

# Review of Procurement Experience from Pilot R&M Interventions in Thermal Power Stations in India



Prepared by:



**WAPCOS Limited**

**Under**

**Technical Assistance to CEA for Addressing Barriers to Energy  
Efficient R&M of Coal Fired Generating Units**

**Under**

**India: Coal Fired Generation Rehabilitation Project**

**( March 2017 )**



**CENTRAL ELECTRICITY AUTHORITY**



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## ABBREVIATIONS

|             |   |
|-------------|---|
| ABB         | Asea Brown Boveri   |
| AC          | Alternating Current   |
| AHP         | Ash Handling Plant  |
| AOH         | Annual Overhauling  |
| APC         | Auxiliary Power Consumption                                   |
| APH         | Air Pre Heater  |
| BFP         | Boiler Feed Pump  |
| BHEL        | Bharat Heavy Electricals Ltd.                                 |
| BoP         | Balance of Plant  |
| BTG         | Boiler, Turbine & Generator                                   |
| C&I         | Control & Instrumentation                                     |
| CEA         | Central Electricity Authority                                 |
| CEP         | Condensate Extraction Pump                                    |
| CERC        | Central Electricity Regulatory Commission                     |
| CHP         | Coal Handling Plant   |
| CW          | Cooling Water   |
| DC          | Direct Current  |
| DCS         | Distributed Control System                                    |
| DCS max DNA | A type of Distributed Control System software                 |
| DDCMIS      | Distributed Digital Control and Management Information System |
| DEH         | Digital Electro Hydraulic                                     |
| DESH        | De Super Heater   |
| DM          | De Mineralized  |
| DPR         | Detailed Project Report                                       |
| EE R&M      | Energy Efficient Renovation & Modernization                   |
| EPC         | Engineering, Procurement and Construction                     |
| ESP         | Electrostatic Precipitator                                    |
| FD          | Forced Draft  |
| GoI         | Government of India   |
| GSECL       | Gujarat State Electricity Corporation Ltd.                    |
| GT          | Generator Transformer   |
| HPGCL       | Haryana Power Generation Corporation Ltd.                     |
| HP Turbine  | High Pressure Turbine   |
| HVAC        | Heating, Ventilation and Air Conditioning                     |
| ID          | Induced Draft   |
| IP Turbine  | Intermediate Pressure Turbine                                 |
| JV          | Joint Venture   |
| KBUNL       | Kanti Bijlee Utpadan Nigam Ltd.- JV of BSEB & NTPC Ltd        |
| kCal        | Kilo Calorie  |
| kW          | Kilo Watt   |
| LE          | Life Extension  |
| LP Turbine  | Low Pressure Turbine  |

|                 |   |
|-----------------|---|
| MDBFP           | Motor Driven Boiler Feed Pump                   |
| MoP             | Ministry of Power                               |
| MOU             | Memorandum Of Understanding                     |
| MPPGCL          | Madhya Pradesh Power Generation Company Ltd.    |
| MSPGCL          | Maharashtra State Power Generation Company Ltd. |
| MU              | Million Units                                   |
| MW              | Mega Watt                                       |
| NA              | Not Available                                   |
| NTPC            | National Thermal Power Corporation Ltd.         |
| OEM             | Original Equipment Manufacturer                 |
| PFC             | Power Finance Corporation                       |
| PG              | Performance Guarantee                           |
| PRDS            | Pressure Reducing and De Superheating           |
| PSPCL           | Punjab State Power Corporation Ltd.             |
| PLF             | Plant Load Factor                               |
| R&M             | Renovation & Modernization                      |
| RLA             | Residual Life Assessment                        |
| RLA/CA          | Residual Life Assessment / Condition Assessment |
| SO <sub>x</sub> | Sulphur Oxides                                  |
| SPM             | Suspended Particulate Matter                    |
| ST              | Station Transformer                             |
| SWAS            | Steam and Water Analysis System                 |
| TDBFP           | Turbine Driven Boiler Feed Pump                 |
| TG              | Turbo Generator                                 |
| TOR             | Terms of Reference                              |
| TPS             | Thermal Power Station                           |
| UPRVUNL         | Uttar Pradesh Rajya Vidyut Utpadan Nigam Ltd.   |
| UAT             | Unit Auxiliary Transformer                      |
| WBPDCL          | West Bengal Power Development Corporation Ltd.  |

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## Executive Summary

Coal fired thermal power stations play a dominant role in power generation in India contributing around 60% of total power generation. There is large fleet of old thermal power stations with capacity including mainly 110MW, 120MW and 200/210MW unit sizes. There are large numbers of 200/210 MW LMZ units, which have already completed their economic life and operate at low efficiencies. R&M has been recognized as cost-effective measure for efficiency enhancement of such units through technology up gradations. During 10<sup>th</sup>, 11<sup>th</sup> and 12<sup>th</sup> Plans, R&M projects have been implemented by various Power Utilities at their units to enhance the efficiency and Plant Load Factor.

Recognizing the need to facilitate Renovation & Modernization of thermal power stations in the country, the World Bank financed the “Coal Fired Generation Rehabilitation Project” with an objective to demonstrate that Energy Efficiency R&M (EE R&M) at old coal fired thermal power stations is possible with uprating of the units and also with a view to address the barriers of R&M at thermal power stations. Under the above project, CEA has implemented the “Technical Assistance Project for Addressing the Barriers to EE R&M of Coal Fired Generating Units in India” and appointed WAPCOS, as a consultant, for the study on “Review of Experiences from Pilot R&M Interventions in Thermal Power Stations in India” with the objective of sharing of experience mainly in procurement, implementation and improvement in performance parameters in R&M projects taken up in India.

The power utilities had procured the goods and services for their R&M projects in the past following their own practices for procurement. The projects were awarded on nomination basis to Original Equipment Manufacturer (OEM) or through the competitive bidding. The procurement is an important process in implementation of the R&M projects, which involves mainly preparation of technical specifications, tendering and award of the contracts for execution of R&M works. As such, capturing and sharing of experiences in procurement at past R&M projects is of much significance especially for providing guidance for the future R&M projects. The units-1&2 of Panipat TPS, units-6,7&8 of Kothagudem TPS, unit-5 of Bandel TPS, units-1&2 of Amarkantak TPS, unit-6 of Koradi TPS, units- 4&5 of NTPC Badarpur and unit-3 of Nashik TPS have been covered for review of procurement experience in the R&M works. The WAPCOS experts visited the thermal power stations for capture of the procurement experience through interactions with power plant engineers and also collected relevant data and information. Based on the interactions, available data/information and feedback obtained in various meetings and Workshop from the members of Task Force on Promotion of R&M, the report on Review of Procurement Experience in Pilot R&M Interventions in India has been prepared by WAPCOS for sharing of procurement experience at R&M projects on the above units. The report provides an insight into analysis of the Detailed Project Reports, bidding documents, qualification requirements, targeted performance guarantees, cost and time overruns, analysis of problems faced in finalization of the contracts and also the suggestions to improve competitiveness in the bidding process.



It has been observed that the Time Gap between completion of the DPR/RLA and the Zero Date of implementation of R&M works at various thermal power units has varied considerably. Such large Time Gap lead to further deterioration of the equipment and changes in the scope of works after preparation of the DPR causing time and cost overruns of the R&M projects. The Time Gap should not normally exceed one year.

It is also essential that the scope of R&M works should be clearly defined based on the RLA/Condition Assessment at the concerned unit before preparing tender documents for Life Extension/R&M projects. The RLA/CA studies need to be done by the experienced consultants. Also, while preparing the contract documents, special care should be taken to clearly define the contract clauses to minimize the problems and disputes at the execution stage. The contractual disputes may be caused by serious flaws and ambiguity in the contract, which may lead to unnecessary delays due to contractual disputes.

