able to achieve.

e. DSM Financing

Vision & Comment- 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 of peak demand reduction and the net saving in infrastructure due to that should be used for DSM/DR activity. This is again a government initiative and does not provide a direct benefit to the utility or to the consumer.

ii. Industrial Sector

It is observed from the various sources that were considered during the study that the total commercial energy consumed by the industries and Small Medium Enterprise (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. Therefore, the 12th Plan proposes that:-

(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 to2016-17 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.[14]

The instruments with which we can 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 should be widened. The anticipated savings in the year 2016-17 of the 12th Plan is certainly high in electricity and thermal energy respectively. The industries have to be encouraged even more in this direction.
  - *Notification of Energy Intensive Sectors as Designated Consumers (DC)*- After the notification of Designated Consumers (DC) among selected industrial sectors, there has been concerted efforts to 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 but unfortunately very few have been able to achieve.

- *Enhanced Capacity Building of Energy Management Professionals (National Certification Examination* - Enrolment & success in National certification examination for Energy Managers / Auditors from industries has been growing at a decent 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

[14] Report of The Working Group on Power for Twelfth Plan (2012-17), Government of India, Ministry of Power, January 2012.

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. With the 2010 amendment in the EC Act the government allowed trading in the energy certificates. 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 through certification of energy saving which can be traded. In other words it aims to improve energy efficiency in industries by trading in energy efficiency certificates in energy-intensive sectors. The scheme is expecting an energy saving of million tons of oil equivalent in seven selective industrial sectors and in Thermal Power Stations by 2014-15. However, there is not much done in this regard too, though the scheme is good but again the market has it own apprehensions and challenges.

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 fund requirement is Rs. 190 crore to support the proposed PAT schemes.[15]

(b) Small & Medium Enterprises

The SME sector is a very important constituent of the Indian economy, contributing significantly in GDP, manufacturing output and export. Also, 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.[16] 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 which are 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

[15] Ibid
[16] Ibid

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 biggest challenge that is faced here is that the process for doing this activity is very lenthy a the people are not much familiar with this set-up. It requires a dedicated institution and a large human resource which is again a limitation in the govenement organizations as well as in other institutions. BEE cannot alone manage all, the SDA have to be pro-active in this regard only then can we achieve what we intend.

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. The S&L Program was quite successful during the 11th Plan period and has contributed to a huge savings of energy. By far this scheme has been able to build confidence among the consumer and the suppliers.

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. Now, the question also arises as to the authenticity of the survey as the data which is available for conducting these surveys raises serious questions. The authenticity of the data available and the survey is doubtful. So it is difficult to say whether the scheme has made a significant change or not. The market survey gives some clarity and not the survey of the organization per se which

can be manipulated.

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. 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.

➢ 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.[17]

(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)[18]. The primary objective of MTEE is to accelerate the shift to energy efficient appliances through innovative measures to make the products more affordable and durable. 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. The market is slowly opening up to this sector and it will take some time as we do not have many manufacturer in the area of such specialised appliances. Moreover, the demand of these appliances is not much so therefore, it will take some time to build the market for this specific sector. Usually, only a handful of manufacturers account for 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. This has again various challeneges, who will be the nodal agenec, why will the consumer trust the companies if they come in direct interation with the consumers. If there occurs any issue with the appliance, where will the consumer go ? whom to approach?. 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

[17] Ibid

[18] NMEE is one of the schemes of Bureau of Energy Efficiency to promote Energy Conservation and Energy Efficiency. It is one of the eight missions under the National Action Plan on Climate Change (NAPCC). NMEEE aims to strengthen the market for energy efficiency by creating conducive regulatory and policy regime and has envisaged fostering innovative and sustainable business models to the energy efficiency sector.

Super efficient appliances (SEA) may consume 30 to 50 percentages less energy than the five star rated e[19]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.

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.[20]

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.[21]

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 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

[19] Ibid
[20] Ibid
[21] Ibid

crore for capacity building and creating awareness regarding S&L and SEEP.[22]

iii. 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 for day use office buildings, BPOs and Shopping complexes have been developed and many 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, approximately 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.[23]

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[24] mode.

[22] Ibid
[23] Ibid
[24] An energy service company or energy savings company (ESCO or ESCo) is an commercial or non-profit business providing a broad range of energy solutions including designs and implementation of energy savings projects, retrofitting, energy conservation, energy infrastructure outsourcing, power generation and energy supply, and risk management.

iv. Residential Sector

a. Bachat Lamp Yojana

The residential sector accounts for around 25.87 percent of the electricity demand in the country. The lighting load comprises of approximately 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 which depends on the respective State. 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 for replacement under the BLY scheme. This Bachat lamp Yojana Scheme is registered as Programme of Activities (PoA)[25] 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

[25] PoA is a modality of project development under the Clean Development Mechanism (CDM) of the United Nations Framework Convention on Climate Change (UNFCCC). Under a programme of activities (PoA) it is possible to register the coordinated implementation of a policy, measure or goal that leads to emission reduction. Once a PoA is registered, an unlimited number of component project activities (CPAs) can be added without undergoing the complete CDM project cycle.

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).

v. Agriculture Sector

a. 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, 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[26].

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

[26] Ibid

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.

vi. Municipal and Public Utility Sector

a. 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[27]. Other Municipal's region neither had energy cells nor having any medium for collection of data for improvement of energy efficiency.

b. 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.[28]

c. Energy Efficiency in Water pumping

During the course of initial Investment Grade Audits[29] (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, were covered during the sample based survey for situation analysis. In this study, the overall estimated electricity consumption in the pumping was 1040 MU with an estimated electricity saving potential of 208 MU.[30]

Based on the survey done by the government, major funding requirement is assessed for the MuDSM Scheme as this scheme would create an institutional mechanism for implementation of the DSM 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

[27] ibid
[28] Ibid
[29] Investment Grad Audit is a technical and economic analysis of potential energy saving projects in a facility that Provides information on current energy-consumption.
[30] ibid

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.

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.

Human Resource & Development Programme

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.

Chapter V

6. Smart Grid Network

One of the key component of DSM measure, it is also one of the essential ambitious programmes of the Ministry of Power. Once the Smart Grid Network is established in the country it will reduce the T&D losses, help the consumer in reducing their energy bills and utilise the supply of power to a great extent. Though establishing the smart grid network requires huge cost investment, but is better than establishing a new power plant. There are many other challenges of establishing this network one of which is cyber security, which can create havoc, if not managed properly. This chapter will analyse how USA has brought in Smart Grid Network in it cities and its processing and then will study the status of India in this regard.

i. United States Of America

Based on the working of major utilities, the study identifies six key levers of successful energy efficiency and DSM initiatives such as rates, the incentives taken, access to the information, technology available and controls, education and marketing, and customer insight and verification. Each of the lever has a distinct impact on customer behavior and depending on the circumstance of the particular utility, such as its customer base and geography, certain combinations of actions within and across levers will produce greater results.

a. Rates.

