SECTOR ASSESSMENT (SUMMARY): POWER

Sector Road Map

1. Sector Performance, Problems, and Opportunities

1. **Sector structure.** The Indian power sector is divided into three broad groups of utilities owned by the central government, state governments, and the private sector. Utilities designated as central power sector undertakings (CPSUs) participate in countrywide wholesale power supply, interstate and interregional bulk transmission, and development finance to the power sector. They include the Power Grid Corporation of India (POWERGRID), the National Thermal Power Corporation (NTPC), the National Hydroelectric Power Corporation, the Power Finance Corporation (PFC), the Nuclear Power Corporation, and the Rural Electrification Corporation (REC). The state sector is operated by state electricity boards (SEBs) or state utility entities unbundled into generation, transmission, and distribution. The private sector comprises independent power producers (IPPs) and transmission companies, as well as distribution companies.

2. **Oversight and regulatory bodies.** The Ministry of Power of the Government of India governs the central power sector and oversees CPSU operations. The Ministry of Nonconventional and Renewable Energy looks after development of such renewable energy sources as wind, solar, and biomass. The Central Electricity Authority advises the Ministry of Power on electricity policy and technical matters. The Central Electricity Regulatory Commission regulates tariffs for CPSUs and other entities with interstate generation or transmission operations. To rationalize electricity retail tariffs and formulate unbundling of the SEBs, electricity regulatory commissions have also been established in each state under the Electricity Act, 2003.

3. **Supply and demand.** Although India is the world's fifth largest producer of electricity, the country faces power shortages equal to about 10% of demand. This is mainly due to insufficient capacity of generation and interregional transmission. These challenges are compounded by high system losses from inefficient distribution systems and commercial losses on each state level. This power deficit threatens the sustainability of the country's high economic growth. In addition to the demand-supply gap, the capacity mismatch between generation and transmission has been expanding. Increasing power supply and improving operational and financial efficiency in generation, transmission, and distribution are major challenges in the sector's entire value chain.

4. **Generation.** As of 31 March 2011, India's power system had an installed generating capacity of 173,626 MW (Table 1). The government accelerated investment in power generation during the past decade to alleviate the country's acute power shortage. The private sector has also increased its generation capacity. After adding 1,931 MW in additional capacity during the Tenth Five-Year Plan (FY2003–FY2007), private investment has already raised capacity by 11,040 MW during the current plan (FY2008–FY2012). A turning point was the Electricity Act, 2003. It promoted sector reform by removing the requirement for the licensing of generation projects, encouraging competition through competitive bidding processes for power supply, identifying transmission as a separate activity, and inviting wider public and private sector participation. Under the Act, private investors were free to begin generating electricity and a power exchange market was established to enable power trading and offering day-ahead or term-ahead contracts. The National Tariff Policy, 2006 later mandated competitive bidding for power procurement by distribution utilities and cleared the way for the awarding of ultra mega

power projects to the private sector. Despite these increases, generation capacity is still expected to fall 10% to 12% short of growing demand every year toward FY2017 by the end of the Twelfth Five-Year Plan. To fill the gap, the government aims to increase renewable energy to 11% of installed capacity and raise solar power generation to 20,000 MW up to 2020.

Table 1: Generation Capacity Growth in India

Sector	Total Installed Capacity (megawatt)	Sector Share (%)	Capacity Addition (megawatt) 10th Plan (FY2003–FY2007)	Capacity Addition (megawatt) 11th Plan (FY2008–FY2012)[a]
Central	82,453	47	13,005	8,750
State	54,413	31	6,244	12,721
Private	36,761	21	1,931	11,040
Total	**173,626**	**100**	**21,180**	**32,511**

[a] As of 31 January 2011. The Eleventh Five-Year Plan will end on 31 March 2012.
Source: 2011. Ministry of Power, Government of India. *Annual Report 2010-11*. New Delhi.

5. **Transmission.** The transmission sector comprises (i) interregional or interstate grids, and (ii) intrastate grids. While 53% of the whole transmission system in India is owned by state utilities, POWERGRID operates more than 95% of interregional power transmission. The transmission system thus remains largely a monopoly even though transmission licenses have been open to private investment since 1998 while the generation sector has experienced substantial increases in private sector participation and investment. This is due to a lack of domestic private sector experience in transmission projects. POWERGRID has established nine joint ventures with private power developers to expand capital investment in transmission through public–private partnerships.[1] Subsequently, the government has issued tariff-based competitive bidding guidelines to attract increased investment from the private sector. [2] These guidelines came into effect in January 2011 and allow private participation through either joint ventures or independent private transmission companies. A committee chaired by the Central Electricity Regulatory Commission has identified 14 interstate transmission projects for private participation. Three have been awarded to independent private transmission companies since 2010. This process is likely to bring private investment gradually into interregional transmission and introduce competition to POWERGRID. The government aims to increase interregional transmission capacity from 22,400 MW to 27,950 MW by 2012, 57,000 MW by 2015, and 75,000 MW by 2017. Considering these expansion targets, both POWERGRID and private sector investors will have significant room to operate either independently or in joint ventures.

