A Study Of Time Overruns In Power Projects

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Abstract: Infrastructure is recognized as a crucial input for economic development of a country. Global reports have identified inadequate infrastructure as the biggest impediment to doing business in India. Since the power sector is an important driver of growth in infrastructure, the focus of the study is on power sector in India. In this paper the time overruns in the thermal power projects added during 9^{th} plan to 11^{th} plan have been evaluated. Variation across sectors, regions, plans, capacities, pre and post electricity Act stages have been analyzed.

Keywords: Infrastructure, Power projects, sectors, regions, pre and post Electricity Act stages, size of plants and variation across plans.

A Study of Time Overruns in Power Projects

Infrastructure, the support services below the real economic structure, plays a vital role in the real growth and development of an economy. Infrastructure refers to the economic or social infrastructure. Economic infrastructure includes broadly three categories of services:

- Public utilities (power, telecommunications, piped water supply, sanitation, sewerage, solid waste collection and disposal, and piped gas supply and storage and warehousing).
- Public works (roads, major dams, canal works for irrigation and drainage)
- Other transport sectors (urban and inter urban railways, urban transport, ports, waterways and airports). (World Bank Development Report 1994)

In the broader sense, infrastructure encompasses what is referred to as the social sector which includes provision of education, health, judiciary and housing.

Infrastructure is recognized as a crucial input for economic development of a country. The adequacy or otherwise of infrastructure largely determines an economy's success or failure in diversifying production, expanding trade, coping with growth, reducing poverty or improving environmental conditions. According to the World Bank Development Report 1994, 1% increase in stock of infrastructure is associated with 1% increase in GDP (Gross Domestic Product) across all countries.

The World Economic Forum's 'Global Competitiveness Report, 2008–09' has identified inadequate infrastructure as the biggest impediment to doing business in India. Since the power sector is an important driver of growth in infrastructure, the focus of the study is on power sector in India. To deliver a sustained growth rate of 8% through 2031-32, India needs to increase its electricity generation capacity/supply by 5 to 6 times of their 2003-04 levels. By 2031-32 power generation capacity must increase to nearly 8, 00,000 MW from the current capacity of around 1, 60,000 MW inclusive of all captive plants. Meeting the energy challenge is of fundamental importance to India's economic growth and development. It implies that the pace of addition of power generation capacities would need to be stepped up. Energy and peak shortages to the tune of 13.8% and transmission and distribution losses around 25% continue to be unreasonably high. The addition of new capacities in earlier Plans has been quite inadequate. The installed capacity addition in the power sector has lagged behind the targets due to a number of reasons. The target achievement has been 54.72% for last 15 years despite huge expenditure to the tune of Rs 572706.17 crores since the 9th plan.

The objective of the present paper is to study the time overruns in the thermal power projects and to know its extent and variation across sectors, regions, plans, capacities, stage through data analysis. Data collected for analysis include thermal power projects completed in 9th to 11th Plan. Thermal power generation contributes 65% of total installed power generation capacity in the country as on October 2011, and contributes 74.6% of capacity addition in the 11th Plan. It is expected to remain major source of energy for power generation in India.

The data for 241 completed projects was collected from the various monthly and quarterly Reviews of Thermal Power from CEA (November 1996 to November 2011). Finally, 233 projects were analyzed as some projects had to be excluded due to lack of actual completion cost data. The dataset of 233 projects represents 90.1% of actual thermal generation capacity added till August 2011. As private participation picked up since 1997, we have compared and analyzed projects in the Central, State and Private Sectors from 9th to 11th plan. The complete information about a project is made available once project has successfully run for some time so completed projects till August 2011 have been considered.

The information about the following variables was collected from the monthly, quarterly and Annual Reviews of Thermal Power from CEA.

Actual completion date of the project and initially planned date of completion was collected from CEA. **Time Overrun (TOR)** was calculated as the difference between the actual completion date and initially planned date of completion of project in months.

Time Lapse (TL) is the time in months that has lapsed since February 1997 till project's actual completion date. Feb 1997 is taken as a reference date as it is the earliest date of actual completion of project in our dataset.