Utility tariffs are already designed to achieve a range of objectives, from making electricity more affordable for lower-income customers to making electricity prices better reflect the cost of generation. Fully 60 percent of the benefit from demand response predicted by FERC for 2019 will come from altered pricing programs. Utilities will need carefully to tailor their tariff designs, including opt-in or opt-out participation, to yield the desired behavior. Utilities (and their regulatory partners) must also account for the winners and losers in any rate design and ensure that particular segments, such as socio-economic classes, do not bear unnecessary costs. [31]

[31] Unlocking Energy Efficiency in the U.S. Economy, McKinsey Global Energy and Materials, July 2009.

b. Incentives.

To encourage participation in demand-side management programs, utilities have found that rebate checks, compensation for participating in a pilot, or free technology such as an in-home display can increase customer adoption.

c. Access to information.

When consumers have access to real-time information they become much more aggressive about managing their usage. In a series of pilots conducted by Hydro One in Canada, customers reduced their electricity consumption by 6.5 percent based on information provided through an in-home display. Power, a smart grid information services company, has developed software that analyzes a customer's bill and compares usage to other customers in the area with similar attributes such as house size. The utility can then provide recommendations on how to reduce energy use. This software has been piloted by the Sacramento Municipal Utility District (SMUD) and has produced energy savings of 3 percent.

d. Utility controls

Direct load control programs are used to curb demand, such as air conditioning, during critical peak periods. The smart grid will enable customers 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 match customer preferences. Increasing levels of control by utilities will enable automated demand response programs, ensuring load shed and enabling utilities to bid this capacity into markets as a resource.

e. Education and marketing.

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

f. Customer insight and verification.

To drive improvements, it is essential to verify DSM program results and collect feedback, regardless of whether the targets are broad or narrow. A powerful benefit of the smart grid is that it enables verification of the impact of DSM programs over different time horizons.

Successful pilots indicate complementary effects interact across the levers and design options.

Providing both in-home displays (IHDs) and pre-pay options, for example, resulted in energy conservation benefits of 13 to 15 percent, while IHDs alone yielded a median impact of 7 percent.

Impact of demand response (DR) on U.S. peak load Gigawatts of peak load expensive, causing programs often to be focused on only the largest customers. The next wave of DSM programs promises to change the face of energy savings throughout the global economy. McKinsey estimates that by 2020 the United States could cut end-use energy consumption by 9.1 quadrillion BTUs, over one-fifth of its total projected demand.1 FERC estimates that demand response programs could cut peak demand by up to 20 percent within 10 years.[32]

ii. The growing role for smart grid

Smart grid provides the scale and scalability— to make demand-side management cost-effective and convenient. The pieces are falling into place: the increasing penetration of smart meters, which may allow homes to connect to data on usage and price; the promise of ubiquitous data networks; and an intelligent grid that gives utilities visibility into real-time supply and demand balancing. These technologies give the DSM programs now being designed by utilities a number of crucial advantages over those of the past.

- Real time information. U.S. utilities alone have committed to the purchase of over 40 million smart meters over the next 5 years. The inevitable prevalence of smart meters will allow utilities to collect and analyze usage information at intervals as narrow as 1 hour or even 15 minutes, rather than relying on a manual monthly reading. This data can be transmitted to consumers in their homes via a home-area network (HAN), allowing real-time feedback on consumption.
- **Two-way networks.** Smart grid networks allow utilities to collect usage data and verify reduced demand (load shed), as well as send time-of-use rates and other information to the customer. Network costs are low enough to justify near-ubiquitous deployment, allowing utilities to communicate in near real time with their entire customer base.

[32] The Smart Grid and The Promise of Demand Side Management, Brandon Davito, Humayun Tai, and Robert Uhlaner, 2010

- **Integration of utility information systems.** The smart grid is driving utilities to stitch together many disparate information technology solutions into highly capable decision engines. By communicating the underlying cost of electricity, utilities can begin to develop a comprehensive view of their customer base, and build targeted programs to appeal to specific segments of customers.
- **Shifts in customer behavior.** The availability of real-time data on energy costs and consumption comes at a time when customers are increasingly aware of the cost and environmental impact of their energy usage, and have begun to expect price fluctuations and an ability to respond to price.
- **Regulatory changes.** Some states, including California, have enacted decoupling regulations that allow utilities to recover revenues lost due to DSM programs. Utilities and regulators have also explored opportunities to use demand response as another source of generation through "megawatts," or the ability to reduce load upon request. Some states and regional grid operators, such as the New England ISO's Ancillary Services Market Project, allow utilities to bid demand response capacity into the wholesale market as if it were generation. This encourages utilities to pursue DSM opportunities, and may improve the efficiency of the market as a whole.

iii. Capabilities required

While smart grid technologies will make these savings possible, utilities will have to build new capabilities to capture the potential benefits fully. A primary focus will be on augmenting program design functions to enable the micro-targeting of customers.

- **Increase the number of products and programs.**

  Smart grid technology will slash the cost of developing, managing, and refining DSM programs. Smart meter networks provide near-ubiquitous connectivity to electric meters, which increases the ability to verify impact, and makes it easier to test and refine different design options. Lowering the cost of deploying DSM programs not only will make it cost effective to provide offerings to the mass market, but it will also enable utilities to use the demographic data they gather to target micro-segments of their customer base with tailored programs.

- **Manage a partner ecosystem.**
  Many utilities and regulators predict smart grid networks will become open platforms that allow third-party development of energy management applications. In this world view, utilities will need to develop the capability to manage and coordinate a wide variety of complementary partners, and will need to clearly define their role in the ecosystem.
- **Accelerate the pace of testing.**
  The two-way reach of smart grids will allow utilities to speed and widen the testing cycle for new products. They will be able to "test and learn" to understand which program features are most effective for specific segments, thereby reducing the time to market for new ideas. Someday, utilities may be more like Capital One Bank, whose rigorous analytics and iterative marketing strategy measure the relative impact of hundreds of thousands of different offers (rates, card designs, promotional materials), to determine which ones have the greatest effect on customer behavior.
- **Build account management capabilities.**
  The Federal Energy Regulatory Commission estimates that two-fifths of the DSM opportunity in the U.S. lies in about 262,000 large commercial and industrial customers. While many of these customers participate in fledgling DSM programs such as curtailment and direct load control, some have never been directly affected by these programs. Utilities will need to develop full-service support for customers to navigate and manage what will likely be increasingly complicated DSM programs.
- **Educate residential customers.**
  Almost half of the demand reduction potential for 2019 comes from the highly fragmented residential market. To reach this market, utilities will have to develop easy to understand programs that give customers the tools (and the incentives) to better manage their energy use.

