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Electricity Generation Sector in India: Opportunities and Challenges

KEYWORDS

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ABSTRACT *India's electricity sector include new project management and execution, ensuring accessibility of fuel quantities and qualities, lack of initiative to develop large coal and natural gas resources present in India, land acquisition, environmental clearances at state and central government level, and training of skilled manpower to prevent talent shortages for in service latest technology plants. Most developed countries has been restructured in recent decades with the aim of reducing costs, improving service quality and encouraging electricity utilities to perform efficiently. The remaining regulated segments provide the infrastructure for the competitive segments and represent an important amount of the total price paid by final customers. Despite the fact that electricity transmission is the baseline for distribution and commercialization, there is a lack of empirical studies that analyze both economic characteristics of the technology and firms' inefficiency in electricity transmission.*

1.1 Introduction

Development of power sector is the key to the fiscal growth of our nation. Growth in manufacture of electricity has led to its extensive use in all the sectors of economy in the succeeding five years plans. The sector had an installed capacity of 225.133 GW as of May 2013, the world's fifth largest. Captive power plants generate an additional 34.444 GW. Non Renewable Power Plants constitute 87.55% of the installed capacity, and Renewable Power Plants constitute the remaining 12.45% of total installed Capacity. India generated 855 BU (855 000 MU i.e. 855 Twh) electricity during 2011-12 fiscal. In terms of fuel, coal-fired plants account for 57% of India's installed electricity capacity, compared to South Africa's 92%; China's 77%; and Australia's 76%. After coal, renewal hydropower accounts for 19%, renewable energy for 12% and natural gas for about 9%.

In December 2011, over 300 million Indian citizens had no right of entry to electricity. Over one third of India's rural population lacked electricity, as did 6% of the urban population. Of those who did have access to electricity in India, the supply was irregular and undependable. In 2010, blackouts and power flaking episodic irrigation and developed across the country. Even though this states such as Gujarat, Pradesh and others provides incessant power supply. The per capita average annual domestic electricity consumption in India in 2009 were 96 kWh in rural areas and 288 kWh in urban areas for those with access to electricity, in contrast to the worldwide per capita annual average of 2600 kWh and 6200 kWh in the European Union. India's total domestic, agricultural and industrial per capita energy consumption estimates vary depending on the source. Two sources place it between 400 to 700kWh in 2008–2009. As of January 2012, one report found the per capita total consumption in India to be 778 kWh.

India at present suffers from a major shortage of electricity generation capacity, even though it is the world's fourth largest energy consumer after United States, China and Russia. The International Energy Agency estimates India needs an investment of at least $135 billion to provide worldwide access of electricity to its population. India's electricity sector is amongst the world's most active players in renewable energy utilization, especially wind energy. As of December 2011, India had an installed capacity of about 28 GW of renewal technologies-based electricity, more than the total installed electricity capacity in Austria by all technologies.

Key implementation challenges for India's electricity sector include new project management and execution, ensuring accessibility of fuel quantities and qualities, lack of initiative to develop large coal and natural gas resources present in India, land acquisition, environmental clearances at state and central government level, and training of skilled manpower to prevent talent shortages for in service latest technology plants.

1.2 Power Generation

India's electricity generation capacity accompaniments from 1950 to 1985 were very low when compared to developed nations. Since 1990, India has been one of the fastest growing markets for new electricity generation capacity. The country's annual electricity generation capacity has increased in last 20 years by about 130 GW, from about 66 GW in 1991to over 100 GW in 2001, to over 199 GW in 2012. India's Power Finance Corporation Limited projects that current and permitted electricity capacity addition projects in India are expected to add about 100 GW of installed capacity between 2012 and 2017. This development makes India one the fastest growing markets for electricity infrastructure equipment. India's installed capacity growth rates are still less than those achieved by China, and short of capacity needed to ensure worldwide accessibility of electricity all over India by 2017.

State-owned and privately owned companies are important players in India's electricity sector, with the private sector growing at a faster rate. India's central government and state governments jointly control electricity sector in India. As of August 2011, the states and union territories of India with power surplus were Himachal Pradesh, Sikkim, Tripura, Gujarat, Delhi and Dadra and Nagar Haveli.

Major financial and social drivers for India's push for electricity generation include India's goal to provide collective access, the need to replace current highly polluting energy sources in use in India with cleaner energy sources, a rapidly growing economy, increasing household incomes, limited domestic reserves of fossil fuels and the unfavorable impact on the environment of rapid development in urban and regional areas.

1.2.1 Thermal Power

Thermal power plants convert energy rich fuel into electricity and heat. Possible fuels include coal, natural gas, petroleum products, agricultural waste and domestic trash / waste. Other sources of fuel include landfill gas and biogases. In some plants, renewal fuels such as biogas are co-fired with coal.

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Coal and lignite accounted for about 57% of India's installed capacity. However, since wind energy depends on wind speed, and hydropower energy on water levels, thermal power plants account for over 65% of India's generated electricity. India's electricity sector consumes about 80% of the coal produced in the country. India expects that its projected rapid growth in electricity generation over the next couple of decades is expected to be largely met by thermal power plants.

