Issues and challenges in electricity sector in India

Durgesh Kumar Dubey
K.P.B. Hinduja College of Commerce, Mumbai

Key Words
Electricity Sector in India, Power Sector in India, Power Industry, Transmission and Distribution, Slippage etc.

Abstract
Over the past 60 years or so, India has taken rapid strides in the development of the electricity sector both in terms of enhancing power generation as well as in making power available to widely distributed geographical boundaries. In order to meet the increasing demand for electricity, to fuel the economic growth of the country, large additions to the installed generating capacity and development of associated transmission and distribution network are required. However, during the past, the power sector was perceived to be riddled with some fundamental weaknesses, which necessitated initiation of the reform process in the Sector. Even though a number of policy initiatives have been put in place, the task of transforming the power sector is yet to be achieved. This paper highlights and quantifies some of these gaps and attempts to analyze the problem. The paper builds on the risks prevalent in the industry, some prominent hurdles that the power sector has already crossed, and more importantly others that have to overcome. The researcher has tried to provide some solution framework to overcome from the various issues and challenges in this sector.

Introduction

The **electricity sector (power sector) in India** had an installed capacity of 255.012 GW as of end November 2014 and generated around 703.1 BU for the period April - November 2014. 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. Over the past 60 years or so, India has taken rapid strides in the development of the power sector both in terms of enhancing power generation as well as in making power available to widely distributed geographical boundaries. In spite of the massive addition in generation, transmission and distribution capacity over the last over sixty years, growth in demand for power has always exceeded the generation capacity augmentation. Although the country has achieved capacity addition of about 1,81,500 MW over the last Six decades, peak and energy shortages of varying magnitude are being experienced.

This paper highlights and quantifies some of these gaps and attempts to analyze the problem. The paper builds on the risks prevalent in the industry, some prominent hurdles that the power sector has already crossed, and more importantly - others that various players have to overcome. The researcher has tried to provide some solution framework to overcome from the various issues and challenges in this sector.

Objectives of the Study

- To study the current scenario of Power Sector in India
- To understand the various challenges and risk in Power Sector
- To suggest solution and remedies to the various problems in Power Sector in India

Methodology

The present study is primarily based on secondary data. The relevant secondary data has been collected from reports of Ministry of Power, Finance Commission of India, Government of India and from some research reports.

Electricity Sector in India: Current Scenario

1. Production: The electricity sector in India had an installed capacity of 255.012 GW as of end November 2014 and generated around 703.1 BU for the period April - November 2014. 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. Renewable Power plants constituted 28.43% of total installed capacity and Non-Renewable Power Plants constituted the remaining 71.57%. India generated around 967 TWh (967,150.32 GWh) of electricity (excluding electricity generated from renewable and captive power plants) during the 2013–14 fiscal. The total annual generation of electricity from all types of sources was 1102.9 TeraWatt-hours (TWh) in 2013.

2. Per Capita Consumption: As of March 2013, the per capita total electricity consumption in India was 917.2 kWh. The per capita average annual domestic electricity consumption in India in 2009 was 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 2,600 kWh and 6,200 kWh in the European Union. Electric energy consumption in agriculture is highest (18%) in India. The per capita electricity consumption is lower compared to many countries despite cheaper electricity tariff in India.

3. Transmission and Distribution: The July 2012 blackout, affecting the north of the country, was the largest power grid failure in history by number of people affected. The introduction of Availability Based Tariff (ABT) has brought about stability to a great extent in the Indian transmission grids.

Table 1: Installed transmission (circuit km) and distribution capacity (MVA) up to June, 2014

Capacity	Substations (MVA)	Transmission lines (c.km)	c.km / MVA ratio*
± 500 kV HVDC	13,500	9,432	0.699
765 kV	88,500	12,367	0.140
400 KV	180,872	127,261	0.704
200 KV	258,444	145,561	0.563

#"Progress of Susstations capacity in the Country up to June, 2014", Central Electricity Authority, GoI, 2014.

* the ratio to be multiplied with transmission line capacity (MVA) to give average installed length of transmission line per one MVA of installed substation capacity at each voltage level.

The all time maximum peak load is not exceeding 151,000 MW in the unified grid whereas the all time peak load met is 136,000 MW on 30/6/2014. The maximum achieved demand factor of substations is nearly 61.91% at 200 KV level. The operational performance of the huge capacity substations and the vast network of high voltage transmission lines with low demand factor is not satisfactory in meeting the peak electricity load.