Even with these new capabilities being brought to market as part of the smart grid, two hurdles remain for DSM to become a reality: the right blend of technology and program design must be adopted to optimize results; and, importantly, regulatory reforms that will allow utilities to capture value from demand-side management need to be established

Utilities have every reason to be sceptical about projections of demand-side management results. Since the 1970s, they have tried to capture load shifting and load reduction benefits, with mixed results. These efforts, however, were limited in scope and relied on costly, proprietary technology solutions.

The good news is that there has been significant progress in areas vital to the success of DSM. Utilities are using federal stimulus funding opportunities to deploy statistically significant pilots to measure the impact of various DSM program designs. And regulators are considering reforms that credit utilities for demand-side reductions. Still, much work at all levels remains to be done if the economic and social promise of DSM is to be fully realized in the next decade.

iv. What is Prompting Smart Grid In India ?

Environmental Impact Smart Grid development is happening at a very fast pace because of the broad interest of policy makers and utilities in decreasing the adverse effect that energy usage has on the environment. Smart Grids uses technology to drive efficiencies in transmission, distribution, and consumption. As a result, fewer generating plants, fewer transmission and distribution assets are required in order to cater the growing demand of electricity. With the possible expectation of wind farm sprawl, landscape preservation is one of the evident benefits. Since maximum generation today results in emission of greenhouse gas, Smart Grids reduces air pollution and plays a significant role in combating global climate change issue. Smart Grids has the capability to accommodate technical difficulties of integrating renewable resources like wind and solar to the grid, providing further reduction in greenhouse gas emissions.

Costs The ability to bypass the cost of the plant and grid development is a major advantage to both the utilities and customers. And Smart Grids will not reduce funds expansion, of course; therefore huge investments are required in order to setup a link between the customers and the Smart Grid. Further with the aid of Smart Grids less generating units would be required in order to fulfill the energy demand of the growing population and cost of setting up more and more plants can be deferred. At that point of time, more emphasis will be on overall development of T&D efficiency based on demand response, load control, and many other Smart Grid technologies. Energy efficiency would be the second priority in

order to save cost with reference to the customers. With timely and detailed information provided by Smart Grids, customers would be encouraged to limit waste, adopt energy-efficient building standards, and invest more and more in energy efficient appliances. Utility Operations Smart Grids can assist the utilities, as the principal focus of the utilities is to improve business processes. Many utilities have an extensive list of projects that they would like to fund in order to improve the customer service or to ease workforce's burden of repetitive work. Calculating Smart Grid benefits by the cost/benefit analysis it puts emphasis in favor of the change and can also significantly decrease settlement/payback periods. Mobile workforce group and asset management group work collectively to organize assets and then maintain, renovate, and replace them. Thus results in increased productivity and fuel saving from superior methods. Similarly, Smart Grid provides customers with real time information and encourages them to do online payments, thus lowering billing costs. Utilities can include these cost and service improvement in the list of Smart Grid benefits. Theft Control is not an issue in developed countries like US, but in developing countries like India, where people have a little insight of the grid and higher poverty rate, power theft is quite common. With development of Smart Grid, power theft can be controlled to a greater extent, thereby improving the efficiency of our distribution system. Thus grids will provide higher quality and reliable power supply, and there will be fewer blackouts.

v. Barriers In Implementation of Smart Grid

a. Policy and Regulation

The current policy and regulatory frameworks were typically designed to deal with the existing networks and utilities. To some extent the existing model has encouraged competition in generation and supply of power but is unable to promote clean energy supplies. With the move towards smart grids, the prevailing policy and regulatory frameworks must evolve in order to encourage incentives for investment. The new frameworks will need to match the interests of the consumers with the utilities and suppliers to ensure that the societal goals are achieved at the lowest cost to the consumers. Generally, governments set policy whereas regulators monitor the implementation in order to protect the consumers and seeks to avoid market exploitation. Over the last two decades, the trend of liberalized market structure in various parts of the world has focused the attention of

policymakers on empowering competition and consumer choice. The regulatory models have evolved to become more and more effective to avoid market abuse and to regulate the rates of return. Moving forward, the regulatory model will have to adopt the policy which focuses much on long term carbon reduction and security of supply in the defined outcomes and they need to rebalance the regulatory incentives to encourage privately financed utilities to invest at rates of return that are commensurate to the risk. This may mean creating frameworks that allow risk to be shared between customers and shareholders, so that risks and rewards are balanced providing least aggregate cost to the customer.

Business Scenario

The majority of examples results in negative business cases, undermined by two fundamental challenges:

- High capital and operating costs – Capital and operating costs include large fixed costs linked to the chronic communications network. Hardware costs do not cause in significant growths in economies of scaleand software integration possess a significant delivery and integration risks.
- Benefits are constrained by the regulatory framework – When calculating the benefits, organizations tend to be conservative in what they can gather as cash benefits to the shareholders. For example, in many cases, line losses are considered to be put on to the customer and as a result any drop in losses would have no net impact on the utility shareholder. The smart grid benefits case may begin on a positive note but, as misaligned policy and regulatory incentives are factored in, the investment becomes less attractive. Therefore regulators are required to place such policies and regulations in place which could provide benefits both to the utilities and the consumers. Therefore the first factor to be considered is to provide incentives to the utilities in order to remove inefficiencies from the system. They should be aptly remunerated for the line losses on their networks. On the budget side of the calculation, there is no avoiding the fact that smart technologies are expensive to implement, and at the present level it is right to factor in the risk associated with delivery. But the policy makers and regulators can mitigate that risk by seeking economies of scale and implementing advanced digital technologies.

