



सत्यमेव जयते

**Report of the  
Comptroller and Auditor General of India  
on  
Capacity Expansion in Hydro Power Sector by CPSEs  
for the year ended March 2012**



**Union Government  
Ministry of Power**  
Report No. 10 of 2012-13  
(Performance Audit)

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## Preface

The Audit Report has been prepared in accordance with the Performance Auditing Guidelines and Regulations on Audit and Accounts, 2007 of the Comptroller and Auditor General of India.

In view of wide gap between demand and supply of power, which is required to be bridged for overall growth of the country, an audit report on the 'Capacity Addition Programme - Project Management by NTPC', mainly covering thermal power projects, which has the largest share in the power generation in the country, was presented to the Parliament in December 2010. As a sequel to that, Audit took up in March-August 2011 Performance Audit of another important component of power generation *viz.* hydro power which is a renewable, economic, non-polluting and environmentally benign source of energy. Hydro power is generated by Central and State Public Sector Enterprises as well as private sector companies.

This Report examines the processes, from conception to implementation, of Hydro Power Projects by Central Public Sector Enterprises *viz.* NHPC Limited, SJVN Limited, THDC India Limited and North Eastern Electric Power Corporation Limited. These CPSEs were required to add a capacity of 11,813 MW of hydro power during Eleventh Five Year Plan *i.e.* April 2007 to March 2012. The actual achievement thereagainst till March 2012 was, however, only 1,550 MW.

Audit acknowledges the cooperation received in conducting this Performance Audit from the Ministry of Power along with NHPC Limited, SJVN Limited, THDC India Limited and North Eastern Electric Power Corporation Limited.

# Executive Summary

## Introduction

Energy has been universally recognized as one of the most important drivers for economic growth and development. Access to affordable and reliable electricity is critical to a country's growth and prosperity. India has made significant progress towards the augmentation of its power infrastructure. However, capacity augmentation of power generation was not commensurate with the exponentially increasing requirements driven by the rising population, expanding economy and a quest for improved quality of life.

National Electricity Policy, 2005 envisaged an ambitious objective of power to all by 2012 and therefore, capacity addition in the power sector infrastructure has been one of the major thrust areas of the Government. Hydro power, one of the sources, is a renewable, economic, non-polluting and environmentally benign source of energy. Hydro power stations have inherent ability for instantaneous starting, stopping, load variations, etc. and help in improving reliability of power system. The generation cost is not only low and inflation free but also reduces with time. Therefore, hydro power is considered to be the best choice for meeting the peak demand. The Central Electricity Authority assessed (1987) country's hydro power potential of 84,044 MW at 60 per cent load factor.

(Para 1.1 and 1.2)

## What does our audit cover?

Hydro power is generated by Central and State Public Sector Enterprises as well as private sector companies. The Central Public Sector Enterprises (CPSEs) in hydro power sector mainly include NHPC Limited (NHPC) including its JV Company NHDC Limited, SJVN Limited (SJVNL), THDC India Limited (THDC) and North Eastern Electric Power Corporation Limited (NEEPCO). This report examines the processes from conceptualisation to implementation of Hydro power projects by NHPC, SJVNL, THDC and NEEPCO which aimed at adding a capacity of 11,813 MW during Eleventh Five Year Plan *i.e.* April 2007 to March 2012. All the 16 projects slated for completion by March 2012, taken up for execution by these CPSEs have been covered in the Performance Audit. However, for contract awarding activities, a representative sample of 24 contracts across these four CPSEs was drawn from a total of 53 contracts.

(Para 1.4, 2.1 and 2.5)

## Our Major Audit Findings

Performance Audit has revealed significant gaps/deficiencies in the processes associated right from the planning stage to award of contract and execution of the projects. Audit observed that with better planning, coordination, adequate survey, investigations, coordination and monitoring, the CPSEs could have achieved capacity addition closer to the targets.

Significant audit findings are discussed below in brief:

### **(i) Slippages in the targets for capacity addition**

All the four CPSEs prepared their capacity addition plans of 11,813 MW hydro power without due diligence and failed to tie up modalities with all the stakeholders within the existing structural framework. Consequently, the plans had to be scaled down from 11,813 MW to 6,794 MW. Even the scaled down targets which were almost 42 *per cent* less than the original targets could not be achieved. CPSEs were able to achieve capacity additions of only 1,550 MW by March 2012 (*i.e.* 13 *per cent* of the original targets and 23 *per cent* of revised targets).

Besides, these CPSEs are likely to add only 3,774 MW capacity in 12 projects in XII Five Year Plan (2012-2017) as against 14,535 MW in 33 projects envisaged in the Hydro Power Policy 2008.

(Para 1.6, 3.3 and 3.4)

### **(ii) Delays in Project planning and initial activities**

The entire process of project planning and implementation was beset with inordinate delays. NHPC, SJVNL and THDC could complete the pre-investment approval activities within the benchmark of 30 months fixed by the Ministry of Power (MOP) in only two out of 14 Projects<sup>1</sup>. While there was a marginal delay of up to six months in completing these activities in five projects, delays ranged up to 50 months in the remaining seven projects.

(Para 3.5)

### **(iii) Allotment of Projects to Private Developers**

Despite specific directions (August 1999) from Prime Minister's Office (PMO), MOP did not form Special Purpose Vehicle (SPV) for survey, investigation and implementation of the Siang and Subansiri multi purpose projects (six) in the Brahmaputra Basin in Arunachal Pradesh. Instead, GOI allocated (May 2000) six projects (20,700 MW) to NHPC of which only one project *i.e.* Subansiri Lower (2,000 MW) is being executed by NHPC. Later Government of Arunachal Pradesh (GOAP) allotted (February 2006, August 2009 and March 2010) four of these projects to the private developers/joint ventures. The remaining one project was allotted (February

<sup>1</sup> Excludes two projects of NEEPCO as planning activities were not covered in this Performance Audit.

2009) to NTPC by GOAP for preparation of pre feasibility report. The decision to move from SPV to NHPC and then to private developers only added to the delay in execution of the projects. The projects originally allotted to NHPC in May 2000 have not yet (March 2012) been initiated even after lapse of more than 12 years (against the benchmark time of 10 years from the date of conceptualization of a project to its commissioning). The private developers/joint ventures are still in the process of getting various clearances. Hence, the estimated benefit of generation of 6,600 MW electricity per annum, as per DPRs of four projects allotted to private developers/joint ventures, has not been achieved.

(Para 3.6)

**(iv) Gaps/deficiencies in Survey and Investigation**

Despite Policy on Hydro Power Development of GOI (1998) emphasising thorough survey and investigation of potential hydro sites on an advanced scientific basis before preparation of DPRs, NHPC and SJVNL did not focus adequately on the critical activities of project survey and investigations. Till 2006, NHPC did not have any norms for the number of holes required to be drilled during survey and investigation. NHPC and SJVNL encountered several 'geological surprises' (like variations in the rock classes during excavation) in the execution of projects causing an adverse cascading impact on the time and cost of these projects. Even after devising norms in January 2007, NHPC expressed difficulty in following these norms on different grounds.

(Para 4.1.1 and 4.1.2)

Audit further noticed that in Parbati-II Project (800 MW), NHPC adopted 'Tunnel Boring Technology'— a technology for drilling a tunnel, despite concerns expressed by various authorities like Geological Survey of India, MOP and Central Water Commission, etc. The Tunnel Boring Machine (TBM) got stuck in the tunnel and NHPC had to terminate (March 2012) the contract due to persistent poor performance of the contractor leading to estimated cost overrun of ₹243.54 crore and time overrun of 99 months.

{Para 4.2 and 6.2 (d)}

A time of 8 months was taken for investment approval after Techno Economic Clearance in case of Subansiri Lower of NHPC whereas it ranged between 10 and 29 months in respect of other 12 projects<sup>2</sup> (excluding Koteshwar Project of THDC<sup>3</sup>).

<sup>2</sup> Excludes two projects of NEEPCO as planning activities were not covered in this Performance Audit.

<sup>3</sup> A time of 127 months was taken in respect of Koteshwar project of THDC after obtaining TEC (August 1989) as Committee of Secretaries decided to take up this project after the work of Tehri Stage-I project picked up.

The Working Group on Power for Eleventh Plan (2007-12) envisaged (February 2007) cost of construction at ₹4.50 crore per MW for the run of the river hydro projects. The approved per MW cost of construction of nine out of 12 run of the river hydro projects<sup>4</sup> approved by CCEA between July 1998 and January 2007 ranged between ₹4.90 crore and ₹14.12 crore as against ₹4.50 crore per MW envisaged by the Working Group. However, the anticipated cost of construction of 11 out of above 12 projects is much higher than the approved cost and ranged between 18 to 112 per cent of the approved cost. Besides per MW anticipated cost of above 12 projects also ranged between ₹4.97 crore to ₹20.80 crore as against ₹4.50 crore per MW envisaged by the Working Group.

(Para 4.3.1)

**(v) Lack of transparency in the process of award of contracts**

Till July 2004, there were no guidelines for fixation of Pre qualification (PQ) criteria in NHPC but a practice of fixation of PQ criteria by a multidisciplinary Committee was being followed. Audit appreciates that out of total 16 contracts (13 contracts prior to July 2004 and three contracts after issuance of guidelines), this practice was followed in 13 contracts.

(Para 5.2(a))

In five out of the 16 contracts examined in Audit, NHPC relaxed PQ criteria after the close of sale of tender documents.

(Para 5.2 (b))

Against the target of 9.5 months for completion of tendering activities from publication of NIT to issue of letter of award, NHPC took 14 to 28 months in 15 out of 16 contracts reviewed in Audit. SJVNL took 21 to 28 months in three contracts selected for examination in audit while THDC took 39 to 80 months in three contracts examined in audit.

(Para 5.4.1)

**(vi) Inadequacies in Execution of Projects**

The Central Electricity Authority envisaged a timeline of 10 years for a large size hydro project from planning to commissioning while NHPC has prescribed a timeline of about 6.5 to 9.5 years. Against this, two projects (Omkareshwar and Sewa-II) completed so far were executed within above benchmark. Two projects- 'Teesta-V' of NHPC and 'Koteshwar' of THDC were completed in 11 and 13 years respectively. Nine ongoing projects are likely to take between 11 and 19 years; Rampur project of SJVNL is likely to be completed in nine years and the data regarding conceptualisation of two projects of NEEPCO was not available.

(Para 6.1)

<sup>4</sup> *Koteshwar project of THDC and Omkareshwar project of NHPC (JV with MP Govt.) are storage type.*

Delay in execution of 16 projects by four CPSEs resulted in revision of their initial approved cost of ₹ 30,005 crore to ₹ 44,712 crore. In seven completed/ongoing projects, the cost overrun was in the range of 53 to 148 per cent.

The main reasons for delay in project execution were geological surprises. Other controllable factors like delay in handing over of access roads to the contractors, wrong assessment of land requirements, delay in issuance of construction drawings, increase in scope of work due to incorrect assessment of bill of quantities, etc. also contributed to delay in execution of the projects.

Thorough survey and investigation as envisaged in the Policy on Hydro Power Development (1998) would have minimized the geological surprises. Other factors like delay in handing over of access roads, delay in issuance of construction drawings, etc. could have been controlled by proper coordination and monitoring by the CPSEs.

(Para 6.1)

NHPC extended undue favour to M/s HJV (led by MAYTAS Infra Limited) in fixation of PQ criteria, relaxation of PQ criteria after close of sale of tender documents and also award of work though M/S HJV did not fulfil the PQ criteria. NHPC also extended advances of ₹131.65 crore to it beyond contractual provisions. There was laxity in monitoring the execution of work and the pace of work was very slow. On being pointed out in Audit, NHPC terminated (March 2012) the contract due to persistent slow progress of work and encashed bank guarantees available with it. This resulted in blocking of ₹182.48 crore with remote chances of recovery, estimated extra expenditure of ₹243.54 crore besides time overrun of 99 months in the execution of project.

{Para 5.2(a) to 5.2(d) and 6.2(d)}

Tunnel boring machine (TBM) deployed by M/s HJV got stuck in the tunnel due to ingress of water slush and loose rock. For resumption of work, a Committee chaired by former Secretary (Power) was constituted by MOP for advice. On the recommendation of the Committee, NHPC released (April 2008) an advance of ₹72 crore to enable M/s HJV to meet its outstanding liabilities. Audit observed that the Chairman of the Committee was also a member of the Board of Directors of one of the JV partners of M/s HJV and therefore, there was a clear conflict of interest in his two responsibilities.

{Para 6.2(e)}

NHPC agreed to compensate a contractor (M/s Om Metals-SPML JV) for compression of schedule of hydro mechanical works relating to Chamera-III and Uri-II projects and paid an amount of ₹13.60 crore to the contractor. Compression of the schedule was not justified as the civil works were already running behind schedule.

{Para 6.2(b)}

As the progress of work was not satisfactory, THDC constituted (March 2007) a high level 'Empowered Committee' to get the work done by making direct payment to the manufacturers/suppliers etc. against the orders placed by M/s PCL Intertech Lenhydro (PCL). As on 31 March 2012, an advance of ₹190.42 crore was recoverable from the contractor (PCL) on account of payments released at his risk and cost against which performance guarantee/cash of only ₹56.28 crore were available with THDC.

{Para 6.2(g)}

NEEPCO failed to protect its financial interest as insurance cover taken by a contractor during execution of tunnel work under Package-I was deficient. NEEPCO did not ensure that the extra items subsequently executed were got insured by the contractor through 'Add on cover' or a new policy. Consequently, NEEPCO suffered a loss of ₹19.88 crore due to damage of extra items of work executed by the contractor in two accidents in January 2007 and December 2007. This amount could not be recovered by NEEPCO either from the contractor or the insurance company.

{Para 6.2(h)}

**(vii) Monitoring Mechanism and Impact Assessment**

Though a monitoring mechanism was in place in these CPSEs, it did not have the desired impact in removing the project impediments. Even controllable factors like delay in handing over of access roads to contractors, issuance of construction drawings, incorrect assessment of Bills of Quantities, etc. were not addressed in time to contain project delays. Monitoring by the MOP also did not help in ensuring timely action on the identified problem areas in execution.

(Para 7.1)

Delays in commissioning of projects have led to CPSEs losing the opportunity of generating 26,282.97 MUs of electricity annually (as per the DPRs). Further, additional return on equity to the tune of ₹1474.57 crore permissible under CERC Regulations, 2009 has also been foregone by the CPSEs.

(Para 7.2)

## What do we recommend?

Based on the audit findings, the following recommendations are made:

### Ministry of Power, Government of India

1. MOP should coordinate with concerned State Government and other authorities like CEA, MOEF, MOWR for timely preparation of DPRs, allocation of projects and monitor progress of projects to ensure timely completion of projects for exploitation of hydro power potential in India. Desirability of a High Powered Committee chaired by Secretary (Power) with Members from other nodal Ministries/State Governments as a single window mechanism to monitor and expedite the process of necessary clearances should be explored.

2. The Hydro Policies 1998 and 2008 of GOI allowed State Governments to select developers through MOU route for hydro projects up to 100 MW only and follow a transparent procedure for awarding potential sites to the private sector. MOP, through its oversight role, should therefore impress upon the State Governments to allocate hydro power projects above 100 MW to the developers in a fair, transparent and competitive manner.

**NHPC Limited, SJVN Limited, NEEPCO and THDC India Limited**

3. CPSEs should ensure that adequate survey and investigation are conducted before preparation of DPR to mitigate the risk of subsequent geological surprises during project execution and consequential increase in volume of work, change in design and resultant Time/Cost overruns.
4. CPSEs should adhere to the established best practices for PQ criteria, bidding and contract management to eliminate the possibility of unfair advantage to some bidders over the others.
5. CPSEs should make their long term plan in line with the GOI Hydro Policy and start their preparedness much in advance as it takes about 10 years from conception to commissioning of a Hydro project.
6. CPSEs should streamline their internal control systems and monitoring mechanism to ensure adherence to the contractual terms by the bidders.

## CHAPTER - 1

# Introduction

### 1.1 Power sector Scenario in India

Energy has been universally recognized as one of the most important drivers of economic growth and development. There is a strong two-way relationship between economic development and energy consumption. Access to affordable and reliable power is critical to a country's growth and prosperity. India has made significant progress towards the augmentation of its power infrastructure. The total installed capacity of power generation has increased from 1,05,046 MW at the beginning of Tenth Plan to the present capacity of 1,99,877 MW at the end of Eleventh Plan (March 2012). However, the capacity augmentation of power generation was not commensurate with the exponentially increasing demand for power driven by the rising population, expanding economy and a quest for improved quality of life. This has resulted in overall deficit of power in the country.

### 1.2 Hydro power potential

Hydro power is a renewable, economic, non-polluting and environmentally benign source of energy. Hydro power stations have inherent ability for instantaneous starting, stopping, load variations, etc. and help in improving reliability of power system. The generation cost is not only low and inflation free but also reduces with time. Therefore, hydro power is considered to be the best choice for meeting the peak demand. The first systematic and comprehensive study to assess the hydro-electric resources in India was undertaken during the period 1953 to 1959 by the Power Wing of the erstwhile Central Water and Power Commission. On the basis of the then prevailing technology with available topographical and hydrological data, the potential was assessed to 42,100 MW<sup>5</sup> at 60 *per cent* load factor in basins/rivers. The re-assessment study of hydro-electric potential of the country was completed by the Central Electricity Authority in 1987 and hydro power potential was estimated at 84,044 MW<sup>6</sup> at 60 *per cent* load factor. Hydro power is generated by Central and State Public Sector Enterprises as well as Private Sector companies.

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<sup>5</sup> *Indus basin (6,583 MW), Ganga basin (4,817 MW), Central India Rivers (4,300 MW), West Flowing Rivers (4,350 MW), East Flowing Rivers (8,633 MW) and Brahmaputra basin (13,417 MW)*

<sup>6</sup> *Indus basin (19,988 MW), Ganga basin (10,715 MW), Central India Rivers (2,740 MW), West Flowing Rivers (6,149 MW), East Flowing Rivers (9,532 MW) and Brahmaputra basin (34,920 MW)*

### 1.3 Snapshot of Hydro Policies - Role of Ministry of Power, Government of India

Ministry of Power (MOP), Government of India (GOI) is primarily responsible for the development of electrical energy in the country. MOP is concerned with perspective planning, policy formulation, processing of projects for investment decision, monitoring of the implementation of power projects and enactment of legislation in regard to thermal & hydro power generation, transmission and distribution. In order to promote hydro sector, a new Policy on Hydro Power Development was announced (August 1998) with the aim and objective of accelerating pace of hydro development. The Hydro Policy emphasized on the following:

- Basin wise development of hydro potential for optimal use of river basins;
- Execution of mega<sup>7</sup> projects through Central Public Sector Undertakings in case State or Private sector is not in a position to implement these projects;
- Encouragement to private investment through joint ventures or Independent Power Producers;
- Thorough survey and investigation of the potential hydro sites on an advanced scientific basis before preparation of Detailed Project Report (DPR);
- Simplification of procedure for clearances to save time, money and reduce gestation period;
- Development of small and mini hydro projects; and
- Allotment of hydro projects upto 100 MW to the private developers through MOU route.

National Electricity Policy (February 2005) had envisaged power to all and increase of per capita availability of electricity to over 1,000 units by the year 2012. Accordingly, Hydro Power Policy 2008 set the following broad policy objectives for accelerating the pace of hydro power development:

- Inducing private investment in hydro power development;
- Harnessing the balance hydro-electric potential;
- Improving resettlement and rehabilitation;
- Facilitating financial viability of hydro projects; and
- State Governments to follow a transparent procedure for awarding potential sites to the private sector.

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<sup>7</sup> *Projects with installed capacity of 500 MW and above.*

## 1.4 Profile of Hydro Power Sector CPSEs

There are mainly four Central Public Sector Enterprises (CPSEs) in hydro power sector *viz.* NHPC Limited (NHPC) including its JV Company NHDC Limited (NHDC), SJVNL Limited (SJVNL), THDC India Limited (THDC) and North Eastern Electric Power Corporation Limited (NEEPCO). The main objective of all these CPSEs is to develop and maintain hydro power stations. Profiles of these CPSEs as on 31<sup>st</sup> March 2012 are as under:

Particulars/Name of the Company	NHPC (incl. its JV company)	SJVNL	THDC	NEEPCO
Month/Year of incorporation	November 1975 (JV in August 2000)	May 1988	July 1988	April 1976
Area of operation	Himachal Pradesh, Madhya Pradesh, Jammu & Kashmir, Uttrakhand, West Bengal and North-Eastern States	Himachal Pradesh and Uttrakhand	Uttrakhand	North-Eastern States
Installed power generating Capacity as on 31 <sup>st</sup> March 2012	5,295 MW <sup>8</sup> (2.65 per cent <sup>9</sup> )	1,500 MW (0.75 per cent)	1,400 MW (0.70 per cent)	1,130 MW <sup>10</sup> (0.57 per cent)
Percentage of All India hydro power generation capacity <sup>11</sup>	13.58	3.85	3.59	2.90
No. of power generating plants	14 hydro	One hydro	Two hydro	Three hydro and two gas based
Share in total electricity generated <sup>12</sup> during 2011-12	23,347 MUs (2.66 per cent)	7,610 MUs (0.87 per cent)	4,591 MUs (0.52 per cent)	2,394 MUs (0.27 per cent)
Percentage of share of Central/State Government to total equity as on 31 <sup>st</sup> March 2012	Central: 86.36 (Balance Public, FIs, etc.)	Central: 64.46 State: 25.50 (Balance Public, FIs, etc.)	Central: 75 State: 25	Central: 100
			Complied from information received from CPSEs	

<sup>8</sup> Includes 1,520 MW of its Joint Venture Company i.e. NHDC Limited

<sup>9</sup> All India power generating capacity was 1,99,877 MW (thermal, hydel and others) as on March 2012 (Source: CEA website)

<sup>10</sup> Hydro (755 MW) and Gas based (375 MW)

<sup>11</sup> Hydro power generation capacity was 38,990 MW as on March 2012 (Source: CEA website)

<sup>12</sup> Total electricity generation was 8,76,888 MUs (thermal, hydel and others) during the year 2011-12 (Source: CEA website)

## 1.5 About the capacity addition programme (2007-12)

Recognizing the fact that decline in hydro share (from 44 *per cent* in 1970 to 25 *per cent* in 1998) was largely responsible for power system instability, Hydro Policy (1998) of GOI had given renewed thrust on hydro power. Therefore, NHPC, SJVNL, THDC and NEEPCO drew up (2002 to 2003) capacity addition plans in the hydro power sector to be achieved up to 2012. The capacity addition programme of these CPSEs envisaged capacity addition of 10,341 MW (NHPC- 11 projects), 412 MW Rampur project (SJVNL), 400 MW Koteshwar project (THDC) and 660MW (NEEPCO-2 projects) during the period 2007-12. NHPC revised (October 2008) its target to 5,322 MW (12 projects).

