



INFRASTRUCTURE & GOVERNMENT

## Power Sector in India

White paper on Implementation Challenges and Opportunities

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KPMG IN INDIA

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## Executive Summary

While the power sector in India has witnessed a few success stories in the last 4-5 years, the road that lies ahead of us is dotted with innumerable challenges that result from the gaps that exist between what's planned versus what the power sector has been able to deliver. This document highlights and quantifies some of these gaps and attempts to analyze the problem. The document 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. Understanding these core issues & risks of the power sector help in identifying the opportunities that lie ahead; for example why is private sector participation an important requirement. A short peek at our past performances indicate that during the last three five year plans (8th, 9th and 10th), we have barely managed to achieve half of the capacity addition that was planned. As we enter the third year of the 11th five year plan, we have already seen slippages on the planned approx. 79 GW capacity addition. Once we break the problem down and identify the bottlenecks, we may be able to better understand the integration challenges that such large projects pose. While there may be heavy dependencies on equipment suppliers and challenges around logistics and work-front availability – with the right and timely application of project management principles along the lifecycle of the project, one can strive to achieve increased project completion against baselines. Certain best practices around stakeholder management, integrated project and asset development and interdependency mapping across various entities can help improve overall project planning. Once we understand the practical implementation challenges, various teams and people get aligned to the overall strategy, then the delivery on our estimated plans becomes more of a reality.



## Indian Power Industry - Current Scenario and Opportunities Ahead

### Generation

India has the fifth largest generation capacity in the world with an installed capacity of 152 GW as on 30 September 2009<sup>1</sup>, which is about 4 percent of global power generation. The top four countries, viz., US, Japan, China and Russia together consume about 49 percent of the total power generated globally. The average per capita consumption of electricity in India is estimated to be 704 kWh during 2008-09. However, this is fairly low when compared to that of some of the developed and emerging nations such as US (~15,000 kWh) and China (~1,800 kWh). The world average stands at 2,300 kWh<sup>2</sup>. The Indian government has set ambitious goals in the 11th plan for power sector owing to which the power sector is poised for significant expansion. In order to provide availability of over 1000 units of per capita electricity by year 2012, it has been estimated that need-based capacity addition of more than 100,000 MW would be required. This has resulted in massive addition plans being proposed in the sub-sectors of Generation Transmission and Distribution.

### Transmission

The current installed transmission capacity is only 13 percent of the total installed generation capacity<sup>3</sup>. With focus on increasing generation capacity over the next 8-10 years, the corresponding investments in the transmission sector is also expected to augment. The Ministry of Power plans to establish an integrated National Power Grid in the country by 2012 with close to 200,000 MW generation capacities and 37,700 MW of inter-regional power transfer capacity. Considering that the current inter-regional power transfer capacity of 20,750 MW<sup>4</sup>, this is indeed an ambitious objective for the country.

### Distribution

While some progress has been made at reducing the Transmission and Distribution (T&D) losses, these still remain substantially higher than the global benchmarks, at approximately 33 percent. In order to address some of the issues in this segment, reforms have been undertaken through unbundling the State Electricity Boards into separate Generation, Transmission and Distribution units and privatization of power distribution has been initiated either through the outright privatization or the franchisee route; results of these initiatives have been somewhat mixed. While there has been a slow and gradual improvement in metering, billing and collection efficiency, the current loss levels still pose a significant challenge for distribution companies going forward.

<sup>1</sup> Netscribes, "Power Sector – India," March 2009

<sup>2</sup> CEA

<sup>3</sup> Ministry of Power Website, June 2009

<sup>4</sup> Ministry of Power Website, "POWER FOR ALL BY 2012" and National Electricity Plan, by Central Electricity Authority, August 2007



## Central and State Utilities Dominate the Industry

The entire value chain of the power sector is dominated by the central and state sector utilities. For instance, in the generation space, out of the overall capacity of 152 GW, the share of central and state utilities stands at 49.8 GW and 76.6 GW, respectively; and that of private sector stands at 25.8 GW. Even, of the 78.7 GW planned capacity additions during the 11th five-year-plan, central and state utilities together are estimated to add nearly 63.7 GW<sup>5</sup>.

