Green Growth and Demand Side Management in India

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Acronyms

ABBY	Atal Bijli Bajat Yojana
ADB	Asian Development Bank
Ag-DSM	Agriculture DSM
BEE	Bureau of Energy Efficiency
BLY	Bachat Lamp Yojana
BU	Billion Units
CDM	Clean Development Mechanism
CEA	Central Electricity Authority
CER	Certified Emissions Reductions
CFL	Compact Fluorescent Lights
CGS	Central Generating Stations
CO	Carbon Monoxide
CPP	Captive Power Plants
DSM	Demand Side Management
DSM-CC	Demand Side Management Consultation Committee
EA	Electricity Act
ECAP	Energy Conservation Action Plan
ECBC	Energy Conservation Building Code
ECO III	Energy Conservation & Commercial Program
EESL	Energy Efficiency Services Limited
EM&V	Evaluation Measurement & Verification
EPSC	Electric Power Survey Committee
ESCO	Energy Service Company
FoR	Forum of Regulators
GEDA	Gujarat Energy Development Agency

GoHP	Government of Himachal Pradesh
GoI	Government of India
GRIHA	Green Rating for Integrated Habitat Assessment
GW	Giga Watts
HP	Himachal Pradesh
HPERC	Himachal Pradesh Electricity Regulatory Commission
HPPCL	Himachal Pradesh Power Corporation Ltd.
HPPTCL	Himachal Pradesh Power Transmission Corporation Ltd.
HPSEBL	Himachal Pradesh State Electricity Board Ltd.
IJEF	Indian Japan Energy Forum
IPP	Independent Power Producers
LeD	Energy Efficient Street Lighting
MSME	Micro Small Scale Enterprises
MU	Million Units
MW	Mega Watts
NAPCC	National Action Plan on Climate Change
NEP	National Electricity Policy
NFA	Norwegian Framework and Agreement
NMEEE	National Mission on Enhanced Energy Efficiency
NPC	National Productivity Council
NTP	National Tariff Policy
PEDA	Punjab Energy Development Agency
PLEC	Peak Load Exemption Charges
PLVC	Peak Load Violation Charges
PSEB	Punjab State Electricity Board
PSERC	Punjab State Electricity Regulatory Commission

PSPCL	Punjab State Power Corporation Limited
PSTCL	Punjab State Transmission Corporation Limited
S&L	Standards & Labeling
SDAs	State Designated Agencies
SECF	State Energy Conservation Fund
SERCs	State Electricity Regulatory Commission
SIDA	Swedish International Development Agency
SLSC	State Level Steering Committee
SMEs	Small Scale Enterprises
ToD	Time of Day
USAID	US Agency for International Development

1. Introduction

Demand for electricity is increasing at a fast pace in India; in the last decade the utility level demand had more than doubled and in the next two decades it is expected to triple ((CEA, 2011a) (CEA, 2011b). Meeting this demand ensuring requisite level of reliability, accessibility and affordability is a major challenge. It is especially so given the growing concerns of environmental and social impacts of supply augmentation and fuel availability. In fact, the supply-demand balance for the past many years shows that demand has been outstripping availability resulting in continuing power shortages of various degrees in different parts of the country. Demand Side Management (DSM) is thus today an important and integral strategy for power sector development in the country.

Accordingly, a number of initiatives on the policy and regulatory front have been taken in recent years at the national and state levels. Suitable business models for implementation are also being formulated and deployed. The challenges being experienced in this regard vary in magnitude and complexity from state to state. This has also brought up the need for state specific strategies taking due note of the consumption patterns as well as the socio-economic and demographic profile of the state.

This paper presents an overview of the DSM initiatives at the national level Section 1 discusses strategies pursued at the national level in promoting green growth and DSM in India. Section 2 and 3 analyze the status of DSM initiatives in terms of technological interventions, financing strategies, institutional framework and policy/regulatory reforms currently in place for DSM. Roadmap suggesting short-term, medium-term and long-term strategies for for effective load management in view of promoting green growth at the end-user consumer level; has also been discussed.