Time Overrun in Percentage (TOR %) was calculated as the ratio of time overrun and planned duration of the project multiplied by hundred.

TEC is the date of Techno Economic Clearance of the project granted by CEA. This has been considered as after Electricity Act 2003, TEC is not required for thermal generation projects. So, we have divided the data into two stages **Pre and Post** Electricity Act under S**tage.** Date of TEC has been noted from the various monthly and quarterly issues from CEA.

Plan is 9th, 10th, or 11th plan. Projects which have been completed during the period, January 1997 to December 2001 have been considered in 9th Plan. Similarly, projects completed during January 2002 to December 2006 have been considered in 10^{th} plan. In the 11^{th} plan projects completed during January 2007 to August 2011 have been considered.

Capacity of the projects has been divided into three types **Small** for project capacity up to 100MW, **Medium** for project capacity more than 100MW and up to 500MW and **Large** for capacity of 500MW and more. This has been done to know the variation in the time overruns capacity wise. The general perception is that small projects are not completed on time.

Implementers, the owners of the project, have been divided into three categories **Central, State** and **Private** Implementers. This has been done to know the variation sector wise.

States represent the respective states where the plant is located. **Regions** are divided into five regions as North (N), South (S), East (E), West (W) and North Eastern (NE).

Unit number has been considered as some projects have different units. These are treated as separate projects by the authorities if time lag is there in their construction. Data about the States, Regions and unit number was also collected from various issues of review of thermal power from CEA.

Major Reasons responsible for the time overruns for each project have been identified and analyzed.

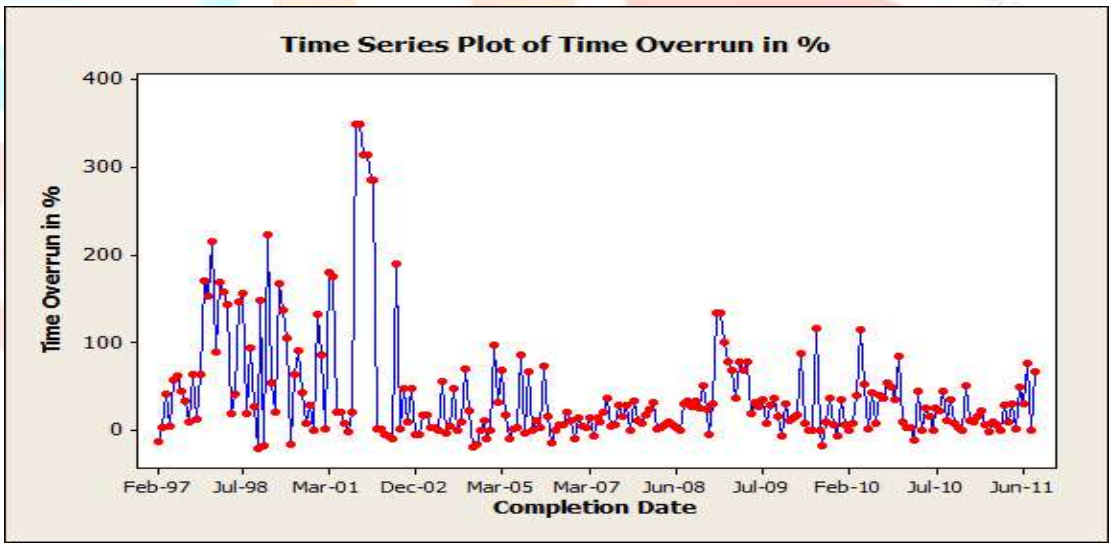
DATA ANALYSIS OF TIME OVERRUNS

233 projects for time overruns were analyzed since the 9th Plan to 11th Plan (till August 2011). As is evident from the following descriptive statistics, there is wide ranging variation in time overruns. Later we have done segregation analysis of the data on various factors like Plan, Sector, Capacity, Region and Stage to understand reasons of variation in detail.

The time overruns vary from -12.20 to 157.33 months. Mean time delay is 14 months. Mean time delay is 14 months and median is 8 months for the 233 projects covered since January 1997. This means 50 % projects are delayed more than eight months. Due to delay the linkage effect also gets delayed. The benefits to be realized by the country through the electricity generated by these projects also get delayed. Time overruns in the power sector have serious implications for the GDP growth rate as increase in power generation can have manifold increase in production capability of India.