b. Technology Maturity and Delivery Risk

Technology is one of the essential constituents of Smart Grid which include a broad range of hardware, software, and communication technologies. In some cases, the technology is well developed; however, in many areas the technologies are still at a very initial stage of development and are yet to be developed to a significant level. As the technologies advances, it will reduce the delivery risk; but till then risk factor have to be included in the business situation. On the hardware side, speedy evolution of technology is seen from vendors all over the world. Many recently evolved companies have become more sceptical to the communications solutions and have focused on operating within a suite of hardware and software solutions. Moreover the policy makers, regulators, and utilities look upon well-established hardware providers for Smart Grid implementation. And this trend is expected to continue with increasing competition from Asian manufacturers and, as a consequence, standards will naturally form and equipment costs will drop as economies of scale arises and competition increases. On the software and data management side, the major challenges to overcome the integration of the entire hardware system and to manage high volume of data. With multiple software providers come multiple data formats and the need for complex data models. In addition, the proliferation of data puts stresses on the data management architecture that are much similar to the telecommunications industry than the utilities industry. Many of these issues are currently being addressed in pilots such as Smart Grid task force and, as a consequence, the delivery risk will reduce as standards will be set up.

c. Lack of Awareness

Consumer's level of understanding about how power is delivered to their homes is often low. So before going forward and implementing Smart Grid concepts, they should be made aware about what Smart Grids are? How Smart Grids can contribute to low carbon economy? What benefits they can drive from Smart Grids? Therefore:

- Consumers should be made aware about their energy consumption pattern at home, offices...etc.
- Policy makers and regulators must be very clear about the future prospects of Smart Grids.
- Utilities need to focus on the overall capabilities of Smart Grids rather than mere

implementation of smart meters. They need to consider a more holistic view.

d. Access to Affordable Capital

Funds are one of the major roadblocks in implementation of Smart Grid. Policy makers and regulators have to make more conducive rules and regulations in order to attract more and more private players. Furthermore the risk associated with Smart Grid is more; but in long run it is expected that risk-return profile will be closer to the current situation as new policy framework will be in place and risk will be optimally shared across the value chain. In addition to this, the hardware manufacturers are expected to invest more and more on mass production and R&D activities so that technology obsolescence risk can be minimized and access to the capital required for this transition is at reasonable cost.

e. Skills and Knowledge

As the utilities will move towards Smart Grid, there will be a demand for a new skill sets to bridge the gap and to have to develop new skills in analytics, data management and decision support. To address this issue, a cadre of engineers and managers will need to be trained to manage the transition. This transition will require investment of both time and money from both government and private players to support education programs that will help in building managers and engineers for tomorrow. To bring such a change utilities have to think hard about how they can manage the transition in order to avoid over burdening of staff with change.

f. Cyber Security and Data Privacy

With the transition from analogous to digital electricity infrastructure comes the challenge of communication security and data management; as digital networks are more prone to malicious attacks from software hackers, security becomes the key issue to be addressed. In addition to this; concerns on invasion of privacy and security of personal consumption data arises. The data collected from the consumption information could provide a significant insight of consumer's behavior and preferences. This valuable information could be abused if correct protocols and security measures are not adhered to. If above two issues are not addressed in a transparent manner, it may create a negative impact on customer's perception and will prove to be a barrier for adoption.

vi. Solutions to Overcome the Barriers In Implementation

Despite the challenges mentioned above, there are a number of steps that can be taken to speed up the implementation of smart grid technologies. Foremost step that is required to be taken is that policy-makers and regulators need to restructure the economic incentives and align risk and reward across the value chain. By building the right economic environment for the private sector investment and focusing more broadly about the way that social value cases are created and presented implementation would become much easier. By analyzing these solutions in bigger environments i.e. in cities, the entire industry will learn what it takes to implement smart grid successfully and will result in developing an industry that is set to boom in the coming periods.

a. Forming Political and Economic Frameworks

Policy makers and regulators have to implement a framework which optimally spread the risk over the whole value chain i.e. to guard the investors from risk and to yield the result at lower cost to the customers. They have to form a robust incentive model in order to attract more and more private investment. Also rate of return should be based on the output generated. Rewards and penalty mechanism should be considered in order to monitor the performance of the utilities and to encourage them to deliver the outcomes in the most efficient manner. Technological and delivery risk associated with Smart Grid are significant. And this can be overcome over a due course of time as more issues arise and are addressed. Risks associated with Smart Grid have to be shared by every member across the value chain. While making the framework regulators must consider how much of that risk a utility can pass on to the contractors, suppliers and consumers. By maintaining the proper balance, there will be an improved alignment of the incentives. And further they have to tackle numerous policy disputes and recommend potential solutions.

b. Moving Towards a Societal Value System

The major challenge for the transition from analogous to digital infrastructure will be to move from utility-centric investment decision to societal-level decisions which determine wider scopes of the Smart Grid. This would help in the accelerated adoption of Smart Grid Technology by the society.

c. Achieving greater efficiency in energy delivery

Smart Grid Technology should consider building greater efficiency into the energy system

which would result in reduction of losses, peak load demand and thereby decreasing generation as well as consumption of energy. New regulatory framework which incentivizes utilities for reducing the technical losses would help utilities to perform more efficiently.

d. Enabling distributed generation and storage

Smart grids will change where, when and how energy is produced. Each household and business will be empowered to become a micro-generator. Onsite photovoltaic panels and small-scale wind turbines are the predominant examples; developing resources consist of geothermal, biomass, hydrogen fuel cells, plug-in hybrid electric vehicles and batteries. As the cost of traditional energy sources continues to rise and the cost of distributed generation technologies falls, the economic situation for this evolution will build.

e. Increasing Awareness on Smart Grids

There is an imperative need to make the society and the policy makers aware about the capabilities of a Smart Grid. The main step is to form a perfect, universal description onthe common principles of a smart grid. Beyond agreement ona characterization, the matter also needs to be debated more holistically as a true enabler to the low-carbon economy, rather than as an investment decision to be taken within the meeting room of distinct utilities. The importance of consumer education is not to be underestimated. The formation of user-friendly and state-of-the art products and services will play a significant role in convincing the societyabout Smart Grids. Also the utilities are required to scrutinize the major challenges in implementation of Smart Grid and their impact on their business model and operations.

f. Creating a Fresh Pool of Skills and Knowledge

Successful implementation of the smart grid will require a large number of highly skilled engineers and managers mainly those who are trained to work on transmission and distribution networks. As a result to on-job training and employees development will be vital across the industry. Simultaneously, there is a requirement for investment in the development of relevant undergraduate, postgraduate and vocational training to make sure the availability of a suitable work force for the future. The investment in T&D should not be limited and neither in research and knowledge development, which would be essential for the development of this sector.

g. Addressing Cyber security Risks and Data

Privacy Issues Smart Grid success depends on the successful handling of two major IT

issues:

- Security
- Integration and data handling

With increase in computers and communication networks comes the increased threat of cyberattack. The Government should look into this matter because consumer's consumption data can be misused by the utilities and the third party. Utilities have to give assurance to the consumers that their valuable information is handled by authorized party in ethical manner. The government has to adopt high standard level in order to withstand cyber-attacks.