Preparedness of the CPSEs for future capacity addition programmes is discussed in detail in Chapter-III.

## 1.6 Progress of Capacity Addition Programme

Four CPSEs envisaged capacity addition target of 11,813 MW during April 2007 to March 2012 but the same were revised to 6,794 MW. As against this reduced target, the CPSEs could add only 1,550 MW<sup>13</sup> through four hydro projects<sup>14</sup> up to March 2012. Incidentally all of these four projects pertained to the previous Plan period (2002-07). Thus, the CPSEs registered shortfall of 10,263 MW (87 *per cent*) and 5,244 MW (77 *per cent*) with respect to the initial and revised targets, respectively. The details of the capacity planned actual achievement thereagainst and shortfall is tabulated below:

Sl. No.	Name of Company	Capacity envisaged (in MW)		Capacity added during 2007-12 (in MW)	Shortfall in percentage achievement of targets	
		Original	Revised		Original	Revised
1.	NHPC	10,341	5,322	1,150	89	78
2.	SJVNL	412	412	0	100	100
3.	THDC	400	400	400	NIL	NIL
4.	NEEPCO	660	660	0	100	100
<b>Total</b>		<b>11,813</b>	<b>6,794</b>	<b>1,550</b>	<b>87</b>	<b>77</b>

<sup>13</sup> Two units of Chutak project each 11 MW have not been included in the capacity addition as these units were synchronised at partial load due to unavailability of desired load and both the units are yet to be put into commercial operation (June 2012)

<sup>14</sup> Teesta-V (510 MW), Sewa-II (120 MW), Omkareshwar JV (520 MW) and Koteshwar (400 MW)

A detail of the approved cost, revised cost, anticipated cost and actual expenditure incurred by the CPSEs upto March 2012 is given below:

Sl. No.	Name of Company	Approved cost of the projects (₹ in crore)	Revised cost of the projects (₹ in crore)	Anticipated cost of the projects as of June 2012 (₹ in crore)	Expenditure incurred as on 31 March 2012 (₹ in crore)
1.	NHPC	23,790.70	34,145.36	34,145.36 <sup>15</sup>	24,396.32
2.	SJVNL	2,047.03	2,047.03 <sup>16</sup>	2,047.03	1,793.40
3.	THDC	1,301.56	2,466.96	2,719.49	2,620.71
4.	NEEPCO	2,865.62	6,052.63	6,052.63	2,091.72
<b>Total</b>		<b>30,004.91</b>	<b>44,711.98</b>	<b>44,964.51</b>	<b>30,902.15</b>

As may be seen from the above, cost of the projects planned by the CPSEs had increased significantly. The increase in the revised cost of the completed/ongoing projects ranged between 12 and 148 *per cent* as compared to original approved cost. The detailed analysis of the reasons of time and cost overruns is discussed in the chapters IV, V and VI.

<sup>15</sup> Based on revised cost estimate (RCE) submitted by NHPC to MOP. RCE of all projects is yet to be approved (June 2012) by the Competent Authority.

<sup>16</sup> RCE is under preparation

## CHAPTER - 2

# Audit Approach

### 2.1 Scope of Audit

The present Performance Audit covers all the activities from conceptualization to implementation of all the hydro projects selected by four CPSEs along with its Joint Ventures for adding a capacity of 11,813 MW<sup>17</sup> during the XI Five Year Plan (2007-2012). The focus is thus essentially on the efforts by the CPSEs in meeting with capacity addition targets.

Performance Audit titled “Implementation of X Plan hydel projects in North Eastern and Eastern Regions by NEEPCO and NHPC” covering award, execution and monitoring for the period from 2002-03 to 2007-08 was carried out by Audit and the Performance Audit Report was included in Report No. PA 27 of 2009-10.

### 2.2 Audit Objectives

The objectives of the Performance Audit were to assess:

- Whether the process of conceptualization, formulation and planning of the projects was adequate and in line with the Hydro Policy of the GOI;
- Whether the projects and contracts processed and concluded were transparent, competitive and equitable.;
- Whether the projects were executed efficiently and expeditiously, the reasons of delays and impact thereof; and
- Whether the systems and procedures for monitoring were adequate and effective at all levels.

### 2.3 Audit Criteria

The audit criteria from various sources adopted for the Performance Audit included:

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<sup>17</sup> 10,341 MW (NHPC), 412 MW (SJVN), 400 MW (THDC) and 660 MW (NEEPCO)

- Provisions of National Electricity Policy (2005) and Hydro Policies of GOI (1998 and 2008),
- Targets as per the Corporate Plans of the respective CPSEs,
- Decisions taken in the meetings of the Board of Directors (BOD) and their sub-committees,
- Timelines and benefits envisaged in the Feasibility Reports (FRs)/Detailed Project Reports,
- Work and Procurement Policies and Procedures, and
- Provisions of the Contract Agreements.
- Best practices adopted by the Industry.

## 2.4 Audit Methodology

Entry conferences<sup>18</sup> were held with the Managements of all CPSEs in March 2011, wherein the scope, objectives, criteria of audit and audit sample were discussed. Audit examined the relevant records in the MOP and the CPSEs during March 2011 to August 2011 and arrived at audit conclusions discussed in the subsequent Chapters. Exit conference was held with the MOP and Management of the CPSEs on 17<sup>th</sup> February 2012 to discuss the audit findings and recommendations. Their responses have been suitably incorporated in the report.

## 2.5 Audit Sample

The projects covered under capacity addition programme of the above CPSEs were to be completed by March 2012. As such, a representative sample of 45 *per cent* was drawn from the list of awarded contracts for the projects identified for capacity addition during 2007-12 by Monetary Unit Sampling technique using Interactive Data Extraction and Analysis (IDEA) software for examination of Contract awarding activities.

All the 16 projects, slated for completion by March 2012, taken up by these CPSEs for execution have been covered in the Performance Audit. However, for examination of contract awarding activities, a representative sample of 24 contracts

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<sup>18</sup> 4<sup>th</sup> March 2011 (NHPC and THDC), 7<sup>th</sup> March 2011 (SJVN) and 15<sup>th</sup> March 2011 (NEEPCO)

across these four CPSEs was drawn from a total of 53 contracts pertaining to 15 projects<sup>19</sup> as detailed below:

Name of CPSE	Population			Sample selected	
	No. of contracts	Value (₹ in crore)	Period of award	No. of contracts	Value (₹ in crore)
NHPC	41	12,942.65	March 2001 to August 2011	16 (39.02%)	9,891.95 (76.43%)
SJVNL	03	1447.95	Feb. 2007 to August 2011	03 (100%)	1447.95 (100%)
THDC	06	684.02	Nov. 2002 to August 2011	03 (50%)	389.40 (56.30%)
NEEPCO	3	151.07	June 2008 to Dec. 2009	2 (66.67%)	119.67 (79.21%)
<b>Total</b>	<b>53</b>	<b>15225.69</b>		<b>24 (45%)</b>	<b>11,848.97 (78%)</b>

## 2.6 Audit findings

This report presents the findings and recommendations from our audit examination in following seven chapters:

- Chapter III:** Framework for initiation and allotment of hydro power projects,
- Chapter-IV:** Survey, Geo-technical investigation and Investment Approval,
- Chapter V:** System of award of contracts,
- Chapter VI:** Execution of Projects,
- Chapter VII:** Monitoring mechanism and Impact Assessment, and
- Chapter VIII:** Conclusion and Recommendations.

## 2.7 Acknowledgment

Audit acknowledges the cooperation extended by Management of CPSEs and MOP in facilitating the conduct of Performance Audit.

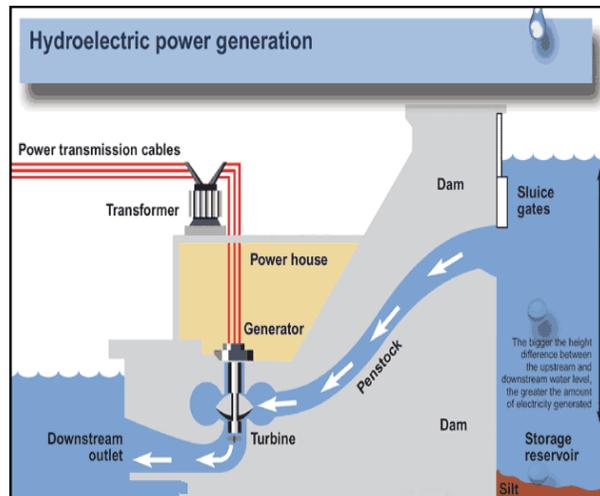
<sup>19</sup> This does not include Tuirial Project of NEEPCO because contracts awarded by the Company were covered in the previous Performance Audit upto March 2008 and no new contract was awarded April 2008 onwards.

## CHAPTER - 3

# Framework for initiation and allotment of Hydro power projects

## 3.1 Profile of Hydroelectric projects

The hydroelectricity is generated through the use of the gravitational force of falling or flowing water. The power extracted from the water depends on the volume and on the difference in height between the source and the outflow of water<sup>20</sup>. A large pipe called penstock delivers water to the turbine.



A hydro power project may be run of river<sup>21</sup> or storage type. Therefore, features and specifications of the hydro power projects vary from project to project. The generating capacity of the hydroelectric project depends on various factors viz. water discharge, head<sup>22</sup>, etc.

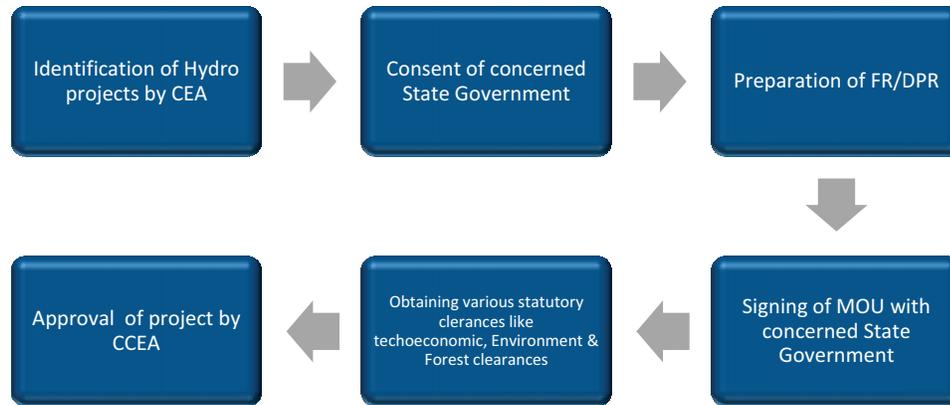
## 3.2 Process for identification of new Hydro power projects

The process of identifying hydro projects begins with the Central Electricity Authority (CEA). The hydro power project sites are identified by CEA. The following processes are followed simultaneously in development of hydro power projects:

<sup>20</sup> *The bigger the height difference between the upstream and downstream water level, the greater the amount of electricity generated.*

<sup>21</sup> *Run of river hydroelectricity stations are those with small or no reservoir capacity, so that the water coming from upstream must be used for generation at that moment, or must be allowed to bypass the dam.*

<sup>22</sup> *The difference in height between the source and the water's outflow is called head.*



The details of the approval and clearances required from different authorities for development of the hydro power projects are given in **Annexure-I**.

### 3.3 Corporate Plan

Company-wise targets fixed alongwith analysis of reasons of slippage in the capacity addition for the period 2007-12 are explained below:

#### NHPC Limited

##### 3.3.1 Descaling the Corporate Plan

The Corporate Plan was approved by Board of Directors (BOD) in March 2002 for capacity addition of 10,341 MW (11 projects) to be achieved by March 2012 as detailed in the **Annexure-II**. The target was scaled down (October 2008) to 5,322 MW in view of the following:

- Three projects with capacity of 4,400 MW were allotted to private developers by the Government of Arunachal Pradesh.
- Two projects with capacity of 1,090 MW planned as Joint Ventures could not materialize during the Plan period *inter alia* due to non resolution of the JV issues with the State Governments.
- One project of 1,020 MW slipped due to non-firming up of Dam Axis and law and order problems.

However, five carried over projects (1,442 MW) from previous Plan period (2002-07)<sup>23</sup> were included and two new projects<sup>24</sup> (89 MW) were added. Therefore, the target for the period 2007-12 was revised down from 10,341 MW to 5,322 MW<sup>25</sup> (12 projects).

<sup>23</sup> Sewa-II (120 MW), Teesta-V (510 MW), Teesta low Dam-III (132 MW), Teesta Low Dam-IV (160 MW) and Omkareshwar JV project (520 MW).

<sup>24</sup> Chutak (44 MW) and Nimmo-Bazgo (45 MW)

<sup>25</sup> Uri-II project which was initially planned for 280 MW was reduced to 240 MW

Ministry/NHPC Management stated (March 2012) that NHPC took all the steps required to take up the projects. With regard to projects in Arunachal Pradesh, the MOU incorporating suggestions of GOAP was submitted but MOU could not be signed. Later GOAP allotted three projects to private developers.

## **SJVN Limited**

### **3.3.2 Improper capacity addition plan**

SJVNL in its Corporate Plan (2004-14) fixed (January 2005) a target of capacity addition of 1,404 MW to be achieved during 2007-12 through implementation of four projects.<sup>26</sup> However, subsequently, SJVNL in the Corporate Plan (2007-17) decided (December, 2008) that during 2007-12 it would implement only one project *i.e.* Rampur project (412 MW).

Audit observed that both these Corporate Plans were approved only by the Chairman and Managing Director and projects (except Rampur project) included in the Corporate Plan (2004-14) did not have specific consent of the respective State governments.

SJVNL Management stated (October 2011) that Company in its wisdom had also included those projects for which efforts would be made in addition to projects already allocated and that due to such vigorous persuasion, the GOUK allocated one project (Luhri).

Ministry/ Management further stated (March 2012) that while preparing Corporate Plan it is not possible to have assurance from Central/State Government for future periods. Further, Ministry/ Management noted (March 2012) Audit observation regarding approval of Corporate Plan by CMD instead of Board of Directors for future compliance.

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<sup>26</sup> *Chunger Chal (240 MW), Khasiyabada (260 MW), Luhri (465 MW) and Rampur (439 MW)*

**THDC India Limited and NEEPCO Limited****3.3.3 Absence of capacity addition plans**

THDC did not plan any new project for execution during XI Plan period of 2007-12. Instead slipped over project (*i.e.* Koteswar hydro project of 400 MW) of X Five Year Plan (2002-07) was included (October 2009) in the Corporate Plan. NEEPCO also did not envisage any new capacity addition during XI Plan period of 2007-12 and included two<sup>27</sup> slipped over projects of X Plan (2002-07).

Thus, in all four CPSEs, only 16 projects having total capacity of 6,794 MW were planned for execution against their original XI Five Year Plan target of hydro power capacity addition of 11,813 MW.

**3.4 Lack of long term planning**

Hydro Power Policy 2008 of GOI envisaged long term plan for XII Plan (2012-17), XIII Plan (2017-22) and XIV Plan (2022-27) with a target of Capacity addition of 30,000 MW, 31,000 MW and 36,494 MW respectively and formulation of action plan for better preparedness for capacity addition besides completion of survey, investigation and DPR preparation of 167 projects. It also envisaged that 33 projects with 14,535 MW capacities were identified in XII Plan for CPSEs.

A review of the preparedness of the CPSEs for the XII Plan revealed as under:

Sl. No.	Name of Company	Capacity addition envisaged for XII Plan (MW)	Capacity expected to be added as per preparedness of CPSEs (MW)	Remarks (Details as furnished by CPSEs)
1.	NHPC	4,502 (10 projects)	1,702 (8 projects)	Capacity addition for XII Plan includes 4,172 MW as carry over from XI Plan. A capacity of 2,800 MW <sup>28</sup> is likely to slip beyond XII Plan.
2.	SJVNL	3,116 (7 projects)	412 (1 project)	Six projects (2704 MW) out of seven projects are expected to be completed in XIII Plan.
3.	THDC	1,000 (1 project)	1,000 (1 project)	Scheduled for commissioning in 2015-16.

<sup>27</sup> Kameng (600 MW) and Tuirial (60 MW)

<sup>28</sup> Parbati-II (800 MW) and Subansiri Lower (2,000 MW).

Sl. No.	Name of Company	Capacity addition envisaged for XII Plan (MW)	Capacity expected to be added as per preparedness of CPSEs (MW)	Remarks (Details as furnished by CPSEs)
4.	NEEPCO	2,511 (7 projects)	660 (2 Projects)	Five projects are expected to be completed in XIII Plan.
<b>Total</b>		<b>11,129</b> <b>(25 projects)</b>	<b>3,774</b> <b>(12 projects)</b>	<b>Expected achievement would be only 34 per cent</b>

From the above, it may be seen that these four CPSEs are likely to add only 3,774 MW capacity<sup>29</sup> (34 per cent of the planned capacity addition) in 12 projects in XII Plan as against 14,535 MW in 33 projects envisaged for 2012-17 in the Hydro Policy 2008.

### 3.5 Inadequate structural framework for initial activities

A systematic approach is required to be adopted for obtaining various clearances as well as post clearance activities viz. preparation of FR/DPR, bid documents, issue of NIT for major work packages, evaluation of bids and award recommendation. Timely completion of these activities ensures ordering of main civil works package immediately after Investment approval so that projects get completed within schedule.

Audit scrutiny revealed that against a time period of 30 months envisaged by MOP (June 2001) for pre-investment approval activities up to submission of note for investment approval to CCEA, actual time taken by CPSEs for different projects was as under:

Sl. No.	Name of the project	Capacity (in MW)	Name of the Company	Actual time taken against the prescribed timeline of 30 months
1.	Parbati-III	520	NHPC	80
2.	Nimmo-Bazgo	45	NHPC	58
3.	Chutak	44	NHPC	58
4.	Uri-II	240	NHPC	58
5.	Teesta Low Dam-IV	160	NHPC	56
6.	Chamera-III	231	NHPC	46
7.	Parbati-II	800	NHPC	42

<sup>29</sup> including 2,444 MW as slipped over capacity from XI Plan

Sl. No.	Name of the project	Capacity (in MW)	Name of the Company	Actual time taken against the prescribed timeline of 30 months
8.	Subansiri Lower	2,000	NHPC	36
9.	Rampur	400	SJVNL	33
10.	Sewa-II	120	NHPC	32
11.	Teesta V	510	NHPC	32
12.	Omkareshwar	520	NHDC (JV between NHPC and Government of MP)	32
13.	Teesta Low Dam-III	132	NHPC	29
14.	Koteshwar	400	THDC	12 <sup>30</sup>

**(a) Delay in pre-investment activities**

It is evident that CPSEs could complete pre-investment approval activities in only two of the 14 projects<sup>31</sup> in time and there was marginal delay up to six months in five projects and in remaining seven projects pertaining to NHPC delay ranged up to 50 months. Thus, NHPC did not have adequate internal controls for monitoring pre-investment activities to ensure timely completion.

Ministry/Management stated (March 2012) that development of hydro electric projects is an intricate and long drawn process spanning over 3 to 5 years. Long time is required for survey and investigation, preparation of DPR, obtaining of statutory/non statutory clearance, investment decision and financial closure. Moreover, delays in obtaining environment and forest clearances have adverse impact on the Capacity Addition programme of the country.

**(b) Time taken in obtaining clearances**

Further analysis of five projects with excessive delays indicates unduly long time taken in obtaining clearances and completion of Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) studies against the benchmarks defined by MOP as under:

<sup>30</sup> *The project was originally conceptualized in November 1986. However, Committee of Secretaries considered (March 1993) taking up the work of Koteshwar project after the work of Tehri Stage-I picked up and therefore, the same was considered for execution in January 1999. As such, the date of initiation of pre-investment activities has been taken as January 1999.*

<sup>31</sup> *Excludes two projects of NEEPCO as planning activities were not covered in this Performance Audit.*

Sl. No.	Name of project	Time taken in completing of EIA/EMP studies against benchmark of 18 months	Time taken in obtaining clearance (TEC, Environment, Forest etc.) against benchmark of 3-12 months
1.	Parbati-III	49	80
2.	TLDP-IV	35	74
3.	Uri-II	20	51
4.	Nimmo-Bazgo	15	60
5.	Chutak	15	66

Ministry/Management stated (March 2012) that timelines specified in the procedure of three stage clearance by MOP are subject to various inter-ministerial/interstate consultations. However, Management agreed that if timelines are fixed for all activities including other Ministries and State Departments, the delays can be reduced.