India's network technical losses were 23.65% in 2013 compared to world average of less than 15%. The Government has pegged the national T&D losses at around 24% for the year 2011 & has set a target of reducing them to 17.1% by 2017 & to 14.1% by 2022. A high proportion of non-technical losses are caused by illegal tapping of lines, and faulty electric meters that underestimate actual consumption also contribute to reduced payment collection. A case study in Kerala estimated that replacing faulty meters could reduce distribution losses from 34% to 29%.

4. Demand Trends: In a May 2014 report, India's Central Electricity Authority anticipated, for 2014–15 fiscal year, a base load energy deficit and peaking shortage to be 5.1% and 2% respectively. India also expects all regions to face energy shortage up to a maximum of 17.4% in North Eastern region.

Table 2: All India (Anticipated) Power Supply Position in FY2014-15

Region	Energy			Peak Power		
	Requirement (MU)	Availibility (MU)	Surplus (+) Deficit (-)	Demand (MU)	Supply (MU)	Surplus(+) Deficit (-)
Western	288,062	289,029	+0.3%	45,980	52,652	+14.5%
Southern	298,180	260,366	-12.7%	41,677	32,423	-22.2%
Northern	328,944	318,837	-3.1%	47,570	46,899	-1.4%
North-Eastern	14,823	12,248	-17.4%	2,543	2,215	-12.9%
Eastern	118,663	114,677	-3.4%	17,608	17,782	+1.0%
All India	***1,048,672***	***995,157***	***-5.1%***	***147,815***	***144,788***	***-2.0%***

#Load Generation Balance Report 2014-15". 30 May 2014. Retrieved 18 July 2014.

Despite an ambitious rural electrification programme, some 400 million Indians lose electricity access during blackouts. While 80% of Indian villages have at least an electricity line, just 52.5% of rural households have access to electricity. In urban areas, the access to electricity is 93.1% in 2008. The overall electrification rate in India is 64.5% while 35.5% of the population still live without access to electricity. 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.**Power cuts** are common throughout India and the consequent failure to satisfy the demand for electricity has adversely effected India's economic growth.

Electricity Sector in India: Challenges and Risks

As the Indian electricity sector is embarking on increasing the generation and transmission capacities, key challenges lie ahead which also resulted the historical underperformance.

Under Performance: India has historically failed to meet its power sector targets by a significant margin and with tremendous opportunities ahead, the power sector continues to be affected by the shortfall both on generation as well as transmission side. For example, for the current installed capacity of around 152 GW, the inter-regional transmission capacity is only about 20 GW (13 percent of the installed capacity). The various proposals in generation and transmission are currently under different implementation stages. However, the power sector in India has been plagued with a set of problems for meeting the planned targets. Although measures have been defined by the policymakers and stakeholders in a sense of complacency that the issues will indeed be resolved and India will plug the supply deficit of power to resolve the same but looking at the past record, it can be estimated that the resolution measures may not be implemented. The biggest indicator of a poor track record is the inability to meet targets on the power generation capacity additions. Variance with the target has been as high as 50 percent in the past. An indication of targets and actual additions is provided in the table below:

Slippage in Generation: For the 11th Five year plan various reasons have been identified for slippage. The target of 78,700 MW capacity additions during 11th Plan was revised to 62,374 MW as per the Mid Term Appraisal (MTA) of Planning Commission. The major reasons for slippage of power projects from the capacity addition target of 78,700 MW are as follows:

Table 3: Major Reasons of Slippage

Sr.	Reasons of Slippage	Amount of Slippage
1	Delay in placement of orders for Main	**6,660**
2	Delay in placement of orders for Civil	**1,860**
3	Slow progress of Civil works	**900**
4	Poor Geology	**4,432**
5	Contractual dispute between project	**4,760**
6	Delay in Land Acquisition	**810**
7	Environmental Concerns	**1100**
8	Law and Order Problem/Local Issues	**580**
9	Electrical & Mechanical work critical	**600**
10	Difficult area and accessibility	**100**
	Total	**21,802**

#Working Group on Power for 12th Plan, Page No.98 and 99

The main reasons for slippage of power are Slow progress of Civil works, Poor Geology, Flash Flood, Local agitation, Law and Order problem, Shortage of Manpower and difficult site conditions etc.