The story remains pretty much the same in power transmission and distribution space. The central and the state utilities own nearly 40 percent and 60 percent, respectively of the total transmission lines of 2.7 million circuit kilometers (ckm). Power Grid Corporation of India Ltd (PGCIL), the central transmission utility (CTU), is the largest transmission company in India<sup>6</sup>.

Similarly, in distribution, the SEBs own nearly 95 percent of the distribution network<sup>6</sup>.

### Regulations are evolving and paving the way for greater private sector participation

Being a highly regulated sector, not surprisingly policies and regulations are playing a pivotal role in the development of this sector. Over the years, the government has realized the importance of the private sector participation. The Electricity Act, 2003 was a turning point in the reforms process which removed the need for license for generation projects, encouraged competition through international competitive bidding, identified transmission as a separate activity and invited a wider public and private sector participation among other things.

Some of the other major reforms that have been implemented over the years include: unbundling of SEBs, tax benefits, Accelerated Power Development and Reform

Program (APDRP) for distribution, permission for trading of power, etc<sup>7</sup>. Furthermore, the National Tariff Policy of 2006 encouraged private investment in the transmission sector through competitive bidding. In addition, the allocation of captive coal blocks to private companies was one of the many noteworthy reforms, increasing the fuel security for the end use project.

Aided by the ambitious plan to add around 78.7 GW of additional generation capacity in the 11th plan by the year 2012, according to CRISIL Research estimates, about INR 7,50,000 crore is likely to be invested in the power sector over the next five years by 2013-14. Of this, INR 4,80,000 crore is expected to be invested in the power generation space. Nearly half of the investments in the power generation space is likely to be made by the private sector<sup>8</sup>. Along with generation this has opened up opportunities in the transmission sector as well. In order to encourage private sectors in transmission line business, Government of India issued guidelines for private sector participation.

These developments have given rise to new opportunities for the private sector especially in the power generation space. As a result, there have been a plethora of new projects announced by the private sector companies many of whom are negligible or have no prior experience in this sector.

This has given birth to the adage of Plans vs. Plants by clearly distinguishing between growth and value utilities.

The new entrants in this sector face a number of challenges relating to the project execution, fuel security, power equipment capacities, infrastructure constraints, etc. The purpose of this dossier is to present a high level overview of the key challenges and the risk factors.

<sup>5</sup> CEA estimates

<sup>6</sup> CRISIL Research, "Power Annual Review – State of the Industry", July 2009

<sup>7</sup> KPMG Research

<sup>8</sup> CRISIL Research, "Power Annual Review – Opinion", August 2009



# Challenges and Risks

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

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:

## Project Execution – Needs to be expedited

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.

Plan Targets Vs. Achievements (MW)



Source: Planning Commission, Government of India



For the 10th Five year plan various reasons have been identified for slippage. They range from inadequate preparedness of projects, shortage of equipment to the delay in financial closure. The shortage of equipment by BHEL has been identified as a major cause of delay in the timely completion of the power generation projects. An analysis of reasons is provided below:

**Table 1 Major reasons of slippage during 2002-07 (MW)**

	Thermal	Hydro
Delay in super critical technology tie up by BHEL	3960	
Geological Surprises		510
Natural Calamities		450
Delay in award of works	998	823
Delay in Ministry of Environment & Forestry clearance		400
Investment decision/ Funds tie up constraints/ delay in financial closure	1500	1400
Delay in Preparation of DPR & signing of MOU with State Govt.		400
ESCROW cover (Private Sector)	500	
R&R issues		400
Court Cases		675
Law & Order problem	500	
<b>Total</b>	<b>7458</b>	<b>5058</b>

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

The target for the current 11th Plan is ambitious, at 78,700 MW, but the first 2 years have already seen a slippage.

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

## Fuel Availability

While additional gas supply from KG Basin has eased shortage to a limited extent, 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 evacuation<sup>9</sup>. 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.

The failure to achieve the planned target from the captive coal blocks presents itself as a major challenge to the power 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 (R&R) issues, permit delays and infrastructure problems<sup>10</sup>. 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

<sup>9</sup> KPMG Research

<sup>10</sup> Infraline Report on Captive Coal Blocks in India, 2009

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.