**(c) Reasons for delays**

The delays in various stages of initial activities are discussed below:

Audit observation	Reply of Ministry/ Management	Further remarks
<p><b><i>Delay in EIA/EMP studies</i></b> NHPC took 7 and 11 months in submission of Environment Impact Assessment (EIA)/ Environment Management Plan (EMP) studies after their completion to MOEF in respect of TLDP-IV and Chamera projects. Audit observed that NHPC did not furnish complete documents with environment clearance which were later on submitted on demand resulting in delay.</p>	<p>Ministry/ Management stated (March 2012) that application form for environment clearance is required to be submitted along with the report of a mandatory Public hearing conducted through State Pollution Control Board (SPCB), which is time consuming and often not in the hands of NHPC.</p>	<p>The reply is not acceptable and lacks merit as NHPC had submitted EIA/EMP studies to MOEF for obtaining environment clearance in respect of Teesta-V, Sewa-II, Parbati-II, Parbati-III and Subansiri Lower projects within a period of one month even after following the prescribed procedure.</p>
<p><b><i>Delay in environment clearance</i></b> MOEF took 5 to 25 months against benchmark of three months for environment clearance for 11 projects (NHPC &amp; SJVNL). The delays were due to submission of incomplete proposal forms, delay in examination of proposals by clearance authorities, raising multiple set of queries in phases and late submission of compliance report to MOEF.</p>	<p>Ministry/NHPC Management stated that delay in environment clearance from MOEF is not due to submission of incomplete proposal by NHPC but mainly due to lengthy process and various supplementary additional information sought in the meetings by Expert Appraisal Committee (EAC) members. SJVNL Management stated (March 2012) that they had submitted complete proposal for environment clearance of</p>	<p>Reply of the Ministry/ Management is not acceptable as multiple queries were raised by the concerned authorities mainly due to non-fulfillment of the prescribed procedure. Had these CPSEs followed the prescribed procedure and submitted proposal accordingly, the inordinate delays could have been minimized considerably.</p>

Audit observation	Reply of Ministry/ Management	Further remarks
	Rampur HEP to MOEF and vigorously pursued with MOEF. Out of total time of 14 months taken in obtaining environment clearance, the time taken at State level was approx. 10 ½ months.	
<p><b><i>Incorrect assessment of land requirement-NHPC</i></b></p> <p>For construction of Parbati-II (800 MW) project NHPC had to revise the initially assessed and approved land requirement of 87.79 ha to 145.62 ha due to increased requirement of submergence area, job facilities, dumping area, quarries, re-alignment of roads and new roads. The forest clearance for additional 57.83 ha land was sought in November 2002 <i>i.e.</i> after award of main civil works in September 2002.</p> <p>Thus, the project was delayed as forest clearance for additional land was granted by MOEF in March 2004.</p>	NHPC Management stated (October 2011) that at the time of actual execution of works, the forest land was found to be inadequate.	Management has accepted the inadequacies as pointed out by Audit.
<p><b><i>Delay in firming up of layout and salient features of the projects-SJVNL</i></b></p> <p>In respect of Rampur project of SJVN Limited, the Company lost 23 months (May 2007 to May 2009) for obtaining additional forest clearance from Ministry of Environment due to delay in firming up the requirement of additional Adit<sup>32</sup> near Kasholi Khad.</p>	Ministry/SJVNL Management stated (March 2012) that adequate survey and investigations were carried out and based on the same, the DPR was prepared which was further examined by various premier authorities of the GOI. In the approved DPR, four numbers of Adits were proposed for the execution of HRT works. However, during execution, Goshai Adit was excavated due to extreme poor geology.	Reply of the Ministry and SJVNL Management is not acceptable as such eventualities could have been foreseen with adequate survey and investigations at the time of preparation of DPR as envisaged specifically in the Policy on Hydro Power Development (1998).

While Audit appreciates that development of hydroelectric projects involves intricate and long drawn process, the feasibility of instituting a single window mechanism through constitution of a High Powered Committee, with Members from nodal Ministries and State Governments, under the chairmanship of the Secretary (Power) for monitoring and fast tracking clearances needs to be looked into.

<sup>32</sup> Adit is a type of entrance to underground tunnels which may be horizontal or nearly horizontal.

### 3.6 Allotment of projects to private developers

The Government of India (GOI) allotted (May 2000) six projects<sup>33</sup> in Arunachal Pradesh to the NHPC. Later on Government of Arunachal Pradesh (GOAP) allotted four of these six projects to private developers/joint ventures, one project to NTPC and remaining one project to NHPC as discussed in succeeding paragraphs.

#### 3.6.1 Chronology of the events

Chronology of the events of allotment of these projects is discussed below:

Date/Month	Brief details
22 January 1999	The Minister of Power wrote to the Prime Minister for expediting the development of hydro power projects in the North Eastern region and suggested that the survey and investigation of Dihang (13,400 MW) and Subansiri (7,300 MW) hydro projects needed early completion. This issue was examined by PMO in consultation with MOWR, MOP and MOF.
9 August 1999	Prime Minister approved that a Special Purpose Vehicle (SPV) should be set up by MOP for survey and investigation and implementation of these projects.
14 September 1999	MOP decided that formation of SPV could take time, therefore it would be in the interest of development of these projects that preparation of DPRs be taken up by dedicated teams forthwith. On formation of SPVs these projects may be taken over by SPV.
25 November 1999	MOP advised NHPC to immediately commence the survey and investigation of the upper and middle sites of Dihang (i.e. Siang) and Subansiri multipurpose projects from its own resources.
11 January 2000	MOP conveyed the sanction of the President of India to NHPC for incurring of an expenditure of ₹ one crore for survey and investigation of Siang Upper, Siang Middle, Subansiri Upper and Subansiri Middle projects.
22 March 2000	All these projects were handed over by the Ministry of Water Resources to NHPC. The MOWR intimated that NHPC may take over all the six sites lock, stock and barrel.
1 May 2000	MOP conveyed the order of the GOI under Section 18A of the erstwhile Electricity (Supply) Act, 1948 entrusting the job of establishing, operating and maintaining the projects in Dihang (13,400 MW) and Subansiri (7,300 MW) hydroelectric projects in Arunachal Pradesh to NHPC.
26 March 2003	The Memorandum of Understanding (MOU) proposed to be signed between NHPC and Government of Arunachal Pradesh (GOAP) for taking up Dihang and Subansiri basin projects was approved by MOP.
2 October 2003	The final MOU approved by MOP and after suitably incorporating the comments

<sup>33</sup> Three projects on Siang (Dihang) River-(i) Siang Upper, (ii) Siang Middle, (iii) Siang Lower and three projects on Subansiri River- (i) Subansiri Upper, (ii) Subansiri Middle and (iii) Subansiri Lower.

Date/Month	Brief details
	of GOAP was submitted to GOAP.
<b>October 2003 to March 2005</b>	The matter was taken up by NHPC with GOAP several times but the MOU could not be signed.
<b>September 2003 to March 2006</b>	Meanwhile, the survey and investigation work was carried out and DPR was prepared by NHPC in respect of four projects (Siang middle, Siang lower, Subansiri upper and Subansiri middle) allotted by GOAP to the private developer/joint ventures subsequently.
<b>22 July 2005</b>	The Cabinet of GOAP shortlisted three private parties namely Reliance Energy Limited, J.P. Associates Limited and D.S. Constructions Limited for allotment of five hydro power projects including Siang lower and Siang Middle projects entrusted to NHPC by the GOI under Electricity (Supply) Act 1948 besides three other projects. The Cabinet of GOAP also decided to constitute a committee consisting of Principal Secretary (Finance), Secretary (Power) and Chief Engineer (Hydro) to negotiate with the private parties to evaluate their technical capability, financial capability, range of power tariff at the time of completion of the project and other relevant details.
<b>29 July 2005</b>	Department of Power, GOAP constituted committee as per decision taken in the Cabinet meeting held on 22.07.2005.
<b>10 August 2005</b>	J.P. Associates Limited submitted their offer to the committee constituted by the cabinet of GOAP.
<b>12 August 2005</b>	Reliance Energy Limited and D.S. Constructions Limited submitted their offer to the committee constituted by the cabinet of GOAP.
<b>06 September 2005</b>	The Committee requested all the above three companies to submit their offers indicating the technical and financial credentials. All the three parties were also invited for negotiations on 05.09.2005 by the committee. Based on evaluation of offers of these companies, the committee recommended to take decision based on the highest benefit in terms of base cash flow.
<b>07 September 2005</b>	After going through the offers of the interested parties and the report of the High Powered Committee, the Cabinet of GOAP decided to offer Lower Siang & Hirong project to J.P. Associates Limited, Tato-II & Siyom <sup>34</sup> projects to Reliance Energy Limited and Naying project to D.S. Constructions Limited for development.
<b>13 September 2005</b>	NHPC informed MOP that the State Government was contemplating transfer of Siang Middle and Siang Lower hydro-electric projects to the private developers.
<b>3 October 2005</b>	Minister of Power wrote to Chief Minister of Arunachal Pradesh that transfer of projects from NHPC at such an advanced stage would not be desirable and would rather send wrong signals to the Central Public Sector Undertakings operating in the State of Arunachal Pradesh. It was also further stated that this would not only hamper the Central Sector Investments in the State but would also have a bearing on the Centre-State relations.
<b>22 February 2006</b>	GOAP executed MOAs with the private developers for implementation of the projects on BOOT basis.
<b>18 March 2006</b>	Minister of Power wrote to Chief Minister of Arunachal Pradesh expressing serious concerns for alleged allocation of projects exceeding 100 MW without

<sup>34</sup> *Siyom and Siang Middle have been used interchangeably by various authorities.*

Date/Month	Brief details
	competitive bidding and also suggested to hold an urgent meeting to resolve the issues.
29 March 2006	GOAP intimated NHPC that they have entered into memorandum of agreement (MOA) with private developers and asked NHPC to hand over all documents of Siang Middle and Siang lower to the Private Developers namely Reliance Energy Limited and J P Associates Limited respectively.
24 April 2006	NHPC sought advice of MOP whether it would be appropriate to put company's point through legal route.
4-5 July 2006	A meeting was held between Minister of Power, Chief Minister of Arunachal Pradesh and CMDs of NHPC, NTPC and NEEPCO wherein it was discussed/ agreed that CPSEs preparing DPRs shall also execute the projects as substantial amount was spent by these CPSEs.
07 August 2007	NHPC Board discussed the issue and decided to hand over survey and investigation data and DPRs of the projects as per GOAP's request in view of the changed scenario due to withdrawal of projects by GOAP and allotment of some new projects.
August 2007	The Board proposal was also submitted to the MOP who viewed that this was a corporate decision to hand over projects to the private developers.
17 December 2007	On referring the matter to Ministry of Finance (MOF) for verification of quantum of money recoverable from the private developer, MOF sought reasons from MOP for withdrawal and transfer of projects to the private developers by GOAP.
20 June 2008	MOP did not actually give their views and only forwarded NHPC's view that NHPC was not aware of the withdrawal of the projects from NHPC by GOAP.
16 February 2009	GOAP allotted Siang Upper to NTPC for preparation of pre-feasibility report.
12 August 2009	The Cabinet of GOAP decided to withdraw <b>Subansiri Middle</b> HEP from NHPC Limited and allotted to the Hydro Power Development Corporation of Arunachal Pradesh for development as a joint venture with Jindal Power Limited.
12 March 2010	The Cabinet of GOAP allotted <b>Subansiri Upper</b> HEP to K.S.K. Energy Venture Pvt. Limited for development as a joint venture.
28 October 2009 and 18 May 2010	GOAP asked NHPC to hand over all documents related to Subansiri Middle and Subansiri Upper projects to Jindal Power Limited and KSK Energy Ventures Limited respectively.
27 September 2007 and 16 July 2010	MOP directed NHPC to hand over the projects to private developers on receipt of expenditure incurred.
April 2008 to February 2011	NHPC handed over three projects <sup>35</sup> along with survey and investigation documents to the private developers on receipt of requisite amount. Fourth project <i>i.e.</i> Subansiri Upper is also in the process of handing over to the private developer (June 2012).

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<sup>35</sup> *Siang Lower, Siang Middle, and Subansiri Middle projects*

It is evident from the above that

- Despite specific directions (August 1999) by the Prime Minister's office (PMO) that an SPV be formed for survey, investigation and implementation of the Dihang and Subansiri multipurpose projects in Brahmaputra basin in Arunachal Pradesh, no SPV was constituted by MOP. The SPV as envisaged with the representation of MOP, CEA, CWC, State Governments, etc. would have facilitated the process of implementation of these projects.
- The Policy on Hydro Power Development 1998 of GOI allowed State Governments for selection of a developer through MOU route for the Hydel project upto 100 MW only. Further, as per Hydro Power Policy of 2008, the State Governments are required to follow a transparent procedure for awarding potential sites to the private sector.

However, GOAP shortlisted (July 2005) only three private parties<sup>36</sup> for allotment of five hydro projects<sup>37</sup> (including two of the projects allocated by GOI to NHPC i.e. Siang Middle and Siang Lower projects) having proposed capacities ranging between 500 MW and 2,700 MW. Other two projects viz. Subansiri Middle (1600 MW) and Subansiri Upper (2000 MW), which were initially allotted by GOI to NHPC were also allocated (August 2009 and March 2010 respectively) by GOAP to the joint venture companies with Jindal Power Limited and KSK Energy Ventures Private Limited respectively wherein GOAP held 26 *per cent* equity and balance by these private developers. Transparency and competitiveness in allotment of hydro power projects as envisaged in the Hydro Policies of 1998 and 2008 was thus overlooked.

One more project viz. Siang Upper (of six projects allotted by GOI to NHPC), was allotted (February 2009) to NTPC by GOAP for preparation of pre-feasibility report only. Thus, out of six projects, only one project (Subansiri Lower) is being implemented by NHPC.

- Further these six projects conceived in January 1999 were allotted by GOI to NHPC in May 2000. DPRs of four of these projects (Siang Middle, Siang Lower, Subansiri Middle and Subansiri Upper) had been prepared by NHPC between September 2003 and March 2006. However, these four projects were subsequently, allotted (February 2006, August 2009 and March 2010) to private

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<sup>36</sup> *Reliance Energy Limited, JP Associates Limited and D.S. Constructions Limited*

<sup>37</sup> *Siang Lower (2700 MW), Siang Middle (1000 MW), Hirong (500 MW), Tato-II (700 MW) and Naying (1000 MW) (Source: CEA website)*

developers/ Joint Ventures by GOAP, which are still (March 2012) at the initial stage of implementation as the private developers/ Joint Ventures are in the process of obtaining various clearances. One project (Siang Upper) allotted (February 2009) to NTPC for preparation of pre-feasibility report is also in the initial stage of implementation. **Thus, decision to allot projects from SPV to NHPC and subsequent allotment to the private developers/joints ventures/NTPC by GOAP resulted in the five projects out of total six conceived in January 1999 not taking off so far even after lapse of 12 years even though a large size hydro project as per CEA norms takes about 10 years from conceptualisation of a project to its commissioning.** The remaining one project (Subansiri Lower) is under execution by NHPC and expected to be completed by December 2016.

Ministry stated (March 2012) that

- A note for formation of SPV was initiated by the MOP but the Minister of Power decided that these projects be executed by NHPC which is much better equipped. MOP also added that withdrawal of the projects from NHPC was based on the GOAP's decision to involve the private sector in the development of hydro power projects and execution of the projects could take place only after signing an MOU with the concerned State Government.
- There are guidelines of GOI directing States to select developers through competitive bidding. The criteria for competition were left to the States and tariff based bidding was not a requirement. Further, State Governments were required to follow a transparent procedure for awarding potential sites to the private sector. MOP has made all efforts to implement the Hydro Policy and has consistently urged the GOAP to award projects to developers in a transparent manner based on competitive bidding. In this regard, MOP had requested GOAP for case-wise details on the method of allocation, methods adopted for publicity for the request for investments, list of bids received at pre-qualification stage and the final financial bids. However, replies of GOAP were awaited.
- The developers of these projects are in the process of obtaining necessary statutory clearances required as a precondition to begin execution.

Reply of the Ministry has to be viewed in the light of the following:

- The SPV was envisaged with the representation of MOP, CEA, CWC and the GOAP. Representatives of all the concerned stakeholders in SPV would have facilitated in expediting the implementation of these projects.
- The reply of the Ministry itself indicates there are guidelines of the GOI for competitive bidding and that the MOP did not have information/record to confirm that GOAP had followed transparency in the process of allocation of projects to the private developers/ joint ventures. From October 2003 when NHPC approached GOAP for signing of MOU for execution of four projects, GOAP did not take any action till July 2005. Instead of signing of MOU, GOAP started the process of identification of private developers for allocation of two of these projects to the developers. Finally, two projects were allotted to private developers by signing MOA on 22 February 2006. It is to be noted that four projects were allocated (May 2000) by the GOI to NHPC. These were subsequently allocated to private developers/joint ventures by GOAP without any consultation with GOI/NHPC. Further, the process of allocation of two out of these four projects was inordinately delayed and these were allotted to joint ventures with private developers, one in August 2009 and second in March 2010, though NHPC approached GOAP in October 2003 for signing of MOU for all the above four projects.
- Ministry's reply also acknowledges that these projects are in the initial stage of implementation. Inordinate delay in allocation of projects and further delay by the private developers/joint ventures, in the execution of these four projects has resulted in non-execution of these projects till date.

Thus, the decision to move from SPV to NHPC and then to private developers/joint ventures only added to the delays and the execution of the projects is yet to be initiated. Hence, the estimated benefit of generation of 6,600 MW electricity per annum, as per DPRs of four projects allotted to private developers/joint ventures, has not been achieved.

## CHAPTER - 4

# Survey, Geo-technical Investigation and Investment Approval

Geo-technical investigation for a hydro project needs to be undertaken with adequate understanding of the local and regional environment as it significantly impacts the design, construction and operation of the hydro power projects. The data thus collected through geo-technical investigations should have detailed description of the geological situation and assessment of the history of the site for appropriate engineering drawing and design.

Policy on Hydro Power Development 1998 envisaged inter-alia thorough survey and investigation of the potential hydro sites on an advanced scientific basis before preparation of detailed project reports. Planning Commission, while finalising the XI Five Year Plan also emphasized on the necessity of bankable Detailed Project Reports, which should be based on a detailed survey so as to avoid geological uncertainty. COPU also while conducting (December 2008) horizontal study of power generating companies observed that advanced technology is yet to become part of Indian practice which indicates importance of the geo-technical studies.

Audit examination disclosed the following inadequacies in the geotechnical survey and investigation.

### 4.1 Gaps in survey and investigation

Drilling is one of the important techniques of survey and investigation apart from other techniques like Topographic mapping, survey, Geomorphological mapping, Geotechnical mapping, Sluicing, etc. The main objective of drilling is to use the knowledge obtained from surface mapping to provide control for the interpretation of any geophysical investigations and to provide access for test equipment *e.g.* for measurement of water levels, pore pressures and permeability, etc.

#### 4.1.1 Inadequate survey

Survey and investigation activity which underpins the effective designing of the hydro projects was not properly taken up by the CPSEs as is brought out from the following audit analysis.

## NHPC Limited

- Out of total expenditure of ₹263.72 crore under the head survey and investigation, only ₹63.10 crore (24 per cent) was incurred on actual survey and investigation activity of 11 projects while the balance 76 per cent was spent on establishment expenditure. The project-wise percentage of establishment expenditure ranged from 26 per cent to 93 per cent. Thus, it is evident that only a small portion of allocated funds was utilised on actual survey and investigation activities. Resultantly, there was a variation between the rock classes<sup>38</sup> envisaged in DPR and classes actually encountered during excavation in respect of all projects due to inadequate survey and investigation.

Ministry/NHPC Management stated (March 2012) that reasons for higher establishment cost are (i) prolonged establishment set up even after submission of DPRs waiting for the necessary clearance from the respective authorities and (ii) NHPC does most of the investigations in-house i.e. survey, drilling, geological mapping, geophysical survey, construction materials survey, etc. Further, rock classes as given in DPRs or in tender documents are for the estimation of rock supports so that the quantities are prepared in a scientific manner.

Ministry/Management's reply corroborates the Audit observation regarding higher establishment cost *vis-à-vis* survey and investigations which is necessary for preparation of DPRs. The stand regarding variation in the rock classes is also not justifiable as bill of quantities is prepared and included in the tender documents based on available survey and investigation reports and the prospective bidders quote for a particular package based on such data.

- In case of Parbati-II project, DPR provided for back hill slope stabilization<sup>39</sup> of Power House, shotcrete<sup>40</sup> and rock bolting. However, due to measures in the DPR not being adequate, the back hill slope failed thrice and was finally stabilized by additional work involving 842 cable anchors of 35 meter length, 2324 rock anchors of 12 meter length, 469 pre grout hole of 15 meter length and

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<sup>38</sup> Class-I (Rock Mass Rating above 80%), Class-II (Rock Mass Rating between 60 to 80%), Class-III (Rock Mass Rating between 40 to 60%), Class-IV (Rock Mass Rating between 20 to 40%) and Class-V (Rock Mass Rating below 20%)

<sup>39</sup> In case of surface power house, it is necessary to stabilize the back hill slope in order to avoid any eventuality in future by way of suitable measures viz. shotcrete, anchors, bolts, etc.

<sup>40</sup> Shotcrete is concrete (or sometimes mortar) conveyed through a hose and pneumatically projected at high velocity onto a surface, as a construction technique.

712 pressure relief holes of 10 meter length. This not only resulted in additional expenditure of ₹59.88 crore but had other consequential impacts like delay of 44 months in completion of Power House package and contractual claims of ₹71.27 crore in respect of Electro-Mechanical contract on account of extended warrantee charges, idling claims, additional amount as agreed and additional price variation.



Back hill slope stabilization of power house of Parbati-II

NHPC Management stated (October 2011) that as per standard practice, the design adopted for back hill slope was based on geological information which could be gathered at the DPR stage. The design was further revised considering site conditions/geological conditions by providing additional strengthening measures.

Management's reply corroborates the audit observation that DPR was prepared on the basis of inadequate data as even the stabilization process of back hill slope failed thrice. Records also revealed that design opted for back hill slope stabilization was revised as measures recommended in the DPR were inadequate.

Ministry/NHPC Management stated (March 2012) that Parbati-II surface power house was investigated by detailed geological mapping, geophysical survey, three drill holes and two long drifts and rock mechanic tests.

The reply is not justified as the back hill slope of Parbati-II project failed thrice, as a result of which NHPC had to incur additional expenditure of ₹59.88 crore and face claims of ₹71.27 crore besides delaying the power house completion by 44 months. Non inclusion of appropriate measures for stabilization of back hill slope in the DPR resulted in the extra expenditure, claims and time overrun.

## SJVN Limited

In the execution of Naptha Jakhri Hydro electric Project (1,500 MW) in the Himalayan range, the Company faced many geological surprises like collapse and rock falls, heavy ingress of water under artesian conditions. Notwithstanding this specific experience, the Company did not focus adequately on survey and investigation pertaining to their Rampur project in the same region due to which eight geological surprises<sup>41</sup> and wide variations in the rock classes<sup>42</sup> were encountered during project execution which impeded the project execution and delivery schedules by 18 months with a cost overrun of ₹184.49 crore (in both Package-I and Package-II). Out of this, cost overrun of ₹13.64 crore was due to:

- Introduction of additional Adit at Kasoli between Khunni and Goshai Adit at a cost of ₹5.20 crore.
- Change in the scope of work due to increase in depth of surge shaft from 128 meter depth to 149.5 meter, resulting in extra cost of ₹8.44 crore.