6. **Distribution.** While POWERGRID maintains overall transmission loss at around 4%, intrastate transmission and distribution losses remain a great deal higher than the global benchmark, at approximately 30%. To reduce operational inefficiency and the adverse financial impact on state utilities, state sector reforms over several years have unbundled SEBs into separate generation, transmission, and distribution entities and some states have privatized power distribution or granted private franchises. The government has also implemented the Accelerated Power Development Program to provide financial incentives for states to renovate and modernize transmission and distribution systems, including metering, to build financial

[1] The private joint venture partners include Tata Power, Reliance, Torrent, Jaiprakash, and Infrastructure Leasing and Financing Services. There are other joint ventures with other CPSUs.

[2] The guidelines were issued under the National Tariff Policy in April 2006. The primary criteria for selection are the quoted transmission service charges and the technical, managerial, and financial capabilities of the bidders. Since 5 January 2011, transmission system projects can be awarded after tariff-based competitive bidding. This excludes projects awarded to POWERGRID up to 4 January 2011 under a cost-plus-based tariff regime.

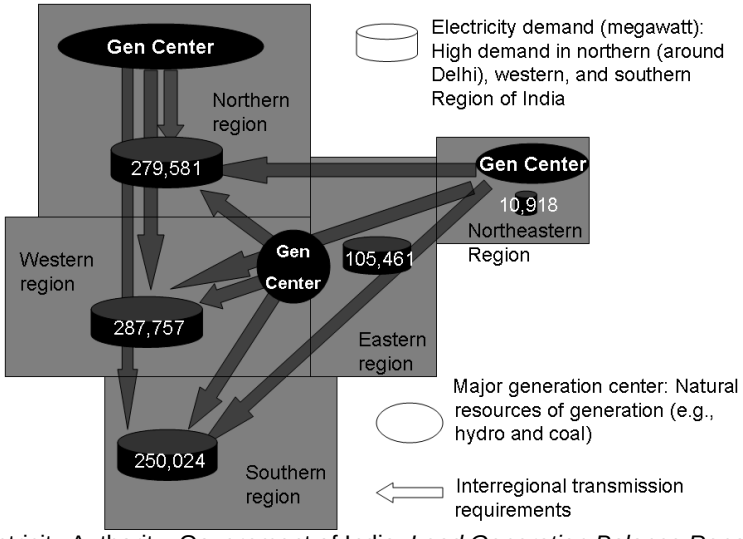
sustainability. In 2000, the government sought to alleviate state-level financial burdens and attract private investment by implementing a one-time settlement scheme to securitize the states' outstanding dues to CPSUs and place additional incentives for timely settlement of current dues. As a result, CPSU cash collection has drastically improved and private investment in generation has expanded. Nevertheless, system losses remain high in a number of states and delays in collection of receivables still are a large challenge for state distribution companies.

2. Government's Sector Strategy

7. **Policy and regulatory framework.** The Electricity Act, 2003 is the legislative cornerstone for India's power sector, providing a legal framework for efficient development and competition. The act's primary concerns are the unbundling of state electricity boards, open access, and competition. It provides for (i) exemption from licensing requirements for electricity generation; (ii) open access in electricity transmission; (iii) licensing for electricity trading; (iv) arrangement of licenses for building private transmission lines; (v) promotion of competition by allowing the presence of more than one distribution company in one area of supply; (vi) allowing 100% foreign equity in generation, transmission, distribution, and trading in the power sector, with no upper limit on the size of investment; and (vii) freeing up the process of setting up captive power plants.

8. **Competition and private participation.** Based on the act, the government has taken steps to encourage the addition of new capacity and improvements to operational and financial efficiency through enhanced competition and private sector participation. Nondiscretionary open access is one of the key thrusts, particularly for a growing number of IPPs that seek to sell power on a merchant basis and thus require long-term open access to transmission and distribution lines to support these bulk power sales. Neighboring intrastate grids will need to be connected to form regional and interregional grids to facilitate power transfer among the states and regions in the country. Because peak power demand does not occur at the same time in all places, one state or region may have a surplus of power when another is facing a deficit (Figure 1). The regional and interregional grids will facilitate transfers from surplus to deficit areas, thereby optimizing the scheduling of maintenance outages and the coordinated use of the overall power supply. The interregional networks will eventually connect to form a national grid, integrating the electricity market in India and encouraging power trading and competitive electricity prices. The development of an integrated national grid is also expected to improve the power supply mix through greater use of renewable energy sources.