To understand the variation in TOR% time series plot has been made for the projects since the ninth plan. Time series plot of TOR% shows improvement since the ninth plan but as is evident the time overrun is still up to 150% for some projects (Figure 1).

Fig 1



Overview of Factors

Data Set 233 Projects (90.1%) of Actual Capacity addition in 9th, 10th and 11th plans

Table 1: Capacity Added in 9th, 10th and 11th Plans

Factors		9th Plan		10th Plan		11th Plan		Total Cap Added mw	%
		No. of Projects	Cap Added mw	No. of Projects	Cap Added mw	No. of Projects	Cap Added mw		
Sector	C	11	1594.0	10	3840.0	27	11130.0	16564	30.1
	P	7	1100.0	14	1153.6	48	14975.5	17229.1	31.4
	S	32	4497.3	32	2933.8	52	13725.2	21156.3	38.5
Capacity	L	3	1500.0	6	3000.0	35	18780.0	23280	42.4
	M	26	5150.0	24	4126.0	87	20822.5	30098.5	54.8
	S	21	541.3	26	801.4	5	228.2	1570.9	2.9
Stage	Pre	50	7193.3	46	7005.3	28	8315.0	22513.6	41.0
	Post	0	0	10	922.2	99	31515.7	32437.9	59.0
Region	E	6	1340.0	2	330.0	26	10170.0	11840	21.5
	N	7	1450.0	15	2996.5	13	4613.0	9059.5	16.5
	Ne	9	190.0	15	190.7	1	21.0	401.7	0.7
	S	16	1126.3	18	3481.6	30	8487.2	13095.1	23.8
	W	12	3085.0	6	928.6	57	16539.5	20553.1	37.4

Source: CEA

Capacity Covered in Dataset	54949.4
Actual Thermal Capacity Addition till Aug 2011	61006.34
% Covered	90.1

Table 1 shows the detailed analysis of capacity (MW) and number of projects added during different plans, sector wise, capacity wise, regions wise, stage wise, and executor wise. This analysis is for actual capacity added by completed projects. **The plans** clearly show the thrust given to the power sector in the eleventh plan. The **sector analysis** shows that almost same capacity has been added by central and private sector projects. State sector's contribution is the highest. Private sector's performance has picked up since the Electricity Act 2003 and it is the highest contributor to thermal capacity addition in the eleventh plan. **Capacity wise** the chart clearly shows the trend towards large and medium projects in the eleventh plan. **Stage wise** capacity added is slightly more in the post Electricity Act 2003**.** Maximum capacity has been added in the **Western region.**

Analysis of Time Overruns (TOR %) Plan wise

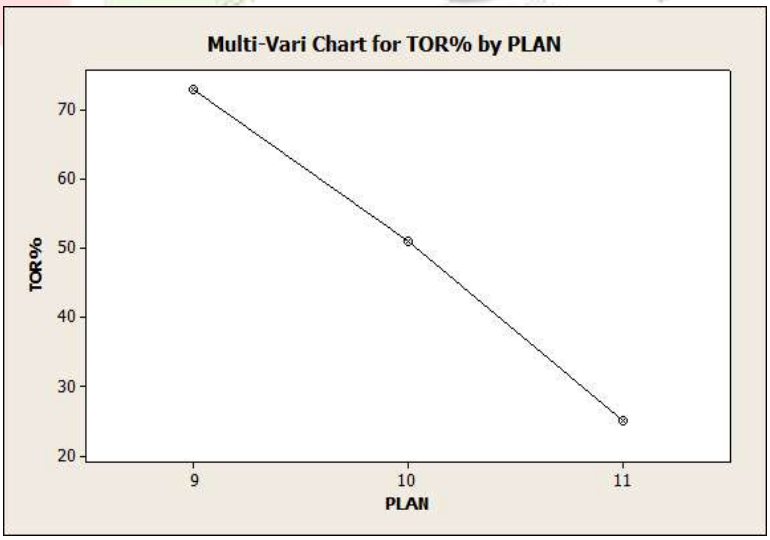
The variation in **Time Overruns** in completed thermal projects for different **Plan Periods,** namely 9th Plan, 10th Plan and 11th Plan has been analyzed in this section (Table 2 and Figure 2). As per the Plan wise analysis of the time overruns in percentage, the time overruns were highest in the ninth plan, less in tenth plan and are least in the eleventh plan. Reduction in the 11th Plan is despite the fact that capacity addition targets were more (almost double) in 11th plan. Also, completion of project earlier meant synchronization but now (from 11th Plan) it means date of actual commissioning of the project which is delay of 1-3 months minimum. In some cases, it can go up to 5 months also. This has been changed as earlier as soon as the plant was synchronized the plant's capacity was included in the achievement rate but it did not contribute to actual generation of power to the grid as it is for testing of the plant. Actual commissioning means generation connected to the grid.