Ministry/SJVNL Management stated (October 2011 and March 2012) that introduction of Kasholi Adit was necessitated due to encountering of adverse rock conditions. It further stated that very poor rock mass quality near bottom of surge shaft was encountered. The Ministry further stated (March 2012) that for the purpose of surge shaft, three holes were carried out and a total depth of 159 meters was explored.

The reply is not tenable as adequate survey would have prevented the variations. Despite drilling up to 159 meters at investigation stage, failure to correctly assess the geological conditions led to increase in depth of surge shaft to 149.5 meter from original 128 meter.

### 4.1.2 Geological surprises due to inadequate drilling

Despite Policy on Hydro Power Development of GOI (1998) emphasized for thorough survey and investigation of potential hydro sites on an advanced scientific basis before preparation of DPRs, NHPC and SJVNL did not focus adequately on the

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<sup>41</sup> *Reasons of geological surprises were ingress of heavy water seepage, cavity formation, gradual collapse of tunnel, shear zone, etc.*

<sup>42</sup> *During excavation in HRT, 35.64 per cent of class I to III rock and 64.36 per cent of class IV & V rock was encountered against 62.5 per cent and 37.5 per cent respectively envisaged in the DPR.*

critical activities of project survey and investigations. Although, NHPC was incorporated in November 1975, it did not have any in-house guidelines up to December 2006 for survey and investigation. No norms for drilling holes along the head race tunnel were prescribed. In January 2007, NHPC issued guidelines which provided a norm of drilling at least one hole after every 1,000 meters along head race tunnel (HRT) alignment.

Audit examination revealed that in the absence of norms, for nine of the 16 projects selected, drilling of holes for the HRT alignment during survey & investigation in the projects was significantly less as these CPSEs<sup>43</sup> drilled only 0 to 4 holes along the length of 4 to 31 Km of the HRTs as below:

Sl. No.	Name of the project	Length of the HRT as per DPR (in kms.)	Desired numbers of drill holes	Actual number of holes drilled during survey & investigation	Expenditure incurred on extra items of work (₹ in crore)
<b>NHPC Limited</b>					
1.	Parbati-II	31.20	31	3	72.95
2.	Parbati-III	7.98	8	2	21.85
3.	Chamera-III	14.70	15	1	5.46
4.	Teesta-V	17.78	18	2	28.95
5.	Subansiri Lower	7.12	7	2	77.36
6.	Sewa-II	10.00	10	4	0.98
7.	Uri-II	4.27	4	2	4.83
8.	Chutak	4.32	4	0	Not furnished
<b>Total</b>					<b>212.41</b>
<b>SJVN Limited</b>					
9.	Rampur	15.08	15 <sup>44</sup>	3	184.49

The maximum depth of the holes drilled was only around 60 metres whereas the HRT was constructed way below this depth ranging between 29 metres to 1550 metres. Insufficient drilling in terms of number as well as depth of the holes resulted in NHPC encountering 58 'geological surprises'<sup>45</sup> during execution of three projects<sup>46</sup> which took up to 20 months to be resolved and consequently impacted the project delivery

<sup>43</sup> There was no HRT or required numbers of holes were drilled in remaining projects of NHPC and THDC.

<sup>44</sup> Based on best industry practice (i.e. NHPC Limited)

<sup>45</sup> 20, 16 and 22 geological surprises like cavity formation and water ingress, collapse or loose rock fall, etc. in Teesta-V, Sewa-II and Parbati-III projects.

<sup>46</sup> Further, data in respect of remaining five projects was not maintained by NHPC.

schedules. Similarly, eight 'geological surprises' were encountered in the execution of Rampur project of SJVNL for which up to about 5 months were taken for rectification. Consequently, NHPC and SJVNL incurred extra expenditure of ₹396.90 crore on extra items of work due to geological surprises.

NHPC, while appreciating the need to encourage as much drilling as possible on long tunnels, expressed (October 2011) difficulty in following their own norms of one hole at every 1,000 metres in the rugged terrain of Himalayas with superincumbent cover and inaccessibility. However, there is no justification for drilling only 0 to 4 holes over the total length of 4 Km to 31 Km tunnels of the projects and NHPC needs to ensure compliance to the norms meant to reduce the geological uncertainties. Ministry/NHPC Management appreciated (March 2012) the concern of Audit regarding more drilling on long tunnels and stated that NHPC is striving hard in arduous terrain to achieve the norms set by it.

Ministry/SJVNL Management stated (October 2011 and March 2012) that required and feasible geological investigations were carried out as 17 holes have been drilled covering maximum length of HRT. The reply is not acceptable as only three holes were drilled along HRT alignment against the requirement of 15 holes as evident from the DPR. Drilling of remaining holes after preparation of DPR reflects inadequacy at DPR stage itself and which further forms the basis for determining the Bill of Quantities.

## 4.2 Selection of inappropriate technology

Tunnel Boring Machine (TBM) methodology for excavation in a 9.05 km stretch of Head Race Tunnel (HRT) between Adit-1 and Adit-2 in Parbati-II project was adopted by NHPC for timely completion of the project. Various concerns were expressed on the TBM as under:

- Geological Survey of India suggested (December 2000) that properties of Manikaran Quartzites may turn out to be problematic lithology for TBM to handle as was the experience in case of Dul Quartzites at Dulhasti project.
- Central Water Commission (CWC) suggested (November 2000) that TBM could be avoided without affecting the project commissioning by appropriately aligning the Adits and by undertaking excavation of Adit and Head Race Tunnel (HRT) by drill and blast method as well as concrete lining and grouting of HRT as parallel activities. CWC had also warned that with available geological information for TBM reach, delays on account of problems during TBM tunneling could be significantly more.

- MOP consistently advised (January 2002) NHPC that single technology should not be specified in the tender documents. Tender documents should specify the task to be achieved and the time frame instead of specifying the technology.

Audit observed the following:

- TBM technology was selected even after concerns expressed by various authorities. Before taking a decision to deploy TBM, suitability of rock for functioning of TBM was not established as all geological information was based on surface mapping and no drills or drifts were carried out in view of huge forest cover.
- PIB memo stated (May 2002) that use of 'TBM or any other technology' should be specified in the bid document for excavation of the portion of HRT instead of restricting the choice to only one technology. Against this, NHPC in its bid documents spelt out the use of only TBM to the contractor which was not in consonance with PIB's concerns.
- Decision to adopt TBM by ignoring the suggestions of various authorities was not judicious and TBM got stuck (November 2006) after tunneling only four kms and since then progress of the work has been adversely affected due to various consequential technical and contractual issues discussed in Para Nos.6.2(c) to 6.2(e). Ultimately, NHPC terminated (March 2012) the contract of the above works and new contract is yet to be awarded (June 2012).

NHPC Management stated (October 2011) that most of DPR studies were mainly based on surface geological mapping and remote sensing and all the investigations and testing required for geotechnical assessment were conducted before the use of TBM technology. Further, the problem of water ingress in HRT occurred in the area in which it was impossible to approach by a drill hole from surface. Therefore, keeping in view these difficulties, core drilling/probe drilling during construction from the tunnel face was recommended.

As accepted by the Management, DPR was mainly based on surface geological mapping and remote sensing. It only corroborates the fact that suitability of rock for functioning of TBM was not established before taking decision to deploy TBM. Further, if drilling from surface was not possible, NHPC could have explored the possibility of deploying alternate appropriate technology which would work in mixed geological conditions.

Ministry/NHPC Management further stated (March 2012) that due to the high forest cover and inaccessibility particularly in TBM portion, direct explorations by drilling could not be conducted. Further, Ministry/Management added that TBM technology

was kept in the tenders as per professional advice of the renowned international consultant and simply a reference to any other technology would not have served the purpose as the contractor has to base his bid on input data from the client.

Reply of the Ministry/Management is not acceptable as various authorities (including MOP itself) had expressed concerns on TBM technology. Despite this, NHPC went ahead and the TBM got stuck after tunneling only four kms. Further, tender documents did not specify the task to be achieved and the time frame but only the technology. As a result, Parbati-II project is running behind the schedule by about 99 months.

### 4.3 Investment Approval

On completion of all preliminary activities including techno economic clearance/ concurrence by CEA, the investment proposal of each project is submitted by the MOP to Cabinet Committee of Economic Affairs (CCEA) for approval. On receipt of the investment approval from CCEA, further activity of awarding of contracts is carried out by the executing Company. Timely approval of the projects ensures efficient planning of further activities viz. awarding and execution of project.

#### 4.3.1 Delays in Investment Approval and higher cost of construction

Scrutiny of records revealed that the time taken for investment approval after Techno Economic Clearance was 8 months in case Subansiri Lower of NHPC whereas it ranged between 10 and 29 months in respect of other 12 projects<sup>47</sup> (excluding Koteshwar Project of THDC<sup>48</sup>). Audit further observed that delays had a cascading impact on the time and cost of the projects.

The Working Group on Power for Eleventh Plan (2007-12) envisaged (February 2007) cost of construction at ₹4.50 crore per MW for the run of the river hydro projects.

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<sup>47</sup> Excludes two projects of NEEPCO as planning activities were not covered in this Performance Audit.

<sup>48</sup> A time of 127 months was taken in respect of Koteshwar project of THDC after obtaining TEC (August 1989) as Committee of Secretaries decided to take up this project after the work of Tehri Stage-I project picked up.

The approved and anticipated cost per MW in respect of 12 run of the river hydro projects<sup>49</sup> approved by CCEA between July 1998 and January 2007 is given below:

(₹ in crore)

Sl. No.	Name of the Project	Capacity (MW)	Date of Investment Approval	Approved cost	Anticipated cost (%age over approved cost)	Cost per MW		Time taken for investment approval after TEC (in months)
						Based on approved cost	Based on anticipated cost	
1	Parbati-II of NHPC	800	11.09.2002	3919.59	5353.21 (37%)	4.90	6.69	20
2	Sewa-II of NHPC	120	09.09.2003	665.46	1108.83 (67%)	5.55	9.24	10
3	TLDP-III of NHPC	132	30.10.2003	768.92	1628.39 (112 %)	5.83	12.34	11
4	TLDP-IV of NHPC	160	30.09.2005	1061.38	1501.75 (41%)	6.63	9.39	21
5	Chamera-III of NHPC	231	01.09.2005	1405.63	2084.01 (48%)	6.08	9.02	22
6	Uri-II of NHPC	240	01.09.2005	1724.79	2082.82 (21%)	7.19	8.68	18
7	Nimmo-Bazgo of NHPC	45	24.08.2006	611.01	936.10 (53%)	13.58	20.80	29
8	Chutak of NHPC	44	24.08.2006	621.26	913.25 (47%)	14.12	20.76	28
9	Rampur of SJVNL	412	25.01.2007	2047.03	2047.03 (0%)	4.97	4.97	13
10	Parbati-III of NHPC	520	09.11.2005	2304.56	2715.92 (18%)	4.43	5.22	24
11	Subansiri Lower of NHPC	2000	09.09.2003	6285.33	10667.09 (70%)	3.14	5.33	8
12	Teesta-V of NHPC	510	11.02.2000	2198.04	2656.95 (21%)	4.31	5.21	11

It may be seen from the above that the approved per MW cost of construction of nine out of 12 projects examined ranged between ₹4.90 crore and ₹14.12 crore as against ₹4.50 crore per MW envisaged by the Working Group on Power for Eleventh Plan. However, the anticipated cost of construction of 11 out of above 12 projects is much higher than the approved cost and ranged between 18 to 112 per cent of the approved cost. Besides per MW anticipated cost of above 12 projects also ranged between ₹4.97 crore to ₹20.80 crore as against ₹4.50 crore per MW envisaged by the Working Group.

<sup>49</sup> *Koteshwar project of THDC and Omkareshwar project of NHPC (JV with MP Govt.) are storage type.*

Ministry/NHPC Management stated (March 2012) that reasons of delay in obtaining investment approval is involvement of various Ministries and Departments whose observations on the proposals are to be satisfactorily replied.

The reply of the Ministry is to be viewed in the background of 8, 10 and 11 months taken in Subansiri Lower, Sewa-II and Teesta-V/TLDP-III projects respectively thereby indicating that with proper planning and monitoring, investment approval period could have been curtailed in other projects as well. The Management/Ministry did not offer any comment on higher cost of construction of projects.

#### ***4.3.2 Project financing***

The Management of CPSEs took timely action for tying up the required finance for execution of the project and the progress of the project did not suffer due to shortage of funds.

## CHAPTER - 5

# System of award of contracts

The contract management is a process of systematically and efficiently managing award, execution and analysis of contract for the purpose of maximizing financial and operational performance and minimizing risk.

Audit examined in detail various stages of contract management, *inter-alia*, cost estimate, preparation of tender documents, invitation of bids, receipt and opening of bids, processing and evaluation of bids, pre-award discussion with the recommended bidder, award of contract, post-award implementation of contract and contract amendments. Audit noticed deficiencies in 13<sup>50</sup> of the 24 contracts<sup>51</sup> reviewed in Audit. Company-wise results of examination are discussed in subsequent paragraphs.

## 5.1 Inadequacies in cost estimation

Cost estimates are prepared to establish reasonableness of the cost at which package could be executed. Therefore, it is essential that the estimates are worked out in a realistic and objective manner. Company-wise analysis of the estimation process disclosed the following inadequacies in some of the elements:

Company	Inadequacies in the Estimation process	Ministry/Management's reply
SJVNL	Cost estimates of Rampur project omitted hard coating of the main equipment involving an expenditure of ₹66.60 crore <i>i.e.</i> 12.4 <i>per cent</i> of the estimated cost; and underestimated the mandatory spares of ₹48.98 crore <i>i.e.</i> 9.1 <i>per cent</i> . Thus, the estimates were not realistic.	Ministry/SJVNL Management stated (March 2012) that these special provisions and additional quantity of spares were finalised in consultation with consultant ( <i>i.e.</i> CEA) and the same could not be included in the revised estimates because of very limited database available.

<sup>50</sup>NHPC-10, SJVNL-2, THDC- 1 and NEEPCO-0

<sup>51</sup> NHPC-16, SJVNL-3, THDC-3 and NEEPCO-2

Company	Inadequacies in the Estimation process	Ministry/Management's reply
NHPC	Estimates did not reflect current market prices as the works were awarded with significant variations ranging between (-) 26.22 <i>per cent</i> (₹204.36 crore) to (+) 37.21 <i>per cent</i> (₹53.71 crore) of the estimated cost in respect of 10 out of 16 contracts (involving seven projects). Logistic constraints and climatic conditions were not considered in case of Nimmo-Bazgo and Chutak projects which reflected maximum variation.	The cost estimate prepared by NHPC were based on the general guidelines of CEA/CWC and variation in quoted prices vis-à-vis estimates occurred in almost all work packages of hydro projects at domestic and global levels. In respect of Chutak and Nimmo-Bazgo projects, the Ministry admitted lack of experience both on the part of NHPC as well as contractors in respect of actual execution intricacies and complexities at such a high altitude as the reason for variations between estimated cost and awarded cost.
	In case of Jiwa Nallah and associated works related to Parbati-II project the actual rock excavation was 5,35,000 cum ( <i>i.e.</i> 1,326 <i>per cent</i> above the estimated Bill of Quantities of 37,500 cum). Under-estimation of work, difference in the road width and change in alignment of road led to additional financial implication of ₹30.97 crore.	Ministry accepted (March 2012) the Audit observation.
THDC	Negative variation of 39.56 <i>per cent</i> (₹35.92 crore) was observed in the estimated and awarded cost in one of the three contracts.	THDC Management and Ministry did not offer any comment on this issue.

The Ministry by and large acknowledged the audit observations. Thus, the estimation process failed to provide a realistic benchmark for the award of works.

## 5.2 Pre-qualification criteria for selection of contractors

Prequalification (PQ) criteria is required to be fixed in such a manner that it is able to weed out and exclude inexperienced, incompetent, un-resourceful and financially unsound applicants and at the same time promote wider participation. The PQ criteria should be objective and unambiguous. The applicants who qualify the PQ criteria would participate in further bidding process.

A review of the formulation of PQ criteria for award of contracts of various projects in NHPC revealed that:

- (a) Till July 2004, there were no guidelines for fixation of PQ criteria in NHPC but a practice of fixation of PQ criteria by a multidisciplinary Committee was being followed. Audit appreciates that out of total 16 contracts (13 contracts prior to July 2004 and three contracts after issuance of guidelines), this practice was followed in 13 contracts. However, in three contracts pertaining to Parbati-II project, PQ criteria was approved (November 2000) by the Chairman and Managing Director.

Ministry/NHPC Management stated (October 2011 and March 2012) that at the time of floating NIT (November 2000) there were no guidelines for formulation of PQ criteria of major civil works as well as requirement of constitution of a Committee for formulation of PQ criteria. The guidelines for constitution of Committee for formulation of PQ criteria came into effect from July 2004.

- (b) For transparency and fairness in the contract management, once the PQ criteria are fixed and tender documents have been issued, PQ criteria should not be relaxed. Audit, observed that out of 16 contracts, in five contracts pertaining to Subansiri lower and Parbati-II projects (as detailed in **Annexure-III** and **Annexure-IV**) PQ criteria was relaxed after closing date of sale of tender documents. In Parbati-II Project, considering the criticality of excavation of 9 km stretch<sup>52</sup> of head race tunnel (HRT), initial PQ criteria envisaged that 'a JV partner should be specialized in use of TBM technology'. However, after the close of sale of tender documents (15 December 2000), requirement of experience of TBM technology by a JV partner was relaxed<sup>53</sup> (February 2001) to 'relevant experience of TBM by a sub-contractors' on the plea that foreign agencies specialized in TBM were unwilling to participate in the bidding as JV partners.

NHPC Management stated (October 2011) that as per normal practice, NHPC invariably considers the representation of prospective bidders to review the PQ criteria. Accordingly, based on representation of a number of bidders, the financial criteria was reviewed by the Committee and modified. While accepting audit observation, Ministry added (March 2012) that since 2004, all PQ/Bid documents and amendments thereto are posted on website of NHPC and presently no amendment to PQ/Bid is being issued after the closure of sale date.

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<sup>52</sup> *Out of total length of HRT of 31.20 km only 9 KM was planned through TBM and the balance was through drill and blast method (DBM).*

<sup>53</sup> *By the Contract Division based on the recommendations of a committee of the company and with the approval of C&MD of NHPC*

However, argument of the Management that foreign agencies specialized in TBM were unwilling to participate in the bidding as JV partners was misplaced as six<sup>54</sup> out of ten bidders pre-qualified by NHPC for HRT package, were those in which either the sole applicant or one of the partners had the required experience of using TBM.

- (c) For JV bidders in NHPC<sup>55</sup>, PQ envisaged that the Lead Partner should meet average annual turnover of not less than 50 *per cent* of specified criteria and other partner(s) should individually meet not less than 20-30 *per cent* of specified criteria. However, PQ criteria of Parbati-II project of NHPC did not specify limit for lead partner as well as other partners. MAYTAS Infra Limited the lead partner of M/S Himachal JV met only 39 per cent of the turnover requirement and one of the other JV partners- Sri Shankarnarayan met only 19 per cent of the average turnover criteria.

NHPC Management stated (October 2011) that PQ criteria were made with a view to have wider participation for various works packages and not with a consideration to favour any individual party. The Ministry added (March 2012) that this criteria was similar to the revised PQ criteria of Teesta-V project.

Reply is not convincing as PQ criteria is meant to ensure weeding out of financially and technically weak parties and should be followed in letter and spirit. Relaxing the criteria in one of the earlier contracts cannot justify deviation for the contract.

- (d) In respect of HRT and associated works of Parbati II Project of NHPC, M/s HJV led by MAYTAS (with Sri Shankaranarayana Construction Company and Nagarjuna Construction Limited) did not meet the specific construction experience as per PQ criteria, however, they were considered eligible as could be seen from the following:

- i. PQ criteria required “completion of tunnel with Tunnel Boring Machine (TBM) of more than 8.0 km length with an excavated volume of 11,000 cum or 300 meter length per month from one tunneling face”. M/s HJV supported

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<sup>54</sup> (1) M/s Dywidag International GMBH, (2) M/s HCC-AMB JV, (3) M/s Skanska-L&T JV, (4) M/s Parbati Tunnel JV, (5) M/s Daelim Industrial Co. Limited (6) M/s Samsung Corporation

<sup>55</sup> In 10 of 13 contracts this practice was followed by NHPC, in case of two contracts, JV was not allowed.

their bid with a work experience of 10.80 km with TBM by their proposed sub-contractor in Sweden involving Head Race Tunnel (HRT) of 7.5 km and Tail Race Tunnel (TRT) of 3.3 km and the same was accepted by the Management.

NHPC Management/Ministry stated (October 2011 and March 2012) that PQ criteria were set out primarily with the objective that the bidder should have experience of completion of tunnel of a particular length as also should have achieved the desired progress rate. As such the Committee considered the experience and felt that the applicant met the criteria of average progress.

Reply is to be viewed in the context that the bidder was required to have experience of more than 8 km length of a tunnel from one tunneling face. Further, the sub-contractor proposed by one of the bidders (M/s Patel-SEW JV) who was L2 bidder had work experience of more than 21 kms with TBM.

- ii. As per PQ criteria, each item of technical criteria of the respective lot was to be individually met by a partner of the joint venture and the experience and performance of various JV partners was not to be summed up. PQ criteria inter-alia prescribed completion of tunnel of more than 5 km (revised to 2 Km in February 2001) with DBM<sup>56</sup>. MAYTAS, the lead partner of M/s HJV claimed the experience of Larji Project executed by a joint venture of MAYTAS together with Sri Shankaranarayana Construction Company.

NHPC Management stated (October 2011) that in the absence of bifurcation of work executed by the JV partners, work experience was available to both the partners of JV. Ministry added (March 2012) that the PQ evaluation Committee had taken a view in its best judgment based on the documents submitted by the bidder.

Replies confirm that the bidder was not fulfilling the PQ criteria and the Committee pre-qualified an ineligible firm who neither fulfilled the technical experience for boring tunnel of more than 8.0 km length from one tunneling face nor fulfilled individual criteria of DBM technology.