1.2.2 Fuel Constraints

A large part of Indian coal reserve is similar to Gondwana coal. It is of low calorific value and high ash content. The iron content is low in India's coal, and toxic trace element concentrations are negligible. The natural fuel value of Indian coal is poor. On average, the Indian power plants using India's coal supply consume about 0.7 kg of coal to generate a kWh, whereas United States thermal power plants consume about 0.45 kg of coal per kWh. This is because of the difference in the quality of the coal, as measured by the Gross Calorific Value (GCV). On average, Indian coal has a GCV of about 4500 Kcal/kg, whereas the quality elsewhere in the world is much better; for example, in Australia, the GCV is 6500 Kcal/kg approximately.

The high ash content in India's coal affects the thermal power plant's potential emissions. Therefore, India's Ministry of Environment & Forests has mandated the use of beneficiated coals whose ash content has been reduced to 34% (or lower) in power plants in urban, ecologically sensitive and other critically polluted areas, and ecologically sensitive areas. Coal benefaction industry has rapidly grown in India, with current capacity topping 90 MT.

Thermal power plants can deploy a wide range of technologies. Some of the major technologies include:

Steam cycle facilities (most commonly used for large utilities);

Gas turbines (commonly used for moderate sized peaking facilities);

Cogeneration and combined cycle facility (the combination of gas turbines or internal combustion engines with heat recovery systems); and

Internal combustion engines (commonly used for small remote sites or stand-by power generation).

India has an extensive review process, one that includes environment impact assessment, prior to a thermal power plant being approved for construction and commissioning. The Ministry of Environment and Forests has published a technical guidance manual to help project proposers and to prevent environmental pollution in India from thermal power plants.

1.2.3 Hydro Power

In this system of power generation, the potential of the water falling under gravitational force is utilized to rotate a turbine which again is coupled to a Generator, leading to generation of electricity. India is endowed with economically exploitable and viable hydro potential assessed to be about 84,000 MW at 60% load factor. In addition, 6,780 MW in terms of installed capacity from Small, Mini, and Micro Hydel schemes have been assessed. Also, 56 sites for pumped storage schemes with an aggregate installed capacity of 94,000 MW have been identified. It is the most widely used form of renewable energy. India is blessed with immense amount of hydro-electric potential and ranks 5th in terms of exploitable hydro-potential on global scenario.

The present installed capacity as of 31 October 2012 is approximately 39,291.40 MW which is 18.77% of total electricity generation in India. The public sector has a predominant share of 97% in this sector. National Hydroelectric Power Corporation (NHPC), Northeast Electric Power Company (NEEPCO), Satluj jal vidyut nigam (SJVNL), Tehri Hydro Development Corporation, NTPC-Hydro are a few public sector companies engaged in development of hydroelectric power in India.

Bhakra Beas Management Board (BBMB), illustrative state-owned enterprise in north India, has an installed capacity of 2.9 GW and generates 12000-14000 MU per year. The cost of generation of energy after four decades of operation is about 20 paise/kWh (=0.2 rupee/kWh = approx. 0.3 US cents/kWh). BBMB is a major source of peaking power and black start to the northern grid in India. Large reservoirs provide operational flexibility. BBMB reservoirs annually supply water for irrigation to 12.5 million(12.5 million) acres of agricultural land of partner states, enabling northern India in its green revolution.

1.2.4 Nuclear Power

As of 2011, India had 4.8 GW of installed electricity generation capacity using nuclear fuels. India's Nuclear plants generated 32455 million units or 3.75% of total electricity produced in India. India's nuclear power plant development began in 1964. India signed an agreement with General Electric of the United States for the construction and commissioning of two boiling water reactors at Tarapur. In 1967, this effort was placed under India's Department of Atomic Energy. In 1971, India set up its first pressurized heavy water reactors with Canadian collaboration in Rajasthan. In 1987, India created Nuclear Power Corporation of India Limited to commercialize nuclear power. Nuclear Power Corporation of India Limited is a public sector enterprise, wholly owned by the Government of India, under the administrative control of its Department of Atomic Energy. Its objective is to implement and operate nuclear power stations for India's electricity sector. The state-owned company has ambitious plans to establish 63 GW generation capacities by 2032, as a safe, environmentally benign and economically viable source of electrical energy to meet the increasing electricity needs of India.

India's nuclear power generation effort satisfies many safeguards and oversights, such as getting ISO-14001 accreditation for environment management system and peer review by World Association of Nuclear Operators including a pre-start up peer review. Nuclear Power Corporation of India Limited admits, in its annual report for 2011, which its biggest challenge is to address the public and policy maker perceptions about the safety of nuclear power, particularly after the Fukushima incident in Japan. In 2011, India had 18 pressurized heavy water reactors in operation, with another four projects of 2.8 GW capacity launched. The country plans to implement fast breeder reactors, using plutonium based fuel. Plutonium is obtained by reprocessing spent fuel of first stage reactors. India successfully launched its first prototype fast breeder reactor of 500 MW capacities in Tamil Nadu, and now operates two such reactors.

