

# Case study of Risk factors involved in Public Private Partnership Power Transmission projects in India

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**Abstract - Indian power sector is going through transition phase. Government of India introduced Public Private Partnership (PPP) model in power transmission sector in 2006. Before 2006 only Power Grid Corporation of India Limited (POWERGRID), the Central Transmission Utility (CTU) of the country under Ministry of Power (MoP) was executing the central power transmission line projects in the India. After 2006 private sector also enthusiastically entered in this sector but while executing power transmission projects they are facing various risks. As many as 120 power transmission line projects have faced delays because of various risk factors. Case study of Bongaigaon-Siliguri power transmission line project is studied. The risks involved in transmission line projects are in every phases. From case study it is found that this project got delayed by 20 months due to various risk factors which not only results in loss of revenue of 1000 million with cost escalation of project by 1080 million to private organization but also the end consumers i.e common peoples who are beneficiaries of that transmission line also suffered**

**Keywords: Public Private Partnership, Risk, Power.**

## I. INTRODUCTION

In India both the central and state governments are responsible for the development of the electricity sector. National Thermal Power Corporation, National Hydroelectric Power Corporation, Tehri Hydro Development Corporation, North Eastern Electric Power Corporation Limited, Satluj Jal Vidyut Nigam Limited, etc. are the central generation utilities and POWERGRID is the Central Transmission Utility (CTU). At the State level, there are Gencos and Transco in the respective States. Like Mahatransco, Mahagenco in Maharashtra state. The country has been demarcated into five electrical regions viz. Northern (NR), Eastern (ER), Western (WR), Southern (SR).

Electricity is a regulated sector in India with Central Electricity Regulatory Commission (CERC) at the central level and State Electricity Regulatory Commission (SERC) in each of the states. Power grid Corporation of India Limited (POWERGRID), the Central Transmission utility (CTU) is responsible for wheeling power of central generating utilities and interstate Mega independent power producers (IPPs), while State Transmission Utilities are responsible for wheeling of power from State generating units and State level independent power producers (IPPs). The CTU plays an important role in the planning of new

transmission systems as well as strengthening of existing networks at the Central level.

In 2006, the Union power ministry decided to involve private sector participation in setting up interstate and interregional transmission lines. This was done with a view to supplement the efforts of the Central transmission utility Power Grid Corporation of India Ltd that was till then the sole agency for developing interstate transmission infrastructure. It was also proposed to select developers using the tariff-based competitive bidding mechanism with a view to encourage competition between private sector aspirants. As many as 120 transmission projects have faced delays because of the developer's inability to acquire land and get timely clearances from all stakeholders. There have been instances of transmission lines being forced to take a different route than planned, resulting in the entire project budget going out of control. Power transmission constraints have also made it difficult to evacuate excess power and channel it to regions that face shortages. Hence, there is an urgent need to timely address underlying issues in the transmission sector to ensure power demand is effectively met in the future.

## Risk

Risks can be defined as an event that negatively affects the project objectives time, cost and quality of work. Risk is nothing but a situation. Power infrastructure projects usually involve long gestation period. High risk is

associated with these projects. Higher is the risk, higher the return, power sector is highly risk prone, with complex and dynamic project environments creating an atmosphere of high uncertainty and risk.

### Challenges in Power Transmission sector

Compared with traditional construction projects, power transmission construction projects have been characterized by large investments, long project cycles, complicated techniques, numerous unpredictable risk factors, and having significant impacts on society and the environment. As a consequence, a number of uncertainties and risks are encountered during the construction of power transmission projects, which may cause project delay, cost overrun, and even negative impacts on society. A power transmission construction project involves multiple complex phases, such as project approval, feasibility research, design, construction, completion acceptance, etc. Meanwhile, it is a complex process with a long investment cycle, huge investment scale, large technology requirement and a complex environment. A complex and uncertain construction environment may generate uncertainties for a project as well as affect project progress and quality. Unlike generation projects, which are confined to four boundaries, the transmission lines run cross-country traversing entire geography of country and therefore, it faces a typical Right of Way (ROW) related challenges for construction of transmission lines.