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<sup>56</sup> *Drill and Blast Method*

## 5.3 Evaluation of bids

Techno-commercial bids are invited from the bidders who qualify the pre-qualification criteria. These are evaluated by the duly constituted Committee comprising representatives from contracts department, project site and finance. Based on such evaluation, price bids are called from the techno-commercially acceptable bidders. In SJVNL and THDC, techno-commercial and price bids are, however, invited after PQ evaluation itself. The reasonability of the rates quoted by the lowest bidders is assessed with estimated rates as well as sensitivity analysed rates by the Committee before recommendation on award of work. Examination of bid process in NHPC revealed the following:

### 5.3.1 *Reconsideration of an ineligible bidder*

For civil works of Subansiri Lower project of NHPC, the PQ bid of Nurool Construction & Trading Inc., Turkey was rejected by the PQ evaluation Committee as it did not meet the financial criteria of 'Turnover' (USD 83.93 million against the requirement of USD 110 million). Despite this, the techno-commercial bid documents were issued to this firm and price bids were also invited after finding the firm techno-commercially acceptable.

Ministry/NHPC Management stated (October 2011 and March 2012) that the firm approached NHPC for reconsideration of their application for pre-qualification. In order to have better competition and international participation, Committee in its supplementary report recommended the firm to be pre-qualified and allowed participation in the SSL2 work package.

Reply of the Management is not acceptable as reconsideration of application of any bidder after evaluation of PQ criteria vitiates the bidding process and denial of equity to other prospective bidders.

### 5.3.2 *Lack of transparency in bid opening*

In case of **Chamera-III project (civil works) of NHPC**, discount of 32.40 per cent offered by the lowest evaluated bidder *i.e.* Hindustan Construction Company Limited (HCC) was not a part of the bid documents submitted by HCC as the same was neither mentioned in the forwarding letter nor specified by the bid opening committee (August 2005). The discount letter furnished suo-moto by the bidder and award of work to HCC is not in order.

NHPC Management stated (October 2011) that the bidder offered rebate in a separate envelope sealed in the outer envelope in line with the bid conditions. Bids for Chamera-III civil works package were opened by bid opening committee in the presence of all the bidders/representative of bidders who chose to remain present. As such, chances for tampering/manipulation cannot be considered. Ministry added (March 2012) that bid documents did not provide for mandatory reference of rebate in the Bid Form. However, as a matter of policy, bidders were permitted to offer discount, if any, only in Bid Form after 18 May 2009.

Reply of the Management is not tenable as bid opening committee did not list any discount letter submitted by HCC at the time of opening of bids. The same was also not mentioned in the forwarding letter of the bid.

### **5.3.3 Opening bid despite poor track record**

For civil work package of Chutak project of NHPC, techno-commercial bid of MAYTAS was set aside (April 2006) as performance of M/s HJV (led by MAYTAS) in Parbati-II project was not good. The tender was annulled as the lowest price bid received was 58 *per cent* higher than the approved cost estimate. During re-tender, the bid of MAYTAS was opened (September 2006) setting aside the earlier rejection of MAYTAS due to poor performance in Parbati-II project. Management by first not considering the offer for its poor performance and subsequently considering it on submission of a project specific financial commitment from a bank displayed lack of consistency.

Ministry/NHPC Management stated (October 2011 and March 2012) that MAYTAS had submitted a project specific assured financial commitment for the entire construction period of ₹25 crore for working capital from a Bank based on which Tender Evaluation Committee qualified the firm.

Reply of the Management is not tenable as their performance was poor in Parbati-II project and as such, it should have been debarred from participating in re-tendering in Chutak project.

## **5.4 Award of contracts**

### **5.4.1 Delays in award of contracts**

NHPC prescribed (June 2004) that tendering activities from the date of publication of NIT to the date of issue of letter of award be completed within 9.5 months. Against this, Management took 14 to 28 months (*Annexure-V*) in case of

tendering activities in 15 out of 16 selected contracts and completed the tendering activities in four months in remaining one contract. SJVNL took 21 to 28 months in three contracts selected for examination in audit while THDC took 39 to 80 months in three contracts examined in audit. Consequently, this resulted in delay in execution of projects.

Ministry/NHPC Management stated (October 2011 and March 2012) that the last date of submission of PQ applications, techno-commercial bid and price bids were extended on the request of the prospective applicants/bidders considering the status of various clearances from time to time. Bids were finalized more or less simultaneously with the accord of CCEA sanction and in most of the cases letters of acceptance were issued soon after approval by CCEA.

Reply of the Ministry/Management that works could not be awarded pending various clearances is not tenable as civil works of Subansiri Lower and Teesta-IV were awarded after three and four months from the dates of investment approval by CCEA. Further, the delays in award of contracts could have been minimised by coordinated efforts with all concerned authorities.

#### ***5.4.2 Avoidable expenditure due to award of work before land acquisition***

Civil work contracts of Subansiri Lower project were awarded (December 2003) by NHPC with instructions for work to be started immediately. However, the land was handed over to NHPC in January 2005 after forest clearance. The contractors of civil works raised claims of ₹135.68 crore on account of idling of men and machinery at the project site. Against this, NHPC has made an interim payment of ₹24.85 crore to the contractor so far (March 2012).

NHPC Management stated (October 2011) that delay in formal forest clearance due to litigation, etc. led to delay in handing over of site. The contractor was allowed to undertake the works after survey and demarcation of area by erecting concreting pillars in January 2005. Ministry added (March 2012) that as a matter of policy, after 2007, award of works is being done only after actual availability of required land for execution of works.

## CHAPTER - 6

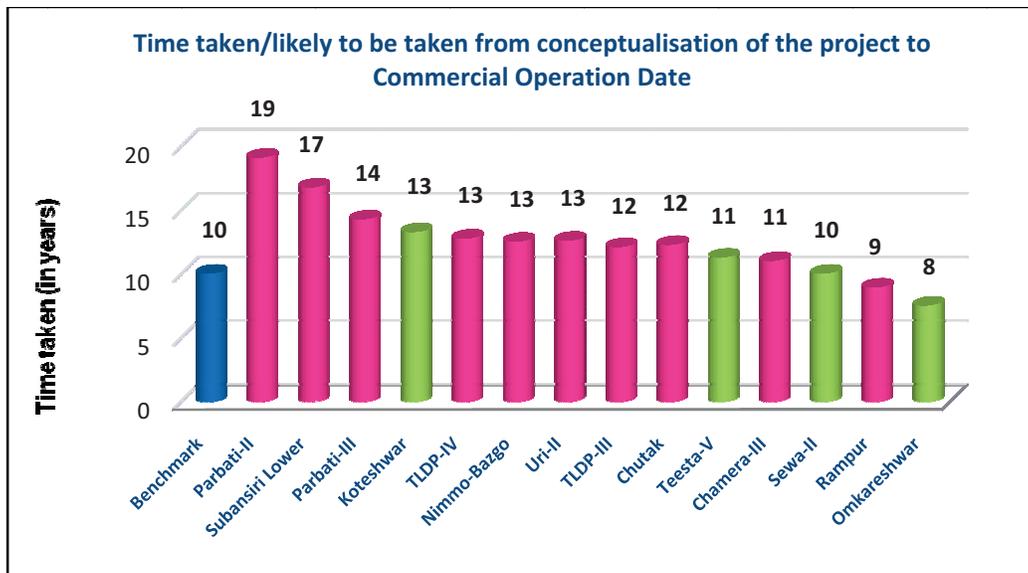
# Execution of projects

Time and cost is the essence of every contract to ensure completion of any project as per schedule. Audit examined various contracts awarded for execution of projects under the Capacity Addition Programme of the four CPSEs. Project-wise details of the scheduled date of commercial operation (COD), actual COD and financial progress as on 31 March 2012 is detailed in **Annexure-VI**.

## 6.1 Delays in commissioning of projects

In the Hydro Development Plan for the XII Plan (2012-17), the Central Electricity Authority envisaged that development of a large size hydro project takes about 10 years from planning to commissioning. Similarly, as per the guidelines of the MOP read with the submission of NHPC before the Committee on Public Undertakings in 2008 also envisaged a timeline of about 6.5 years to 9.5 years from planning to the date of Commissioning of hydro power projects.

Overall time taken/likely to be taken from conceptualisation to commercial operation date of 14 out of 16 projects (except two projects of NEEPCO<sup>57</sup>) is depicted in the following chart:



<sup>57</sup> Data regarding conceptualization of 2 projects of NEEPCO were not available

Considering the CEA benchmark of 10 years for completion of projects, two projects (Omkareshwar and Sewa-II) were completed within the benchmark. Two other projects- 'Teesta-V' of NHPC and 'Koteshwar' of THDC were completed in 11 and 13 years respectively. Of the remaining 10 ongoing projects, nine projects are likely to take between 11 and 19 years and one project (Rampur of SJVNL) is likely to be completed in nine years.

With reference to time lines envisaged in the Investment approval of the respective projects, one project (Omkareshwar project) was completed within the scheduled date of commercial operation while three projects<sup>58</sup> were completed with delays ranging between 14 months and 84 months with reference to scheduled date of commercial operation. Remaining 12 projects are running behind the scheduled date of commercial operation by 20 months to 115 months (*Annexure-VI*).

The delays in the project execution had significant cost implications. 16 projects under execution/executed by four CPSEs approved at the aggregate cost of ₹ 30,005 crore, were revised to ₹ 44,712 crore. In seven completed/ongoing projects, the cost overrun was in the range of 53 to 148 per cent (*Annexure-VII*).

**Project-wise analysis of reasons of delay and consequential cost escalation noticed in 12 out of 16 projects are detailed below:**

**(i) Sewa-II of NHPC (Delay of 34 months)**

Audit analysis revealed that main reasons of delay in completion of this project were (i) delay in handing over access roads to work sites to the contractors, (ii) delay in obtaining forest clearance for approach road of 2 kms which initially was not envisaged at the DPR stage, (iii) rerouting of head race tunnel after observing loose starta, (iv) revision of envisaged design and drawings of the foundation structure in anchor block which was not envisaged at tendering stage. Besides reasons like floods of July 2005 and September 2006 which washed away coffer dams and agitation by workers also affected the pace of work.

The approved cost of project at ₹665.46 crore was revised to ₹1,108.83 crore (increase of 67 per cent) in execution of works which were not initially envisaged due to inadequate investigation. As a result per unit cost of generation of power from the project has increased from ₹2.98 per unit to ₹4.17 per unit.

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<sup>58</sup> *Teesta-V & Sewa-II projects of NHPC and Koteshwar of THDC*

NHPC Management while accepting the delays on the part of Company in handing over of access road to the contractor stated (October 2011) that there was no mention for approach road of 2 km length in the bidding documents. Re-routing of HRT and revision of envisaged design was due to geological conditions, performance of sub-contractors was not satisfactory and therefore, the main contractor terminated their contract and the balance works of HRT was undertaken by another contractor. The coffer dams were also washed away in July 2005 and September 2006 as the same were designed for non-monsoon flood.

Reply of the Management is not tenable as responsibility of providing access roads rests with NHPC who should have immediately provided the same to the contractor for mobilisation of men & machinery. Adverse geological conditions were encountered due to inadequate survey & investigation. Further, NHPC failed to ensure credentials of the sub-contractor before approval to ensure smooth execution of the work. Designing of coffer dams only for non-monsoon season also revealed shortsightedness of the Management.

#### **(ii) Parbati-II of NHPC (Delay of 99 months)**

The main reasons as analysed by audit for the tardy progress were (i) wrong assessment of land required for the project at DPR stage requiring the Management to submit application for additional land after award of main contracts, (ii) non-completion of infrastructure works before award of main contracts and delay in handing over site to main civil contractors, (iii) delay in issuance of construction drawings, (iv) increase in scope of work due to incorrect assessment of BOQ, (v) inordinate time taken by the management in conveying decision on issues like development of new quarry in the light of Shimla High Court order, finalization of design and methodology for ground treatment of face-4 due to excessive water and sand/silt, etc. (vi) inordinate time taken in resolving technical and contractual issues with contractors, (vii) not taking all-embracing measures for power house back hill slope treatment after its first failure in April 2004 as a result of which it repeatedly failed in June 2006 and again in February 2007, and (viii) delay in finalization of erection agency by electro-mechanical contractor (BHEL).

The anticipated date of completion of July 2014 was worked out by the Management on the assumptions that (i) lining work of HRT face-1 would be resumed by December 2010 and would be carried out at a pace of 120m per month, (ii) the contract for balance work of Lot PB-IV would be awarded by December 2010, and (iii) claim of electro-mechanical contractor would be settled and work would be resumed by November 2010. However, the contract (PB-2) for tunneling through TBM of the Parbati-

II project has been terminated (March 2012) by NHPC and new contract is yet (June 2012) to be awarded.

NHPC Management while accepting delays in the issue of drawing stated (October 2011) that infrastructure work and handing over site to the main contractor got delayed due to delay in accord of forest clearance/felling of trees. Further, scope of work increased due to adverse geological conditions during execution and delays in treatment of shear/fault zone. The work was also affected due to non-finalisation of erection agency by BHEL.

Reply of the Management is not tenable as prime responsibility for completion of infrastructure work and handing over of site to the contractor rests with NHPC. Further, construction drawings should also have been issued to the contractor timely. Inadequate survey/investigations and delay in finalization of erection agency by BHEL also led to delay in completion of project and extra cost on the Company.

### (iii) Parbati-III of NHPC (Delay of 26 months)

Audit analysis revealed delay in handing over access roads to civil contractors, Poor performance by the civil work agency, delayed supplies by electro-mechanical contractor and poor performance of erection sub-contractor. Besides, poor geological conditions in TRT, change in dumping yard, non-availability of agency for Raise Boring<sup>59</sup>, disorder in project area and additional work of HRT beyond original scope of contract also contributed to the delays.

NHPC Management stated (October 2011) that unit-1 was re-scheduled to be commissioned in January 2012 but delay in commissioning may further increase and all four units may be commissioned by August 2012. Work in open area like dam filling, excavation in plunge pool area, concreting in surge shaft and pot head yard got delayed due to intermittent and heavy rains. Erection of steel liners in pressure shaft suffered badly due to cloud burst. Moreover, erection work of machines hampered due to seepage in power house cavern and construction activities on all fronts were held up during the strikes called by local people. Further, although geology encountered in TRT downstream was more or less comparable to as given in pre-construction stage but main reason of delay was formation of unexpected cavity.

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<sup>59</sup> *A raise borer is a machine used in underground mining, to excavate a circular hole between two levels of a mine without the use of explosives.*

Had Management conducted survey & investigations adequately as per site requirement, impact/delays due to adverse geological conditions could have been minimised.

**(iv) Chamera-III of NHPC (Delay of 21 months)**

Audit analysis revealed that slow progress was due to (i) consent from Himachal Pradesh Pollution Control Board was accorded in April 2006 though civil works package was awarded in September 2005, (ii) closure of crushing plant by State Government since February 2009 to October 2009, (iii) washing away of upstream and downstream coffer dams in floods of July 2008 in July 2010, and (iv) damage to contractor's construction equipment due to rock fall in September 2009 and December 2010 from right hill slope at Dam site.

**(v) Subansiri Lower of NHPC (Delay of 75 months)**

Audit noticed that slow progress of the project is attributable to (i) delay in handing over site to civil contractors, (ii) non-finalization of specialized agency for cut off wall for dam by the civil contractor, (iii) delay in treatment of power house back hill slope after its failure in January 2008, (iv) change of design/layout from surge chamber to surge tunnels necessitated due to back hill slope failure for which go ahead was given to the existing contractor in May 2009 (with completion period of 42 months), and (v) intermittent law and order problems and strike/bandh by local groups/organizations.

Further, delay in signing of MOU with Government of Arunachal Pradesh also resulted into delay in progress of work (though the work started in 2005, MOU was signed in January 2010)<sup>60</sup>. The project has missed the scheduled COD in September 2010.

NHPC Management stated (October 2011) that formal forest clearance led to delay in handing over of site to the civil contractors. The forest clearance was delayed due to litigation and net present value payments issue. The contractor was allowed to undertake the works after survey and demarcation of area by erecting concreting pillars w.e.f. 01 January 2005. Further, delay in resolving contractor's claims was due to absence of condition in the contract for addressing idling claims which was being included in future contracts. Regarding back hill slope failure, it was stated that external expert committee recommended additional rock mechanic tests and stress/stability

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<sup>60</sup> *MOU signing with Government of Assam is still pending.*

analysis of the structure. The additional geological investigation indicated unfavourable rock mass properties. Therefore, the design and layout of surge arrangement was modified. Moreover, intermittent law and order problems and bandh/strike by local groups/organizations had major adverse impact on ensuring the uninterrupted and steady progress of the work. However, NHPC was trying to maintain close coordination with the local, district & State authorities to minimise the extent of impact to the best extent possible.

Reply of the Management is not tenable as NHPC awarded works to the contractor without obtaining statutory clearance from MOEF and in process incurred an extra expenditure of ₹24.85 crore (against total claims of ₹135.68 crore) on account of payment of idling charges of men & machinery. The contractual clause was also defective as no provision of settlement of idling claims were included in the contract agreement due to back hill slope failure which indicates that survey & investigations were not carried out properly and resulted in time/cost overruns to the project.

**(vi) Uri-II of NHPC (Delay of 39 months)**

Audit observed that main reasons for delay in the project were *inter alia* (i) delay in award of E&M work due to poor participation resulting in contract completion schedule slipping beyond CCEA approved date of completion by 4 months, (ii) unprecedented flood in river Jhelum in March 2007 breaching the coffer dam, and (iii) intermittent agitation/bandh and curfew called by different organizations affecting the supply of construction material and manpower.

**(vii) TLD-III of NHPC (Delay of 69 months)**

Audit noticed that the main reasons of delay included (i) non handing over of forest land, (ii) regular right bank slope failure since 2005, (iii) delay in submission of drawings by the civil contractor and approval of the same by the Company, (iv) flash flood in May 2009 and July 2010, and (v) frequent strike/bandh by local groups/organizations. This project was initially approved at a cost of ₹768.92 crore and is now anticipated to be completed at a cost of ₹1,628.39 crore. The levelled tariff at the sanctioned cost of ₹2.02 per unit would increase to ₹4.95 per unit based on revised cost. The main reasons for variation in cost are (i) increase in quantities because of slope protection measures, extension of cut off wall, increase in excavation quantities due to debris and slush and subsequent modification: ₹351.19 crore and (ii) increase in IDC & FC because of time overrun and cost overrun: ₹246.07 crore.

NHPC Management while accepting delays in handing over of civil fronts stated (October 2011) that forest clearance for the project was received in April 2004 and accordingly works were started by the civil contractor from May 2004. Further, the right bank slope failures occurred during the monsoon of year 2005 & 2006 and unprecedented flash flood occurred in July 2007, 2008, 2009 & 2010, caused disruptions of works.

Reply of the Management is not tenable as NHPC awarded civil works without obtaining forest clearance and land acquisition. Further, Management did not carry out thorough analysis of the flood data of the project site to ensure proper quantification in the in the Bill of Quantities (BOQ) leading to extra cost.

**(viii) TLD-IV of NHPC (Delay of 47 months)**

Audit analysis revealed that the main reasons of delay are: (i) increase in overall quantities on account of foundation rock located at a lower level than anticipated in Power House, Service Bay and Power Dam, and (ii) increase in length of Power house and increase in weight of radial gates. The E&M package was awarded in May 2007 with completion period of 36 months i.e. by May 2010 against the initial project completion schedule of September 2009.

This project initially approved at a cost of ₹1,061.38 crore is now anticipated to cost ₹1,501.75 crore. The main reasons for variation in cost are (i) increase in quantities because of inclusion of extra/new items owing to various restoration works required because of frequent floods, increase in civil works items on account of availability of foundation rock at a level lower than the anticipated (₹138.53 crore) and (ii) increase in IDC & FC because of time overrun and cost overrun (₹150.36 crore).

NHPC Management stated (October 2011) that variations in foundation occurred due to soft nature of rock and due to dental treatment provided in the coal seams for laying the foundation of civil structures. Further, due to non-availability of boulder of required size in the vicinity of project area required for diversion channel protection, which was damaged in the flash flood of 2007, the length of the power house has been increased from 100m to 104m during the final design from the tendered provision.

Reply of the Management is not tenable as the geological problems were encountered due to inadequate survey & investigations by the management. It is also observed that flood data was also not properly analysed to avoid any eventuality in future. The designs were also not prepared properly as length of power house had to be increased during the final design.

**(ix) Nimmo Bazgo of NHPC (Delay of 29 months)**

Audit noticed that the delay in execution of project was due to (i) delays in issuance of drawings/instructions by the Company in respect of power dam concreting, right bank non-flowing blocks, switchyard and dam power pack room, (ii) additional work due to change in design, (iii) delay in supply and erection of E&M equipment by BHEL. Besides cloud burst of August 2010 damaging many enroute bridges also affected the construction schedule.

NHPC Management stated (October 2011) that all the construction drawings were issued in commensurate with the construction activities and there is no delay on account of this account. There is no additional work due to change in design. Further, delay in commissioning of the project was due to (i) the working season is only six months due to extreme cold conditions, (ii) materials/supplies got stranded for long time due to curfew, bandh and other law & order problems, (iii) non-availability of skilled or non-skilled local labour, (iv) extreme climatic conditions, etc.

Reply of the Management is not tenable as NHPC delayed in issuing drawings/instructions to the contractors. Further, BOQ increased due to change in design. NHPC did not schedule all activities in a planned manner.

**(x) Chutak of NHPC (Delay of 20 months)**

Audit analysis revealed that the delay in completion of project were (i) shortage of manpower with civil contractor, (ii) delay in supply of material by E&M contractor (BHEL), and (iii) variation in the BOQ of reinforcement, pre-cast lagging and excavation of shaft.

The project initially approved at a cost of ₹621.26 crore is now anticipated to be completed at a cost of ₹913.25 crore. The levelled tariff at the sanctioned cost was ₹3.16 per unit which would increase to ₹7.49 per unit based on revised cost.