## 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.

### Hydro Projects

Table 2 Requirement of construction equipment for Hydro Projects

Particulars of Equipment	Estimated Requirement	Available	Augmentation Required
Hydraulic Drill Jumbos (1 to 3 boom)	210	85	125
Hydraulic Excavators (0.2 to 5.2 cum)	520	210	310
Loaders	540	220	320
Dozers	420	165	255
Dumpers (12T to 35 T)	730	290	440
Road Rollers	55	20	35
Raise Borer/Climber	45	20	25
Concrete Batching plant (30 to 360 cum/hr)	210	85	125
Aggregate Processing Plant (50 to 600 TPH)	110	40	70
Tower Crane (6.5 to 10 T)	120	45	75
Shutter with travellers	470	190	280
Dry Shotcrete machines	440	180	260
Wet Shotcrete machines	130	50	80
Cranes (5 T to 60T)	405	160	245
EOT/ Gantry Cranes (10T to 20T)	175	70	105

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

## Thermal Projects

The major equipment required to be deployed for simultaneous construction of 24 projects of less than 500 MW and 21 projects of more than 500MW is summarized below.

**Table 3 Requirement of construction equipment for Thermal Projects**

Particulars of Equipment	Estimated Requirement	Available	Augmentation Required
325 T Fm Crane Or Equivalent	47	12	30
Sumitomo crane or equivalent 150 t	177	120	57
Crawler mounted crane 100 t	90	72	18
Crawler mounted crane 75 t	444	312	132
Mobile crane - 20 mt / 8 mt	1206	732	474
Mobile crane – 40 mt	156	98	58
Heavy duty trailer 20-50 mt	1206	732	474
Dumpers	3540	3540	-
Dozers ( heavy duty d-6 & d-8) (hydraulic)	132	68	64
Vibro compactors	444	312	132
Concrete pump	444	312	132
Truck mounted concrete pumps with placing boom	177	100	77
Transit mixer (min. 5 cum.Capacity)	884	528	356
Batching plant (more than 30 cum. / hr. Capacity)	288	166	122
Rotaritory hydraulic piling rig	177	100	77
Compressors	177	100	77
DG sets	354	200	154
Boring equipment for trench less construction	45	31	14
Welding machines	12060	12060	-
Slip form equipment	45	41	14
Strand and jack arrangement for boiler	21	1	20
ETDA cleaning arrangement for boiler	21	1	20
Passenger cum goods lifts for boiler	156	98	58
Induction heating machines	156	98	58
Gantry Crane	156	98	58
Pock lain	444	312	132
Tipper	3120	1960	1160

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

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.

## Land Acquisition and Environment Clearance

Land Acquisition poses an increasingly significant challenge in the Indian Power 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.

## Financial

Rapid build 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.

## 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:

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
<b>Total</b>	<b>8550</b>	<b>5130</b>	<b>3420</b>

Category	Estimated requirement	Available	Augmentation required
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
<b>Total</b>	<b>24804</b>	<b>16380</b>	<b>8424</b>

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

## 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.

From the perspective of power generation projects, it is critical for project specific transmission projects to be set up before the commissioning of the plant to enable timely evacuation of power. This adds another scheduling constraint for the project.

# Project management principles to address challenges

A common theme across the challenges enumerated earlier is the need for sound project management principles in a well-structured framework. This is likely to enable the project owner to clearly evaluate all aspects of project execution across the project lifecycle. A sound

project reporting system enables the project owner to efficiently keep track of all the aspects of project execution thus helping ensure problems are addressed and resolved in a timely manner.