## II. LITERATURE REVIEW.

### Singh Rajiv Kumar, et.al, (2013)

According to them Indian power sector is consistently facing multiple challenges of fund availability, fuel linkages, land acquisition, environmental clearances, poor management practices of erstwhile State electricity boards, delivery schedule for the equipments, & inadequately trained manpower. The power sector role in the overall growth of the economy is increasingly becoming important and critical. Any slowdown in its performance severely impacts Gross domestic product (GDP) growth of the country as a whole. They recommends effective measures to be initiated in terms of efficient governance of this sector as a whole so as to put back the power sector on the fast track of development with efficiency and effectiveness.

### Mahalingam Ashwin (2010)

He studied five key barriers that PPP projects face in the urban Indian context. These barriers are distrust between the public and private sector, a lack of political willingness to develop PPPs, the absence of an enabling institutional environment for PPPs, a lack of project preparation capacity on the part of the public sector, and poorly designed and structured PPP projects. A series of measures that the Government of India has undertaken to enable PPPs are evaluated and it is observed that these programs address only three of the five barriers identified

**Furbey Lita et.al, (1988)** According to them the effect of electric power transmission lines on property value is controversial issue and conventional compensation procedure appear to be a major source of public discontent over the sitting of transmission lines. Their study reviews and critiques current method of determining transmission line impact on land values and current practices in compensating property owners for losses associated with power lines, relevant theoretical issues regarding property rights ,nature of property value and meaning of compensation. Empirical study of the effect of transmission line on property value is also reviewed and relation between different type of assessment, procedures and measures of economic value are also explored.

**Slovic Paul et,al (1988)** They studied public perception of electric transmission line according to them electric transmission lines have recently met significant amount of public opposition. Source of such opposition varies from case to case such objections include land use conflict, noise created by lines, aesthetic concern, and fear of health and safety threats. Despite sometime enormous cost and long delays caused by strong opposition to transmission line construction, both utilities and government regulators are getting affected. This paper also reviews attitude toward transmission line and outlines a conceptual framework for understanding the determinants of those attitude.

### Qureshi Nadir Hussain (2015)

He studied the reasons behind the serious power shortages in India and impact of power plants on environment and citizens. The present power position in India is alarming as there are major power shortages in almost all states of the country leading to crippling of industries and hundreds of thousands of people losing jobs and a heavy loss of production. The overall power scene in India shows heavy shortage almost in all states in the country. The situation is going to be aggravated in coming years as the demand is increasing and the power industry is not keeping pace with the increasing demand. Many of the states in India depend to a large extent on hydro generation. The increase in demand has far outstripped the installation of new plants. Also there is no central grid to distribute excess energy from one region to another. The experience in the operation of thermal plants is inadequate. All these have led to heavy shortage and severe hardship to people.

## III.METHODOLOGY

It is found that work has been done on PPP projects in road sector but work on PPP power transmission line work is very less. Wide range of survey of published literature from several journal, books and published papers and interview of people involved in past PPP projects regarding risk in PPP power projects in India is carried out. From discussion with various stake holders involved in PPP power sector it is found that there is huge risk involved in PPP power transmission line project. Unlike Power

generation projects, which are confined to four boundaries, the transmission lines run cross-country traversing entire geography of country and therefore, it faces a typical Right of Way (ROW) related challenges for construction of transmission lines. From various literature and experts opinion it is found that risk in PPP power transmission line project is involved in various phases. These phases are initial phase, execution phase, operation and maintenance phase, and transfer phase. Each phase consist of number of risk factors. In order to get actual understanding of various phases and risk factors a case study from power transmission sector in India is selected. After interaction with various stakeholders involved in this project it is found that this project got delayed due to various reasons and risk factors which are discussed in case study.

### **Case Study Bongaigaon (Assam) to Siliguri (West Bengal) 400 Kilovolt (KV) Double Circuit (D/C) Transmission line.**

M/s Sterlite Technologies Ltd (STL) was building 400 Kilovolt (KV) Double Circuit Power transmission line of length 220km between Siliguri (in West Bengal State) and Bongaigaon (in Assam State). It will supply 900 Megawatts (MW) of additional power to Assam.