NHPC Management stated (October 2011) that delay in completion of project were (i) shortage of manpower with the civil contractor, (ii) delay in supply of material by E & M contractor (iii) variation in BOQ, (iv) delay in issuance of construction drawings, (v) poor geological conditions at site, and (vi) inclement weather condition in the region.

The reply of the Management is not tenable as BOQ increased due to change in design. Poor geological conditions were not anticipated due to inadequate survey &

investigations. NHPC awarded civil works to a contractor who did not have adequate manpower.

**(xi) Rampur of SJVNL (Delay of 20 months)**

Audit noticed that the main reasons for delay were (i) poor performance of civil work contractors due to encountering of many geological surprises; (ii) late award of electromechanical package; and (iii) delay due to MOEF clearance for acquisition of additional forest land for Kasholi Adit.

The revised schedule of project completion by September, 2013 as anticipated by the Management seems to be doubtful as Consultant (Hydro) has observed (March, 2010) that considering the critical construction activity of 'heading excavation of about 2600m length of HRT between downstream of Kasholi and upstream of Goshai Adit', even if the project is commissioned during last quarter of the financial year 2013-14 it would be an appreciable achievement.

SJVNL Management stated (October 2011) that the main reasons for delay are encountering of geological surprises and adverse/extremely poor rock conditions vis-à-vis anticipated, time taken in MOEF clearances for acquisition of additional forest land for Kasholi Adit, etc.

The reply of the Management is not acceptable as adverse geological conditions and requirement of additional forest land for extra Kasholi Adit were encountered mainly due to inadequate survey & investigations by the Management. Had Management conducted thorough survey & investigations, above problems could have been mitigated/minimised.

**(xii) Kameng Hydro Electric Project (Delay of 87 months)**

Kameng Hydro Electric Project (Kameng project-600 MW) was contemplated as a run-of-the-river scheme situated in the West Kameng district of Arunachal Pradesh. The original schedule of completion of project (December 2009), however, slipped to March 2017 due to revision of design of the major works, geological surprises encountered during detailed engineering and slow progress of work.

NEEPCO Management while accepting (September 2011) the slow progress of work intimated that efforts would be made to expedite the progress of work. Management also intimated that constant monitoring was being done to adhere to the schedule. Ministry added (March 2012) that in-spite of vigorous persuasion by NEEPCO,

contractor (Patel Engineering Limited) is not achieving the desired progress, primarily on the plea of revision of rates for the items requiring steel and cement in particular.

The reply is not acceptable because the progress of work was far from satisfactory despite monitoring by NEEPCO. The Management should have taken timely decision to resolve the contractual issues to expedite the progress of work.

Besides the above 12 projects, the delay in Teesta-V Project had already been highlighted in the CAG Report No.27 of 2009-10.

**Thus, it is evident from the above that main reasons for delay in project execution were:**

- **geological surprises; and**
- **other controllable factors like delay in handing over of access roads to the contractors, wrong assessment of land requirements, delay in issuance of construction drawings, increase in scope of work due to incorrect assessment of bill of quantities, inordinate time taken in resolving contractors' claims on idling of resources, etc.**

**Thorough survey and investigation as envisaged in the Policy on Hydro Power Development (1998) would have minimized the geological surprises. Further, other factors like delay in handing over of access roads, delay in issuance of construction drawings, etc. could have been controlled by proper coordination and monitoring by the CPSEs.**

## 6.2 Other points of interest

### *(a) Adverse cascading impact on project*

Water discharged by Parbati-II will not be available for generation of electricity till December 2017. As a result, Parbati-III project, which is a downstream project of Parbati-II, can not become fully operational till commissioning of Parbati-II project for want of water discharged by this project. Only two units<sup>61</sup> (260 MW) of Parbati-III will be able to generate power from water available in the Sainj River including water discharge from Jiwa Nallah.

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<sup>61</sup> *Anticipated to be commissioned in December 2012 and January 2013*

Balance two units (260 MW) will remain idle for five years<sup>62</sup>. This would result in loss of generation of 4,882 million units during next five years.

NHPC Management accepted (October 2011) that only two units of Parbati-III would be able to generate electricity from the water available in Sainj River.

**(b) *Payment without commensurate benefits***

NHPC agreed (July 2011) to compensate a contractor (M/s Om Metals) for compression of schedule of hydro mechanical works relating to Chamera-III and Uri-II projects. Accordingly, NHPC paid an amount of ₹13.60 crore to the contractor. Audit observed that the compression of the schedule was not required at all as the civil works were already running behind schedule and completion of hydro mechanical works without civil works was of no use.

NHPC Management stated (October 2011) that due to delay in completion of civil works, completion of hydro-mechanical works were likely to go beyond 2011. Therefore, compression of erection period of hydro-mechanical works packages was felt essential. Ministry further added (March 2012) that the compression schedule given to hydro-mechanical contractor has helped in early completion of erection of vital hydro-mechanical components/works as compared to scheduled completion of hydro-mechanical works under original Contract Agreements of both projects.

Replies are not tenable as compression of the schedule of hydro mechanical works without completion of civil works did not deliver the desired results.

**(c) *Non-compliance with contractual terms***

As per terms of contract for construction of Head Race Tunnel (HRT) of Parbati-II project, no partner of the Joint Venture was allowed to off load his portion of work (in any manner) to other party, partner or sub-contractor without prior permission of the owner. It was, however, observed that MAYTAS off loaded his entire work to Sri Shankarnarayna, with least work capacity

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<sup>62</sup> *Difference between anticipated date of COD of Parbati-III {(i.e. December 2012 (Unit-III) and January 2013 (Unit-IV)} and of COD of Parbati-II (December 2017)*

partner in the Joint Venture in terms of specific work experience as well as financial participation (19.71 per cent).

NHPC Management stated (October 2011) that NHPC had no records with regard to offloading the works by MAYTAS to Sri Shankarnarayna. Ministry added (March 2012) that a show cause notice has been issued by NHPC to M/s HJV.

Reply of the Management and Ministry is devoid of merit as NHPC's records<sup>63</sup> indicate that MAYTAS was not involved in the execution of contract. NHPC has also issued show cause notice to the lead partner and JV on this issue.

**(d) Extra-contractual financial assistance**

The performance of M/s HJV in the construction of Head Race Tunnel of Parbati-II project was not satisfactory from September 2002. However, instead of cancelling the contract in 2005-06, when its performance was noted as far from satisfactory, NHPC sanctioned (December 2004 to October 2009) advances of ₹131.65 crore<sup>64</sup> beyond contractual provisions for recommencement of TBM work, bridging gap and balance work. NHPC also deferred the recovery of advances and interest from time to time. On being pointed out (October 2011) by Audit, NHPC cancelled (9 March 2012) the contract of M/s HJV, encashed their bank guarantees available with it and adjusted the security deposit. Finally as on 21 June 2012, an amount of ₹182.48 crore was still outstanding, chances of recovery of which were remote. This has also led to estimated cost overrun of ₹243.54 crore and time overrun of 99 months in the project.

Ministry/NHPC Management stated (October 2011 and March 2012) that the issue of slow progress of works by M/s HJV was deliberated in its various meetings since July 2005 and the Board in order to find the way out, took decisions in the overall interest of the Company and early commissioning of the project.

Thus, due to award of the work to ineligible contractor by relaxing PQ criteria after sale of tender documents (as discussed earlier), and ignoring the

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<sup>63</sup> 325<sup>th</sup> meeting (Agenda item No.325.3.1), 328<sup>th</sup> meeting (Agenda item No.328.3.1) and 330<sup>th</sup> meeting (Agenda item No. 330.2.5) held on 28.10.2010, 20.12.2010 and 27.01.2011 respectively.

<sup>64</sup> Out of total advances of ₹131.65 crore, an amount of ₹21 crore was approved by CMD and balance by Board of Directors.

non fulfillment of eligibility conditions, led to blocking of ₹182.48 crore besides estimated cost overrun of ₹243.54 crore and time overrun of 99 months in the project.

**(e) *Lack of transparency in resolving contractual issues***

The work for boring of head race tunnel had to be suspended as tunnel boring machine got stuck in the tunnel due to ingress of water slush and loose rock. MOP constituted (January 2008) a High Level Committee under the Chairmanship of Shri P. Abraham, former Secretary (Power) to suggest (i) possible solutions with M/s HJV to recommence work on fronts other than tunnel boring machine (TBM) face immediately and (ii) a rate restructuring for recommencement of work with TBM. The Committee recommended (March 2008) release of an advance of ₹72 crore to enable M/s HJV to meet its outstanding liabilities. Accordingly, the Company released (April 2008) ₹72 crore to M/s HJV.

Audit observed that Chairman of above Committee, was also a member on the Board of Directors of Nagarjuna Construction Company Limited, one of the partners of M/s HJV. Thus, there was a clear conflict of interest in his both the responsibilities. Audit also observed that the Ministry neither asked the Chairman of the Committee nor he himself disclosed his interest while chairing the Committee.

Ministry/NHPC Management stated (October 2011 and March 2012) that recommendation of the Committee was jointly made by the Committee members and was further approved by the Board. Further, Chairman of the Committee decided (August 2010) to dissociate himself from the Committee after having 14 meetings. NHPC further issued (01 December 2010) instructions to all the appointees to the Committees obtain a declaration seeking disclosure of interest. Ministry further added (March 2012) that since the Chairman of the Committee was former Secretary (Power), GOI, it was expected that he would be aware of rules/guidelines pertaining to clash of interest.

**(f) *Settlement of Claims***

The claim settlement mechanism in NHPC is not prompt as a large number of contractual claims were pending for one to seven years. Age-wise analysis of claims as on 31st March 2012 is given below:

Age of the claims	No. of claims	Amount of claims (₹ in crore)
Less than one year	47	2,456.93
One to two years	51	1,734.90
Two to three years	34	258.05
Three to four years	30	338.05
Four to five years	59	415.85
Five to six years	45	985.73
More than six years	30	806.91
<b>Total</b>	<b>296</b>	<b>6,996.42</b>

It is evident from the above table that 164 claims amounting to ₹2,546.54 crore are outstanding for more than three years. Non-settlement of claims of the contractor for a long period affected the cash flow position of the contractor and consequent progress of work. It was observed that prior to October 2010, no procedure for valuation of claims of contractors and processes of amicable settlement were prescribed in NHPC.

NHPC Management accepted (October 2011) the observation and added that the procedure for valuation of claims of the contractors and processes of amicable settlement had been formulated (October 2010).

**(g) *Payments without adequate securities***

As the progress of work in Koteshwar project was not satisfactory, THDC constituted (March 2007) a high level “Empowered Committee” to get the work done by making direct payment to the manufacturers/suppliers etc. against the orders placed by M/s PCL at their risk and cost. As on 31 March 2012, an advance of ₹190.42 crore (Principal ₹124.95 crore and interest ₹65.47 crore) was recoverable from the contractor (M/s PCL) on account of risk and cost.

THDC Management stated (August 2011) that performance securities, security deposit, the guarantees for mobilization advances and mortgages on equipment brought by contractor are available with THDC. Ministry added (March 2012) that Board of THDC took a prudent decision to carry out the execution of work at the risk and cost of contractor even beyond the amount available in securities in hand. This facilitated completion of a derailed project, which was a non-starter up to March 2007, within a shortest period of four years.

The reply is not acceptable as security amounting to ₹56.28 crore (performance guarantee/cash) only is available against recoverable amount of ₹190.42 crore with THDC, thereby exposing the Company to risk of default. Thus, THDC did not take necessary safeguards before releasing payments to the manufacturers/suppliers.

**(h) *Loss due to inadequacies in the insurance policy:***

During execution of Tunnel work under Package-I, a mishap took place on 12 January 2007 followed by another mishap on 28/29 December 2007. As per contractual provisions, the contractors were solely responsible for lodging and persuasion of claims with Insurance Companies against contractor's all Risk policy taken by them in case of any damage except due to *force majeure* claim. The contractor had taken insurance policy covering only items included in the Bill of Quantities (BOQ). During execution while extra items were being executed, neither the contractor insured these items nor NEEPCO on its part ensured that contractor took insurance policy for these extra items as well. As a result, when NEEPCO asked (February 2008) the contractor to lodge claim with the Insurer for recovering the loss due to the said incidents, the contractor informed that the loss was out of the scope of the insurance policy. Thus, NEEPCO could not recover the loss amounting to ₹19.88 crore from the Insurance Company due to deficient policy taken by the contractor and poor monitoring by the Management.

Ministry/NEEPCO Management stated (March 2012) that claim lodged by the contractor was disallowed by the Insurance Company being extra items.

Reply is not acceptable as extra items should also have been included as 'add on' in the insurance policy by the contractor or a fresh policy for such extra items should have been taken. NEEPCO Management failed to monitor and ensure that the insurance policy taken by the contractor includes extra items as well.

## CHAPTER - 7

# Monitoring Mechanism and Impact Assessment

### 7.1 Monitoring Mechanism

Performance of the projects was continuously monitored in NHPC, SJVNL as well as in THDC through progress review meetings (PRMs) held every month at project level. In addition Board of directors of the CPSEs also reviewed the progress of the projects regularly.

Audit observed that though these progress review meetings were held regularly, these did not have the desired impact. Despite identification of responsibility centres for removing the project impediments, action taken by these centres was not deliberated in the subsequent meetings. Even regular meetings at the senior Management level were not effective in containing the delays as they did not specifically address the controllable factors like delay in handing over of access roads to contractors, issuance of construction drawings, incorrect assessment of Bill of Quantities, etc. In NEEPCO, the Monitoring Committee also failed to ensure that all risk insurance policy taken by the contractor included extra items as well.

Regular meetings by the MOP also did not help in ensuring the timely action on the identified problem areas in execution.

Ministry/NHPC and SJVNL Managements stated (March 2012) that effective monitoring mechanism was being followed and major reasons for delay were adverse geology, natural calamities, etc.

The reply is not tenable as the action taken by the responsibility centres was not followed up in the subsequent meetings. Monitoring mechanism established by CPSEs as well as the MOP could not accelerate the progress of the projects and delays remained a major constraint in achieving the targets. Even the controllable issues were not resolved in time resulting in delayed completion of the projects.

## 7.2 Impact due to loss of opportunity

Augmentation of hydel power capacity addition was taken up to bridge the gap between the supply and the demand of power. Progress of capacity addition of 6274 MW by March 2012 has been delayed; of which 1030 MW was commissioned with delay ranging from 14 to 84 months and 5244 MW would be commissioned beyond March 2012 and with delays ranging from 20 to 115 months from the scheduled date of commissioning. This has led to loss of opportunity of generating 26,282.97 million units<sup>65</sup> (Annexure VIII) of electricity annually (as per the DPRs). Further, as per CERC (Terms and Conditions of Tariff) Regulations, 2009, for projects commissioned within the scheduled timeline from April 2009 to March 2014, an additional Return on Equity at the rate of 0.50 per cent is allowed over the life of the project of 35 years. Due to delays, the CPSEs would also forgo this additional return on equity which works out to ₹1,474.57 crore (details given in **Annexure IX**) over the life of projects from the date of scheduled commissioning.

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<sup>65</sup> Worked out on the basis of annual energy generation (after auxiliary consumption & transformer loss) envisaged in the DPR. The annual energy generation of Tuirial project (60 MW) of NEEPCO has been calculated based on 60 per cent load factor and after deducting auxiliary consumption & transformer loss.

## CHAPTER - 8

# Conclusion and Recommendations

### 8.1 Conclusion

8.1.1 Hydel power sector CPSEs embarked upon an ambitious target of capacity addition of 11,813 MW during the period 2007-12. However, the CPSEs did not prepare their capacity addition plans with due diligence as two CPSEs (THDC and NEEPCO) did not envisage any new project for capacity addition and two CPSEs (SJVNL and NHPC) included projects without consultation with the State Governments with the result that the plans did not materialize. As a result the plans had to be scaled down (11,813 MW to 6,794 MW). Even the scaled down targets which were almost 42 *per cent* less than the original targets could not be achieved. CPSEs had achieved only 1,550 MW (13 per cent and 23 per cent of the original and revised targets respectively) by March 2012.

Besides, these CPSEs are likely to add only 3,774 MW capacity in 12 projects in XII Five Year Plan (2012-2017) as against 14,535 MW in 33 projects envisaged in the Hydro Power Policy 2008.

8.1.2 Audit observed that the entire process for project planning and implementation was beset with inordinate delays. The CPSEs could complete the pre-investment approval activities within the benchmark of 30 months fixed by the Ministry of Power (MOP) in only two out of 14 Projects. While there was a marginal delay of up to six months in completing these activities in five projects, there were delays ranging from 12 to 50 months in remaining seven projects. Further analysis disclosed that NHPC took up to 49 months to complete 'Environmental Impact Assessment/Environmental Management Plan' studies for obtaining environment clearance and a further time of up to 11 months in submitting these studies to the Ministry of Environment and Forests, Government of India (GOI) for clearance.

8.1.3 Despite specific directions from Prime Minister's Office (PMO), MOP did not form Special Purpose Vehicle (SPV) for survey, investigation and implementation of the Siang and Subansiri multi purpose projects (six) in the Brahmaputra Basin in Arunachal Pradesh. GOI allocated six projects (20,700 MW) to NHPC of which only one project i.e. Subansiri Lower (2,000 MW) is being executed by NHPC.

These six projects were first allotted by GOI to NHPC and later, out of these projects, GOAP allotted two projects to the private developers based on limited tendering from private parties only; two projects to its Joint Ventures and one project to NTPC<sup>66</sup>. Transparency and competitiveness in allotment of Hydro Power Projects as envisaged in the Hydro policies of the GOI was, thus, overlooked. Hence, decision to allot projects from SPV to NHPC and subsequent allotment to the private developers/joint ventures/NTPC by GOAP resulted in the five projects conceived in January 1999 not taking off so far even after lapse of 12 years even though a large size hydro project as per CEA norms takes about 10 years from conceptualisation of a project to its commissioning. Besides, the estimated benefit of generation of 6,600 MW electricity per annum, as per DPRs of four projects allotted to private developers/ joint ventures, has not been achieved.

8.1.4 Audit noticed that even the first stage of implementation, *i.e.* survey and investigation which is the critical activity in the entire process was not accorded due importance by NHPC and SJVNL despite Policy on Hydro Power Development (1998) envisaging for thorough survey and investigation of hydro project sites before preparation of DPRs. There were no norms for drilling till 2006 and the drilling by NHPC and SJVNL during the survey stage was significantly inadequate as compared to requirements thereby exposing the CPSEs to several geological surprises causing a cascading impact on the time and cost of the projects. NHPC, in Parbati-II Project, resorted to use of inappropriate technology for drilling the head race tunnel despite concerns of various authorities like Geological Survey of India, MOP and Central Water Commission, etc. The tunnel boring machine was stuck in the tunnel and finally NHPC had to terminate the contract.

8.1.5 A time of 8 months was taken for investment approval after Techno Economic Clearance in case of Subansiri Lower of NHPC whereas it ranged between 10 and 29 months in respect of other 13 projects<sup>67</sup> (excluding Koteswar Project of THDC<sup>68</sup>).

The Working Group on Power for Eleventh Plan (2007-12) envisaged (February 2007) cost of construction at ₹4.50 crore per MW for the run of the river hydro

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<sup>66</sup> *Only for preparation of Pre Feasibility Report*

<sup>67</sup> *Excludes two projects of NEEPCO as planning activities were not covered in this Performance Audit.*

<sup>68</sup> *A time of 127 months was taken in respect of Koteswar project of THDC after obtaining TEC (August 1989) as Committee of Secretaries decided to take up this project after the work of Tehri Stage-I project picked up.*

projects. The approved per MW cost of construction of nine out of 12 run of the river hydro projects<sup>69</sup> approved by CCEA between July 1998 and January 2007 ranged between ₹4.90 crore and ₹14.12 crore as against ₹4.50 crore per MW envisaged by the Working Group. However, the anticipated cost of construction of 11 out of above 12 projects is much higher than the approved cost and ranged between 18 to 112 per cent of the approved cost. Besides per MW anticipated cost of above 12 projects also ranged between ₹4.97 crore to ₹20.80 crore as against ₹4.50 crore per MW envisaged by the Working Group.

- 8.1.6 The process of award of contracts by the CPSEs revealed significant departures from the generally accepted financial best practices and instances of inequitable and unfair contracting. The PQ criteria had been relaxed after closure of sale of bid documents, which allowed undue advantage to certain bidders over others. NHPC extended undue advantage to a bidder M/s HJV (led by MAYTAS), by relaxing the pre-qualifying criteria regarding requirement of JV partner specialized in the use of Tunnel Boring Machine and minimum average annual turnover requirement for lead and other partners in contrary to the practice in vogue in NHPC. These relaxations, after closure of sale of bid documents, were neither transparent nor fair to other parties who could also have participated due to relaxation in the criteria. M/s HJV (led by MAYTAS) was further favoured by prequalifying them on the basis of incomplete experience for tunnel boring machine. NHPC further compromised the transparency of the bid opening process for its Chamera III project as the discount letter of the lowest bidder did not form part of the bid documents submitted by them.

NHPC considered bid of MAYTAS in case of civil works package of Chutak project though it was decided to set aside their bid in view of poor performance in Parbati-II project.

- 8.1.7 M/s HJV (led by MAYTAS) was not only favoured in the award of contract but was extended undue favours during the execution of the contract also. MAYTAS the lead partner of the M/s HJV offloaded their portion of work to the least capable partner of the JV in violation of the terms of the contract. Due to undue favour to M/s HJV (led by MAYTAS) in the PQ stage itself, NHPC ended up in selecting an incompetent contractor who failed to execute the work in time. To tide over the situation, NHPC extended financial assistance of ₹131.65 crore beyond contractual provisions to M/s HJV. For resumption of work, a committee

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<sup>69</sup> *Koteshwar project of THDC and Omkareshwar project of NHPC (JV with MP Govt.) are storage type.*

chaired by former Secretary (Power) was constituted by MOP. Audit observed that Chairman of this committee was a member of the Board of one of the JV partners of M/s HJV and had a clear conflict of interest in both his responsibilities. Finally the contract was cancelled, bank guarantees were encashed leaving a balance of ₹182.48 crore unrecovered. This has resulted in blocking of ₹182.48 crore with remote chances of recovery and estimated cost over run of ₹243.54 crore and time over run of 99 months.

