

## SECTOR ASSESSMENT (SUMMARY): ENERGY

### Sector Road Map

#### 1. Sector Performance, Problems, and Opportunities

1. **Sector overview.** India is entering its most energy-intensive phase of economic growth with industrialization, infrastructure development, and increased use of transportation. India is one of the world's fastest growing economies accounting for about 5% of the world's total annual energy consumption. While India is the third largest consumer of energy in the world after the United States and the People's Republic of China (Enerdata, 2014),<sup>1</sup> the nation's per capita energy consumption is still substantially lower than that of most developed and some developing countries, predicating soaring energy demand in the future. Projected gross domestic product growth in India stands at 9%, further boosting industrial development and improvement in the well-being of the nation. To meet the increasing energy demand, installed generation capacities are expected to grow at around 6% annually.

2. **Oversight and regulatory bodies.** The Government of India's Ministry of Power governs the central power sector. The Bureau of Energy Efficiency (BEE) was established in 2001 with a mandate to develop policy and strategies on energy efficiency with a focus on self-regulation and market principles, within the overall framework of the Energy Conservation Act, 2001. The Ministry of Power set up the Energy Efficiency Services Limited (EESL) in December 2009 as a joint venture of four National Public Sector Enterprises (National Thermal Power Corporation Limited, Power Finance Corporation, Rural Electrification Corporation, and Powergrid). EESL is a super energy service company, acting as a resource center for capacity building of state distribution companies, the Energy Regulatory Commission, State Designated Agencies, upcoming super energy service companies, and financial institutions; and is currently implementing several energy efficiency projects in the country across several sectors.

3. **Electricity supply and demand.** As of 31 March 2016, the overall generation in the country has seen an increase of 5.6% over the previous year (2014–2015) from 1,048.673 million megawatt hour (MWh) to 1,107.386 million MWh. The overall installed capacity is currently 298 gigawatt (GW); the energy demand deficit is 1.5%, and the peak demand deficit is 1.7%. The national average for transmission and distribution losses continued to average around 22%. Even though new generation capacity has been gradually increasing every year, a large percentage of India's population continues to live without electricity. It is estimated that there are 11,399 villages still to be electrified nationwide.<sup>2</sup>

4. **Sectoral electricity consumption and intensity.** India, with its high growth trajectory of both economy and population, is confronted with a multitude of energy sector challenges. Alongside the energy capacity challenge, other key challenges in both the energy supply and demand side include a high import dependence on thermal sources of energy (particularly oil) and ongoing difficulties in enabling energy access across the nation (particularly in rural areas). Trends of total electricity consumption show a cross sector increase in 2004–2005 and 2012–2013 (Table 1). Industry and the domestic sectors continue to be the major electricity consuming sectors in 2004–2005 and 2012–2013. Electricity consumption increased from 34.88 million tons of oil equivalent (Mtoe) in 2002 to 74.71 Mtoe from 2002 to 2012 and is expected to continue to rise.<sup>3</sup>

<sup>1</sup> Enerdata. <https://yearbook.enerdata.net/energy-consumption-data.html> (accessed on 31 August 2015).

<sup>2</sup> Central Electricity Authority. 2016. *Power Sector Report*.

<sup>3</sup> International Energy Agency. 2014. *Energy Efficiency Market Report 2014: Market Trends and Medium Terms Prospects*, International Energy Agency.

**Table 1: National Electricity Consumption (sold) by Sector**  
(GWh)

Category	Electricity Sold During 2012–2013	Electricity Sold During 2011–2012	Electricity Sold During 2005–2006	Electricity Sold During 2004–2005
Domestic	183,700	171,100	100,090	95,700
Commercial	72,790	65,380	35,970	31,400
Industrial	365,990	352,290	214,120	199,450
Agriculture	174,460	140,0960	90,290	88,560
Municipalities (excluding public buildings)	24,320	22,700	15,440	14,590
Public lighting	8,100	7,450	5,180	4,970
Public water works and sewage pumping	16,220	15,250	10,260	9,620
Miscellaneous	30,000	32,750	18,550	18,360
<b>Total</b>	<b>851,300</b>	<b>785,200</b>	<b>474,450</b>	<b>448,000</b>

GWh = gigawatt hour.