The project was awarded to M/s Sterlite Technologies Ltd (STL) from Central Government of India on build-own-operate-maintain (BOOM) basis

As per timeline given to M/s Sterlite Technologies Limited for completion of project was from March-2010 to March-2013 but actually it completed in November 2014. i.e delayed by 20 months. The various risk factors were involved during various phases of this project. This project is divided in four phase's namely Initial phase, Execution Phase, Operation & Maintenance phase and Transfer phase these four phases involve number of risk factors as discussed below.

#### **Initial phase**

In initial phase following risks were encountered.

#### **Bidding Risks**

As M/s Sterlite Technologies Ltd was first time entering into power sector project beforehand they did not have any experience of power project. there were possibility of various risks like bid could have been unresponsive, No single party competent enough for the project, Prequalification standards are too high, and at the prequalification stage all parties withdraws etc. inspite of all those risks M/s Sterlite Technologies Ltd applied for bidding and won this project of building Bongaigaon (Assam) to Siliguri (West Bengal) 400 kv D/C Transmission line.

#### **Financial Risks**

As M/s Sterlite Technologies Ltd (STL) did not have any experience of power project there was risk like project cost comes out to be high and company may face financial problem after getting the project.

#### **Technology Risks**

As this was first new PPP project in power transmission sector there was risk like untried technology as M/s Sterlite Technologies Ltd was first time doing such kind of project.

#### **Execution phase**

In execution phase following risks were encountered.

#### **Construction Risk**

As project was awarded to M/s STL in March-2010 during actual execution of project it faced following difficulties.

#### **Risk of Change in scope**

Initial line length of Bongaigaon (Assam) to Siliguri (West Bengal) 400 kv D/C Transmission line was 217 km when contract was awarded to M/s STL but during execution it was found that actual line length was 220 km. (i.e 3 km more than awarded quantity) that required additional cost and time for construction of transmission line.

#### **Risk of blockade**

While executing the project in mid July 2012 Assam state was hit by ethnic riots which led to the deployment of army personnel and indefinite curfew was imposed in several areas including districts of Kokrajhar, Chirang, Dhubri and Bongaigaon. These are the districts through which Bongaigaon-Siliguri line was passing. The riot led the displacement of over 400,000 people from the affected area and imposition of indefinite curfew in few areas due to this construction work was stopped several times which caused delay of several days for completion of project. Details are given in table 1 and depicted in fig.1.

#### **Risk of security issues in and around Bongaigaon Substation area**

In Kokrajhar district around Bongaigaon substation in year 2011-12, significant security issues and unstable law and order situation occurred, several instances like security issues including killings of innocent people by militants, exchange of fire between security personnel and militants, killing of militants by security personnel, kidnapping of traders/local people by militants etc. happened. Due to this work was stopped several times in that area. The impact of above events on the project progress has been illustrated by way of envisaged vs. actual foundation development progress comparison chart for Bongaigaon- Siliguri line from November 2011 onwards. Till the onset of blockade the foundation development progress was in line with the envisaged progress. However, post the riots the progress slowed down significantly leading to slowdown of the development of entire line. Details are depicted in fig.2