Figure 1: Electricity Demand by Region in India, 2011–2012



Source: Central Electricity Authority, Government of India. *Load Generation Balance Report 2011-12.* New Delhi.

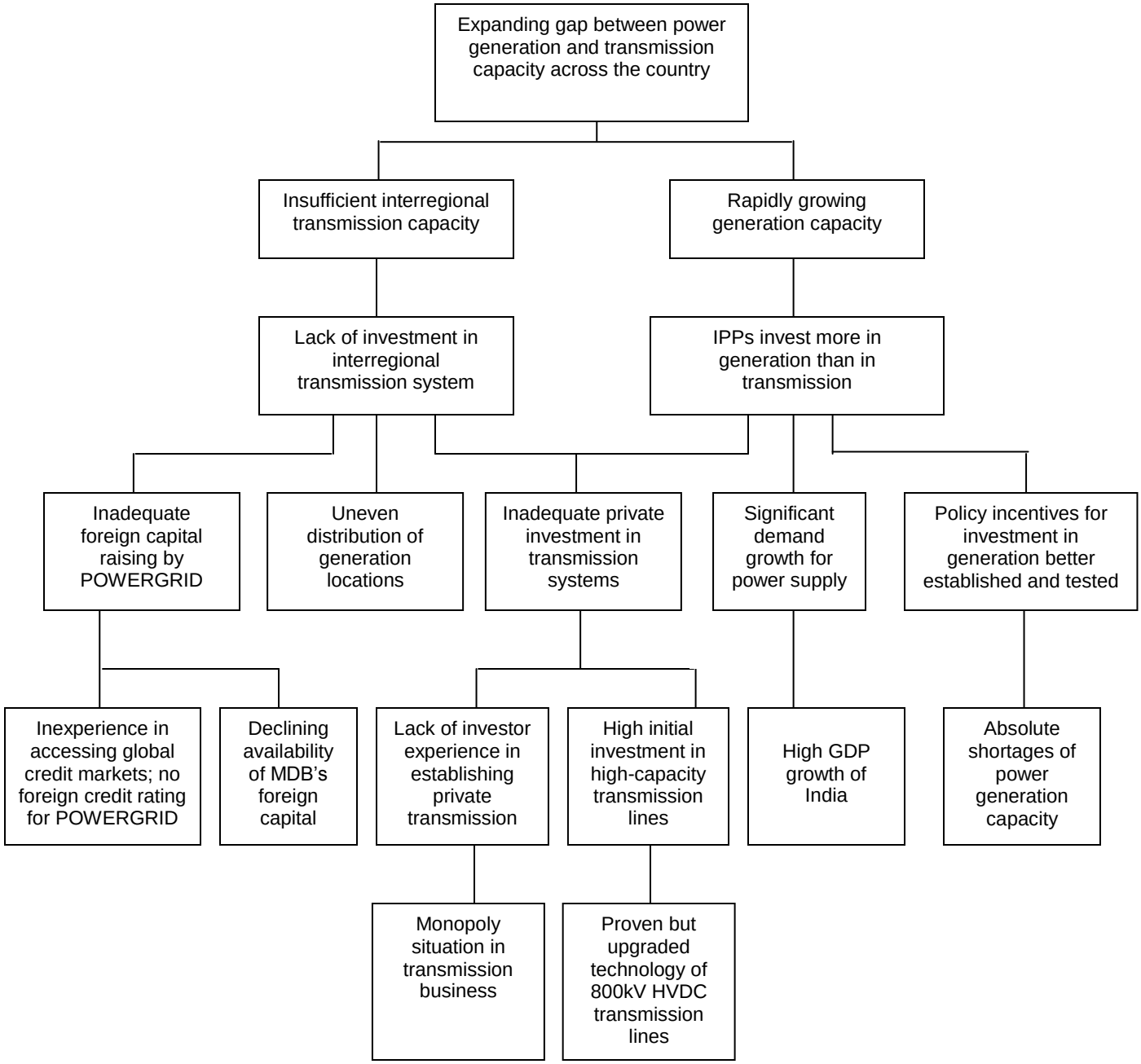
3. ADB Sector Experience and Assistance Program

9. **Public sector operations.** In supporting the national goals of the Indian power sector through its sovereign operations, the Asian Development Bank (ADB) has supported public utilities in states, including Assam, Bihar, Gujarat, Himachal Pradesh, Madhya Pradesh, and Uttarakhand to develop clean hydropower generation and strengthen their transmission and distribution networks. ADB has also approved financing to CPSUs including, POWERGRID, the PFC, REC, and NTPC.