Descriptive Statistics: TOR%

Table 2

Variable	Plan	N	Mean	Std. Deviation	Minimum	Median	Maximum
TOR%	9	50	72.86	68.88	-21.03	55.46	223.46
	10	56	51.0	99.8	-18.7	7.5	350.1
	11	127	25.09	29.25	-17.36	16.06	134.05

Fig 2 TOR % by plan



This section gives the analysis of **time overruns sector wise** (Table 3, Figure 3). As is evident from the charts for TOR% by sector, the mean % time overruns are most for state sector projects and least for private

sector. As electricity comes in the concurrent list both centre and state Governments are involved in policy making. This leads to delays and coordination problems especially in interstate matters.

Sector wise Analysis Descriptive Statistics: TOR%

Table 3

Variable	Sector	N	Mean	Std. Deviation	Minimum	Median	Maximum
TOR%	C	48	36.22	59.34	-21.03	9.71	171.19
	P	69	31.47	40.41	-5.81	16.06	189.25
	S	116	49.81	77.13	-18.70	21.69	350.14

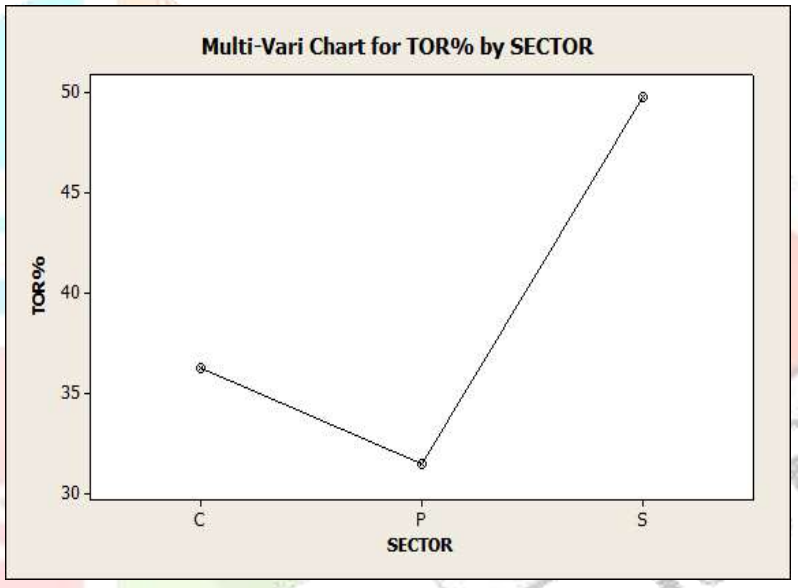


Figure 3: TOR% by Sector

Time Overruns Regionwise

As is evident from the histogram that the **time overruns** are maximum for North Eastern **Region**. The obstacles faced in developing infrastructure have long plagued the projects which are located in remote areas and difficult terrains. The lack of adequate transportation has rendered many developers helpless in ensuring smooth movement of equipment and manpower for the projects.To combat the infrastructure threats that have hindered the development of hydropower and thermal power in the North Eastern region, the IMC has promoted the construction of bridge between Dhola and Sadia ghats that will facilitate various HEPs being built in the state of Arunachal Pradesh and harbor socio-economic development in Arunachal Pradesh as well as Assam. In a positive turnaround to the crippling situation, the extensive deliberation done by the Inter Ministerial Group (IMG) on this issue of grave concern has found favor with the IMC. Support

ing IMG's long standing recommendations, the committee has asserted that the Trans-Arunachal highways, alongside the connecting bridge, must be implemented by the Ministry of Road Transport and Highways (MoRTH) on priority basis (Table 4,Figure 4).