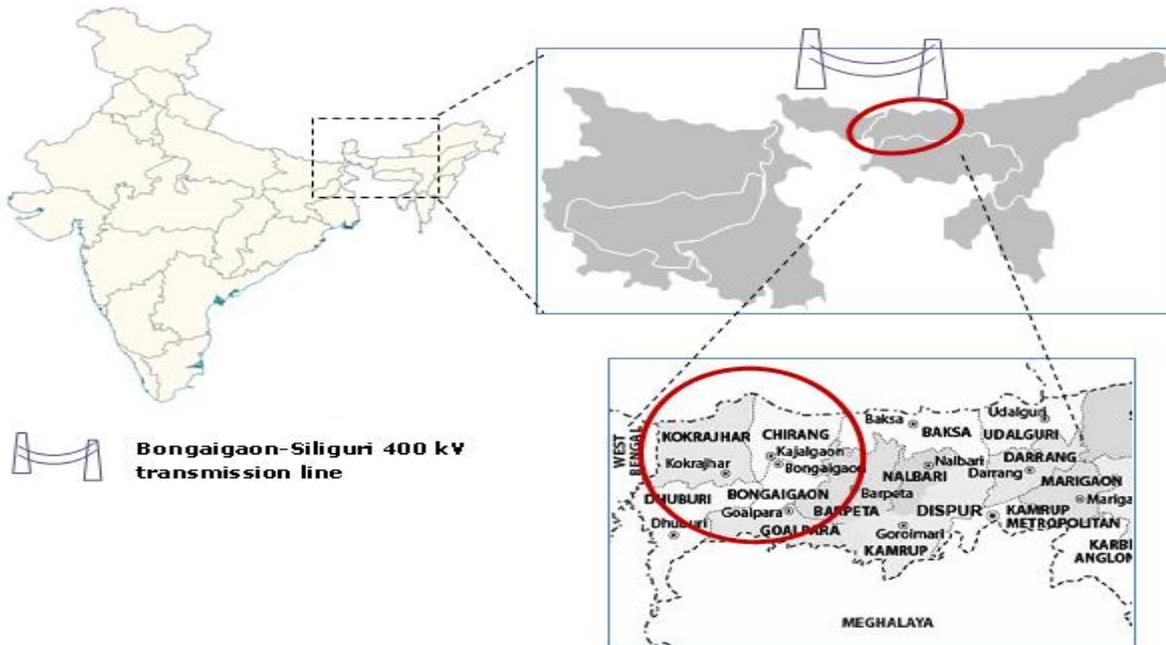


Fig.1 Area affected by riots during July to October 2012  
 Source: Asian Centre for Human Rights

Table 1 Details of riots affected Section and location number of Bongaigaon Siliguri Transmission line

BS Line	Section details	Start	End	Days
Riots-Assam	Assam- Location no 8/5,8/6,16/5,9/0,8/1,8/2,8/3,8/4,9c/0,10/0,10/5,11/1,15/2,16/1,19/0,19/3,19/4,19/5	11-Jul-12	30-Oct-12	112
Riots-Assam	22/5,23/0,24/1,25/1,26/2,27/3,27/5,28/0,28/1,28/2,28/3,28/6,28/7,32/1,36/0,36D/0	15-Nov-12	26-Dec-12	42
Total				154