1.1 Key trends

As per the 18th Electric Power Survey Committee (EPSC) survey, the all India electrical energy requirement (EER) is expected to be 1,354,874 MU by the end of 12th Five Year Plan (FYP) (2016-17) and 1,904,861 MU by the end of 13th FYP (2021-22). Long term EER is assessed to increase to 2710 BU and 3710 BU by the end of 14th FYP (2026-27) and 15th FYP (2031-32) respectively. While the long term peak electric loads are estimated to be 199,540 MW in the 12th FYP and 283,470 MW in the 13th FYP, it is forecasted that the load would increase to 400.7 GW and 541.8 GW in the 14th and 15th FYP respectively. (CEA 18th EPS, 2011) The electrical energy consumption is expected to increase to 1,099 BUs by 2016-17, 1611 BUs by 2021-22, 2301 BUs by 2026-27, and 3162 BUs by 2031-32. (CEA, 2011a). Forecasted category-wise break up of sales to different consumer categories is shown in the figure 1.

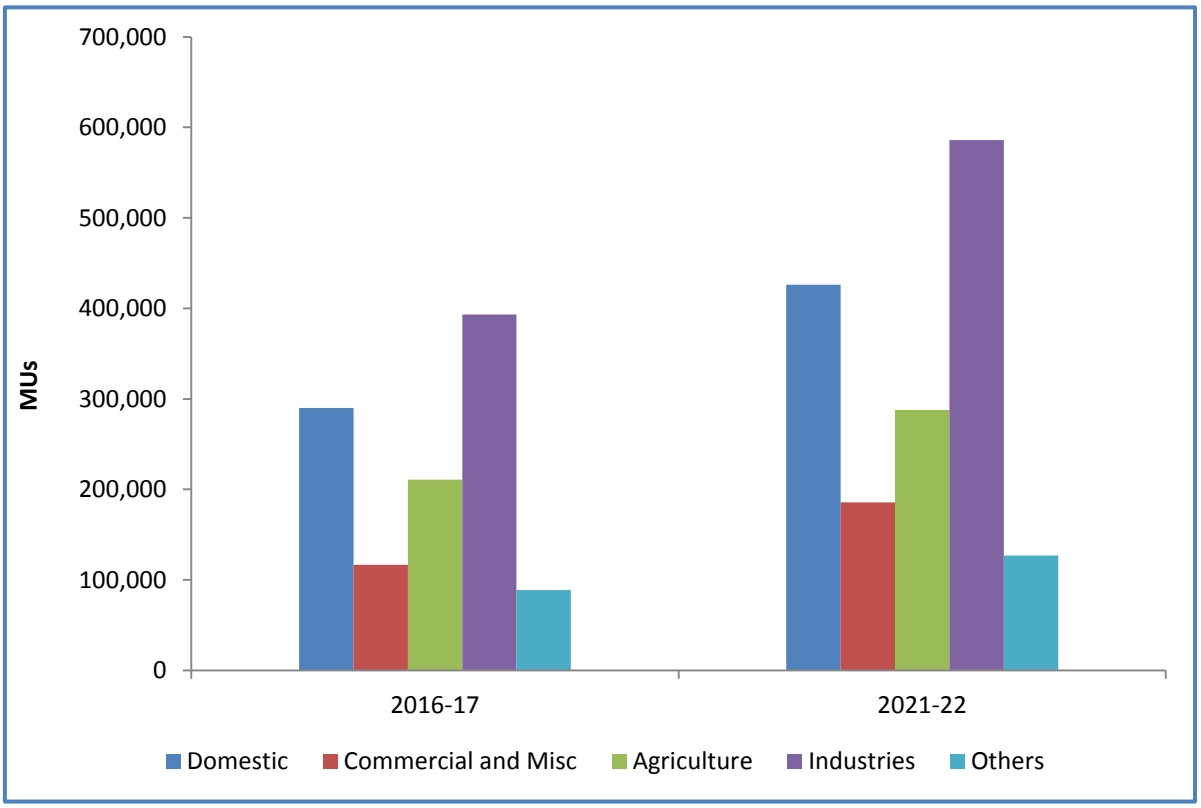

Figure 1 Forecasted category-wise sales by the end of 12th and 13th plan for overall India

Source: (CEA, 2011a)

Although increase in sales and growth in demand is anticipated in the next two decades, due to the implementation of various measures initiated for improvement of energy efficiency and DSM, it has been indicated that there may be marginal reduction in electricity demand.