Analysis of TOR% by Region

Descriptive Statistics: TOR%

Table 4

Variable	Region	N	Mean	Std. Deviation	Minimum	Median	Maximum
TOR%	E	34	37.02	38.86	0.00	29.13	175.07
	N	35	20.74	48.76	-21.03	2.32	215.33
	NE	25	129.1	125.7	-18.7	143.5	350.1
	S	64	39.78	49.07	-15.77	21.52	223.46
	W	75	25.73	34.70	-18.46	10.88	148.05

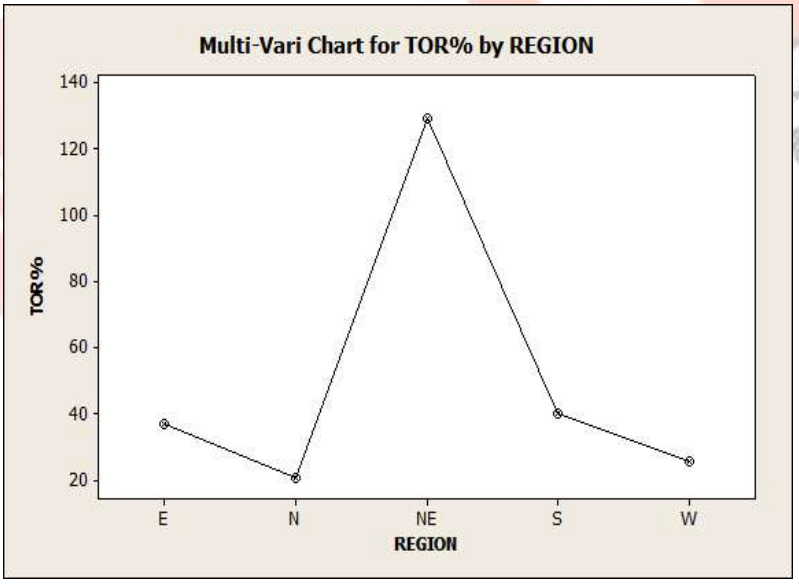


Figure 4: TOR% by Region

This histogram (Table 5, Figure 5) clearly brings out the impact of **Electricity Act 2003** on the **time overruns** of the thermal power projects in the country. There is sharp decrease in the time overruns of the projects in the post Electricity Act 2003. The median of post era is 18.21 while median of the pre-era is 32.21. We can further conclude that Electricity Act 2003 has contributed to lowering of time overruns in

the 10th plan and 11th Plan. As after the Act Techno-Economic Clearance (TEC) from CEA is not needed for thermal generation. Main reasons for the delay in projects are:

- Delay in placement of orders - mainly Civil Works & BOPs.
- Delay and non-sequential supply of material for Main Plant and BOPs.
- Shortage of skilled manpower for erection and commissioning.
- Contractual disputes
- Inadequate deployment of construction machinery.
- Shortage of fuel (Gas)
- Delay in Land Acquisition
- Delay in creation of infrastructure facilities

Analysis of TOR% by Stage

Descriptive Statistics: TOR%

Table 5

Variable	Stage	N	Mean	Std. Deviation	Minimum	Median	Maximum
TOR%	Post	109	24.17	29.36	-17.36	16.06	134.05
	Pre	124	56.88	81.74	-21.03	21.59	350.14