Some of the specific challenges have been elaborated in the following paragraphs:

1. Fuel Availability: While additional gas supply from KG Basin has eased shortage to a limited extend, supply constraints for domestic coal remain and are expected to continue going forward. Consequently, public and private sector entities have embarked upon imported coal as a means to bridge the deficit. This has led to some Indian entities to take upon the task of purchasing, developing and operating coal mines in international geographies. While this is expected to secure coal supplies it has again thrown upon further challenges. For example, the main international market for coal supply to India – Indonesia, poses significant political and legal risks in the form of changing regulatory framework towards foreign companies. Similarly, coal evacuation from mines in South Africa is constrained by their limited railway capacity and the

capacity at ports is controlled by a group of existing users making it difficult for a new entrant to ensure reliable evacuation9. In this case it is essential to manage the risk of supply disruption by different options like – diversification of supply, due diligence on suppliers, unambiguous contracting and strict monitoring among others.

2. Problems of Coal Blocks: The failure to achieve the planned target from the captive coal blocks presents itself as a major challenge to the electricity sector, as only 24 blocks have become operational out of the total 210. Experts believe that the non-operational status of majority of these blocks is attributed to land acquisition (RULES AND REGULATIONSR) issues, permit delays and infrastructure problems. In addition, the developers who have been given the charge of captive blocks are not putting diligent efforts to expedite the mining operations due to their lack of experience in coalmine development.

Coal is the mainstay of the power production in India and is expected to remain so in the future. Additional power generation is likely to require incremental amount of coal transportation by Indian Railways within the country and increasing unloading at ports in India for imported coal. In both cases India currently faces capacity shortage. Hence, a project developer has to account for and manage its logistics chain in a manner that minimizes disruption to its fuel supply. In many cases this is likely to involve self development of relevant supply infrastructure which poses additional project execution complexity for the developer. For example, some imported coal based power plants are also forced to set up an unloading jetty for coal carrying shipping vessels. This has to be ensured before the commissioning of a power plant which requires an alternate set of project execution skills in the port sector.

3. Equipment Shortage: Equipment shortages have been a significant reason for India missing its capacity addition targets for the 10th five year plan. While the shortage has been primarily in the core components of Boilers, Turbines and Generators, there has been lack of adequate supply of Balance of Plant (BOP) equipment as well. These include coal-handling, ash- handling plants, etc. Apart from these, there is shortage of construction equipment as well. The Working Group on Power for 11th Plan has outlined the requirement for construction equipment for Hydro and Thermal power plants.

To alleviate supply shortage of equipment two measures are being adopted – enhancement of domestic equipment manufacturing capability by establishing JVs between Indian and foreign suppliers and second measure is procuring equipment directly from international markets. In both cases equipment sourcing needs to be managed effectively throughout the procurement cycle. For instance, it may be a challenge for new project owners to select a reliable supplier, monitor its performance and ensure the quality of supply on a sustained basis. Also, the timelines for availability of additional domestic equipment supply has not been clearly defined.

4. Land Acquisition and Environment Clearance: Land Acquisition poses an increasingly significant challenge in the Indian electricity sector. Power plants and utilities face major constraints and delays regarding the availability of land and obtaining the requisite environment and other clearances for the projects. The new Bill relating to land acquisition has continued to face political opposition. While it provides for acquisition by project development agencies to the extent of 70 percent of the land required for a project, with the balance to be obtained by the Government. In addition, it has been reported that in some cases, even after land owners were asked to sell and handover their land in 'Public Interest', the project was not completed for several years due to other delays, a fact that eroded the credibility of both the industry and the government. Consequently there is a significant mismatch of expectations from the Project Affected Persons (PAP). Stakeholders or other land owners may collectively object of

the project execution. In such cases, it is essential to proactively manage the environment and stakeholders' expectations.

5. Financial Problem: Rapid builds up of the generation capacity is being aided by setting up of Ultra Mega Power Projects (UMPPs) each of which is 4000 MW. However, the execution of the Ultra Mega Power Projects (UMPP) is a significant challenge as India has not witnessed an execution of such a large scale power project before. Furthermore, with each UMPP costing above INR 16,000 Crore, financing such a large project is a critical constraint for any developer. In addition, considering the high financial stake involved through private investments, delay in payments may put severe pressure on developers/suppliers to meet the performance commitments.