1.2 Institutional framework

- Bureau of Energy Efficiency (BEE) has been a front-runner institution in pioneering several DSM and energy efficiency initiatives in India. BEE is the policy advisor to the central and state governments and assists in developing policies and strategies with a thrust on self-regulation and market principles, with the primary objective of reducing energy intensity of the Indian economy.
- Forum of Regulators created under Section 166(2) of the Electricity Act 2003 constituted a Working Group on "DSM and Energy Efficiency" to deal with the issue of developing approaches for implementation of energy efficiency and DSM in the distribution sector in the country (Forum of Regulators, 2008). This group consists of representatives from State Electricity Regulatory Commissions, Central Electricity Regulatory Commission as members of those working groups.
- At the state level, distribution utilities and Electricity Regulatory Commissions have the primarily responsibility of implementing DSM measures in their respective states. As required by the DSM regulations in some of the states, DSM

cells for conducting various activities associated with DSM have also been constituted.

- State Designated Agencies also have a regulatory, promotional and enforcement role in implementation of the Energy Conservation Act and in implementing various other schemes in the states.

2. Statutory and legislative provisions

Energy efficiency and DSM efforts have been initiated gradually at the state and central level through enforcement of various legislative provisions. Key provisions have been discussed in detail below:

2.1 EC 2001

The EC Act encouraged adoption of several measures by the central government for promoting energy efficiency, which include the following: 1) prescribe guidelines for energy conservation building codes (ECBC)[1] for efficient use of energy and its conservation in the building or building complex, 2) establish energy consumption norms for designated consumers, 3) specify the norms for processes and energy consumption standards for equipment/appliances, 4) establish and prescribe such energy consumption norms and standards for designated consumers[2], 5) adopt measures to create awareness and disseminate information for efficient use of energy and its conservation, 6) undertake research and development in the field of energy conservation, 7) promote use of energy efficient processes, equipment, devices and systems, 8) support innovative financing of energy efficiency projects that have been responsible for use of energy efficient processes, equipment, devices and systems (Ministry of Law, 2001). Additionally, Section 16 of the Energy Conservation Act advocates constitution of state energy conservation funds that would enable states to encourage energy efficiency and meet the expenses incurred (Ministry of Law, 2001). Under the provisions of the EC Act, Government of India (GoI) established Bureau of Energy Efficiency (BEE) to promote energy efficiency through various regulatory and promotional instruments and assist in developing policies and strategies with the primary objective of reducing energy intensity of the Indian economy. BEE has emerged as a key institution in the area of energy conservation, and is being regarded as a driving force behind energy efficiency efforts in India.

2.2 EA 2003

The Electricity Act (EA) 2003 consolidated the laws relating to generation, transmission, distribution, trading and use of electricity. The Section 166 (5)(c) of the Electricity Act provided for the establishment of a committee in each district to promote energy efficiency and its conservation (Ministry of Law and Justice, 2003) in addition to several competition enhancing provisions such as de-licensed generation, open access in transmission at the

[1] The ECBC sets minimum energy standards for new commercial buildings having a connected load of 100kW or contract demand of 120kVA in terms of Energy Conservation (Amendment) Act, 2010, for more details, read <http:/ / powermin.nic.in/ acts_notification/ energy_conservation_act/ introduction.htm>

[2] A section of energy intensive industries have been identified as "designated consumers" that account for a major share of about 45% of commercial energy use in India and contribute 25% to the national gross domestic product (GDP).

outset and distribution in phases, unbundling of SEBs, and multiple distribution licensees in a supply area.