On Going Smart Grid Initiatives[33]

- APDRP, R-APDRP initiative for distribution reform (AT&C focus)
- DRUM India – Distribution Reform Upgrade, Management
- Four pilot sites (North Delhi, Bangalore, Gujarat, Maharashtra)
- Smart Grid Vision for India
- Smart Grid Task Force – Headed by Sam Pitroda
- BESCOM project – Bangalore – Integration of renewable and distributed energy resources into the grid
- KEPCO project in Kerala India - $10 Billion initiative for Smart-Grid
- L&T and Telvent project – Maharashtra – Distribution Management System roll-out
- Distributed generation via roof-top solar for 40% in a micro-grid.

[33] http://smartgrid-for-india.blogspot.in/, last visited on 11.11.2015, at 10:30am

Chapter VI

7. Review of DSM activities

In this section, we have summarised the DSM activities of SERCs, DISCOMs, and SDAs in different states in the country.

i. Activities of State Actors

a. State Electricity Regulatory Commissions (SERCs)

SERCs have mostly relied on those measures which have strong legal backing as given in the Electricity Act 2003, such measures include tariff mechanisms, such as the Time of Day (ToD) tariff, incentives and surcharges based on the power factor and load factor, as well as kVAh billing. The SERCs in Maharashtra, Gujarat and Tamil Nadu have issued DSM regulations, while Delhi has put out draft DSM regulations which are yet to be notified and there are many states which have not yet started thinking on this direction. Maharashtra also has regulations on the procedure to determine the cost-effectiveness of DSM programmes. A number of SERCs have issued general as well as specific directives to the DISCOMs regarding DSM in their periodic tariff orders. Also, quite a few SERCs have allowed the DSM expenses to be included in the ARR to be recovered from the consumers. In a few states, the SERCs have asked DISCOMs to include savings from the DSM activities in their power purchase planning.

a (i). Tariff Mechanisms

The Time of Day (ToD) tariff is the most commonly adopted tariff mechanism by SERCs. Under this tariff, peak hours are specified depending upon the system peak and demand. The peak hours can be morning peak hours, evening peak hours, or both depending upon the consumption pattern. There is a surcharge on the energy charges if the consumption is in the specified peak hours. Barring two states, AP and WB, all the SERCs that have been reviewed

offer a rebate on the energy charges for the consumption in specified off-peak hours. [34]In Delhi, the ToD tariff varies depending on whether the season is a peak season or an off-peak season. The ToD is mandatory in some states, typically for High Tension (HT) consumers, and some categories of Low Tension (LT) consumers as well. ToD meters should be fitted by the DISCOMs in order to measure time-wise consumption.

The two common barriers for the ToD tariff implementation in the states have been opposition from consumers who state their inability to shift loads, and delay by DISCOMs in their efforts to install ToD meters. Most of the states seem to have overcome this barrier and the ToD tariff is in place. However, there has been no systematic study to evaluate the impact of the ToD tariff on the peak demand. In many cases, the ToD peak hour timings and tariff have been determined on an ad-hoc basis.

Almost all the states have surcharges for low power factor. These are mostly directed towards the HT consumers, but are also applicable to some LT categories of consumers. There is a minimum value specified for the power factor, and the surcharge increases in steps as the power factor goes down. Some SERCs have also approved incentives for consumers with power factors above the specified limit. Also, some SERCs adopt the lead + lag logic in calculating the power factor, whereas some ignore the lead power factor. A number of states have also introduced kVAh billing which incorporates the power factor, thus eliminating the need for levying the surcharge additionally. Nonetheless, the SERCs have continued with the power factor surcharge as well as the kVAh billing. Also, some SERCs have mandated LT consumers to install measures like capacitors, or ISI marked motors. This won't have any tariff impact, but in case the DISCOMs observe that these measures are not being complied with, then they can levy penalties and also cut power supply.

Andhra Pradesh has a unique differential tariff for agricultural consumers based on the implementation of DSM measures. The agricultural connections with DSM measures like frictionless foot-valves, capacitors, good piping and ISI marked pumps have a lower tariff than the connections without DSM measures. All new connections are supposed to be provided with DSM measures. However, there is no information about whether this is being followed, and about the impact of the differential tariff.

(ii) Regulations

[34] Demand Side MAngement in India: An Overview of State Level Initiatives, Aditya Chunekar, Mrudula Kelkar, Shantanu Dixit, September 2004.

The Forum of Regulators (FoR) issued model DSM regulations in 2008[20]. Few of the states have adopted these regulations with minor changes. These regulations provide guiding principles for several aspects of DSM measures such as core objectives, research activities, planning, funding sources, programme approval, monitoring, evaluation, and sharing of information. The regulator is required to establish DSM targets for each DISCOM, and the DISCOM in turn is required to make DSM an integral part of their day-to-day operations, and plan, design, and implement various programmes. SERCs from Maharashtra, Gujarat, and Tamil Nadu have notified DSM regulations in their states, while Delhi has published draft DSM regulations. The SERCs in Maharashtra and Tamil Nadu have also established a DSM Consultative Committee (DSM-CC) at the commission. The primary objectives of the DSM-CC are

(a) to assist the commission in evaluating, reviewing, and monitoring the DSM measures by DISCOMs;

(b) to advise the DISCOMs on conducting various studies like load research, consumer behavior, etc. and

(c) to act as a platform to enable the DISCOMs to share their experiences, and interact with the commission on DSM.

The members of the committee are from the commission, DISCOMs, SDAs, academic institutions, and consumer organisations. Along with the DSM regulations, the SERC in Maharashtra has also notified regulations to determine the cost-effectiveness of DSM programmes. Only those programmes meeting the cost-effectiveness criteria are approved by the commission, and the costs can be included in the ARR.