- 8.1.8 NHPC agreed to compensate a contractor for compression of schedule of hydro mechanical works relating to Chamera-III and Uri-II projects and paid an amount of ₹13.60 crore to the contractor, which was not justified as the civil works were already running behind schedule and completion of hydro mechanical works without civil works was of no use.

NEEPCO suffered a loss of ₹19.88 crore due to damage of extra items of work executed by the contractor in two accidents in January 2007 and December 2007. This amount could not be recovered by NEEPCO either from the contractor or the insurance company as the contractor had not insured these extra items of work.

- 8.1.9 Delay in execution of 16 projects by four CPSEs resulted in revision of their initial approved cost of ₹ 30,005 crore to ₹ 44,712 crore. In seven completed/ongoing projects, the cost overrun was in the range of 53 to 148 per cent.

The main reasons for delay in project execution were geological surprises and other controllable factors like delay in handing over of access roads to the contractors, wrong assessment of land requirements, delay in issuance of construction drawings, increase in scope of work due to incorrect assessment of bill of quantities, etc. also contributed to delay in execution of the projects.

Thorough survey and investigation as envisaged in the Policy on Hydro Power Development (1998) would have minimized the geological surprises. Other factors like delay in handing over of access roads, delay in issuance of construction drawings, etc. could have been controlled by proper coordination and monitoring by the CPSEs.

- 8.1.10 Though a monitoring mechanism was in place in these CPSEs, it did not have the desired impact in removing the project impediments. Even controllable factors like delay in handing over of access roads to contractors, issuance of construction drawings, incorrect assessment of Bills of Quantities, etc. were not

addressed in time to contain project delays. Monitoring by the MOP also did not help in ensuring timely action on the identified problem areas in execution.

- 8.1.11 In brief, based on the anticipated date of commercial operation of 10 ongoing projects of NHPC, SJVNL and THDC it is reasonable to conclude that a period of 9 years to 19 years would be taken by these CPSEs from conceptualisation to commercial operation of these projects.

Delays in commissioning of projects have led to CPSEs losing the opportunity of generating 26282.97 MUs of electricity annually (as per the DPRs). Further, additional return on equity to the tune of ₹1474.57 crore permissible under CERC Regulations, 2009 has also been foregone by the CPSEs.

## 8.2 Recommendations

Based on the audit findings, the following recommendations are made:

### Ministry of Power, Government of India

1. MOP should coordinate with concerned State Governments and other authorities like CEA, MOEF, MOWR for timely preparation of DPRs, allocation of projects and monitor progress of projects to ensure timely completion of projects for exploitation of hydro power potential in India. Desirability of a High Powered Committee chaired by Secretary (Power) with Members from other nodal Ministries/State Governments as a single window mechanism to monitor and expedite the process of necessary clearances should be explored.
2. The Hydro Policies 1998 and 2008 of GOI allowed State Governments to select developers through MOU route for hydro projects up to 100 MW only and follow a transparent procedure for awarding potential sites to the private sector. MOP, through its oversight role, should therefore impress upon the State Governments to allocate hydro power projects above 100 MW to the developers in a fair, transparent and competitive manner.

### NHPC Limited, SJVN Limited, NEEPCO and THDC India Limited

3. CPSEs should ensure that adequate survey and investigation are conducted before preparation of DPR to mitigate the risk of subsequent geological surprises during project execution and consequential increase in volume of work, change in design and resultant Time/Cost overruns.

4. CPSEs should adhere to the established best practices for PQ criteria, bidding and contract management to eliminate the possibility of unfair advantage to some bidders over the others.
5. CPSEs should make their long term plan in line with the GOI Hydro Policy and start their preparedness much in advance as it takes about 10 years from conception to commissioning of a Hydro project.
6. CPSEs should streamline their internal control systems and monitoring mechanism to ensure adherence to the contractual terms by the bidders.



(A K PATNAIK)

Deputy Comptroller and Auditor General  
and Chairman, Audit Board

New Delhi  
Dated: 3<sup>rd</sup> August, 2012

Countersigned



(VINOD RAI)

Comptroller and Auditor General of India

New Delhi  
Dated: 3<sup>rd</sup> August, 2012

**Annexure-I**  
**(As referred to in Para No.3.2)**

### Statement showing approval and clearances from different authorities for development of hydro power project

Sl. No.	Type of clearances	Issuing Authority	Reason for its requirement	Procedure
I	Land	State Government	To ensure land availability	Application is submitted to the concerned State Revenue Department for land acquisition as per requirement of project.
II	Water	State Government/CWC	To ensure water availability and free from any dispute	Application is submitted to State Water Resource Department.
III	Comfort letter from Beneficiaries	Concerned SEBs	Willingness of SEBs to buy power.	Letters sent to SEBs/successor entities for giving their consent to buy power.
IV	Forest clearance (if applicable)	MOEF/State Government	This is required as per law.	Application is submitted to State Government for onward submission to Ministry of Environment & Forests (MOEF) in case forest land is to be acquired by the project. Presently it is issued in two stages, first in-principal and once conditions stipulated are complied then formal clearance. In case of projects in J&K State, forest clearance is given by the State Government under their Forest (Conservation) Act, 1997.
V	Defence clearances (for project located in proximity to International Border, LOC, restricted area, etc.)	Defence Authority	This is required as per law.	Application giving location and other details is submitted to MoP for taking up the matter with Ministry of Defence for Defence Clearance.
VI	Clearance for inter-state & international angle (if applicable)	MOWR/ CWC	This is required as per law.	Request is submitted to MoP for obtaining this clearance from MOWR.
VII	Clearances from Archeological Survey of India (ASI) (if applicable)	ASI	This is required as per citing criteria of MOEF	Application is submitted to Archeological Survey of India indicating location of project and other details for seeking NOC.
VIII	Preparation of Detailed Project Report	Chairman/ Board of Directors	As per guidelines of CEA, DPR is prepared for implementation of the project	DPR is prepared by the project in association with all the concerned divisions of Corporate Office.

Sl. No.	Type of clearances	Issuing Authority	Reason for its requirement	Procedure
IX	Concurrence of the scheme (earlier called Techno-economic clearance)	Central Electricity Authority	Electricity Act, 1948 amended from time to time	The DPR is submitted to CEA for Concurrence of the scheme (earlier Techno-economic clearance).
X	Approval of Terms of Reference (TOR) along with the clearance for pre-construction activities from MOEF	MOEF	Approval of TOR and for pre-construction activities from MOEF is required under EIA Notification 2006	Filing of Application with filled in Form I along with a copy of PFR and draft TOR for undertaking EIA & EMP study to MOEF.
XI	Public Hearing by State Pollution Control Board (SPCB)	SPCB	Public Hearing is required under EIA Notification 2006	Application along with draft EIA & EMP reports and its executive summary in English and local language are to be submitted. SPCB to issue a notice in two local newspapers for public hearing.
XII	Environment clearance	MOEF	Obtaining environmental clearance is required under the Act.	Final EIA & EMP reports incorporating comments received during Public consultation process is to be submitted to MOEF. The proposal is referred to Expert Appraisal Committee.
XIII	Investment approval	CCEA	Hydro projects are approved by CCEA, Gol	Investment proposal is submitted by MoP to PIB for its recommendation and thereafter to CCEA for sanction.

**Annexure-II**  
**(As referred to in Para No.3.3.1)**

**Statement showing details of the hydro projects planned for capacity addition (Original and revised) during 2007-12 by the CPSEs**

Sl. No.	Name of the Company/project	Capacity (MW)		Remarks
		Original	Revised	
<b>(A)</b>	<b>NHPC Limited</b>			
1.	Loktak downstream, Manipur	90	0	Slipped into 12 <sup>th</sup> Plan due to delay in resolution of JV issues with State Govt.
2.	Subansiri Lower, Arunachal Pradesh	2,000	2,000	
3.	Parbati-II, Himachal Pradesh	800	800	
4.	Parbati-III, Himachal Pradesh	520	520	
5.	Chamera-III, Himachal Pradesh	231	231	
6.	Siang Middle, Arunachal Pradesh	700	0	Transferred to Private parties
7.	Siang Lower, Arunachal Pradesh	1,700	0	
8.	Subansiri Middle, Arunachal Pradesh	2,000	0	
9.	Pakal Dul, Jammu & Kashmir	1,000	0	JV issue not settled
10.	Bursar, Jammu & Kashmir	1,020	0	Slipped due to non-firming of dam axis and law & order problems
11.	Uri-II, Jammu & Kashmir	280	240	
12.	Teesta V, Sikkim	0	510	Slipped from 10th Plan
13.	Sewa II, J&K	0	120	
14.	Teesta low Dam III, West Bengal	0	132	
15.	Teesta low Dam IV, West Bengal	0	160	
16.	Omkareshwar, MP	0	520	
17.	Nimmo-Bazgo, J&K	0	45	
18.	Chutak, J&K	0	44	
	<b>TOTAL (A)</b>	<b>10,341</b>	<b>5,322</b>	

Sl. No.	Name of the Company/project	Capacity (MW)		Remarks
		Original	Revised	
<b>(B)</b>	<b>SJVN Limited</b>			
1.	Rampur, Himachal Pradesh	412	412	
	<b>TOTAL (B)</b>	<b>412</b>	<b>412</b>	
<b>(C)</b>	<b>THDC India Limited</b>			
1.	Koteshwar, Uttarakhand	400	400	
	<b>TOTAL (C)</b>	<b>400</b>	<b>400</b>	
<b>(D)</b>	<b>North Eastern Electric Power Corporation Limited</b>			
1.	Tuirial, Mizoram	60	60	
2.	Kameng, Arunachal Pradesh	600	600	
	<b>TOTAL (D)</b>	<b>660</b>	<b>660</b>	
	<b>GRAND TOTAL (A to D)</b>	<b>11,813</b>	<b>6794</b>	

## Statement showing relaxation in the PQ criteria in respect of Subansiri Lower project

Sl. No.	PQ criteria as originally approved on 28.9.01	Revised PQ criteria as issued on 17.2.03	PQ criteria as relaxed vide letter dated 17.3.03
<b>A.</b>	<b>Lot-SSL1 and Lot-SSL2</b>		
i	Average annual turnover by Joint Venture partners over the preceding 5 years at <b>US\$ 85 million</b> or equivalent	<b>US\$ 140 million</b>	<b>US\$ 110 million</b>
<b>B.</b>	<b>Specific Criteria for Lot-SSL1</b>		
i.	Completion of tunnel of over 8 m dia and length aggregating to 2 km in one project.	Condition of 2 Km in one project was deleted	No further change
ii.	Heading excavation volume of 4,500 cum per month from one tunneling face in an ongoing/completed project more than one time in one project	No such criteria	No further change
iii.	Excavation in tunnel(s) of more than <b>15,000 cum per month</b> more than one time	Average Heading excavation in tunneling of <b>15000 cum per month</b> or above in an ongoing/completed project	Average Heading excavation in tunneling reduced to <b>10000 cum per month</b> or above in an ongoing/completed project
iv.	concrete lining volume of 2,000 cum per month per face in an ongoing/completed project more than one time	No such criteria	No further change
v.	Completion of Earthfill/ Rockfill/Cofferdam/dam of at least <b>25 m height</b> with certain grouting underneath	Construction of cut off wall (in rock) of more than 40 m depth for foundation treatment of dam.	No further change
vi.	Placement rate of 40,000 cum per month in cofferdam/dam in ongoing/completed project more than one time	This PQ was removed	No further change
vii.	Construction of Concrete Gravity Dam of at least <b>100 m height</b>	Construction of Concrete Gravity Dam of <b>90 m</b> or above height	No further change
viii.	Excavation in foundation/abutment of approx. <b>15,00,000 cum quantity</b> with progress rate of <b>70,000 cum per month</b> in an ongoing/completed dam more than one time in one project.	Average excavation in foundation/abutment of <b>70,000 cum per month</b> or above in an ongoing/completed Dam but requirement of <b>15,00,000 cum was relaxed</b>	Average excavation in foundation/abutment of <b>50,000 cum</b> per month or above in an ongoing/completed Dam.

ix.	Concreting of approx. <b>12,50,000 cum</b> with placement rate of <b>50,000 cum</b> in one month in an ongoing /completed dam(s) more than one time in one project.	Concreting of <b>18,00,000 cum</b> or above in an ongoing/completed Dam. The average placement rate of was raised to <b>60,000 cum</b> in a month.	Concreting of <b>12,50,000 cum</b> or above in an ongoing/completed Dam and average concrete placement of <b>40,000 cum</b> per month or above in an ongoing/completed Dam
<b>C. Specific Criteria for Lot-SSL2</b>			
i.	Completion of tunnels of over 8 m dia and length aggregating to 2 km in one project	Requirement of 2Km in one project removed	No further change
ii.	Heading excavation volume of 4500 cum per month from one tunneling face in an ongoing/completed project more than one time in one project and	<b>This criteria was removed</b>	No further change
iii.	Excavation in tunnel(s) of more than <b>15,000 cum per month</b> more than one time and	Average Heading excavation in tunneling of <b>15,000 cum per month</b> or above in an ongoing/completed project	Average Heading excavation in tunneling of <b>10,000 cum per month</b> or above in an ongoing/completed project
iv.	Completion of underground Power House/Transformer Hall of minimum cavern width of 20 m	No further change	No further change
v.	Excavation progress rate of 10,000 cum per month achieved more than once in any ongoing/completed project	Average Excavation progress of <b>10,000 cum per month</b> or above in caverns in an ongoing/completed project	Average Excavation progress of <b>5,000 cum per month</b> or above in caverns in an ongoing/completed project
vi.	Concreting progress of 2,800 cum per month achieved more than once in an ongoing/completed project and	<b>This criteria was removed</b>	No further change
vii.	Completion of a pressure shaft/vertical shaft of approx. 7 m finished dia and over-55 m height.	Mechanized open excavation in rock of <b>20,00,000 cum</b> or above in an ongoing/completed project <b>including excavation height of 50 m or above</b>	Mechanized open excavation in rock of <b>20,00,000 cum</b> or above in an ongoing/completed project
viii.	<b>No such PQ requirement</b>	Average progress of <b>60,000 cum per month</b> or above in mechanized open excavation in rock in an ongoing/completed project	Average progress of <b>25,000 cum per month</b> or above in mechanized open excavation in rock in an ongoing/completed project
ix.	Individual item of technical criteria to be solely met by the sole applicant /JV partner/sub-contractor. No percentage of criteria to be met by individual JV partner was envisaged	Maximum two partners(including the Lead Partner) of proposed Joint Venture/Consortium partners individually have the specific construction experience of these <b>sub-activity(ies) equal to or more than 30%</b> of the corresponding qualifying criteria for such sub-activity(ies).	Maximum two partners(including the Lead Partner) of proposed Joint Venture/Consortium partners individually have the specific construction experience of these sub-activity(ies) equal to or more than <b>20% of the corresponding qualifying criteria</b> for such sub-activity(ies).

**Annexure-IV**  
**(As referred to in Para 5.2.b)**

### Relaxations in the PQ criteria in respect of Parbati-II project

Sl. No.	PQ criteria as per PQ document	Relaxed PQ criteria
1.	Minimum average annual turnover in civil and Hydro-mechanical work of US\$ 55 million or equivalent.	Minimum average annual turnover in civil and Hydro-mechanical work of US\$ 45 million or equivalent.
2.	Completion of tunnel of more than 5 Km with Drill and Blast Method(DBM) with an excavated volume of 4500 cum per month from one tunneling face and concrete lining volume of 3500 cum per month in ongoing/completed project, more than one time in one project.	Completion of tunnels aggregating to more than 2 Km with Drill and Blast Method(DBM) with an excavated volume of 4500 cum per month from one tunneling face and concrete lining volume of 2500 cum per month in ongoing/completed project, more than one time in one project.
3.	Joint Venture Partner who has the experience of TBM shall execute the TBM portion of tunnel.	Joint Venture Partner/approved sub-contractor who has the experience of TBM shall execute the TBM portion of tunnel.

**Annexure-V**  
**(As referred to in Para 5.4.1)**

**Details of the time taken from NIT to award and comparison of cost estimates vis-à-vis award value**

Sl. No.	Name of Project	Name of the Package	Date of NIT for PQ	Name of contractor	Date of award	Time taken from NIT to Award (in months)
1	Chamera-III of NHPC	Construction of DT & DT Gate, Cofferdam, Concrete Dam, Intake Structure, Desilting Arrangements, HRT Surge Shaft, Pressure Shaft, Underground Power House TRT and Pothead Yard (Lot-I)	Second week of Dec. 2003	HCC	21.09.05	21
2	Uri-II of NHPC	Construction of DT including Gates, Concrete Gravity Dam, HRT, Surge Shaft, Pressure Shaft, Power House & TRT(Lot-I)	29.12.03	HCC	21.09.05	21
3	Nimoo Bazgo of NHPC	Civil Works for Concrete Dam, Cofferdams, DT, Surface Power House, Tail Pool & Switch Yard (Lot-I)	06.05.04 re-tendered on 26.05.06	Gammon (After re-tender HCC)	23.09.06	28
4	Chutak of NHPC	E & M Works Package (Lot - 3)	29.08.05	BHEL	16.08.07	23
5	Parbati-II of NHPC	Civil and Hydro-Mechanical works for Diversion Dam and Part HRT ( Lot-PB-1)	08.11.00	Patel-Sew JV	11.09.02	22
6	Parbati-II of NHPC	Civil and Hydro-Mechanical works for HRT and Associated work (Lot-PB-2)	08..11.00	Himachal JV	11.09.02	22
7	Parbati-II of NHPC	Civil and Hydro-Mechanical works for Power House, Pressure Shaft, Surge Shaft and Part HRT (Lot-PB-3.)	08.11.00	Gammon	13.09.02	22
8	Parbati-III of NHPC	Construction of Diversion cum spillway tunnels including gates and hoists, coffer dams, rock fill dam, spillway, intake structures and part HRT (Lot-1)	17.12.03	Patel-L&T JV	15.12.05	24
9	Parbati-III of NHPC	E & M Works Package (Lot- 4)	18.08.04	BHEL	29.12.06	28
10	Subansiri Lower of NHPC	Civil works for DT, Cofferdams, Concrete Gravity Dam, Plunge Pool and Cuf off Wall (Lot-SSL-1)	16.08.01	BGS-SGS-SOMA	19.12.03	28
11	Subansiri Lower	Civil works of HRT Intake Structures, Head Race Tunnels, Surge Chamber, Pressure Shafts, TRT, Adits and Surface Power House (Lot- SSL-2)	16.08.01	L & T	19.12.03	28
12	Subansiri Lower of NHPC	E & M Package (Lot - 4)	07.04.03	Alstom	11.02.05	22

Sl. No.	Name of Project	Name of the Package	Date of NIT for PQ	Name of contractor	Date of award	Time taken from NIT to Award (in months)
13	Teesta Lower Dam-IV of NHPC	Civil works for construction of Diversion Arrangement, Concrete Gravity Dam alongwith Spillway, Roller Compacted Concrete (RCC) Dam, Intake Structure, Surface Power House, Tail Race Channel, Switch Yard and other associated Civil Work (Lot-1)	04.06.04	HCC	19.01.06	19
14	Teesta-V of NHPC	Civil works for underground Power House, Surge Shaft, Part HRT including Adit-5 (Lot-4)	28.12.99	JAL	09.03.01	14
15	Chutak of NHPC	Civil works for construction of DT, Coffor Dams, Barrage, Intake Structure, Head race Tunnel, Surge Shaft, Pressure Shafts, Underground Power House, Transformer cavern, Tailrace Tunnel and Switch yard (Lot-1)	26.05.06	HCC	23.09.06	4
16	Omkareshwar (JV of NHPC with MP Govt.)	Turnkey contract.	09.02.01	JPUSC	09.06.03	28
17	Rampur of SJVNL	Construction of civil works for part HRT, river diversion work, adits, vehicular gates, etc.	04.05.05	PGJV	01.02.07	21
18	Rampur of SJVNL	Construction of civil works for part HRT, surge shaft, pressure shaft, valve house, power house complex, TRT, adits and HM works	04.05.05	PGJV	01.02.07	21
19	Rampur of SJVNL	Electro-mechanical works	04.05.06	BHEL	16.09.08	28
20	Koteshwar of THDC	Construction of civil works of Dam, Spillway and Power House works	14.05.99	PCL-JV	31.08.02	39
21	Koteshwar of THDC	Design, manufacturer, supply, transportation, testing, erection and commissioning of Gates, Hoists in Spillways, Power House, Intakes, etc.	14.05.99	PTEL	09.02.06	80
22	Koteshwar of THDC	Design, manufacturer, supply, transportation, testing, erection and commissioning of main generating units & EOT crane	14.05.99	BHEL	28.02.03	45

**Annexure-VI**  
**(As referred to in Chapter-VI and Para 6.1)**

**Statement showing project-wise details of the scheduled date of commercial operation (COD), actual COD, delays and financial progress as on 31<sup>st</sup> March 2012**

Sl. No.	Name of project	Scheduled COD	Actual/Anticipated COD	Delays (in months)	Financial progress
1.	Teesta-V of NHPC	February 2007	April 2008	14	Completed
2.	Sewa-II of NHPC	September 2007	July 2010	34	Completed
3.	Koteshwar of THDC	April 2005	April 2012	84	Completed
4.	Parbati-II of NHPC	September 2009	December 2017	99	90.21 %
5.	Parbati-III of NHPC	November 2010	January 2013	26	76.22%
6.	Chamera-III of NHPC	September 2010	June 2012	21	127.65%
7.	Subansiri Lower of NHPC	September 2010	December 2016	75	89.15%
8.	Uri-II of NHPC	November 2009	February 2013	39	98.07%
9.	TLD-III of NHPC	March 2007	December 2012	69	189.18%
10.	TLD-IV of NHPC	September 2009	August 2013	47	103.91%
11.	Nimmo Bazgo of NHPC	August 2010	January 2013	29	118.35%
12.	Chutak of NHPC	February 2011	October 2012	20	117.61%
13.	Rampur of SJVNL	January 2012	September 2013	20	87.61%
14.	Kameng of NEEPCO	December 2009	March 2017	87	71.62%
15.	Tuirial of NEEPCO	July 2006	February 2016	115	82.30%

**Annexure-VII**  
**(As referred to in Para 6.1)**

**Statement showing approved, revised and actual/anticipated cost of the completed/ongoing projects of CPSEs**

Sl. No.	Name of the projects	Capacity (in MWs)	Date of Investment Approval	Approved cost (Rs. in crore)	Revised Cost <sup>1</sup> (Rs. in crore)	Actual/Anticipated Cost of completion (Rs. in crore)	Increase in the project cost (Rs. in crore)	Percentage of increase in Actual/Anticipated cost to Approved cost
<b>A</b>	<b>Completed projects:</b>							
1	Koteshwar of THDC	400	10.04.2000	1301.56	2466.96	2719.49	1417.93	109%
2	Sewa-II of NHPC	120	09.09.2003	665.46	1108.83	1108.83	443.37	67%
3	Teesta-V of NHPC	510	11.02.2000	2198.04	2656.95	2656.95	458.91	21%
4	Omkareshwar (JV of NHPC with MP Govt.)	520	29.05.2003	2224.73	2497.04	2497.04	272.31	12%
	<b>Total (A)</b>	<b>1550</b>		<b>6389.79</b>	<b>8729.78</b>	<b>8982.31</b>	<b>2592.52</b>	
<b>B</b>	<b>Ongoing projects:</b>							
5	Tuirial of NEEPCO	60	07.07.1998	368.72	913.63	913.63	544.91	148%
6	Teesta Low Dam-III of NHPC	132	30.10.2003	768.92	1628.39	1628.39	859.47	112%
7	Kameng of NEEPCO	600	02.12.2004	2496.90	5139.00	5139.00	2642.10	106%
8	Subansiri Lower of NHPC	2000	09.09.2003	6285.33	10667.09	10667.09	4381.76	70%
9	Nimoo Bazgo of NHPC	45	24.08.2006	611.01	936.10	936.10	325.09	53%
10	Chamera-III of NHPC	231	01.09.2005	1405.63	2084.01	2084.01	678.38	48%
11	Chutak of NHPC	44	24.08.2006	621.26	913.25	913.25	291.99	47%
12	Teesta Low Dam-IV of NHPC	160	30.09.2005	1061.38	1501.75	1501.75	440.37	41%
13	Parbati-II of NHPC	800	11.09.2002	3919.59	5353.21	5353.21	1433.62	37%
14	Uri-II of NHPC	240	01.09.2005	1724.79	2082.82	2082.82	358.03	21%
15	Parbati-III of NHPC	520	09.11.2005	2304.56	2715.92	2715.92	411.36	18%
16	Rampur of SJVNL	412	25.01.2007	2047.03	2047.03	2047.03	0.00	0%
	<b>Total (B)</b>	<b>5244</b>		<b>23615.12</b>	<b>35982.20</b>	<b>35982.20</b>	<b>12367.08</b>	
	<b>Grand Total (A+B)</b>	<b>6794</b>		<b>30004.91</b>	<b>44711.98</b>	<b>44964.51</b>	<b>14959.60</b>	

<sup>1</sup> Based on revised cost estimate of the projects submitted by the respective CPSEs to Ministry of Power for approval.