For minimizing the problems in procurement process, it is advisable that a standard procurement procedure may be adopted by the power utilities. It has been observed that delay in procurement can adversely affect the progress of R&M works. It is important that standardization of tender procedures should be done along with clearly defined delegation of power, responsibilities and time lines. Also, the bidders should be asked to submit a list of mandatory spares at the procurement stage. The successful bidders should assure to make available the mandatory spares as and when needed.

It is observed that there are limited executing agencies in the market who are capable to execute the R&M work on turnkey basis. Many players were left out of fray, as they could not participate in the bidding process. Competitiveness in the bidding process can be improved by dividing the R&M works in minimum number of smaller packages. It encourages competition in the market and leads to a better price discovery. In case of unit-5 of Bandel TPS of WBPDC, the R&M work was divided in five different Packages (Main Plant i.e. BTG Package, CHP Package, Electrical Package, AHP Package, and Air Conditioning System of Control Room and associated areas of unit-5 of Bandel TPS) resulting in better coordination and inter-facing which helped consequently in smoothening the speedy implementation of R&M works.

Recently, the R&M works for unit-5 of Bandel TPS of WBPDC as well as for unit 6 of Koradi TPS of MSPGCL have been awarded following the International Competitive Bidding (ICB) route. In these projects, adoption of ICB for R&M procurement has been a good attempt to get the competitive rates. Hence, in order to have better competition among suppliers/vendors and for efficient and timely execution of R&M works, ICB route should be preferred over awarding of R&M works on nomination basis to get better prices through enhanced competition.

The study has been an attempt to capture the available experience in procurement for the R&M projects implemented at various old thermal power stations. The experience made available through data/information and interactions during the visits by WAPCOS team to concerned power stations as well as the feedback from members of the Task Force has been



consolidated and analyzed. The experience has also been shared among the power utilities and other stakeholders during the Workshop organized by WAPCOS. The learnings and suggestions made in the report would provide guidance to power utilities for taking up appropriate advance action for planning and implementation of the future R&M projects at their thermal power stations.

## Chapter-1

### Introduction

#### 1.1 Introduction

The total installed capacity of India was 302,087.84 MW as on 31<sup>st</sup> March, 2016 out of which major share of 185,172.88 MW (61.29 %) is contributed by Coal based thermal power stations. This includes old thermal units commissioned way back in 1970s or even earlier, which have already outlived their useful life, and also those commissioned in early 1980s.

The following Tables give the status of Power Supply Position in various Regions of the country during the period from April-2015 to March-2016. Despite the installed capacity of more than 3 lakhs MW, there have been shortages in the Peak Demand and energy.

**Table: 1.1** Peak Demand and Peak Met (April-2015 to March-2016)

| S. No. | REGION               | PEAK DEMAND    | PEAK MET       | Surplus (+)/Deficit (-) |             |
|--------|----------------------|----------------|----------------|-------------------------|-------------|
|        |                      | MW             | MW             | MW                      | %           |
| i      | Northern Region      | 54474          | 50622          | -3852                   | -7.1        |
| ii     | Western Region       | 48640          | 48199          | -441                    | -0.9        |
| iii    | Southern Region      | 40445          | 39875          | -570                    | -1.4        |
| iv     | Eastern Region       | 18076          | 17972          | -104                    | -0.6        |
| v      | North Eastern Region | 2573           | 2367           | -206                    | -8.0        |
|        | <b>ALL INDIA</b>     | <b>153,366</b> | <b>148,463</b> | <b>-4,903</b>           | <b>-3.2</b> |

*Source: Central Electricity Authority (CEA). Lakshadweep and Andaman & Nicobar Islands are stand-alone systems, power supply position of these, does not form part of regional requirement and availability.*

It is observed that there was Peak Deficit in all the Regions ranging from 0.6% to 7.1%. The deficit in Northern, Southern and North Eastern Regions was remarkably high compared to other Regions.

**Table: 1.2** Power Supply Position (April-2015 to March-2016)

| S. No. | REGION          | REQUIREMENT | AVAILABILITY | Surplus (+)/Deficit (-) |      |
|--------|-----------------|-------------|--------------|-------------------------|------|
|        |                 | MU          | MU           | MU                      | %    |
| i      | Northern Region | 340,488     | 324,021      | -16,467                 | -4.8 |
| ii     | Western Region  | 346,650     | 345,848      | -802                    | -0.2 |
| iii    | Southern Region | 288,004     | 283,473      | -4,531                  | -1.6 |

|    |                      |                  |                  |                |             |
|----|----------------------|------------------|------------------|----------------|-------------|
| iv | Eastern Region       | 124,608          | 123,635          | -973           | -0.8        |
| v  | North Eastern Region | 14,487           | 13,736           | -751           | -5.2        |
|    | <b>ALL INDIA</b>     | <b>1,114,235</b> | <b>1,090,713</b> | <b>-23,522</b> | <b>-2.1</b> |

*Source: Central Electricity Authority (CEA). Lakshadweep and Andaman & Nicobar Islands are stand-alone systems, power supply position of these, does not form part of regional requirement and availability.*

While efforts are being made to develop maximum capacity through Central/State Power Sector Undertakings, large capacity additions through Private sector are also envisaged. Though there is full effort both at State and National level to develop new power projects, the R&M of old thermal units is also a cost effective option to bridge the gap in the power supply in the country.

## 1.2 Renovation & Modernization (R&M)

The objective of Renovation & Modernization (R&M) of thermal power plants is to equip the operating units with latest modified & augmented technology equipment/systems with a view to improve their performance in terms of output, reliability, efficiency and availability, reduction in maintenance requirements, ease of maintenance and minimizing inefficiencies. The R&M Programme is primarily aimed at Generation sustenance and overcoming problems such as rise in Heat Rate, Specific Coal Consumption & Auxiliary Consumption and reduced Gross Generation & PLF etc. The Life Extension (LE) Programme is meant for operation of the plant beyond their original Designed Life, after carrying out life assessment studies of critical components. R&M Programme was initiated in 1984 as a centrally sponsored programme during 7<sup>th</sup> Plan and the programme continued during the two Annual Plans 1990-91 & 1991-92. The R&M works continued during the 8<sup>th</sup> & 9<sup>th</sup> Plan. However the same could not be sustained during 10<sup>th</sup> Plan.

Central Electricity Authority (CEA) has prepared a National Perspective Plan for execution of Renovation & Modernization (R&M) and Life Extension (L.E.) works at various State owned Thermal Power Stations in the country. The document in this respect was released by Honorable Minister of Power on 14.12.2009 on the occasion of Energy Conservation Day. The above said Perspective Plan provides for rehabilitation of the old thermal power units with an objective of Efficiency Enhancement, Life Extension, Up-rating and reduction in Greenhouse Gases, emissions by through modification and technology up-gradation. The table gives out the status of R&M and Life Extension up to 11<sup>th</sup> Plan Period.

**Table 1.3: Renovation and Modernization (R&M) and Life Extension Programme (LEP) from 7<sup>th</sup> Plan onwards till 11<sup>th</sup> Plan**

| S. No. | Five Year Plan       | No. of Units | Capacity (MW) | Additional Generation Achieved MU/Annum | Equivalent MW* |
|--------|----------------------|--------------|---------------|---|----------------|
| 1      | 7 <sup>th</sup> Plan | 163          | 13570         | 10000                                   | 2000           |

|   |  |                      |       |       |      |
|---|--|----------------------|-------|-------|------|
| 2 | 8 <sup>th</sup> Plan<br>(R&M)<br>(LE)  | 198<br>(194)<br>(4)  | 20869 | 5085  | 763  |
| 3 | 9 <sup>th</sup> Plan<br>(R&M)<br>(LE)  | 152<br>(127)<br>(25) | 18991 | 14500 | 2200 |
| 4 | 10 <sup>th</sup> Plan<br>(R&M)<br>(LE) | 25<br>(14)<br>(11)   | 3445  | 2000  | 300  |
| 5 | 11 <sup>th</sup> Plan<br>(R&M)<br>(LE) | 72<br>(59)<br>(13)   | 16146 | 5400  | 820  |

Source: *Quarterly Review Report-Renovation and Modernization of Thermal Power Stations (January-March; 2016), CEA.*

*\*Equivalent MW has been worked out assuming PLF prevailing during that period*

For the 12<sup>th</sup> Plan, 70 units with total capacity of 12066 MW for L.E. works and 65 Units with a total capacity of 17301 MW for R&M works have been identified as reflected below.