(iii) Directives

Almost all the SERCs have been consistently issuing directives to DISCOMs asking them to conduct DSM programmes. These directives have tended to be generic, for example: DISCOMs should pursue DSM activities; they should conduct load research studies; they should submit annual reports on the DSM activities. However, the SERCs have been lax in ensuring compliance from DISCOMs. The DISCOMs have been submitting standard responses with no specific information. In states like Andhra Pradesh and Maharashtra, a number of individuals and consumer organisations have raised questions about the progress of the DISCOMs regarding various DSM activities, but the responses from the DISCOMs have been evasive with no follow-

up by the ERCs. In this context, it will be insightful to learn the fate of two important directives issued by the SERC in Maharashtra, with a strict follow-up on ensuring the compliance of these directives by the DISCOMs.

(iv) Awareness Generation & Energy Audits

Awareness generation is the most common DSM activity conducted by DISCOMs. The common channels of communication have been leaflets, emails, electricity bills, celebrating the energy conservation day and week, etc. A number of DISCOMs have electricity consumption calculators on their website. These calculators help the residential consumers to estimate the total electricity consumption from different appliances, as well as the possible savings from a switch to energy efficient appliances. Tata Power (Mumbai) runs an innovative campaign called Club Enerjid, by way of which an informal energy conservation club formed in 2007 creates awareness about energy conservation among the general public with a focus on children. Its activities include publishing energy conservation booklets, conducting essay competitions and quizzes, and several workshops and events.

The second most common DSM activity conducted by the DISCOMs is the energy audit for commercial and industrial consumers. Certified BEE energy auditors conduct these audits and identify areas of improvement of efficiency. Tamil Nadu has made an energy audit mandatory for designated consumers.22 However, most of the DISCOMs do not follow-up with consumers on whether they have taken any action based on the energy audits. Hence it is difficult to evaluate its impacts.

(v) Lighting Programmes

Almost all the DISCOMs have undertaken energy efficient lighting programmes in some form or the other. The most common programme was the Bachat Lamp Program (BLY) by the BEE. It was an ambitious programme to replace 400 million incandescent bulbs with Compact Fluorescent Lamps (CFLs). The programme was particularly attractive for DISCOMs as it did not require capital investment. An aggregator or manufacturers invested the money to cover the cost difference of the CFL, and then recovered it through the Clean Development Mechanism (CDM). The programme received a good response initially, but has since been stalled due to the fall in carbon markets. The manufactures are not participating in the programme due to the lack

of a cost recovery mechanism.

Taking a cue from BLY, some DISCOMs have started implementing their own lighting exchange programmes, where they provide CFLs or LEDs at a discount to consumers. They strike a deal with the manufacturers because they purchase in bulk, and the costs are generally claimed in the ARR to be recovered from the consumers. There has been one interesting pilot programme that the MSEDCL (a DISCOM in Maharashtra) conducted to promote CFLs. The CFLs were sold to consumers with a financing scheme through the company billing collection centres, retail outlets, and some self-help groups. The consumers paid a small amount (equivalent to the cost of the incandescent bulb), and the rest of the money was recovered through monthly bills. See Box 5 for more details.

Some DISCOMs have been replacing the existing High Pressure Sodium Vapour (HPSV) lamps and other inefficient types of lamps with LED lighting. DISCOMs have also installed timer switches in some areas to automatically control the switching on and off of street lights. Although a number of DISCOMs have adopted street lighting projects, they have reported difficulties in coordinating with the local municipal bodies for the execution of the project.

(vi) Agricultural DSM programmes

Agricultural consumers all over India are heavily subsidised by the state government and pay either nothing or a tariff much lower than the average cost of supply. Since there is no economic incentive for the consumers to invest in efficiency, inefficient agricultural pump-sets are commonplace. A number of DISCOMs have targeted agricultural consumers for DSM programmes. The most common type of programme has been to replace inefficient pump-sets with 5-star pumps. BESCOM's programme in Karnataka and MSEDCL's programme in Maharashtra are good examples. A number of DISCOMs have also installed capacitors on the pump-sets to improve the power factor. One serious concern of these programmes has been the performance of the energy-inefficient pumps and the capacitors in the field, given the poor quality of power supply to most agricultural consumers. The MSEDCL addressed this issue by providing a 5-year warranty/free-maintenance contract[35]. Another concern has been the measurement of savings from these programmes. Most of the connections are unmetered, and consumers strongly resist any installation of meters.

[35] Effect of Demand Side Management on Present Indian Power Sector Scenario, International Journal of Innovative Research in Science, Engineering and Technology, Vol.4, Issue 2, February 2015.

(vi) Appliance exchange programmes

DISCOMs in Delhi and Mumbai have launched appliance exchange programmes for their consumers and have received a good response. Under these programmes, the DISCOMs provide a substantial rebate to the consumers (to the tune of 40-50%) to replace their old inefficient appliances with new 5-star rated appliances. The old appliances are scrapped in an environment friendly manner. Some DISCOMs are also extending the scheme to new purchases. In some cases, an additional warranty is offered. These programmes have been offered for ceiling fans, refrigerators and air-conditioners. For the latter two, only models less than a specified size are incentivised.

(vii) Solar Water Heater programmes

A number of DISCOMs have provided incentives to residential consumers to shift to the solar water heater since electric water heaters account significantly for morning peak hour electricity consumption. In some states, there are subsidies given by the state government. The Bangalore Electricity Supply Company (BESCOM) has made it mandatory to install solar water heating systems in order to get a new connection. Additionally, a rebate of 0.50/kWh or up to Rs. 50/-, whichever is less, is given to the consumer.[36] Central government assistance is also available for those who install solar water heaters.

(viii) Thermal energy storage

Tata Power launched India's first Thermal Energy Storage (TES) programme for commercial and industrial consumers in Mumbai. The idea behind the TES is to run the central AC plants of buildings at night and convert water to ice which can be stored in ice tanks. During the day, the AC plants are switched off and the building is cooled with the energy stored in ice. The TES has benefits for consumers as well as the DISCOM. The consumers can also avail of the ToD tariff incentives where applicable. The TES system also improves the load factor and the power factor and consumers can benefit from the incentives based on these. With the decrease in overall load, the investment in transformer capacity also goes down. The backup Diesel Generation (DG)

[36] Electricity Demand Side MAnaagemnt: Various Concepts and Prospects, Praveen Dabur, Gurpreet Singh, Naresh Kumar Yadav, International Journal of Recent Technology and Energy, ISSN: 2277-3878, Volume-I, Issue-I, April 2012.

capacity can be reduced. For the utility, it results in a flatter load curve and saves on high power purchase costs. Under this programme, the TPC educates the consumer on installing TES system and provides an online measurement and verification system for the consumer's chillers. It provides an additional rebate of Re. 1/kWh on consumption during the night. As of January 2014, the TPC had engaged 15000 tons of refrigeration (TR) capacity in the programme and achieved a load shift of 3.6 MUs.26

(viii) Demand response

Demand Response (DR) is the consumer's ability to reduce electricity consumption at their location when wholesale prices are high or the reliability of the grid is threatened. There are two types of interventions possible in a DR programme, automatic and manual. The manual DR programme is most basic, wherein the system operator sends a manual signal to the customer through the telephone to curtail his load. The Automated Demand Response consists of fully automated signaling from a utility to provide automated connectivity to customer end-use control systems and strategies. The Tata Power Company – Distribution (TPC-D) in Mumbai has launched a Demand Response programme which is manual. TPC-D in Delhi has launched an automatic DR programme.