**Annexure VIII**  
**(As referred in para No.7.2)**

**Statement showing loss of generation on ongoing projects due to non-completion within scheduled timeframe**

Sl. No.	Name of Project	Unit No.	Scheduled COD as Investment Approval	Anticipated/ COD	Actual	Delays (Days)	Annual energy generation after auxiliary consumption & transformer loss as per DPR (in million units)	Annual energy generation of each unit as per DPR (in million units)
<b>Completed projects:</b>								
1	Teesta-V of NHPC (510 MW)	I to III	11/02/2007	10/04/2008	(Act)	424	2163.20	2163.20
2	Sewa-II of NHPC (120 MW)	I to III	09/09/2007	24/07/2010	(Act)	1049	534.19	534.19
3	Koteshwar of THDC (400 MW)	I	31/10/2004	01/04/2011	(Act)	2343	1234.00	308.50
		II	31/12/2004	26/10/2011	(Act)	2490		308.50
		III	28/02/2005	13/02/2012	(Act)	2541		308.50
		IV	30/04/2005	01/04/2012	(Act)	2528		308.50
<b>Total (Completed projects) - 1030 MW</b>								<b>3931.39</b>
<b>Ongoing projects:</b>								
1	Parbati-II of NHPC (800 MW)	I to IV	11/09/2009	15/12/2017	(Ant)	3017	3046.26	3046.26
2	Parbati-III of NHPC (520 MW)	I to IV	09/11/2010	15/01/2013	(Ant)	798	1952.31	1952.31
3	Chamera-III of NHPC (231 MW)	I	01/09/2010	15/06/2012	(Ant)	653	1093.51	364.50
		II	01/09/2010	15/06/2012	(Ant)	653		364.50
		III	01/09/2010	15/06/2012	(Ant)	653		364.50
4	Subansiri Lower of NHPC (2000 MW)	I to VIII	09/09/2010	15/12/2016	(Ant)	2289	7475.78	7475.78
5	Teesta Low Dam-III of NHPC (132 MW)	I to IV	15/03/2007	15/12/2012	(Ant)	2102	588.49	588.49
6	Teesta Low Dam-IV of NHPC (160 MW)	I	30/09/2009	15/06/2013	(Ant)	1354	712.82	178.21
		II	30/09/2009	15/07/2013	(Ant)	1384		178.21
		III	30/09/2009	15/08/2013	(Ant)	1415		178.21
		IV	30/09/2009	15/08/2013	(Ant)	1415		178.21
7	Uri of NHPC (240 MW)	I	30/11/2009	15/01/2013	(Ant)	1142	1070.35	267.59
		II	30/11/2009	15/01/2013	(Ant)	1142		267.59
		III	30/11/2009	15/02/2013	(Ant)	1173		267.59
		IV	30/11/2009	15/02/2013	(Ant)	1173		267.59
8	Nimoo Bazgo of NHPC (45 MW)	I	24/08/2010	15/10/2012	(Ant)	783	236.88	78.96
		II	24/08/2010	15/11/2012	(Ant)	814		78.96
		III	24/08/2010	15/01/2013	(Ant)	875		78.96
9	Chutak of NHPC (44 MW)	I	24/02/2011	15/06/2012	(Ant)	477	213.82	53.46
		II	24/02/2011	15/06/2012	(Ant)	477		53.46
		III	24/02/2011	15/07/2012	(Ant)	507		53.46
		IV	24/02/2011	15/10/2012	(Ant)	599		53.46
10	Rampur of SJVNL (412 MW)	I	27/01/2012	15/09/2013	(Ant)	597	2057.11	342.85

Sl. No.	Name of Project	Unit No.	Scheduled COD as per Investment Approval	Anticipated/ COD	Actual	Delays (Days)	Annual energy generation after auxiliary consumption & transformer loss as per DPR (in million units)	Annual energy generation of each unit as per DPR (in million units)
		II	27/01/2012	15/09/2013	(Ant)	597		342.85
		III	27/01/2012	15/09/2013	(Ant)	597		342.85
		IV	27/01/2012	15/09/2013	(Ant)	597		342.85
		V	27/01/2012	15/09/2013	(Ant)	597		342.85
		VI	27/01/2012	15/09/2013	(Ant)	597		342.85
11	Kameng of NEEPCO (600 MW)	I	15/12/2009	31/03/2017	(Ant)	2663	3592.00	898.00
		II	15/12/2009	31/03/2017	(Ant)	2663		898.00
		III	31/12/2009	31/03/2017	(Ant)	2647		898.00
		IV	31/12/2009	31/03/2017	(Ant)	2647		898.00
12	Tuirial of NEEPCO (60 MW)	I	15/07/2006	16/02/2016	(Ant)	3503	312.21	156.11
		II	15/07/2006	16/02/2016	(Ant)	3503		156.11
<b>Total (Ongoing projects) - 5244 MW</b>								<b>22351.58</b>
<b>Total (All CPSEs) - 6274 MW</b>								<b>26282.97</b>

Note: The annual energy generation of Tuirial project (60 MW) of NEEPCO has been calculated based on 60 per cent load factor and after deducting auxiliary consumption & transformer loss 0.5% as DPR data is not available.

For anticipated and actual COD, 15th of the month has been adopted in the absence of actual date of the respective month.

### Statement showing loss of additional Return on Equity on hydro projects due to non-completion within timeframe fixed by CERC

Sl. No.	Name of Project	Unit No.	Timeline as per CERC regulations	Date of Investment Approval (i.e. date of CCEA clearance)	Scheduled COD per CERC's criteria	Anticipated COD	Whether eligible for Addl. ROE	Completed/anticipated revised cost (Rs. in crore)	Cost of one generating unit (Rs. in crore)	Debt @ 70% of Col. 10 (Rs. in crore)	Equity @ 30% of Col.10 (Rs. in crore)	Rate of Addl. Return on Equity	Total loss of additional Return on Equity (Rs. in crore)**
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Parbati-III of NHPC	1	As per concurrence of CEA (i.e. COD of 1, 2, 3 & 4 unit in 57, 58, 59 & 60 months respectively from the date of CCEA clearance)	09.11.2005	09/08/2010	15/10/2012 (Ant)	Yes	2715.92	678.98	475.29	203.69	0.50%	35.65
		09/09/2010			15/11/2012 (Ant)	Yes		678.98	475.29	203.69	0.50%	35.65	
		09/10/2010			15/12/2012 (Ant)	Yes		678.98	475.29	203.69	0.50%	35.65	
		09/11/2010			15/01/2013 (Ant)	Yes		678.98	475.29	203.69	0.50%	35.65	
2	Chamera-III of NHPC	1	As per concurrence of CEA (i.e. COD of 1, 2 & 3 unit in 56, 58 & 60 months respectively from the date of CCEA clearance)	01.09.2005	01/05/2010	15/06/2012 (Ant)	Yes	2084.01	694.67	486.27	208.40	0.50%	36.47
		01/08/2010			15/06/2012 (Ant)	Yes		694.67	486.27	208.40	0.50%	36.47	
		01/10/2010			15/06/2012 (Ant)	Yes		694.67	486.27	208.40	0.50%	36.47	
3	Teesta Low Dam-IV of NHPC	1	As per concurrence of CEA (i.e. COD of 1, 2, 3 & 4 unit in 45, 46, 47 & 48 months respectively from the date of CCEA clearance)	30.09.2005	30/06/2009	15/06/2013 (Ant)	Yes	1501.75	375.44	262.81	112.63	0.50%	19.71
		30/07/2009			15/07/2013 (Ant)	Yes		375.44	262.81	112.63	0.50%	19.71	
		30/08/2009			15/08/2013 (Ant)	Yes		375.44	262.81	112.63	0.50%	19.71	
		30/09/2009			15/08/2013 (Ant)	Yes		375.44	262.81	112.63	0.50%	19.71	

Sl. No.	Name of Project	Unit No.	Timeline as per CERC regulations	Date of Investment Approval (i.e. date of CCEA clearance)	Scheduled COD per CERC's criteria	Anticipated COD	Whether eligible for Addl. ROE	Completed/anticipated revised cost (Rs. in crore)	Cost of one generating unit (Rs. in crore)	Debt @ 70% of Col. 10 (Rs. in crore)	Equity @ 30% of Col. 10 (Rs. in crore)	Rate of Addl. Return on Equity	Total loss of additional Return on Equity (Rs. in crore)**
1	2	3	4	5	6	7	8	9	10	11	12	13	14
4	Subansiri Lower of NHPC	1	As per concurrence of CEA (i.e. COD of 1 & 2, 3 & 4, 5 & 6 and 7 & 8 unit in 77, 81, 82 & 84 months respectively from the date of CCEA clearance)	09.09.2003	09/02/2010	15/12/2016 (Ant)	Yes	10667.09	1333.39	933.37	400.02	0.50%	70.00
2		09/02/2010			15/12/2016 (Ant)	Yes	1333.39		933.37	400.02	0.50%	70.00	
3		09/06/2010			15/12/2016 (Ant)	Yes	1333.39		933.37	400.02	0.50%	70.00	
4		09/06/2010			15/12/2016 (Ant)	Yes	1333.39		933.37	400.02	0.50%	70.00	
5		09/07/2010			15/12/2016 (Ant)	Yes	1333.39		933.37	400.02	0.50%	70.00	
6		09/07/2010			15/12/2016 (Ant)	Yes	1333.39		933.37	400.02	0.50%	70.00	
7		09/09/2010			15/12/2016 (Ant)	Yes	1333.39		933.37	400.02	0.50%	70.00	
8		09/09/2010			15/12/2016 (Ant)	Yes	1333.39		933.37	400.02	0.50%	70.00	
5	Uri-II of NHPC	1	As per concurrence of CEA (i.e. COD of 1, 2, 3 & 4 unit in 48, 49, 50 & 51 months respectively from the date of CCEA clearance)	01.09.2005	01/09/2009	15/01/2013 (Ant)	Yes	2082.82	520.705	364.49	156.21	0.50%	27.34
2		01/10/2009			15/01/2013 (Ant)	Yes	520.705		364.49	156.21	0.50%	27.34	
3		01/11/2009			15/02/2013 (Ant)	Yes	520.705		364.49	156.21	0.50%	27.34	
4		01/12/2009			15/02/2013 (Ant)	Yes	520.705		364.49	156.21	0.50%	27.34	
6	Nimoo Bazgo of NHPC	1	As per concurrence of CEA (i.e. COD of 1, 2 & 3 unit in 46, 47 & 48 months respectively from the date of Govt. Sanction/clearance)	24.08.2006	24/06/2010	15/10/2012 (Ant)	Yes	936.10	312.033	218.42	93.61	0.50%	16.38
2		24/07/2010			15/11/2012 (Ant)	Yes	312.033		218.42	93.61	0.50%	16.38	
3		24/08/2010			15/01/2013 (Ant)	Yes	312.033		218.42	93.61	0.50%	16.38	

Sl. No.	Name of Project	Unit No.	Timeline as per CERC regulations	Date of Investment Approval (i.e. date of CCEA clearance)	Scheduled COD as per CERC's criteria	Anticipated COD	Whether eligible for Addl. ROE	Completed/anticipated revised cost (Rs. in crore)	Cost of one generating unit (Rs. in crore)	Debt @ 70% of Col. 10 (Rs. in crore)	Equity @ 30% of Col. 10 (Rs. in crore)	Rate of Addl. Return on Equity	Total loss of additional Return on Equity (Rs. in crore)**
1	2	3	4	5	6	7	8	9	10	11	12	13	14
7	Chutak of NHPC	1	As per concurrence of CEA (i.e. COD of 1, 2, 3 & 4 unit in 51, 52, 53 & 54 months respectively from the date of Govt. Sanction/clearance)	24.08.2006	24/11/2010	15/06/2012 (Ant)	Yes	913.25	228.31	159.82	68.49	0.50%	11.99
2		12/12/2010			15/06/2012 (Ant)	Yes		228.31	159.82	68.49	0.50%	11.99	
3		24/01/2011			15/07/2012 (Ant)	Yes		228.31	159.82	68.49	0.50%	11.99	
4		24/02/2011			15/10/2012 (Ant)	Yes		228.31	159.82	68.49	0.50%	11.99	
<b>Total loss of Additional Return on Equity (NHPC)</b>													
8	Rampur of SJVNL	1	55,56,57,58,59 and 60 months for Unit 1 to 6 respectively from the date of Govt. sanction	25.01.2007	25/08/2011	15/09/2013 (Ant)	Yes	2047.03	341.17	238.82	102.35	0.50%	17.91
2		25/09/2011			15/09/2013 (Ant)	Yes		341.17	238.82	102.35	0.50%	17.91	
3		25/10/2011			15/09/2013 (Ant)	Yes		341.17	238.82	102.35	0.50%	17.91	
4		25/11/2011			15/09/2013 (Ant)	Yes		341.17	238.82	102.35	0.50%	17.91	
5		25/12/2011			15/09/2013 (Ant)	Yes		341.17	238.82	102.35	0.50%	17.91	
6		25/01/2012			15/09/2013 (Ant)	Yes		341.17	238.82	102.35	0.50%	17.91	
<b>Total loss of Additional Return on Equity (SJVNL)</b>													
9	Kameng of NEEPCO	1	60 months from the date of Govt. Sanction	02.12.2004	02/12/2009	31/03/2017 (Ant)	Yes	5139.00	1284.75	899.33	385.43	0.50%	67.45
2		02/12/2009			31/03/2017 (Ant)	Yes		1284.75	899.33	385.43	0.50%	67.45	
3		02/12/2009			31/03/2017 (Ant)	Yes		1284.75	899.33	385.43	0.50%	67.45	
4		02/12/2009			31/03/2017 (Ant)	Yes		1284.75	899.33	385.43	0.50%	67.45	
<b>Total loss of Additional Return on Equity (NEEPCO)</b>													
<b>Total loss of Additional Return on Equity to all CPSEs</b>													
<b>1097.31</b>													
<b>107.46</b>													
<b>269.80</b>													
<b>1474.57</b>													

\*\*Based on useful life of 35 years of the hydro power plant as specified in the CERC's Regulations)

## Glossary

Term used in report	Description
<b>Adit</b>	Adit is a type of entrance to underground tunnels which may be horizontal or nearly horizontal.
<b>Back hill slope stabilisation</b>	In case of surface power house, it is necessary to stabilize the back hill slope in order to avoid any eventuality in future by way of suitable measures viz. shotcrete, anchors, bolts, etc.
<b>Coffer dam</b>	Coffer dam is a watertight structure, usually of sheet piling, that encloses an area under water, pumped dry to enable construction work to be carried out.
<b>Diversion Tunnel</b>	Diversion tunnel is constructed to divert the flow of river for the construction of dam/barrage on it.
<b>Dam Axis</b>	The vertical plane or curved surface, chosen by a designer, appearing as a line, in plan or in cross-section, to which the horizontal dimensions of the dam are referenced.
<b>Drill and blast method (DBM)</b>	DBM is the method of manual excavation of tunnels i.e. through drilling and blasting.
<b>Environmental Impact Assessment (EIA)/ Environmental Management Plan (EMP) studies</b>	These studies are conducted to assess the possible positive or negative impact that a proposed project may have on the environment, together consisting of the environmental, social and economic aspects and subsequent plan of action. EIA/EMP studies are required to be conducted before submission of proposal for obtaining Environment clearance.
<b>Geological surprises</b>	This term is used to identify the problematic sectors of the geological conditions of the project site.
<b>Geomorphological mapping</b>	Geomorphological mapping gathers various mathematical, statistical and image processing techniques to quantify morphological, hydrological, ecological and other aspects of a land surface.
<b>Geotechnical mapping</b>	Geotechnical mapping is done for identification and location of all surface features relevant to the establishment of geotechnical models at the sites.
<b>Head of the power station</b>	The difference in height between the source and the water's outflow is called head.
<b>Head Race Tunnel (HRT) and Tail Race Tunnel (TRT)</b>	HRT is a tunnel connecting water intake at dam site to power house for generation of hydro electricity whereas TRT is a tunnel for flowing water used for generation of electricity again into the river.
<b>Raise borer</b>	A raise borer is a machine used in underground mining, to excavate a circular hole between two levels of a mine without the use of explosives.
<b>Run of river power stations</b>	Run of river hydroelectricity stations are those with small or no reservoir capacity so that the water coming from upstream must be used for generation at that moment or must be allowed to bypass the dam.

Term used in report	Description
<b>Shotcrete</b>	Shotcrete is concrete (or sometimes mortar) conveyed through a hose and pneumatically projected at high velocity onto a surface, as a construction technique.
<b>Sluicing</b>	Sluicing is an effective measure of investigation on steep and rocky slopes where soil is relatively thin and sandy.
<b>Surge Shaft</b>	Surge shaft is an additional storage space or reservoir fitted between the main storage reservoir and the power house.
<b>Topographic mapping</b>	A topographic map is a type of map characterized by large-scale detail and quantitative representation of relief, usually using contour lines in modern mapping, but historically using a variety of methods.
<b>Tunnel Boring Machine (TBM)</b>	TBM is used for excavation of underground tunnels. This technology is suitable in cases where adequate numbers of faces for tunneling are not available.
<b>Water ingress</b>	Water ingress means entrance of excessive water in the project site at the time of construction.

## Abbreviations

Sl No.	Abbreviation	Full Form
1	ADB	Asian Development Bank
2	ASI	Archeological Survey of India
3	BOD	Board of Directors
4	BOQ	Bill of Quantities
5	CCEA	Cabinet Committee on Economic Affairs
6	CERC	Central Electricity Regulatory Commission
7	CMD	Chairman and Managing Director
8	COD	Commercial Operation Date
9	COPU	Committee on Public Undertakings
10	CPSE	Central Public Sector Enterprises
11	CVC	Central Vigilance Commission
12	CWC	Central Water Commission
13	DBM	Drill and Blast Method
14	DPR	Detailed Project Report
15	DT	Diversion Tunnel
16	EAC	Expert Appraisal Committee
17	EIA	Environmental Impact Assessment
18	EMP	Environmental Management Plan
19	EOT Crane	Electrical Overhead Travelling Crane
20	FR/PFR	Feasibility Report/ Pre Feasibility Report
21	GOAP	Government of Arunachal Pradesh
22	GOI	Government of India
23	GOUK	Government of Uttrakhand
24	GSI	Geological Survey of India
25	HEP	Hydro Electric Project
26	HM	Hydro Mechanical
27	HRT	Head Race Tunnel
28	MOA	Memorandum of Agreement

Sl No.	Abbreviation	Full Form
29	MOEF	Ministry of Environment and Forests
30	MOF	Ministry of Finance
31	MOP	Ministry of Power
32	MOU	Memorandum of Understanding
33	MOWR	Ministry of Water Resources
34	NEEPCO	North Eastern Electric Power Corporation Limited
35	NOC	No objection Certificate
36	PIB	Public Investment Board
37	PMO	Prime Ministers Office
38	PQ	Pre qualification
39	PRM	Project Review Meeting
40	RCC	Roller Compacted Concrete
41	SEB	State Electricity Board
42	SPCB	State Pollution Control Board
43	SPV	Special Purpose Vehicle
44	TBM	Tunnel Boring Machine
45	TEC	Techno Economic Clearance
46	TLD	Teesta Low Dam
47	TOR	Terms of Reference
48	TRT	Tail Race Tunnel