**Table 1.4:** Renovation and Modernization (R&M) and Life Extension Programme (LEP) for 12<sup>th</sup> Plan (2012-2017)

| S. No. | Category | No. of Units Identified | No. of Units Achieved | Capacity Identified (MW) | Capacity Achieved (MW) |
|--------|----------|-------------------------|-----------------------|--------------------------|------------------------|
| 1      | LE       | 70                      | 18                    | 12,066                   | 2131.76                |
| 2      | R&M      | 65                      | 11                    | 17,301                   | 2060.50                |
| 3      | Total    | 135                     | 29                    | 29,367                   | 4192.26                |

Source: *Quarterly Review Report-Renovation and Modernization of Thermal Power Stations (January-March; 2016), CEA.*

### 1.3 Coal Fired Generation Rehabilitation Project

The World Bank has financed the “Coal-Fired Generation Rehabilitation Project-India” for demonstrating Energy Efficiency Rehabilitation & Modernization (EE R&M) at coal fired generating units through rehabilitation of 640MW of capacity across three States- West Bengal, Maharashtra and Haryana. The project would also try to address the critical barriers to large scale Energy Efficiency R&M in India. The project is funded through IBRD Loan of USD 180 Million and GEF grants 45.4 million out of which 7.5 million have been earmarked to technical assessment/studies. The project has two components viz.

- Component-1: Energy Efficiency R&M Pilot Projects
- Component-2: 7.5 million USD have been earmarked for Technical Assistance to address Critical Barriers to EE R&M. The sub-components for the technical assistance program (Component 2) would cover:



- i) Support for design of Energy Efficient R&M projects
- ii) Support for implementation of demonstration of EE R&M investments funded under Component-1 of the project
- iii) Support for addressing barriers to implement EE R&M projects in India
- iv) Support for strengthening of institutional capacities of the generation utilities and other relevant sector entities.

#### **1.4 Technical Assistance Project for Addressing Barriers to Implementation of R&M in India**

Under the sub-component (iii) of the component-2 (Technical Assistance) around US\$ 1.1 million of GEF Grants are being made available to provide technical support to CEA aimed at addressing barriers to implementation of R&M in India. This component was to be implemented through the Central Electricity Authority through appointments of Consultants including Implementation Support Consultant (ISC) to carry out following studies.

- i) Review of Institutional Capacity and Implementation of Capacity Strengthening Interventions at CEA
- ii) Reduction of barriers to R&M interventions in thermal power plants in India
- iii) Developing markets for implementation of R&M scheme in thermal power stations in India
- iv) Review of experience from Pilot R&M interventions in thermal power stations in India

CEA engaged WAPCOS Ltd on 23.07.2012 for undertaking study on “(iv) Review of experience from Pilot R&M interventions in thermal power stations in India”. The objective of the study is sharing of experience mainly in procurement, implementation and improvement in performance parameters in Pilot R&M projects and other R&M/LE projects taken up during 11<sup>th</sup> plan and 12<sup>th</sup> plan.

The study covered the following activities.

- a) Review of Procurement Experience including preparation of DPR, Bidding documents, etc.
- b) Review of R&M Implementation Experience
- c) Review of Experience in Strengthening of O&M Practices
- d) Review of Post-R&M Experience in O&M
- e) Dissemination of Learnings from Pilot R&M Interventions

#### **1.5 Objective of the Assignment**

The objective of this study is to present the procurement experience of the said utilities. It reviews the procurement process including the firm who did the DPR/Feasibility study, qualification requirement of bidders both in terms of technical as well financial, firms who purchased the bidding documents, associated liquidated damages, guaranteed project schedule etc. It also indicates the problems/challenges faced by different utilities including reasons for delay during the procurement process for R&M works. In the report all the above aspects are highlighted which would help the other power plants which are planning to go for R&M of old units in future, this would help and guide them in saving time and money.

## 1.6 Scope of Work of the Assignment

The detailed scope of work to be undertaken is provided below:

- a. To analyze and review the procurement experience in awarding R&M works for Pilot R&M projects funded by the World Bank and KfW. To look into the DPR, Bidding documents, Qualification Requirements, Performance Guarantees and Project Schedule. Also to review the Evaluation Criteria including Project Schedule and Performance Parameters and the impact of these on the overall level of competition and price bid discovery. For review of the procurement experience, to cover all the R&M related procurement activities completed till May 2014 at the identified thermal power stations as part of study.
- b. To carry out analysis of bidding process followed by the concerned Power Generating companies in selection and procurement of consultants / suppliers to undertake the required R&M interventions. Also to analyze and review the key steps undertaken to ensure competitiveness in the bidding process and suggest the possible options to improve the competitiveness in the bidding process.
- c. To examine the various other factors that may have affected the procurement outcome at the Pilot R&M Projects of World Bank and KfW; and also analyze the problems faced while finalizing the contract(s) for Pilot R&M Projects.
- d. To visit the selected thermal power stations to collect and compile the relevant information and document to undertake the desired review and analysis.
- e. To prepare and submit a report on learnings from the procurement experience from the Pilot R&M Projects of the World Bank and KfW projects for dissemination purposes for future R&M projects.
- f. The review exercise will be limited to the thermal power stations as mentioned in the attached list of projects as Annexure I.

List of thermal power stations considered for Review of Procurement Experience as per Annexure-I of TOR, Contract Ref. No. WBR11 (GEF/CEA) dated 23.07.2012 and CEA's letter dt. 21.11.2012 visited by WAPCOS Team of Experts during the period September-2012 to May-2013 is given below:-

**Table 1.5:** List of Thermal Power Stations

| S. No. | Name of Thermal Power Station (TPS)                       |
|--------|---|
| 1.     | Panipat Thermal Power Station, HPGCL, Haryana             |
| 2.     | Kothagudem Thermal Power Station, APGENCO, Andhra Pradesh |
| 3.     | Bandel Thermal Power Station, WBPDCL, West Bengal         |
| 4.     | Amarkantak Thermal Power Station, MPPGCL, Madhya Pradesh  |
| 5.     | Koradi Thermal Power Station, MSPGCL, Maharashtra         |
| 6.     | Badarpur Thermal Power Station, NTPC, New Delhi           |
| 7.     | Nasik Thermal Power Station, MSPGCL, Maharashtra          |