TPC-D has a manual DR programme where commercial and industrial consumers with a connected load above 500 kW offer voluntary load curtailment to manage peak demand. The consumers enroll in the programme and a Memorandum of Understanding (MoU) is entered into. In case of events, the TPC-D calls the aggregator who in turn calls individual consumers and asks them to curtail their load. The consumption data during the event is compared with the baseline estimated using the load profile of 4-5 similar days. The events last up to 2 hour each and there can be 50 maximum events in a year. The TPC-D offers an incentive for every unit curtailed. The incentive is paid to the aggregator who in turn pays the consumers. The aggregator also helps the consumers with energy audits to identify the curtailable load at a short notice.

b. State Governments/State Designated Agencies (SDA)

SDAs have been the least active of all the three actors. In most of the states, the renewable energy development agency is the SDA because of which their focus is mostly on RE. All of

them started with about Rs. 2 crores from BEE and equal amount from the state government for the programmes. However, by and large there has been no activity on this front. The most common programmes by SDAs have been awareness programmes and street lighting programmes. [37]One example of this programme is the Belaku programme under which Rs. 20 crores were provided for implementation to the Karnataka Renewable Energy Development Limited (KREDL) during 2012-13 by the Government of Karnataka (GoK). The main objective of the scheme was to replace approximately 20 lakhs incandescent bulbs of beneficiaries with CFL lamps in select villages and towns in all districts in the state. The KREDL website shows no information on the progress of the scheme. Similarly, a number of state governments have come up with orders, such as the Maharashtra government issued Government Resolution (GR) to procure only 4-star and 5-star labelled appliances in all government/semi-government/local bodies, etc. Only where the above appliances are not available, 3-star appliances can be purchased. There is a need to review to what extent these orders have been followed.

On the industrial front, the SDAs are also responsible for implementing the Perform, Achieve and Trade (PAT) programme, which is a market based mechanism to enhance cost effectiveness of improvements in energy efficiency by designated consumers. These consumers will be provided with energy savings certificates that could be traded. The baseline studies have already been conducted, and the scheme is in the implementation phase.

It is imperative to analyse the implementation of these programmes carried out by the SDAs. For this purpose, the BEE comes up with an annual savings report which mentions the energy saved by the SDAs, and there are three such reports available in the public domain. These savings are said to be verified by the National Productivity Council (NPC). For the states that have been reviewed in this study, the latest available report estimates energy savings of a hundred MUs by SDAs of GJ, AP and KA, whereas the estimated potential or self-imposed targets was close to ten to fifteen thousand MUs. The MEDA had started reducing the VAT on CFLs by 4% due to which there were increased sales of CFLs, which in turn saved around 900 MUs 29 which is still very short of the actual potential.

[37] http://gokenergy.gov.in/documents/Belaku%20Yojana_G.O.%20No.%20EN20PSR%202012%20Dtd%2030.01.2013.pdf last visited on 11.11.2015 at 10:30 am

c. Analysis of DSM Initiatives In the States

Being a power sector professional the practical challenges were considered while analysing the existing institutions, EE & DSM related initiatives in the different States. This analysis is presented in the form of comparison between various States with respect initiatives undertaken by SERCs, formation of DSM Cell in distribution utilities, initiatives related to DSM measures undertaken by distribution utilities and initiatives related to EE & EC measures undertaken by SDAs.

a. DSM initiatives by SERCs

As discussed in the previous sections, the SERCs in the four States have taken certain initiatives and issued several directives related to & DSM programmes to the distribution utilities in their jurisdiction. In order to compare the directives/initiatives of SERCs of various States, we have broadly categorised various initiatives/directives into following six broader categories:

- Creation of DSM Cell in SERCs;
- Directives to distribution utility for creation of DSM Cell;
- Directives to distribution utility to undertake DSM activities;
- Tariff related directives that promote DSM e.g. ToD, PF Incentives/Penalty;
- Guidelines to assist distribution utility in undertaking DSM programmes;
- Initiatives to allow recovery of DSM related costs through ARR

Based on the analysis, it is observed that most SERCs have issued several tariff related directives such as ToD & PF incentives and penalties as there is a strong legal backing for these initiatives under EA 2003. Most SERCs have also understood the importance of EE & DSM and directed distribution utilities to undertake DSM related activities. However, initiatives related to formation of DSM Cell in the distribution utilities as well as in Commission itself have not been taken up so easily. Various other innovative initiatives such as preparation of guidelines and allowing recovery of DSM related cost through ARR have been taken up by only MERC though SERCs in other States, during 'one-on-one' discussions have shown their willingness for doing the same.

b. DSM Cell in Utilities and EE&DSM initiatives

DSM Cells have been created by utilities in Maharashtra and Haryana. Followed by MERC directive, the three electricity distribution companies operating in the city of Mumbai have constituted DSM Cells. One of the utilities in Haryana also has a DSM Cell. In Chhattisgarh and Gujarat, a few officials are looking after EE/DSM activities as additional charge.

c. DSM Initiatives by State Designated Agencies

BEE had engaged National Productivity Council to review performance of SDAs. As per the report, the SDAs of the identified States are categorised as ones that are having 'good performance'. The criteria for evaluation used by NPC included broad understanding, resourcefulness, management style and HRD & exposure. SDA's in all the four States have dedicated teams of officials working on energy efficiency and energy conservation activities. They have dedicated resources, funds and implementation mechanisms in place to undertake various activities.

d. Key observations

The review of State initiatives reveals the following key points

- Most SERCs have adopted tariff related DSM measures;
- Most SERCs as well as Distribution Utilities lacks have limited dedicated resources to take up DSM related activities;
- Distribution Utilities have taken up several DSM measures but most of them are pilot scale in nature;
- SDAs have taken initiatives in the area of energy efficiency/ conservation which are mostly market transformation in nature
- Limited capacity in the sector to assess EE & DSM potential in the sector
- Limited capacity to undertake Monitoring & Verification of projects
- Many stakeholders indicated need to engage independent agency for M&V, as well as potential assessment
- Currently very little interface exists between SDA and SERC or utility on EE/DSM issues;
- While SDAs have teams designated for EE/ EC activities, limited understanding of

DSM implementation issues

- Limited or no institutional capability at utility level.