2.3 National Electricity Policy and National Tariff Policy

Although both EC Act and EA have several provisions that are conducive for efficient end-use of electricity, the Acts do not explicitly require the distribution utilities to undertake DSM measures for end-use energy efficiency. Pursuant to the EA 2003, the Central Government notified National Electricity Policy (NEP) in 2005 and National Tariff Policy (NTP) in 2006 which gave a specific direction to utilities and regulators in the context of DSM and energy efficiency. Some of the key aspects of these policies were: 1) financing of power sector programs, 2) promotion of the efficient pump sets and the water delivery systems in the agriculture sector,3) promotion of energy efficient technologies such as motors and drive systems and conducting energy audits in the industrial sector, and 4) promotion of energy efficient lighting technologies in industries, commercial and domestic establishments, 5) adoption of suitable load management techniques such as differential tariff structure for peak and off peak supply and metering arrangements to meet the load management objectives (MoP, 2005) (MoP, 2006).

2.4 National Mission on Enhanced Energy Efficiency

In 2008, the National Action Plan on Climate Change proved as a guiding national strategy in addressing India's development concerns and mitigation and adaptation challenges. The framework in NAPCC identified long term and integral strategies – 8 national missions focused towards dealing with the challenge of climate change. National Mission on Enhanced Energy Efficiency (NMEEE) is one such mission emphasized on development of "market-based approaches to unlock energy efficiency opportunities, which was estimated to be about INR 740 billion". The mission also set a target of cumulative avoided capacity addition of 19,000 MW; out of which 14,335 MW is expected to be avoided through DSM programmes by 2014-15 (Kumar & Chatterjee, 2012).

Under the NMEEE mission, four initiatives have been mandated by the Ministry of Power to enhance energy efficiency (S.P.Garnaik, BEE). These include: 1) market based mechanisms to enhance cost effectiveness of improvements in energy efficiency in energy-intensive large industries and facilities (Performance, Achieve and Trade)[3], 2) accelerating the shift to energy efficient appliances in designated sectors through innovative measures to make the products more affordable, 3) creation of mechanisms that would help finance DSM programs in all sectors by capturing future energy savings, and 4) developing fiscal instruments to promote energy efficiency.

2.5 FoR Model Regulations

In 2010, Forum of Regulators (FoR) came out with a set of model regulations to assist State Electricity Regulatory Commissions (SERCs) in drafting state-specific DSM regulations. These model regulations provided guidelines for all the activities, ranging from planning and approval to evaluation of DSM in the states. These included: 1) assessing the technical

3 The mission targets avoiding 5623 MW through PAT under which the designated consumers have to mandatorily achieve specified energy savings

potential of DSM; 2) setting of targets; 3) constitution and functioning of DSM cells in the utilities; 4) preparation of base line data and formulation of DSM Plan; 5) review and approval of the same; 6) preparation and approval of DSM Program Document; 7) implementation schedule and prioritization for each DSM program; 8) monitoring and reporting; and 9) evaluation, measurement and verification (EM &V) of the programs. (Forum of Regulators, 2010)

3. Key DSM initiatives at the national level

Since 2010, a number of states[4] have come up with DSM regulations in their respective states. Under the directions of State Electricity Regulatory Commissions and utilities, several initiatives have been adopted nationwide in various consumer segments. These are briefly described below:

- **Standards and labeling (S&L) programme** has been identified as one of the key activities for energy efficiency improvements which provide the consumer an informed choice about energy savings and thereby the cost saving potential of the relevant marketed product. The scheme was launched on 18th May 2006 and is currently invoked for 12 equipment/appliances, i.e. air conditioners (ACs), tube lights, frost-free refrigerators, distribution transformers, induction motors, direct cool refrigerator, geysers, ceiling fans, color televisions (TVs), agricultural pump sets, liquid petroleum gas (LPG) stoves and washing machines.[5]

- Under the **Bachat Lamp Yojna (BLY) scheme,** BEE coordinated voluntary efforts to provide high quality CFLs to domestic consumers for about INR 15 per lamp, i.e., at a rate comparable to that of incandescent bulbs. The price reduction would be achieved by utilizing the Clean Development Mechanism (CDM) of the Kyoto Protocol through which the CFL suppliers would earn Certified Emissions Reductions (CERs) on the basis of the CO emissions reductions that would occur because of the low electricity consumption of CFLs compared to incandescent bulbs (BEE Guide). This scheme estimated savings of 6,000 MW of generation capacity. BLY scheme was launched in many states like Punjab, Haryana, Andhra Pradesh, Orissa, Chhattisgarh, Madhya Pradesh, Uttar Pradesh, Uttarakhand, Rajasthan, Goa, West Bengal, Tamil Nadu and Delhi. (Ministry of Power)