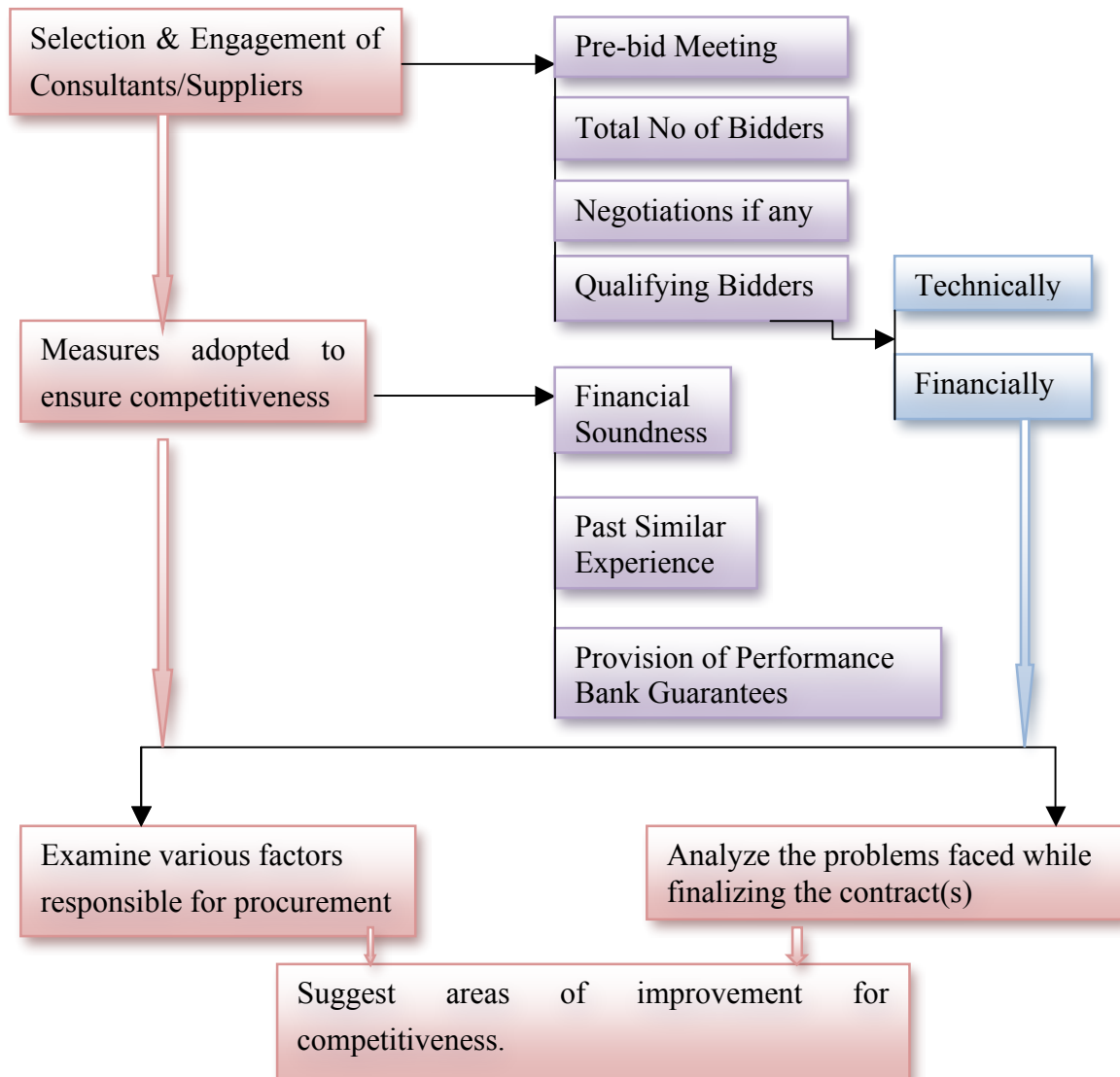
## Chapter-2

### Approach and Methodology

#### 2.1 Approach & Methodology

The available documents were obtained from the concerned utilities with the help of CEA. Subsequently a Questionnaire was also developed for collecting the relevant information. The available documents/information thus collected from the Utilities, were then scrutinized to prepare the Review Report.

Analysis/Review of the Bidding Process is given below in the form of flow chart:



The Teams of Experts have undertaken the following assignments:

- i. Review of Procurement Experience including preparation of DPR, Bidding documents, etc.
- ii. Site visits to Thermal Power Stations
- iii. Interactions with the concerned Project Authorities and collection of relevant Data/information.
- iv. Preparation of Draft Report on Review of Procurement Experience.

### 2.3 Dissemination of Learning from Pilot R&M Projects and other R&M Projects

WAPCOS in association with CEA conducted a workshop in Delhi on 03<sup>rd</sup> February, 2017 for sharing of experience with different stakeholders on R&M activities carried out at Pilot R&M projects and other R&M Projects which was attended by authorities from various utilities and firms like CEA, CERC, World Bank, WBPDC, HPGCL, MSPGCL, NTPC, PSPCL, UPRVUNL, GSECL, MPPGCL, KPCL, RRVUNL, OPGC, BHEL, KBUNL and ABPS Infra Ltd.

### 2.4 Site Visits to Thermal Power Stations

Dates of visits to the designated thermal power stations are given as under:-

**Table 2.1:** Site Visits of TPS with Dates

| S. No. | Unit No | Capacity (MW) | Name of Thermal Power Station | Name of Utility/ State  | Date of Visit   |
|--------|---------|---------------|-------------------------------|-------------------------|---|
| 1.     | 6       | 1x210         | Koradi TPS                    | MSPGCL, Maharashtra     | 21.03.2013 to 23.03.2013 & 26.10.2015 to 30.10.2015                           |
| 2.     | 5       | 1x210         | Bandel TPS                    | WBPDC, West Bengal      | 28.01.2013 to 30.01.2013, 05.10.2015 to 09.10.2015 & 03.08.2016 to 05.08.2016 |
| 3.     | 1 & 2   | 2x110         | Panipat                       | HPGCL, Haryana          | 27.09.2012 to 29.09.2012 & 14.09.2015 to 16.09.2015                           |
| 4.     | 4&5     | 2x210         | Badarpur                      | NTPC                    | 25.04.2013, 22.10.2013, 08.10.2015 & 13.11.2015 07.09.2016 & 08.09.2016       |
| 5.     | 6,7&8   | 3x110         | Kothagudem                    | APGENCO, Andhra Pradesh | 09.01.2013 to 13.01.2013 & 12.10.2015 to 16.10.2015                           |
| 6.     | 3       | 1x210         | Nasik TPS                     | MSPGCL, Maharashtra     | 02.05.2013 to 04.05.2013  |
| 7.     | 1 & 2   | 2x120         | Amarkantak                    | MPPGCL                  | 04.03.2013 to 05.03.2013 & 21.09.2015 to 25.09.2015                           |

## Chapter-3

# General Procurement Procedures

### 3.1 Stages for Implementing of R&M Project

R&M project is implemented in several stages, which are included in the following points.

#### i. Early R&M Planning:

The units, which require Renovation & Modernization, are identified based on key performance parameters. Key parameters such as PLF, Auxiliary Consumption, Fuel Consumption and Emissions etc. are regularly monitored. During early planning process, R&M project needs to be considered as part of the power system and the corporate strategy. The implementation of the R&M project needs to be justified as least-cost development plan.

#### ii. R&M Project Assessment and Preparation:

During this stage, R&M project scope is defined keeping in view available data, conducting specialized testing and analysis, RLA/LE studies and cost-benefit analysis. Thermal power plant equipments are designed for about 25 years of operation as these are working under high Temperature and Pressure, which leads to metallurgical deterioration of the metals after prolonged operation. Apart from this, there may be early failures due to deviations in operation practices. As such, before undertaking any preparation of R&M project, assessment of the extent of equipment ageing/deterioration/residual life etc. needs to be made for which following studies/tests are conducted.