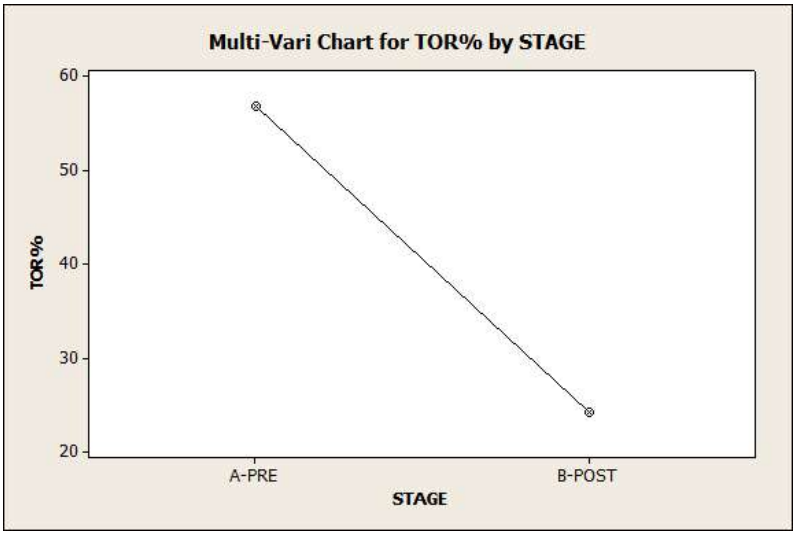


Figure 5: TOR% by Stage

Analysis of TOR% by Capacity

Descriptive Statistics: TOR%

Table 6

Variable	Capacity	N	Mean	Std. Deviation	Minimum	Median	Maximum
TOR%	L	44	9.35	16.48	-18.46	6.80	40.57
	M	137	33.86	42.46	-21.03	20.07	215.33
	S	52	89.2	103.7	-18.7	50.4	350.1

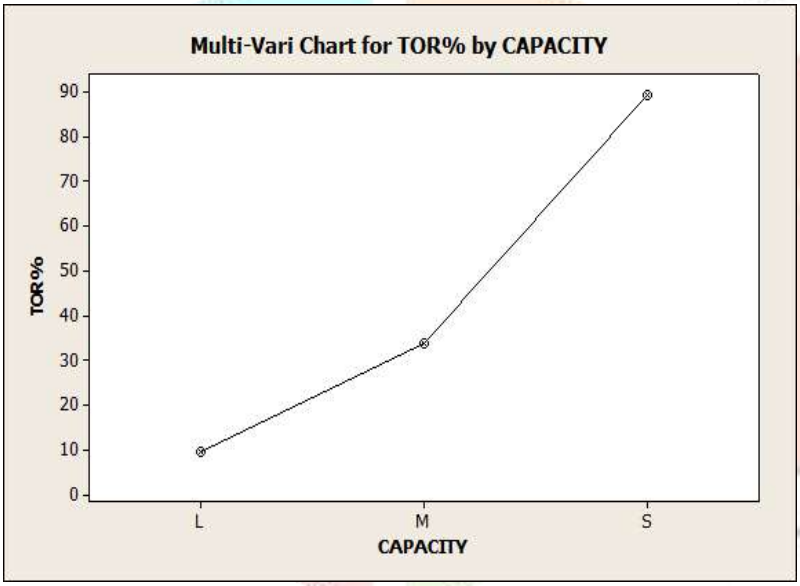


Figure 6: TOR% by Capacity

Capacity wise (Table 6, Figure 6) large size projects are best as they have least time and cost overruns in percentage terms. This is the one of main reasons why government plans to add capacity by medium and large plants in future.

Conclusion and Suggestions

Data analysis of the completed thermal power projects since the ninth plan show that time overruns in percentage have improved but still the time overruns are as high as 150%.

As per the Plans the time overruns percentage, was the highest in the ninth plan, less in tenth plan and are least in the eleventh plan. We can further conclude that Electricity Act 2003 has contributed to lowering of time overruns in the 10^{th} plan and 11^{th} Plan. State Sector projects are the worst in terms of time overruns in percentage terms. Poor health of State Electricity boards, law and order situations, interstate problems and

lack of coordination between Centre and State and higher inefficiencies could be responsible for this. Capacity wise large size projects are best. The time overruns are highest for the North Eastern Region. There is sharp decrease in the time overruns of the projects in the post Electricity Act 2003.

Better coordination between stakeholders, proper delegation of work and IT based monitoring of projects will help in reducing the delays. Financial health of State Electricity Boards should be improved. Its better to build medium and large sized plants for economies of scale.

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