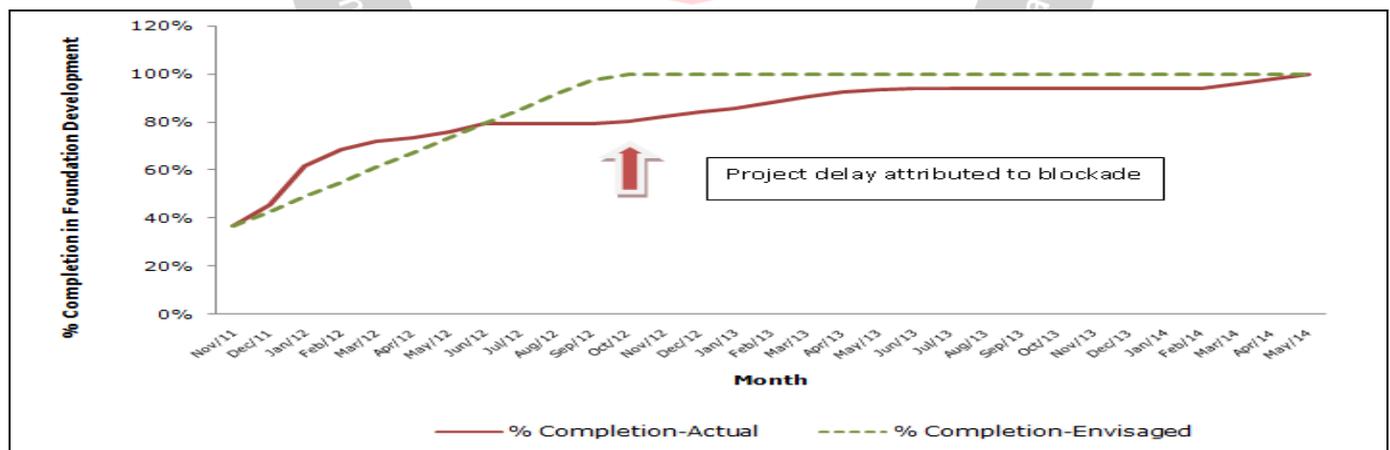


Fig.2 Envisaged rate of foundation development is assumed to be 37 foundations per month based on actual overall project progress from December 2011 to June 2012.in Bongaigaon-Siliguri transmission line

### Risk of Right of Way Issue- Crop Compensation

Bongaigaon- Siliguri line was passing through several villages and farms, At some places land and farm owner were agreed for construction of transmission line through their land .with compensation rate as per Governments rule ( transmission line consist of three activities of construction i.e Tower foundation, Tower erection and

stringing between erected towers.) After construction of tower foundation and erection compensation demanded by the land owners was significantly higher than the crop compensation norms for the damaged portion of crops. The compensation demanded by owners was up to 40 times of the applicable average crop compensation rates in chicken-neck area through which the Bongaigaon- Siliguri line

passes. Analysis of the benchmark crop compensation rates and actual claim payments made to the local villagers for the selected areas, shows that there is significant escalation in the RoW compensation rates. There is significant variation in compensation rates for foundation, erection and stringing with owners demanding highest compensation for stringing. This is because of the fact that once foundation

and erection work is completed, the line path cannot be changed. Hence at this stage project became hostage to exorbitant compensation demand for stringing from local villagers / owners. Hence STL being a private developer, for whom timely completion of project is of utmost essence, agreed to pay higher compensation rates for the land to ensure project progress. Details are given in table 2

Table 2 Details of Crop compensation Rates for Bongaigaon Siliguri Transmission line

Particulars	Foundation	Erection	Stringing		
			First 70Km	Second 75Km	Last 75Km
Initially envisaged as per Base Bid in Rs. / Sq Mt.	12.70	12.70	12.70	12.70	12.70
As per Industry Benchmarks in Rs. / Sq Mt.	9.64	9.64	9.64	9.64	9.64
Actually Paid / Claimed by M/s Sterlite Contractor in Rs. / Sq Mt.	46.37	22.90	156.79	519.86	287.71

**Risk of Change in Bill of Quantity (BOQ) and Design**

Bongaigaon- Siliguri line was passing through several villages and farms before actual construction survey was carried out by M/s STL to finalize route of transmission line. Based on this survey they calculated tower quantity, design of tower etc. But while execution of work they found that the land owner/farm owner of that area through which transmission line was passing were not allowing construction of work in their lands in spite of giving compensations as per Government rule. The route which was initially finalised by M/s STL was then modified in order to avoid confrontation with land owners due to this overall tower locations, their type etc. changed which results into additional cost to M/s STL as in initial survey quantity of Type DB, DC and DD tower were less but after modification of route quantity of these type of towers increased.(price of DB,DC,DD type of tower is several times more than DA type).

Details are given in table 3

Table 3 Details of Tower mix in preconstruction and in advanced construction stage of Bongaigaon Siliguri Transmission line

Tower Type	Preconstruction	Advanced Under Construction stage	Increase (+)/Decrease(-)
DA	371	291	-80
DB	52	92	+40
DC	87	97	+10
DD	84	130	+46
<b>Total</b>	<b>594</b>	<b>610</b>	

**Risk of new development:**

During construction of Bongaigaon- Siliguri line it is found that at select places during preconstruction survey the land was open means there were no development of land was there like house etc.(as there will be time gap of minimum 6 months in survey and actual construction of transmission line) but during actual construction M/s STL found that on the land through which transmission line supposed to be passed there were new developments like house, shop etc due to this M/s STL had to change the route of transmission line due this also total tower mix was changed which also result in cost escalation.