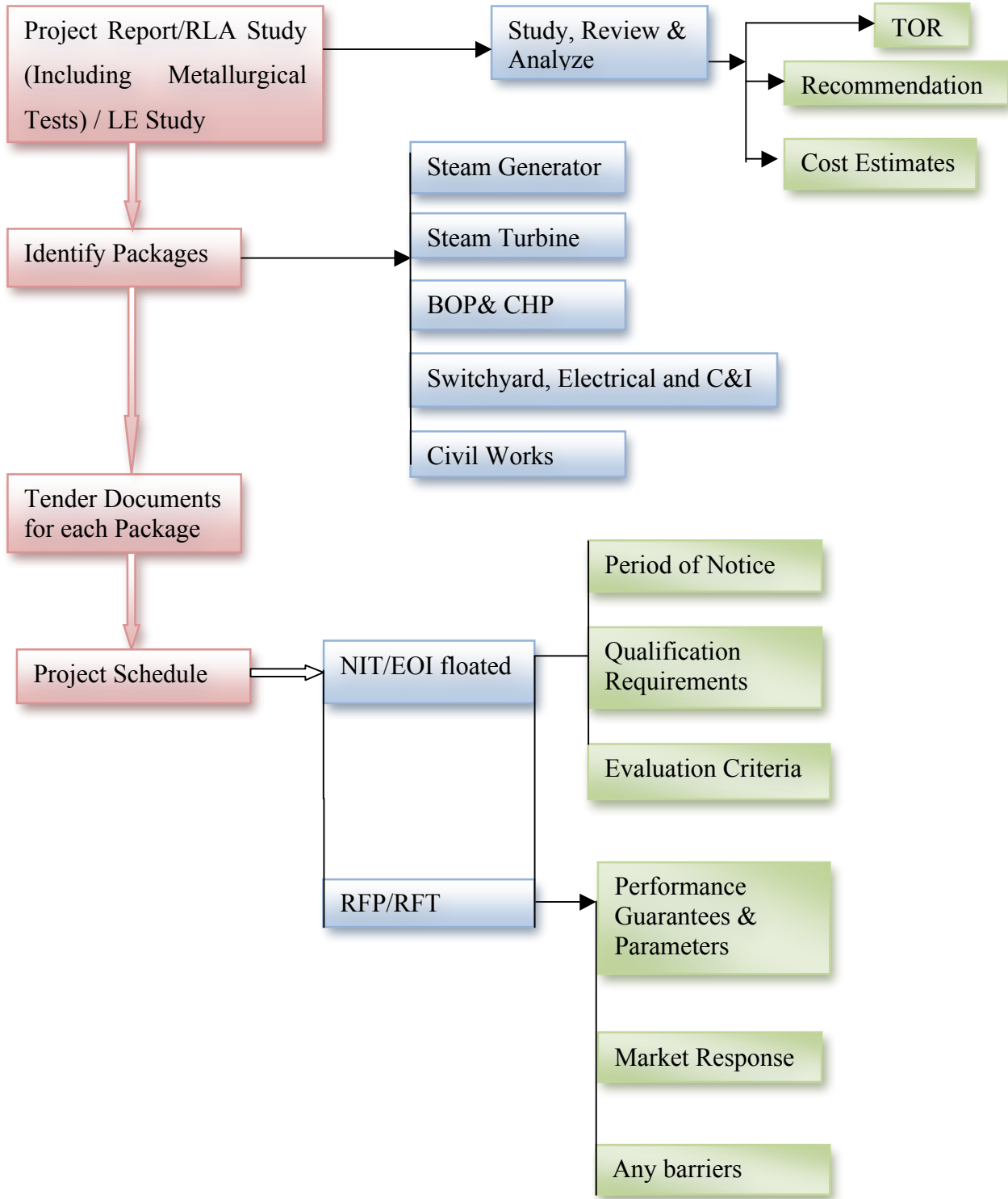
- a) RLA (Residual Life Assessment)
- b) LE (Life Extension)
- c) Energy Audit
- d) Condition Assessment
- e) Past History of the Plant

Based on above studies, scope for R&M project is prepared

#### iii. Development of Procurement Strategy:

After defining the scope of R&M project, design specifications and different packages are decided. It covers tendering, pre-bid meetings, evaluation of technical and commercial bids, negotiation proceedings and finally award of work to suppliers/manufacturers. In some cases R&M works are awarded to the Original Equipment Manufacturers.

The procedure generally adopted by various utilities for procurement is given below in the form of below Flow Chart.



#### iv. **R&M Project Implementation:**

The following activities are carried out for implementation of R&M Projects:

- a) Ordering of material required for R&M works
- b) Inspection of material
- c) Receipt of material at site
- d) Planning of Unit shutdown
- e) Monitoring and execution of work

### 3.1 **Type of Contract**

Procurement strategy is entirely based on the scope and requirements of the project, the requirements of the financing institutions and potential regulatory requirements/constraints. The development of the procurement strategy is discussed in the following paragraphs:

#### i. **EPC Contract**

As the name stands for, EPC contract includes all the activities connected with Engineering, Procurement and Construction, which are combined together. This contract is awarded to a single contractor who is responsible for the entire Project. However, EPC contract price is usually higher than the sum of individual contracts in view of uncertainty in the scope. As such the EPC contractor has to load risk factors into the price of the contract to account for the unforeseen surprises after opening the boiler or the steam turbine.

#### ii. **Engineering, Procurement and Contract Management (EPCM)**

EPCM entails hiring an engineering company to evaluate and develop design specifications, issue RFPs, select qualified suppliers and assist in developing commercial contracts. It is a better option than EPC since it accommodates surprises and risks.

- a. Material is also procured from Original Equipment Manufacturers (OEMs) when engineering support offered by the OEMs is considered adequate to address the issues associated with R&M/O&M projects.
- b. Partnership Agreement
  - i) This agreement between the power company and an equipment supplier covers multiple units and power plants. The supplier offers a price, which may be negotiated.
  - ii) Individual contracts for multiple packages are another option.

### 3.2 **Contract Packages**

There are two options for execution of R&M projects as under:

#### i. **Single Contract:**

Under EPC/EPCM, both Single and Multiple contracts are feasible. However in case of Multiple Contracts, it is difficult to integrate all the packages into one system. The integration risk can be reduced with careful planning and multiple packages (either in EPC or EPCM procurement).



## ii. Multiple Contract:

Multiple Contracts can be divided into following Packages:

- a. Steam Turbine and Boiler separately.  
OR  
Boiler-Turbine-Generator (BTG) as one package
- b. BoP (Balance of Plant)
- c. ESP
- d. Coal Handling Plant
- e. Ash handling Plant
- f. Water Treatment Plant
- g. Electrical & C&I
- h. Civil

## 3.3 Contract Guarantees

The following Guarantees could be laid down under the Contracts:

- i. Maximum Continuous Rating (MCR) of Steam flow and Power output (MW)
- ii. BTG efficiency or separate efficiency of the three components of the BTG i.e. Boiler, Steam Turbine and Generator
- iii. Auxiliary Power Consumption
- iv. Fuel Consumption (Both Coal and Oil)
- v. Availability guarantee for the first one or two years of operation. However, this may not be feasible since the plant availability is also affected by plant operation practices

If unit output and station Heat Rate are specified, guarantee for MCR of steam flow may be skipped. There could be more parameters for which guarantees are necessary, like, ppm level at ESP outlet, Flue gas exit temperature, unburnt carbon in ash, etc.

## 3.4 Tendering Procedures

After preparation of the tender document, a suitable tender procedure is adopted. The various tendering procedure are as described below:

### a. Single Stage Two Envelope Tendering Procedure (without pre-qualification)

Under this procedure, bidders are required first to submit their technical bid. The technical bids are opened in public at the appointed date and time. The technical bids are evaluated and discussed with the bidders. Any deficiencies or any technical features are pointed out to the bidders who are allowed to give clarifications on their technical bids to meet the requirements. After receipt of clarifications, the evaluation of technical bids shall be done. Bidders who are unable or are unwilling to bring their bids to the acceptable technical standard are rejected as non-responsive bidders. After completing the evaluation of technical bids, price bids of the technically qualified



bidders are opened in public at the appointed date and time. The price bids are evaluated and the contract is awarded to the lowest evaluated responsive bid.

OR

Alternatively, the evaluation of bids can be done on QCBS (Quality & Cost Based System) through which contract can be awarded on the basis of cumulative evaluation of both technically qualified bids weightage as well as price bid weightage.