Source: Central Electricity Authority.

5. **Overall energy efficiency potential.** A report prepared in 2011 for India's Planning Commission (now Niti Ayog) estimated the energy saving potential to be between 124 million and 255 million MWh, translating approximately to \$11 billion to \$22 billion of financial savings at average tariffs.<sup>4</sup> India's National Productivity Council (NPC) undertook a study for BEE on State-wide Electricity Consumption and Conservation Potential in India.<sup>5</sup> The study found that the implementation of energy efficiency measures in key sectors would lead to overall electricity savings of 75.4 billion kWh. (Table 2).

**Table 2: Sectoral Electricity Saving Potential 2007–2008**

Sector	Consumption (Billion kWh)	Saving Potential (Billion kWh)
1. Agriculture pumps	92.33	27.79
2. Commercial buildings (load>500kW)	9.92	1.98
3. Municipalities	12.45	2.88
4. Domestic	120.92	24.16
5. Industry	265.38	18.57
<b>Total</b>	<b>501.00</b>	<b>75.36</b>

kWh = kilowatt hour.

Source: National Productivity Council.

6. **Sectoral energy efficiency potential: agriculture.** This sector is the third highest consumer of electrical energy with a total consumption of 92.33 billion kWh in 2007–2008.<sup>6</sup> This accounts for 20% of the overall national electricity consumption. The NPC study estimates a total saving potential of 27.79 billion kWh in this sector. Apart from energy savings, the benefits derived from a reduction in subsidies are also significant. Subsidised tariffs for agriculture consumers are supported partly by budget subsidies from respective state governments. In 2007–2008, this subsidy was estimated to be Rs141.6 billion. Agriculture demand-side management programs involving the replacement of existing inefficient pump sets with energy-efficient star-rated pump sets is one solution to addressing this issue.

7. **Sectoral energy efficiency potential: domestic.** The overall energy efficiency potential in the residential sector is estimated to be around 20%, with lighting and high efficiency appliances (fans, refrigerators) offering the largest potential. Following the

<sup>4</sup> Government of India, Planning Commission. 2011. *Low Carbon Strategies for Inclusive Growth - An Interim Report*. Delhi.

<sup>5</sup> National Productivity Council. 2011. *State-wise Electricity Consumption and Conservation Potential in India, prepared for Bureau of Energy Efficiency*. Delhi.

<sup>6</sup> National Productivity Council. 2009.

BEE-initiated Bachat Lamp Yojana scheme, which promoted compact fluorescent lamps, the transition from incandescent lamps and compact fluorescent lamps to light-emitting diodes (LEDs) is currently underway through several pilot programs undertaken by EESL. The BEE has also initiated the Super-Efficient Equipment Program under the Market Transformation for Energy Efficiency component of the National Mission for Enhanced Energy Efficiency (NMEEE). The Super-Efficient Equipment Program is an incentive-based program for manufacturers to design high efficiency electrical appliances with the best technology available globally. Table 3 provides a summary of the energy efficiency potential of super-efficient appliances.

**Table 3: Energy Saving Potential of Super-Efficient Appliances Compared to Five Star Models<sup>7</sup>**

Type of appliance	Current Sales (million)	Decrease in Energy Consumption (%)
Ceiling fan	30.0	42
Refrigerator	8.8	69
Television without standby power	14.9	41
Air conditioner	3.1	36

Source: Prayas Energy Group.

8. **Sectoral energy efficiency potential: municipalities.** Street lighting, water and/or sewage pumping, and buildings have the highest energy consumption in municipalities. With the availability of energy-efficient LED technologies, streetlights represent one of the most cost-effective opportunities for energy savings and peak demand reduction. In India, street lighting consumed about 8,478 gigawatt hour (GWh) of electricity in FY2013, about 1.5% of total national electricity consumption, and this can be reduced by 25% to 60% through the use of energy-efficient LED technologies.<sup>8</sup> In addition, the operational optimization—such as the use of twilight switching controls, dimming, and voltage optimization—could lead to an additional energy savings of 15%–20%.