6. Manpower Shortage: There is a general consensus that shortage of talent in the construction sector is a long term problem and is likely to continue to push up project costs and risks. The flow of talent into construction and power sector has been gradually drying up as candidates have sought an alternative – and often more lucrative – career options. The Government, which is the biggest buyer of the capital projects, has also not done enough to address this challenge. The education system is often not delivering the required number of specialists across project management, engineering, estimating, surveying and contract management. Facing a desperate game of catch up, the industry needs a genuine collaboration between project owners, contractors and governments to attract more school leavers and graduates. Companies should also seek to stay in touch with changing employee aspirations. By encouraging diversity in its employment practices and by offering greater flexibility in working hours, the sector can reach out to a wider potential audience that perhaps would not previously have considered such a career. Investment in existing employees is also crucial in order to offer better-defined career structures, with a greater focus on training and higher salaries where possible.

The profile of manpower shortage at supervisory staff level in hydro power and thermal power sector is outlined below:

Table 4: Manpower Requirement in Hydro Power and Thermal Power Sector

Category	Estimated requirement	Available	Augmentation required
Hydro Power Sector			
Senior level Executives	550	330	220
Middle level Executives	2000	1200	800
Junior level Executives	4300	2600	1700
Non executives	1700	1000	700
Total	8550	5130	3420
Thermal Power Sector			
Senior level Executives	1014	660	354
Middle level Executives	3702	2400	1302
Junior level Executives	7308	5040	2268
Non executives	12780	8280	4500
Total	24804	16380	8424

#Source: The Working Group on Power for 11th Plan, Planning Commission

7. Schedule Dependency on Transmission Lines: Significant enhancement in construction activity is likely to be required to meet the 11th plan target of additional transmission capacity. A significant portion of this enhancement is likely to be in the North Eastern region, Sikkim and Bhutan, which have difficult terrain reducing the margin of error for project execution. Additional transmission capacity is required to evacuate power from surplus regions to supply

to deficit regions and to enable electricity trading. This is essential to meet the target of 'Power for all'. Hence, the criticality of implementing transmission projects cannot be ignored. In this context, it is imperative to establish sound project management principles to the sector to help ensure timely completion of projects.

Remedies and Solutions

It is evident that the deficit in power availability in India is a significant impediment to the smooth development of the economy. In this context, bridging the gap in demand and supply has become critical and consequently, large projects are being undertaken in different segments of the sector; Generation, Transmission and Distribution. As India has not witnessed such a large scale of implementation before, there is a need to review and enhance project execution capabilities to help ensure targets are met.

The table below summarizes the key implementation challenges and remedies and solutions for successfully achieving the implementation of power generation plans.

Key Challenges	Measures being adopted	Resulting issues	Solutions and Remedies
Addition of significant generation capacity	UMPP	Technical and financial capability to execute such large projects	Project execution Costs/Cash flow management
		Risks increase manifold	Risk Management strategy and planning
Ensuring fuel availability and quality	Purchase and development of coal mines abroad	Risks in operating in different geographies. Eg. - political risks	Risk management through effective contracting, supply diversification, etc.
		Uncertainties in logistics operations	Control over supply infrastructure
Plant equipment shortage	Procurement from abroad	Vendor reliability	Robust procurement management, vendor monitoring
	Setting up of new supply units	Execution timelines	Project scheduling
Land acquisition and environment clearances	Speeding up processes	Inadequate communication with stakeholders resulting in mismatch of expectations from project affected persons	Environment and stakeholder management
Manpower shortage	Enhance training		Resource planning and management

This strongly necessitates employing a comprehensive project management structure to address the major challenges of the power sector projects and to be able to deliver them as per the planned targets. Historical records also indicate the presence of a weak project management structure which does not assess all the key project aspects leads to various issues and challanges. As discussed initially, the overall intent of this paper is to highlight the opportunities and challenges of the electricity sector, and the project management solutions and remedies that are required to address these challenges.

References

Report of The Working Group on Power for Twelfth Plan (2012-17)

Report of GOI: Ministry of Power, 2012

Report of Finance Commission of India, 2013

Yoginder Alagh, Former Minister of Power and Science Technology of India (2011). "Transmission and Distribution of Electricity in India Regulation, Investment and Efficiency". OECD.

"Progress of Susstations capacity in the Country up to June, 2014". Central Electricity Authority, GoI. 2014.

Load Generation Balance Report 2014-15". 30 May 2014. Retrieved 18 July 2014.

"Progress of Susstations capacity in the Country up to June, 2014". Central Electricity Authority, GoI. 2014.

Reforming the Power Sector: Controlling Electricity Theft and Improving Revenue". The World Bank.

http://en.wikipedia.org/wiki/Electricity_sector_in_India#cite_note-95

https://www.kpmg.de