**b. Two Stage Tendering Procedure**

The Borrowers receiving funds from the World Bank follow this Procedure. These have been prepared by the World Bank to be used for procurement of goods through International Competitive Bidding (ICB) in projects that are financed in whole or in part by the World Bank. They are consistent with the Guidelines for Procurement under IBRD Loans and IDA Credits. These Bidding Documents for Procurement of Goods, assumes that no prequalification has taken place before bidding. In certain cases, it may be impractical to prepare complete Technical Specifications in advance such as Contracts for:

- i. Large complex facilities awarded as single responsibility/turnkey contracts for the design, supply and installation,

OR

Single responsibility contracts for the supply and installation of a facility or plant;

- ii. Works of a complex and special nature;

OR

Complex information and communication technology that are subject to rapid technology advances,

Due to the complex nature of such contracts and in order to avoid deviations from the Borrower's specifications, the World Bank [or any other International Lending Agency] may require the use of a two-stage bidding procedure. In the First Stage, un-priced technical proposals on the basis of a conceptual design or performance specifications are invited, subject to technical as well as commercial clarifications and adjustments, to be followed by amended bidding documents and the submission of final technical and priced bids in the Second Stage.

**c. Prequalification of Bidders**

Prequalification is usually necessary for large or complex works, or in any other circumstances in which the high costs of preparing detailed bids could discourage competition. This also ensures that invitations to bid are extended only to those who have adequate capabilities and resources. Prequalification shall be based entirely upon the capability and resources of prospective eligible bidders to perform the particular contract satisfactorily, taking into account objective and measurable factors, including:

- i. Relevant general and specific experience, and satisfactory past performance and successful completion of similar contracts over a given period



- ii. Financial position
- iii. Where relevant, availability of construction and/or manufacturing facilities

### **3.5 Qualification Requirements**

Different Qualification Requirements are followed by the Utilities. Generally the following aspects are considered:

- i. Technical knowledge and experience in the field
- ii. Regular manufacturer and supplier for the required material
- iii. Financial stability to execute the works
- iv. Average annual turnover and availability of liquidity for the last 3-5 years
- v. Organization to support the execution of works
- vi. Quality assurance systems
- vii. Documents supporting Bidder's eligibility and qualification

### **3.6 Criteria for Evaluation of Bids**

The Procedure and Criteria for evaluation of the bids vary among the Utilities. Broadly the following considerations are taken into account:

- a. Qualification requirements
- b. Any Commercial or Technical deviations.
- c. Work schedule
- d. Guaranteed Parameters.
- e. Price Escalation
- f. Price bid evaluation

### **3.7 Scope Surprises**

There are almost always diversions, usually additions to the scope of an R&M Project. The following steps could be considered for addressing the surprises:

- a. Scope adjustments below and above a certain value may be clearly specified
- b. Source of Finance for such scope changes to be laid
- c. Prepare a list of the potential additional scope and the means to address them



## Chapter-4

### Procurement Experience

WAPCOS Team of Experts visited various Thermal Power Stations listed in TOR, starting from 09/2012 till date and held discussions with the concerned Authorities and collected relevant data regarding their Procurement Experience in awarding the R&M works. A Check List/Questionnaire was also subsequently prepared and supplied to the Project Authorities to give additional data/information. The Questionnaire covered the following:

- i) Name of firm who carried DPR/Feasibility study
- ii) Brief details of these reports
- iii) Name of firms to whom Bidding documents for R&M works were sent.
- iv) Qualification requirements of Bidders may be given as per both technical and financial bids.
- v) Name of packages with corresponding names of firms to whom contracts were awarded.
- vi) What were the Financial Guarantees & Associated Liquidated Damages for major packages
- vii) Guaranteed project schedule and associated liquidated damages
- viii) Performances parameters asked for with no LDs
- ix) Nature of contract, whether fixed price or with price escalation
- x) Problems faced during bidding process, if any
- xi) Key steps undertaken to analyze the problems faced while finalizing the contracts(s) for Pilot R&M projects may be elaborated suitably.
- xii) The information/data regarding the key steps undertaken to ensure competitiveness in the bidding process.
- xiii) Complete Cost of Project with possible breakups. Whether it was as stipulated or was high/low. The reasons for the same.
- xiv) Technical surprises if any, encountered during the execution of R&M works, with their cost.”

The Team conducted the analysis and review of various aspects of procurement as discussed plant-wise in the following paragraphs.

#### 4.1 Unit # 1 & 2 (2x110 MW) Panipat TPS, Haryana

WAPCOS Team of Experts visited Panipat Thermal Power Station (PTPS) from 27.09.2012 to 29.09.2012 and again from 14<sup>th</sup> to 16<sup>th</sup> September 2015 and held discussions with the Chief Engineer, PTPS-1, Superintending Engineer/ R&M, Executive Engineer and their subordinate engineers regarding their procurement experience in awarding the R&M works. It was brought

out by the Project Authorities that their procurement experience in respect of R&M works was not good in case of unit-1, as they had to make extra payments even for petty items, not laid out in the original contract. Further in respect of unit-2, the Project Authorities had to take procurement action in respect of un-finished works by ABB which led to delay in execution and hence increase in cost of R&M works.

The Haryana Power Generation Corporation (HPGCL) operates 4x110 MW (Stage I & II) Thermal Power Station at Panipat. Out of these four units, unit-1 was commissioned on 01.11.1979. HPGCL engaged Utility Powertech Limited (A joint venture of BSES & NTPC, Noida) for carrying out the R&M, LE and RLA Study of unit-1 so as to achieve the Life Extension for the next 15-20 years at the rated parameters.

LE and RLA Testing, and Condition Assessment of unit-1, was carried out using state of the art testing equipments, techniques and well established engineering methodology/practices. The Unit#1 was under shutdown for capital overhauling, retrofitting/replacement of Coal Feeders, Coal Mills, PA Fans, Burners etc. and LE/RLA Study from November-December, 2001.

The R&M work of unit-1 was awarded to M/s. BHEL on turnkey basis, being OEM which included procurement of equipments and material also. The R&M work of unit-2 was awarded to M/s. ABB through ICB. But they did not complete the work and left in-between. The pending works were got completed from M/s. BHEL as they were OEM.

#### 4.1.1 Unit # 1 (110 MW)

##### a. Review of Procurement Experience

Broad Scope of supply for R&M works are given below:-

##### i. Boiler & Auxiliaries:

Material required for replacement of Economizer tubes, Water Wall up to 37m elevation, Buck Stays, Front & Rear side Steam Cooled wall, Ceiling Super Heater (SH), LTSH, Platen SH and final SH, Re-Heater, Soot Blower system, SH/RH Spray Control valves, Feed Control valves, provision of additional oil elevation, furnace insulation, Refurbishment of Critical piping and replacement of Russian type Actuators etc.

##### ii. Turbine, Generator & Auxiliaries:

Material required for uprating of Turbine to 117.8MW by modification of inner Casings and Rotors of Impulse type HP, IP and LP Turbines to suit Reaction type Blading, provision of additional HP Evacuation Valves, HP/LP Seal Steam valves, Barring gear system etc. Re-coring & Rewinding of Generator Stator, Rewinding of Rotor, Replacement of Static excitation system, Diaphragm valves and Regulating valves etc. Replacement of tubes of HP Heater 1 & 2 and LP heaters 1 & 2, Hydrogen coolers, Level control valves/Actuators, Overhauling of BFP Hydraulic couplings with modified cartridges and other pumps & motors, Replacement of valves, critical piping insulation etc.

##### iii. Control & Instrumentation:

Material required for replacement of old C&I system for Boiler & Turbine with Max DNA (BHEL make DCS) microprocessor based electronic system & man machine interface,

replacement of regulating Actuators for auto loops in Boiler & Turbine controls, UPS & Batteries, Annunciation system, soot blowing system, FSSS, SADC and Turbo supervisory system etc.