10. **Private sector operations.** Through its private sector window, ADB supported the first public–private partnership transmission project between POWERGRID and the Tata Power Company. ADB also provided loans to the Mundra power megaproject and to wind power projects in Maharashtra, Gujarat, and Karnataka.

11. **Innovative operations.** Through the use of more commercial approaches, ADB intends to support the deployment of advanced, energy efficient, and renewable energy technology, including solar and wind energy. In the area of transmission networks, high voltage direct current lines will be extended to reduce electricity losses significantly and thereby contribute to lower carbon dioxide emissions. POWERGRID's adoption of this advanced technology will demonstrate the technical and operational viability of high voltage direct current transmission to private competitors and set higher energy efficiency benchmarks in the transmission business. ADB will also leverage its non-sovereign loans to help CPSUs meet substantial borrowing requirements and foster access to more commercial forms of financing. Nonsovereign public sector financing facilities will enable financially viable subsovereign entities to increase infrastructure development services for economic and social purposes. The facilities will thereby serve as an effective catalyst for inclusive and sustainable growth and reduce the strain on central government finances while increasing its fiscal space for other priority programs in the social sector and in supporting states with weak development capacity. Nonsovereign operations will allow financially strong CPSUs to be graduated in a phased manner from use of sovereign facilities. Nonsovereign operations will also promote POWERGRID's ability to raise funds on a self-sufficient basis, at par with private players, and showcase its ability to operate in a competitive environment.

Figure 2: Problem Tree for the Power Sector in India



GDP = gross domestic product, HVDC = high voltage direct current, IPP = independent power producers, MDB = multilateral development banks.
Source: Asian Development Bank.

Sector Results Framework (Power Sector, 2009-2012)

Country Sector Outcome		Country Sector Outputs		ADB Sector Operations	
Outcomes with ADB Contributions	**Indicators with Targets and Baselines**	**Outputs with ADB Contributions**	**Indicators with Incremental Targets (Baselines Zero)**	**Planned and Ongoing ADB Interventions**	**Main Outputs Expected from ADB Contributions**
Electricity connection provided to all villages and below-poverty-level households, and round-the-clock power established by the end of the 11th Five Year Plan	115,000 villages electrified and 23.4 million households below the poverty line connected	(i) Promotion of higher efficiency, low-carbon energy sources	16,553 MW of hydropower capacity added	(i) Planned key activity areas: Clean energy development	Increased run-of-river hydropower and solar power capacity additions
Generation capacity increased	Capacity increased by 78,577 MW during the 11th Plan	(ii) Expansion and optimization of transmission and distribution systems	Interregional transmission capacity raised by at least additional 6,000 MW from 2011	Transmission & distribution system investments (ii) Projects in the Pipeline (2011)	Continued support for capacity development and sector reforms at the state level
National transmission system strengthened and expanded	Interregional capacities of 27,950 MW and above added during the 11th Plan	(iii) Institutional strengthening to implement reforms required by the Electricity Act, 2003, including development of more flexible power delivery and trading systems	Interstate transmission system availability maintained at not less than 99.0%	POWERGRID, Himachal Pradesh, Gujarat, Madhya Pradesh for T&D (iii) Ongoing Projects	T&D substation capacity enhancement and renovation of lines Augmentation of distribution transformer capacity and system-strengthening activities
	Power system able to handle 100,000 MW peak load			POWERGRID Transmission	
AT&C losses reduced	AT&C losses reduced from 40% to 15% by the end of the 11th Plan	(iv) Lowering of AT&C losses	Transmission losses cut by 3%–4%	Uttarakhand Power Sector Development (MFF) Madhya Pradesh Power Sector Development Project	
Energy efficiency increased and Primary energy demand reduced	Demand reduced 5% from 7%	(v) Promotion of private sector participation	Additional 4,000 MW generation and 14 interregional transmission projects From 2011	Himachal Pradesh Clean Energy Development Investment Program (MFF) ($800 million)	
Low-carbon energy sources promoted	Renewable energy increased by 20% 2017	(vi) Rural electrification	Rural areas electrified to 100%	Assam Energy Efficiency Enhancement Project Bihar Power System Improvement Project	

ADB = Asian Development Bank, AT&C = aggregate technical and commercial, kV = kilovolt, MFF = multitranche financing facility, MW = megawatt, POWERGRID = Power Grid Corporation of India, T&D = transmission and distribution.
Source: Asian Development Bank estimates.