- The government of India launched **Energy Conservation Building Code (ECBC)** on 27th May, 2007 to set minimum energy standards for commercial buildings. ECBC is intended for new commercial buildings having a connected load of 100 kW or contract demand of 120 kVA and above. These codes define norms of energy requirement per square meter of area and takes into consideration the following parameters: 1) the climatic regions of the area where the building is located, and 2) the major components of the building which are being addressed through this code

[4] Andhra Pradesh, Assam, Bihar, Chattisgarh, Dadra and Nagar Haveli, Goa, Gujarat, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Odisha, Maharashtra, Rajasthan, Punjab, Tamil Nadu, Uttar Pradesh, Uttarakhand, West Bengal (CEA, 2014)

5 Out of which, ACs, Tube lights, Frost Free Refrigerators, Distribution Transformers have been notified under mandatory labeling from January, 2010 while the rest are under voluntary labeling phase.

(which include walls, roofs and windows; lighting systems, HVAC systems, electrical distribution systems, water heating and water pumping systems).

- Various types of **load management programs** are prevalent to motivate industrial and commercial consumers to shift from peak period to off-peak periods by having differential tariff pricing throughout the day. In India, Time of Day tariff (ToD)[6], Peak Load Exemption Charges (PLEC), and Staggered Load programs are designed in such a way that there are different pricing signals during different hours of the day thereby motivating intra-day shifting of load/reduction of consumption.

- The EA 2003 has provisions for implementation of energy efficiency measures through institutional mechanism of BEE in the central level and **State Designated Agencies (SDAs)** in every state. In this regard, several states have either set up SDAs either as separate entities or as a part of utility. SDAs act as a development agency, as a facilitator, and as a regulator / enforcing body to implement energy conservation measures at the state level.

- **Energy Conservation Action Plan** (ECAP) was carved out for taking measures which would be necessary to build institutional and human capacity, enabling the SDAs to implement energy efficiency programmes and undertake evaluation and monitoring of the energy conservation activities implemented in the state.

- One of the key elements of ECAP was the **State Energy Conservation Fund** (SECF). The Energy Conservation Act requires Indian states to establish energy conservation funds at the state level to financially support SDAs for carrying out energy conservation activities and facilitate implementation of energy efficiency projects. Kerala has been the first state in India to take the initiative to establish this fund. The Ministry of Power approved the scheme "Contribution to SECF by the BEE" for which Rs. 70 crores was sanctioned and to be disbursed during the years 2009-12. The funds were disbursed to those states which have constituted their SECFs and finalized the rules and regulations to operationalize the same. (Ministry of Power)

- DSM in agriculture sector promises immense opportunity in reducing the overall power consumption, improving efficiencies of ground water extraction and reducing the subsidy burden of the states. The **Agriculture DSM (Ag-DSM)** project aims to replace inefficient irrigation pumps with high efficient pumps (five star rated pumps). In the initial phase 5 states i.e. Maharashtra, Gujarat, Rajasthan and Punjab were selected for implementation of Ag-DSM programme[7].

- The Government launched a **National Campaign on Awareness** to make people aware about the need of energy conservation and benefits to the individual, society and nation as a whole. Salient features of the scheme were: 1) spreading simple energy saving methods that can be applied in everyday life, 2) present a wider variety of energy conservation methods to improve energy consumption behavior, including prevention of energy waste and leakage, 3) spread information about

6 ToD is a tariff structure consisting of rates with fixed price blocks that differ by time of day.
7 (Tamil Nadu Electricity Governance Initiative)

power and oil situations and its rising prices and effectively meeting this challenge through energy savings and substitution, and 4) involve SDAs in the outreach programme.

- Energy Efficiency Services Ltd. (EESL), an Energy Service Company (ESCO) has been established as an energy efficiency financing platform to provide market leadership and aid in financing several demand side management programmes in various sectors by capturing future energy savings.