It is evident here that there is a need to establish institutional framework for coordination of activities between SDA, Distribution Utility & Regulatory Commission.

Prior to further analysis of the existing institutional framework and developing options for desired framework, a review of international best practices with regard to administrative structure for EE & DSM may prove useful.

8. CONCLUSION

It is unfortunate that many institutions dealing in power sector has yet not realised the importance of DSM and Energy efficiency Measures. This process of energy conservation is in a very initial phase although it was introduced much before in the country.

It is observed that people are more comfortable in choosing a conventional route which is what making a hurdle in the development of this energy conservation mechanism. It is further observed that, till date there are challenges which are faced by power sector institutions in interpreting the provisions of the Electricity Act, 2003, thus expecting them to do something which is not explicitly defined in the Act is impractical. Considering the petty yet significant challenges and the humongous need of energy conservation, there is a need to have crisp and explicit provisions in the current legislations.

It is to appreciate that, other states which make a good example for implementation DSM activities like Maharashtra and specially the city of Mumbai cannot be overlooked but at the same time this cannot be expected from every state as Mumbai has four private distribution companies running in the city which value the power they buy and sell and also making the consumer aware of its importance unlike the other DISOM's which are mostly government owned entities.

Since, DSM is not provided as the primary concern of the State Commission in the EA itself, therefore, the action taken in this regard lacks conviction. It is thus important to have a strong explicit provision in the EA which talks about the role of a State Commission and the utilities in this regard.

It is high time that DSM should be acknowledged as an inevitable part of the Power Sector. This can be achieved by overall participation from the government, utilities and the consumer at large. Sensitisation of consumer and utilities is required the most. It is further observed that only when there will be a concern and interest shown by the consumer and utilities the market will itself grow. As has been discussed in the study an institutional structure has to be brought in place which clearly determines the roles, functions and duties of institutions involved with less ambiguity.

The utilities are apprehensive about the mechanism of DSM and energy efficiency techniques which is justified to an extent considering the geographical, demographical and cultural condition of each state which are not addressed while planning the DSM policy by BEE

for the states.

As mentioned above, the utilities are apprehensive, Regulators do not consider it as their primary job, the market is yet not evolved and the lethargic approach is what is adding as a hindrance to this major power sector initiative. What we need to do is to strengthen the legislation and to make it more specific, making DISCOM realise DSM as one of the primary concern and making the consumer aware about its benefits so as to reduce the amount of their energy bills. A little push in this direction will help lit up many lamps in the deserted withered area of the country.

9. REFERENCES

1. The Electricity Act, 2003 THE ELECTRICITY ACT, 2003[No.36 of 2003] notified on 26th May, 2003.

2. The Energy Conservation Act, 2001 THE ENERGY CONSERVATION ACT, 20001[No. 52 of 2001] notified on 29th September 2001.

3. Padmanaban. S. Sarkar, Ashok, "*Electricity Demand Side Management in India- A Strategic and Policy Perspective*", Office of Environment, Energy and Enterprise US Agency for International Development, New Delhi, India.

4. Rajan, C.C.A, "*Demand side management using expert system*", IEEE Conference on Convergent Technologies for Asia-Pacific Region TENCON 2003.

5. www.upm.ro/proiecte/EEE/Conferences /papers/s335.pdf.

6. www.upm.ro/proiecte/EEE/Conferences /papers/s335.pdf.

7. Mukhopadhyay,S.,Rajput, A. K, "*Demand side management and load control. An Indian Experience*", IEEE trans, on power and Energy Society General Meeting, 2010.

8. Boshell, F., Veloza, O.P., "*Review of developed demand side management programs including different concepts and their results*", IEEE/PES trans. On Transmission and Distribution conference and Exposition, Latin America, 2008.

9. Yun, Lim, Taylor, Philip, "*Innovative Application of Demand Side Management to Power Systems*", First International Conference on Industrial and Information Systems, ICIIS, Sri Lanka, 8 - 11 August 2006.

10. Gupta. B.R., "Generation of electrical energy", 2nd edition, Ch: 21, S. Chand, 2007.

11. ABPS Infrastructure Advisory Private Ltd., Final Report On," *Institutionalising Energy Efficiency & Demand Side Management In Utility Sector In India"*, September 2009.

12. Aditya Chunekar, Mrudula Kelkar, Shantanu Dixit, Prayas Energy Group on ,"Demand Side Management in India: An Overview of State Level Initiative".

13. Gellings C.W, Efficient use and Conservation of Energy- Vol-II- Using Demand Side Management to Select Energy Efficient Technologies and Programmes.

14. Yogita Ashtekar, Gopi Ghole, *"Effect of Demand Side Management on Present Indian Power Sector Scenario"*, International Journal of Innovative Research in Science, Engineering and Technology. Vol.4, Issue 2, February 2015.

15. Praveen Dabur, Gurdeepinder Singh, Naresh Kumar Yadav, *"Electricity Demand Side Management: Various Concept and Prospects."* International Journal of Recent Technology and Engineering, ISSN: 2277-3878, Volume-I, Issue-I, April 2012.

16. Rangan Banarjee, IIT Bombay, *"Energy Efficiency and Demand Side Management"*, submitted to Integrated Energy Policy Committee, Govt. of India 2005.

17. Raminder Kaur, *"Energy Conservation And Demand Side Management In Present Indian Powr Sector Scenario"*, International Journal of Power System Operation and Energy Management ISSN (Print) 2231-4407, Vol-2, Issue 3,4.

18. http://powermin.nic.in/Punjab

19. http://powermin.nic.in/Maharashtra

20. Bangalore Electricity Supply Company Limited, Notification No.: BESCOM/GM(A&HR)/BC-50/02/2015-16

http://bescom.org/wp-content/uploads/2015/09/DSM-C.pdf

21. Forum of Regulators, Regulatory Updates on Demand Side Management July 2010.

22. http://www.forumofregulators.gov.in/completed.aspx

23. N. Mohan, Manager-Technical, Energy Efficiency Services Limited, "Developing A Market For Energy Efficiency In India".