India has nuclear power plants operating in the following states: Maharashtra, Gujarat, Rajasthan, Uttar Pradesh, Tamilnadu and Karnataka. These reactors have an installed electricity generation capacity between 100 to 540 MW each. New reactors with installed capacity of 1000 MW per reactor are expected to be in use by 2012.

In 2011, The Wall Street Journal reported the discovery of uranium in a new mine in India, the country's largest ever. The estimated reserves of 64,000 tonnes could be as large as 150,000 tonnes (making the mine one of the world's largest). The new mine is expected to provide India with a fuel that it currently imports. Nuclear fuel supply constraints had limited India's ability to grow its nuclear power generation capacity. The newly discovered ore, unlike those in Australia, is of slightly lower grade. This mine is expected to be in operation in 2012. India's share of nuclear power plant generation

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capacity is just 1.2% of worldwide nuclear power production capacity, making it the 15th largest nuclear power producer. Nuclear power provided 3% of the country's total electricity generation in 2011. India aims to supply 9% of its electricity needs with nuclear power by 2032. India's largest nuclear power plant project under implementation is at Jaitapur, Maharashtra in partnership with Areva, France.

1.3 Problems with India's Power Sector
India's electricity sector faces many issues. Some are:

Government giveaways such as free electricity for farmers, partly to curry political favour, have depleted the cash reserves of state-run electricity-distribution system. This has financially crippled the distribution network, and its ability to pay for power to meet the demand. This situation has been worsened by government departments of India that do not pay their bills.

Shortages of fuel: despite abundant reserves of coal, India is facing a severe shortage of coal. The country isn't producing enough to feed its power plants. Some plants do not have reserve coal supplies to last a day of operations. India's monopoly coal producer, state-controlled Coal India, is constrained by primitive mining techniques and is rife with theft and corruption; Coal India has consistently missed production targets and growth targets. Poor coal transport infrastructure has worsened these problems. To expand its coal production capacity, Coal India needs to mine new deposits. However, most of India's coal lies under protected forests or designated tribal lands. Any mining activity or land acquisition for infrastructure in these coal-rich areas of India has been rife with political demonstrations, social activism and public interest litigations.

Poor pipeline connectivity and infrastructure to harness India's abundant coal bed methane and shale gas potential.

The giant new offshore natural gas field has delivered less fuel than projected. India faces a shortage of natural gas.

Hydroelectric power projects in India's mountainous north and northeast regions have been slowed down by ecological, environmental and rehabilitation controversies, coupled with public interest litigations.

India's nuclear power generation potential has been stymied by political activism since the Fukushima disaster in Japan.

Average transmission, distribution and consumer-level losses exceeding 30% which includes auxiliary power consumption of thermal power stations, etc.

Over 30 crore (300 million) people in India have no access to electricity. Of those who do, almost all find electricity supply intermittent and unreliable.

Lack of clean and reliable energy sources such as electricity is, in part, causing about 80 crore (800 million) people in India to continue using traditional biomass energy sources – namely fuel wood, agricultural waste and livestock dung – for cooking and other domestic needs. Traditional fuel combustion is the primary source of indoor air pollution in India, causes between 300,000 to 400,000 deaths per year and other chronic health issues.

India's coal-fired, oil-fired and natural gas-fired thermal power plants are inefficient and offer significant potential for greenhouse gas (CO_2) emission reduction through better technology. Compared to the average emissions from coal-fired, oil-fired and natural gas-fired thermal power plants in European Union (EU-27) countries, India's thermal power plants emit 50% to 120% more CO_2 per kWh produced.

The July 2012 blackout, affecting the north of the country, was the largest power grid failure in history by number of people affected.

1.4 ConclSusions
The electricity industry in most developed countries has been restructured in recent decades with the aim of reducing costs, improving service quality and encouraging electricity utilities to perform efficiently. The remaining regulated segments (i.e. transmission and distribution) provide the infrastructure for the competitive segments and represent an important amount of the total price paid by final customers. Despite the fact that electricity transmission is the baseline for distribution and commercialization, there is a lack of empirical studies that analyze both economic characteristics of the technology and firms' inefficiency in electricity transmission.

REFERENCE
1. "All India Region wise Generating Installed Capacity of Power". Central Electricity Authority, Ministry of Power, Government of India. May 2013. | 2. "Power sector at a glance: All India data". Ministry of Power, Government of India. June 2012. | 3. "Power Sector in India: White paper on Implementation Challenges and Opportunities". KPMG. January 2010. | 4. The Partnership for Clean Indoor Air – Sierra Club. Pciaonline.org. Retrieved on 2012-01-13. | 5. Ganguly et al (2001). "Indoor Air Pollution in India – A Major Environmental and Public Health Concern". Indian Council of Medical Research, New Delhi. | 6. "Housing condition in India: Household amenities and other characteristics (July – September 2002)". Government of India. | 7. "Annual Report 2002-2003". Department of Power, Govt of India. 2003. | 8. "Load Generation and Balance Report". Central Electricity Authority, Ministry of Power, Government of India. 2012. | |