4. Ways forward

Rise in demand, fuel price volatility and high levels of carbon emissions underline the need to manage demand in different consumer categories in the power sector. Introducing DSM programs for market transformation through effective and lucrative price incentive schemes; conducting behavioural studies to understand consumption patterns of consumers; and organizing awareness campaigns for all stakeholder categories, would be useful for power sector development.

In view of recent targets set by the government and what can be envisioned, national roadmap has been carved out briefing steps that need to be taken in the short-term (4-5 years), mid-term (10-15 years) and long-term (25-30 years) period.

Short term

- 24X7 power supply to all households in the country by March 2019[8]
- 100% metering connecting all consumers to the grid
- Enabling programs and projects in distribution utilities to reduce AT&C losses to below 15% by 2017 (MoP, 2013)
- Mandate the states to come up with DSM regulations (in the states which are yet to notify them) by 2016-17 and come up with implementable DSM plans based on outcomes of load research analysis
- Focus on providing facilitation support to implement recommendations that are identified in Energy Audits
- Including more industry sectors under the PAT scheme,
- Special focus on installation of solar pumps for pumping purposes in domestic and agriculture sectors
- Implement energy efficient/DSM solutions specifically targeting medium and small scale enterprises

[8] Except agriculture consumers, the hours of supply to agriculture will be decided by the states as per their requirement

- Investment in research and development, training and capacity building programs
- Creation of adequate resource pools, Energy Service Companies (ESCOs) and business models for implementing DSM programs
- Formulation of effective customer outreach and communication programs for active involvement of consumers in DSM and energy efficiency
- Integrated technology trials through a set of smart grid pilot projects by 2015; and based on outcome of the pilots, full rollout of smart grids in pilot project areas by 2017 (MoP, 2013)

Medium term

- Improve the reliability, security and quality of supply along with evolving pricing structures
- Impact analysis of the DSM regulations and incorporate modifications to make it effective
- Impact analysis of business models developed for implementation of DSM programs
- Increase the State Energy Conservation Fund and monitor its utilization
- Enabling programs and projects in distribution utilities to reduce AT&C losses to below 12% by 2022, and below 10% by 2027 (MoP, 2013)
- Continued research and development, training and capacity building programs
- Regulatory impact studies on tariff based interventions
- Full rollout of smart grids in urban areas by 2022 and nationwide by 2027 (MoP, 2013)

Long term

- Integrate renewable energy, off grids, demand response options and storage solutions and with advanced information and communication technology (ICT) infrastructure
- Improve reliability, security and quality of supply along with evolving pricing structures
- Continued research and development, training and capacity building programs

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About TERI

A unique developing country institution, TERI is deeply committed to every aspect of sustainable development. From providing environment-friendly solutions to rural energy problems to helping shape the development of the Indian oil and gas sector; from tackling global climate change issues across many continents to enhancing forest conservation efforts among local communities; from advancing solutions to growing urban transport and air pollution problems to promoting energy efficiency in the Indian industry, the emphasis has always been on finding innovative solutions to make the world a better place to live in. However, while TERI's vision is global, its roots are firmly entrenched in Indian soil. All activities in TERI move from formulating local- and national-level strategies to suggesting global solutions to critical energy and environment-related issues. TERI has grown to establish a presence in not only different corners and regions of India, but is perhaps the only developing country institution to have established a presence in North America and Europe and on the Asian continent in Japan, Malaysia, and the Gulf.

TERI possesses rich and varied experience in the electricity/energy sector in India and abroad, and has been providing assistance on a range of activities to public, private, and international clients. It offers invaluable expertise in the fields of power, coal and hydrocarbons and has extensive experience on regulatory and tariff issues, policy and institutional issues. TERI has been at the forefront in providing expertise and professional services to national and international clients. TERI has been closely working with utilities, regulatory commissions, government, bilateral and multilateral organizations (The World Bank, ADB, JBIC, DFID, and USAID, among many others) in the past. This has been possible since TERI has multidisciplinary expertise comprising of economist, technical, social, environmental, and management.

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