9. **Barriers to energy efficiency implementation.** The adoption of energy efficiency measures and technologies remains limited largely because of the barriers to large-scale implementation of energy efficiency. Key barriers relevant to India are summarized below:

- (i) **Policy barriers.** Several voluntary energy efficiency regulations have been introduced in India. Along with them, a number of programs have been launched that focus on the implementation of energy efficiency, such as the Perform, Achieve and Trade Scheme. However, implementation of these schemes and/or programs has not progressed as anticipated because they are voluntary in nature.
- (ii) **Institutional barriers.** While the Government of India has created an institutional structure for energy efficiency, bodies like the BEE are constrained in terms of their capacity to support implementation of energy efficiency projects at the scale envisaged under the NMEEE. The capacity of the local level bodies, such as the state-designated agencies, also needs to be built up to support energy efficiency initiatives.
- (iii) **Financial barriers.** Some key barriers to financing energy efficiency projects include: lack of awareness of energy efficiency among conventional lenders, high transaction costs, high project development costs, lack of capacity in banks and financial institutions in evaluating energy-efficient projects, and limited capacity of energy-efficient service providers.

<sup>7</sup> Prayas Energy Group. 2011. Potential Savings from Selected Super-Efficient Electric Appliances in India. <http://www.prayaspune.org/peg/publications/item/155.html>

<sup>8</sup> Energy Efficiency Services Limited. 2016. *Detailed Program Document: Streetlight Program in Rajasthan*. Delhi.

## 2. Government's Sector Strategy

12. **Energy-efficient policy and regulatory framework.** The Electricity Act, 2003 is the legislative cornerstone for India's power sector, providing a legal framework for sector development. The act's primary concerns are the unbundling of state electricity boards, open access, and competition. The most important policies from an energy efficiency perspective are the Integrated Energy Policy, Energy Conservation Act 2001, and NMEEE. India's overall energy policy is governed by the Integrated Energy Policy, which has a broad vision to reliably meet the demand for energy services of all sectors.

13. **Energy efficiency policies.** India's energy efficiency policy framework was formally initiated upon the enactment of the Energy Conservation Act in October 2001. The act provides for the efficient use of energy and its conservation. It also provides for the creation of the BEE at the national level, state designated agencies at the state level, and the Appellate Tribunal for Energy Conservation. The act targets the following key schemes for energy efficiency in India: (i) appliance standards and labeling, (ii) energy efficiency in building sector for new buildings, (iii) energy benchmarking in designated consumers, (iv) energy efficiency in small- and medium-scale industries, (v) certification of energy managers and auditors, and (v) energy conservation awards.

14. NMEEE targets key programs for energy efficiency in the country. Implementing NMEEE would save about 23 Mtoe of fuel by 2015 and about 19,000 MW of capacity addition would be avoided. The initiatives under NMEEE include the following:

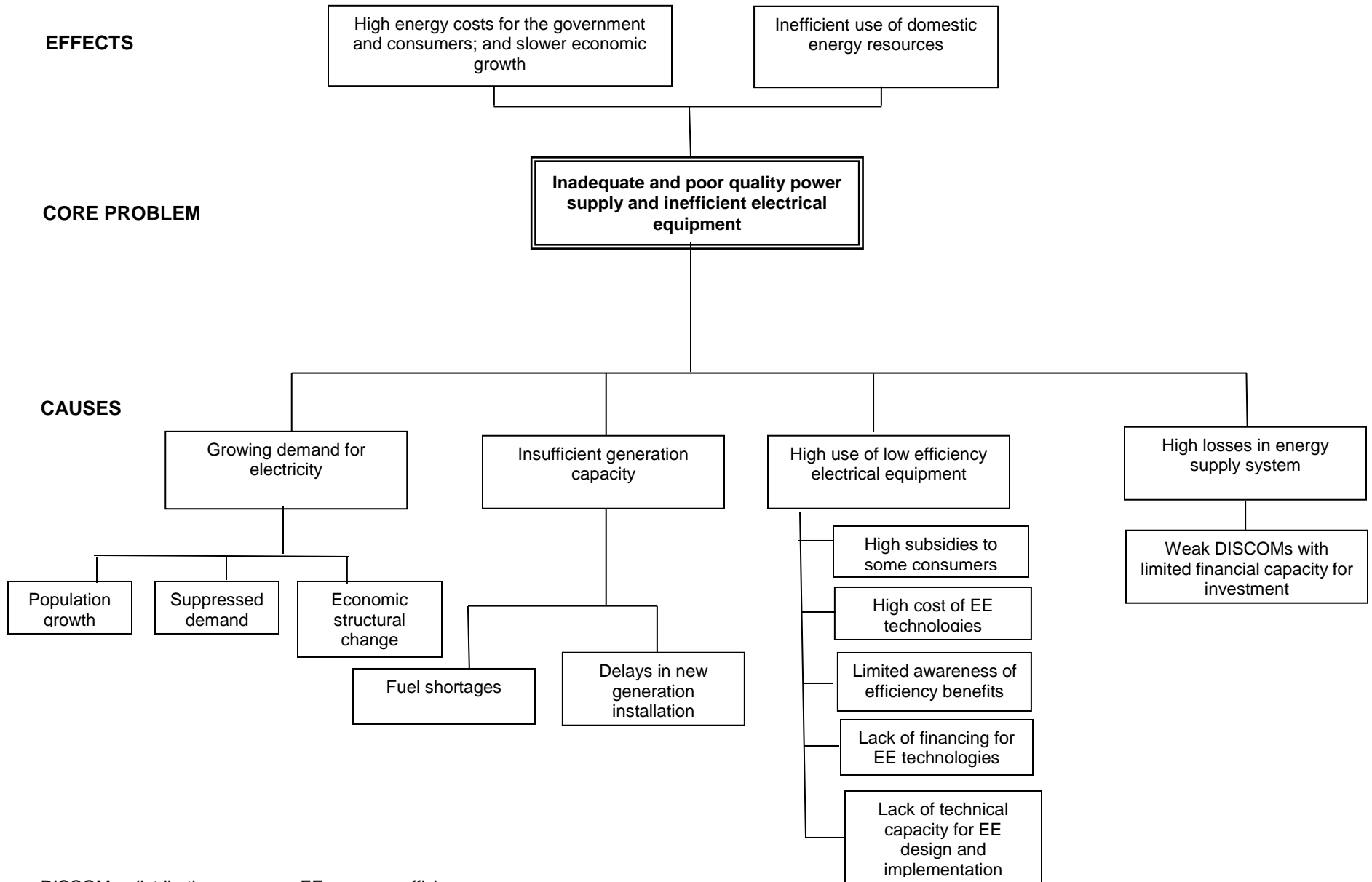
- (i) **Perform, Achieve and Trade.** This market-based mechanism enhances the cost effectiveness of improvements in energy efficiency in energy-intensive large industries and facilities by certifying energy savings that could be traded.
- (ii) **Market Transformation for Energy Efficiency.** This initiative accelerates the shift to energy-efficient appliances in designated sectors through innovative measures to make the products more affordable.
- (iii) **Energy Efficiency Financing Platform.** This initiative creates mechanisms that would help finance demand-side management programs in all sectors by capturing future energy savings.
- (iv) **Framework for Energy Efficient Economic Development.** This framework develops fiscal instruments to promote energy efficiency.

15. **Other government energy efficiency initiatives.** There are several schemes driven by the government on promoting energy efficiency across sectors. These include the following: standards and labelling; agriculture demand-side management; municipal demand side management; capacity building of distribution companies; energy efficiency in small- and medium-enterprises sector; strengthening of state designated agencies; contribution to state energy conservation fund scheme; and national energy conservation awards.

## 3. ADB Sector Experience and Assistance Program

16. **ADB's public sector operations.** From 1994 to 2000, ADB was instrumental in initiating and funding the Industrial Energy Efficiency Project (IEEP) to promote efficient and environmentally sustainable industrialization. ADB provided a loan to the Industrial Development Bank of India for onlending to industrial firms. The total funding provided was \$150 million. The key objective of the project was to support investments in energy efficiency and related environmental improvement measures by energy-intensive industries in India. The IEEP focused on increasing the economic and technical efficiency of energy use. The project also included technical assistance to strengthen the Industrial Development Bank of India's capabilities in three areas: (i) policy and program development for IEEP; (ii) institutional strengthening through training; and (iii) raising awareness about the need to improve energy efficiency.

## Problem Tree for Energy Efficiency



DISCOM = distribution company, EE = energy efficiency.  
Source: Asian Development Bank.