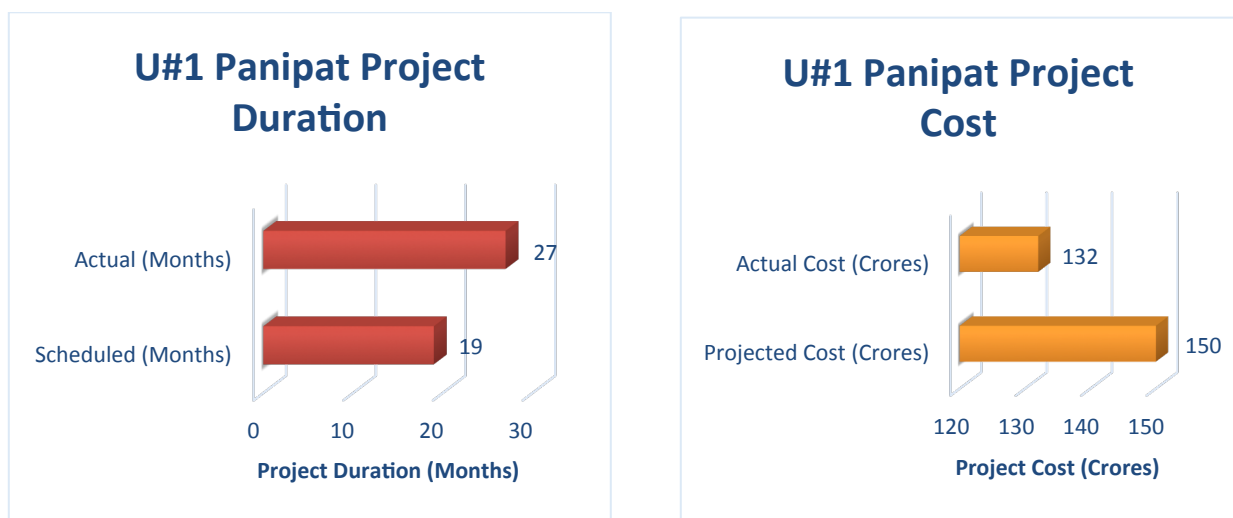
**iv. Balance of Plant:**

Refurbishment/Augmentation of Fuel oil handling system, Renovation of Ash Handling Plant, Overhauling of CW/BCW system, Provision of new Compressors, Debris Filter and Oil Line Tube Cleaning system, Refurbishment of Air conditioning & ventilation system with additional 2x20 Ton Air conditioning, Refurbishment of firefighting system, Overhauling of DM plant, Servicing/Overhauling of 6.6kV Switchgear, HT & LT motors, Replacement of old cables etc.

**b. Liquidated Damages for Delay**

Supplies were to be made in a phased manner to match the unit commissioning schedule. Subject to force majeure conditions, if the Contractor failed to attain the commissioning of main plant of Unit-1, PTPS, Panipat in accordance with the time schedule fixed in the Contract for completion, the Contractor was liable to pay liquidated damages at the rate of 0.25% of the contract price of the main plant of the unit for each completed week or part thereof such delay but the amount of such liquidated damages were not, in any case, to exceed 5% of the contract value of main plant of the unit. For BoP, LD was to be computed separately based on individual prices of concerned BoP system and was not to be linked with the unit price.

The Figure 4.1 below depicts the comparison of Project Duration [Actual versus Schedule] & Project Cost [Actual versus Projected]. The R&M Work of Unit#1 was awarded to BHEL on turn-key basis being OEM, with time schedule of 19 Months. But the work was actually completed in 27 Months due to some technical surprises. Further the project cost for the Unit was Rs.150/- Crores but actual cost came out to be Rs.132/- Crores.



**Figure 4.1:** Project Duration and Cost of Unit#1 Panipat TPS

**c. Performance Guarantee Parameters**

BHEL had to conduct testing to prove the following Guaranteed Performance, details of which were given in BHEL offer no. PS-SSBG: PPIB: HPGCL dated 05.07.2005.

|  |   |                |
|--|---|----------------|
| a. Turbine Generator Maximum Continuous Rating | : | 120MW          |
| b. Boiler MCR capacity                         | : | 375 Ton/Hr.    |
| c. Turbine Heat Rate                           | : | 2018 kCal /kWh |
| d. Boiler efficiency                           | : | 86%            |
| e. Unit availability                           | : | 90%            |

The PG test was conducted by BHEL and proved guaranteed performance achieved.

**d. Liquidated Damages for Performance**

After full loading of unit and stabilization, PG test was to be conducted within 2 months of first synchronization and all the guarantees related to performance of the unit were also to be checked. In case the contractor failed to achieve the guarantees, penalty was to be levied by the owner as mentioned below. For shortfall of guaranteed parameters by 1%, penalties leviable were as under.

|  |   |                                      |
|--|---|--------------------------------------|
| a. Shortfall in Turbine Heat Rate            | : | 0.5% of contract price of main plant |
| b. Shortfall in Boiler Efficiency            | : | 0.5% of contract price of main plant |
| c. Shortfall in output at Generator Terminal | : | 0.4% of contract price of main plant |
| d. Shortfall in Main Steam Flow              | : | 0.2% of contract price of main plant |
| e. Shortfall in Availability                 | : | 0.2% of contract price of main plant |
| Total  | : | 1.8% of contract price of main plant |

Overall penalties for shortfall in performance and delay in completion period taken together were not to exceed 12.5% of contract price.

**e. Analysis of Bidding Process followed in selection/Procurement of Consultants /Suppliers. Review of key steps undertaken**

Competitive bids were invited through Press Tender Enquiry No.1/R&M-216/2001, for 110MW Unit 1 for carrying out RLA studies & to provide key recommendations for R&M/L.E. works. Four firms submitted their offers, out of which, the work was awarded to M/s Utility Power-Tech Ltd NOIDA, who carried out RLA studies during November-December, 2001 & submitted DPR. However, for some reasons work of R&M/LE could not be processed thereafter.

It was finally in February, 2007 that the work of R&M/LE was awarded to M/s BHEL, who had to carryout RLA study again, for revalidating scope of work, as there was a gap of more than five years, since the last study. The work of R&M/L.E. was eventually completed in November, 2008. Thus, there had been undue delay in the execution of R&M/LE works.

**f. Analysis of various factors affecting the procurement outcome & the Problems faced in finalizing the contracts**

The cost of the project had increased as the Contractor demanded extra payments on account of petty items/works which were not clearly defined in the Purchase Orders/Work Orders.

**g. Resolutions**

- i. Purchase Orders/Work Orders should clearly provide and define the spares needed for R&M/LE.
- ii. Time of framing of RLA/LE study and time of execution need to be taken into consideration while defining the Scope of R&M/LE Works and arranging the requisite funds thereof.

**4.1.2 Unit # 2 (110 MW)**

**a. Review of Procurement Experience**

A contract was signed with M/s. ABB, German on 23.05.1997 by erstwhile HSEB for R&M works of 4x110MW units of PTPS, Panipat. The work of R&M of Unit 2 was started by M/s. ABB in January 1999 who did not complete the job and abandoned the unit in dismantled condition after terminating the contract unilaterally on 17.04.2000 because of contractual difference. The unit remained out of service for almost 3 years. The work for its revival was subsequently awarded to M/s. BHEL on 26.03.2002 and unit was revived in March 2003. List of left over work carried out by M/s BHEL is as under.

**i. Boiler:**

Erection of APH, uprating the capacity of milling system and retrofit of SADC system, replacement of RC feeders and pipes, PA fans and motors and related ducting, modification in wind box arrangement and coal piping.

**ii. Control & Instrumentation:**

Installation of Pro Control Panels and commissioning of Distributed Digital Control System.

**iii. Electrical:**

Replacement of existing MCC at raw water, CHM, DM plant, refurbishment of existing LT MCCs, replacement/rewiring of old TBs of various HT, LT panels, checking of healthiness of HT Bus Ducts, LT/HT power cables and motors.

**iv. Balance of Plant:**

Installation of ash slurry pumps with drives and repair of ash slurry pipelines, installation of Instrument Air driers [2 No's] and Debris Filter for CW system, installation of new Firefighting system with protections and alarms and installation of Chlorination plant.