**Risk of forest clearance**

When contract was awarded to M/s STL there was no forest in Bongaigaon- Siliguri line. But during execution when M/s STL carried out survey they discovered that Bongaigaon sub-station of Powergrid from where line was supposed to start was located in the center of Satbhendi reserved forest even though bid process coordinator had represented in the survey report as well as confirmed in the pre-bid meetings that there is no forest area in the entire line route. But actually on site forest was present this required forest clearance for 1.84 km (8.46 Ha forest land). M/s STL subjected to lengthy procedure and significant time delay involved in obtaining all clearances for construction of the transmission line in the reserved forests. As a result M/s STL was unable to undertake construction of the portion of Bongaigaon- Siliguri line that falls in the forest area which has caused undue delay of 15 months in the execution of the line.

**Risk of cost overrun**

Due to various risks involved in construction phase M/s STL arranged additional financing. The overall cost of Bongaigaon- Siliguri line was escalated due to various reasons as shown in table 4

Table 4 Details of Cost escalation of Bongaigaon Siliguri Transmission line

S.No.	Challenge	Capital Cost Escalation Factor	Total Capital Cost Escalation (Rs Cr)
1	Forest Clearance and Riots / Blockade	Interest during Construction (IDC) due to delay	54.51
2	Overall overheads (Admin, Travel etc ) increase due to delay	Overheads	5.73
3	Riots / Blockade	Labor Idling / Reduction in Efficiency	2.66
4	RoW / Blockade	Crop Compensation	35.96
5	RoW / Blockade	Increase in number of tension towers	9.94
6	<b>Total</b>		<b>108.79</b>

#### IV. OPERATION AND MAINTENANCE PHASE

After facing all these risks and obstacles Bongaigaon-Siliguri transmission line finally completed in November-2014. i.e delayed by 20 months. Now currently it is in Operation & Maintenance Phase (O&M). This line is facing following risk related to O&M.

##### Tariff Risk

As Bongaigaon-Siliguri was supposed to be completed by March-14 this line lost revenue of INR ~ 50 Million. from March-13 to November-14 .i.e near about INR ~1000 Million.

##### Transfer phase

The O & M period is for next 35 years in which this line may face The following risks like issue of transfer or retention of existing line of staff, capacity of line needs to be increased, replacement of machinery and equipments, change of management, legal risks like facility has come to an end of its economic life, extension of concession period, and problem in identification of assets to be transferred etc.

Like Bongaigaon-Siliguri transmission line after 2006 there are number of PPP projects of power transmission line are awarded to private players most of them are getting delayed due to various risk factors involved in various phases of project as discussed in above case study hence there is an urgent need to look into issues of power transmission line projects.

#### Performance analysis

From this case study and various transmission line projects it is found that more risk is involved in execution phase.

Phase	Risk type
Execution phase	Very high
Initial phase	High
Operation and maintenance phase	Low
Transfer phase	Low

#### V. CONCLUSION

From analysis of case study it is observed that risk is involved in every phase of project like in Initial phase, Execution, Operation & Maintenance phase and Transfer phase. Risk in initial phase is high it involve various risks like bidding risk, financial risk and technology risk. If private player is new in such project such risk must be addressed before taking contract. Risk in execution phase is very high .Most risk factors are involved in execution phase like Change in scope, Change in BOQ, right of way issue, new development etc.this risk can also be avoided if proper care is taken before execution of project in planning and surveying stage only. If proper care is taken in planning of project by taking lessons from past project in those areas most of the risk factors can be eliminated at early stage of project. In case of risks like riots, flood, natural calamities etc. Government should support private players. Risk in Operation & Maintenance and transfer phase is low but it should not be neglected as gestation period of project is more than 30 years it up to expertise of private player how to tackle those risk is coming years.