## Broad phases for a project lifecycle:



## Key stakeholder outputs as indicators of the overall health of the project:



## Primary constituents of any large project that ascertain the degree of control and influence on the resulting stakeholder outputs as listed above:



## KPMG Projects Advisory Services - Key areas of assistance:

<ul style="list-style-type: none"> <li>• Preparation of a detailed project charter</li> <li>• Project breakdown structure</li> <li>• Policies procedures and controls</li> <li>• Stakeholder identification communication planning</li> <li>• Resource planning and management</li> <li>• Recruiting, hiring and retention strategy</li> </ul>	<ul style="list-style-type: none"> <li>• Contracting strategy</li> <li>• Estimating and budgeting standards</li> <li>• Cost optimization</li> <li>• Contract compliance - Identification of contract weaknesses and quantification of excess costs paid</li> <li>• Cash flow management</li> <li>• Asset management</li> </ul>	<ul style="list-style-type: none"> <li>• Tax efficient procurement</li> <li>• Procurement planning - services and materials</li> <li>• Delegation of authority</li> <li>• Lead time tracking</li> <li>• Contract administration</li> <li>• Claims management</li> <li>• Materials management</li> </ul>	<ul style="list-style-type: none"> <li>• Baseline scope development</li> <li>• WBS Review</li> <li>• Change management</li> <li>• Risk management, strategy and planning</li> <li>• Environmental management and compliance</li> <li>• Project and site security</li> <li>• Labour planning and training</li> <li>• Quality - planning, assurance and control</li> </ul>	<ul style="list-style-type: none"> <li>• Baseline schedule development</li> <li>• Interface engineering - work front availability</li> <li>• Progress management and reporting</li> <li>• Schedule change management</li> <li>• Schedule integration across vendors, contractors and consultants</li> </ul>
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The project management framework shown above can contribute to a structured manner of addressing the typical challenges of the Indian power sector throughout the project life-cycle and aid in managing the power projects better. The main buckets under which all the challenges of the power sector can be addressed are:

- a. Project Strategy, Organization & Administration
- b. Cost and Financial Management
- c. Procurement Management
- d. Project Controls, Quality & Risk Management
- e. Schedule Management

By tracking each of the aspects in a well-defined framework, the reporting on project execution becomes focused.

Few examples of how some processes of the framework can address the major challenges are illustrated below.

### Procurement planning and management

This is a key element which is essential to execute and monitor a project successfully. A detailed procurement level planning that can address the current challenges of fuel availability and equipment shortage. By addressing the constraints of coal transportation through Indian railways and ports availability, a realistic procurement plan can be prepared showing the overall impact on the achievement of the 11th plan. Addressing these constraints upfront can bring the needed transparency upfront and is likely to trigger the corrective actions on timely basis in case of negative deviations.

Planning for construction equipments becomes a critical aspect of procurement planning, achievement of which can assess the vendors' reliability and provide well established vendors to be used for future projects.

### Stakeholder Identification and Communication Planning

Stakeholder identification is required in the project's early stages to measure their expectations and assess their impact on the overall project life-cycle. The impact can be on the design or construction scheme which can adversely affect the project schedule and budget. Therefore, R&R and clearance planning should be in place before the project plan is finalized. Communication planning can eliminate the mismatch between stakeholders' expectations, helping ensure the buy-in from all affected parties to prevent any hurdles in the future. For example, all the project affected persons (PAPs) should be consistently involved through-out the project to make the planning for balance work realistic and achievable.

The fact that land acquisition and permits are major concerns for captive coal blocks operations exemplifies that stakeholder identification and communication planning was missing during the 11th plan formulation.

### Schedule Integration

Schedule integration enables building a detailed master schedule where dependencies across different projects plans and external factors can be built in and addressed regularly. Schedule integration is the key to avoid any gaps and mismatch between stakeholders' planning and expectations. The impact of major dependencies such as equipment supply (BTG etc.), land acquisition and R&R, and environment clearances can be ascertained in the master schedule and addressed prudently.



## Summary and Conclusion



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.

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.

As discussed initially, the overall intent of this paper is to highlight the opportunities and challenges of the power sector, and the project management drivers that are required to address these challenges.

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

**Table 5: Key implementation challenges and drivers for success in power sector**

Key Challenges	Measures being adopted	Resulting issues	Drivers for determining success
Addition of significant generation capacity	UMPP	Technical and financial capability to execute such large projects	Project execution Costs/Cash flow management
Ensuring fuel availability and quality	Purchase and development of coal mines abroad	Risks increase manifold	Risk Management strategy and planning
		Risks in operating in different geographies. Eg. – political risks	Risk management through effective contracting, supply diversification, etc.
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



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