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#### REFERENCES

- [1] Adel. A, Abouzar.Z, Shaban Elahi and Abbas Moghbel, (2013), "Assessing and understanding the key risks in a PPP power station projects", Advances in Management & Applied Economics, Vol.3, pp 11-33.
- [2] Dubey Durgesh Kumar, (2015), " Issues and challenges in electricity sector in India" The Business & Management Review, Volume 5 Number 4 International Conference on Issues in Emerging Economies (ICIEE), 29-30th January 2015
- [3] Enzo Sauma and Chung-Li Tseng (2009), "Multiple Perspectives in Power Transmission Expansion Planning under Environmental Awareness" Journal. Energy Eng. Vol. 135(3), pp 53-54.

- [4] Esther Cheung and Albert P. C. Chan (2011) "Risk Factors of Public-Private Partnership"
- [5] Projects in China: Comparison between the Water, Power, and Transportation Sectors", Journal of Urban Planning and Development, Vol. 137, pp 409-415.
- [6] FICCI (2013) Report on "Power Transmission the real bottleneck" ([ficci.in/spdocument/20311/power-transmission-report\\_270913.pdf](http://ficci.in/spdocument/20311/power-transmission-report_270913.pdf))
- [7] Furbey Lita, Gregory Robin, Slovic Paul and Fischhoff, Baruch (1988), "Electric Power Transmission lines, Property Value and Compensation", Journal of Environmental Management Vol.27, pp 69-83
- [8] Kiran.R., Padmavathi.S and Virupaxi V. Betagari "Risk Management in Power sector" ELK Asia Pacific Journals – Special Issue ISBN: 978-81-930411-0-9
- [9] Lead story on Ultra mega transmission needs policy boost Electrical Monitor (2014) (<http://www.spml.co.in/mediaroom/2014/Electrical-Monitor-May-2014.pdf>)
- [10] Mahalingam Ashwin (2010) "PPP Experiences in Indian Cities: Barriers, Enablers, and the Way Forward", Journal of Construction Engineering and Management, Vol.136, pp 419-429.
- [11] Okoro O I and Chikuni E (2007 ), "Power sector reforms in Nigeria: opportunities and challenges" Journal of Energy in Southern Africa Vol. 18 No 3 pp-52-57
- [12] Omer Ankur, Ghosh Smarajit and Kaushik Rajnish (2013), " Indian power system: Issues and Opportunities", Vol.2, pp 1089-1094.
- [13] Parihar Shwetank and Bhar Chandan (2015) "A study on risk factors involved in electrical transmission line projects: A comparative study of Interpretative Structural Modelling and Analytical Hierarchy Process method" ISSN: 0971-1023 | NMIMS Management Review January-February 2015 Vol. 27 pp.70-88
- [14] Position paper on the power sector in India (2009).
- [15] ([pppinindia.com/pdf/ppp\\_position\\_paper\\_power\\_122k9.pdf](http://pppinindia.com/pdf/ppp_position_paper_power_122k9.pdf))
- [16] Patel Kinnareesh (2013), "A study on risk assessment and its management in India", American Journal of Civil Engineering, Vol. 1(2), pp 64-67.
- [17] Qureshi Nadir Hussain (2015) "Problems of power sector in India" Proceedings of 14th IRF International Conference, Bengaluru, India ISBN: 978-93-85465-25-3
- [18] Singh Rajiv Kumar, Choudhary Suresh K., Paul IPS and Raj Kumar, (2013) "Study of Indian Power Sector for Planned Power Capacity" AKGEC International Journal of Technology, Vol. 4, pp 34-38.
- [19] Smith N.J (2006), "Managing risk in construction projects", 2nd Edition "Blackshell publications
- [20] Tummala V M Rao and Burchett John F, (1999), "Applying a Risk Management Process (RMP) to manage cost risk for an EHV transmission line project", International Journal of Project Management Vol. 17, pp.223-235.
- [21] Xueqing Zhang, (2005) "Critical Success Factors for Public-Private Partnerships in Infrastructure Development", Journal of Construction Engineering and Management, Vol. 131, pp 3-14.