**b. Performance Guarantees and Project Schedule:**

- i. The equipments were under warranty for a period of 12 Months from the Date of Commissioning.

- ii. All out efforts were to be made to run this unit at the original rated capacity.

Evaluation Criteria (Including Project Schedule & Performance Parameters) and the impact of these on the overall level of competition.

The R&M work of Unit # 2 was initially awarded to M/s ABB with schedule completion time of 8 Months, but they did not complete the job and left the R&M work, in-between due to contractual dispute. The Unit remained out of service for almost 3 Years, and its revival was subsequently awarded to BHEL. Thus total time for completion of R&M of the Unit#2 took 52 Months.

**c. Analysis of Bidding Process followed in selection / procurement of Consultants/Suppliers. Review of key steps undertaken**

In the case of Unit-2, the R&M/LE work got delayed due to breach of contract and the unit remained out of operation for about 5 years, resulting into large generation loss, as well as cost escalation of the R&M works. As such, the Contract should be well defined and provisions therein should be properly laid out to cover breach of contract.

**d. Analysis of various factors affecting the procurement outcome & the Problems faced in finalizing the contracts.**

The following problems were faced:

- i. RLA Study of Unit 2 was initially conducted by M/s ABB during 1998. However, they left the work due to breach of contract. The matter is still under arbitration. Later on the work against Single Tender vide LOI Dated 27.03.2002 was awarded to BHEL who completed the same on 10.03.2003.
- ii. Contractual Disputes between M/s ABB and HPGCL resulted into long implementation period.

**4.2 Unit# 6, 7 & 8 (3x110 MW) Kothagudem TPS, APGENCO, Andhra Pradesh**

WAPCOS Team of Experts visited Kothagudem Thermal Power Station from 09.01.2013 to 13.01.2013 and again from 12<sup>th</sup> to 16<sup>th</sup> October 2015 and held discussions with the Chief Engineer, Superintending Engineer, Executive Engineer and their Subordinate Engineers regarding their Procurement Experience in awarding the R&M/LE works. During discussions in the meeting it was gathered that all the four Units were running satisfactorily after the R&M/LE Works. The Authorities were fully satisfied with R&M works carried out by them.

Further, they were of the view that as far as possible the units should be refurbished to operate at the rated capacity. RLA studies of Unit No. 6, 7 & 8 were carried by M/s Power Plant Improvement Ltd. (PPIL) (Joint Venture of BHEL and Siemens AG Germany) and key recommendation were detailed in the DPR, where in, Turbo-Generator was proposed to be upgraded from 110 MW to 120 MW. R&M Works were awarded to BHEL, in different packages like BTG, BOP, C&I and Electrical etc.



#### 4.2.1 Procurement Procedure

The RLA study of all three units was conducted in June, 1995 but the zero date of R&M of Unit # 6 was 2<sup>nd</sup> October, 2001, for Unit # 7 it was 4<sup>th</sup> August, 2003 and for Unit # 8 it was 7<sup>th</sup> October, 2003. The time gap between RLA study and zero date of R&M was huge, since it took long time in preparing tender specification, furnishing clarifications to the firms, processing of offers and finalization of contract. Tender was floated on 15<sup>th</sup> March, 1996 to carry out the R&M. letter of Intent (LOI) was issued on 9<sup>th</sup> March, 1998 and purchase order no. GC2256 dated 7<sup>th</sup> August, 1999 was awarded to M/s. PPIL (Power Plant Performance Improvement Ltd.), as prime contractor and M/s. BHEL as the contractor. Agreement dated 20<sup>th</sup> July, 1999 was signed between BHEL, Siemens and PPIL wherein BHEL and Siemens had promoted PPIL as joint venture Company for carrying out plant performance improvement activities including R&M and Life Extension studies of fossil fuel Thermal Power Plant. To carry out the R&M of four units of Kothagudem TPS i.e. unit 5, 6, 7 & 8. Open tender was floated as single package, in which five companies purchased and participated in the Stage-I bidding process namely (a) M/s. BHEL, New Delhi (b) M/s. ABB, Hyderabad (c) M/s. Siemens Ltd., New Delhi (d) M/s. DLF Industries Ltd., Faridabad (e) M/s. Tata-TUA Power Plant Refurbishment Group, Mumbai. Three companies were selected for Stage-II bidding viz. (a) M/s. BHEL, New Delhi (b) M/s. ABB, Hyderabad (c) M/s. Siemens Ltd., New Delhi. Finally the project was awarded to M/s. BHEL. M/s. DLF Industries Ltd and M/s. Tata-TUA Power Plant Refurbishment Group were disqualified.

#### 4.2.2 Qualification Requirement of Bidders

Following documentary evidences were sought for prequalification of the companies.

- a. Profile of the company
- b. Net worth of the company
- c. Latest audited balance sheet
- d. Reference list giving details of similar works carried out
- e. Methodology of execution
- f. Completion period
- g. Source of procurement of additional equipment and spare
- h. Assessment of modification works that had to be carried out
- i. Loan schedules and schedule for submission of financial information indicating the amount in percentage for local and foreign loans

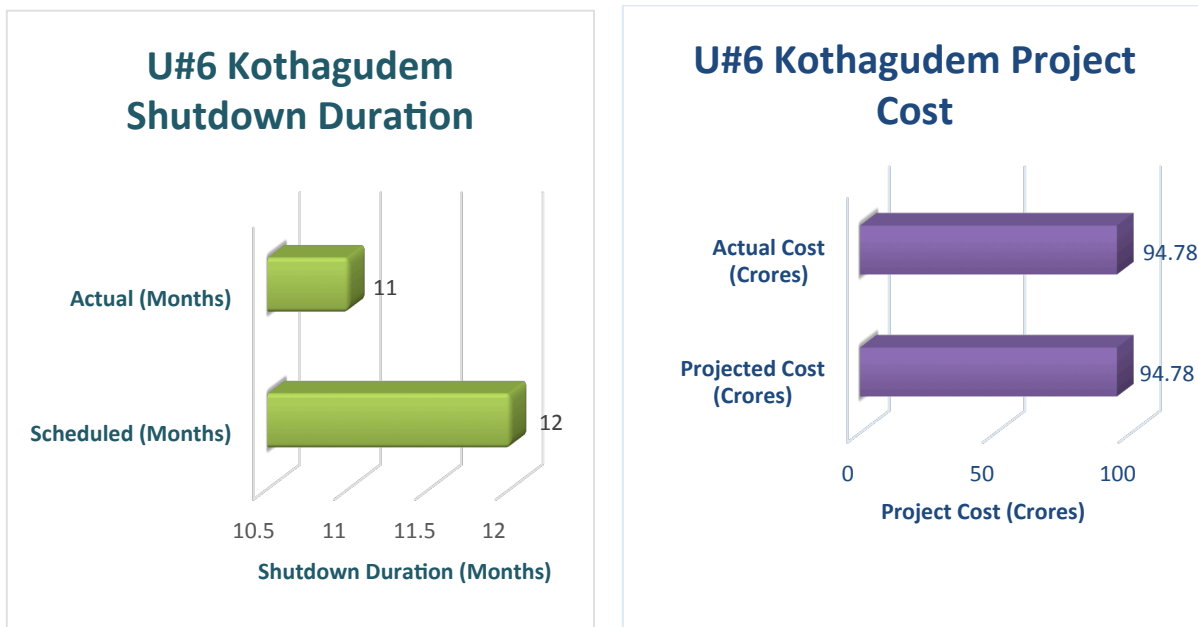
The bidders were required to deposit Earnest Money Deposit (EMD) of 0.5% of estimated cost of refurbishment or Rs. 10,00,000/- whichever was less in the form of Demand Draft to the employer as Security Deposit. The Contractor was asked to deposit Performance Guarantee of 10% value of the total contract price to the employer in the form of Bank Guarantee.

#### 4.2.3 Project Schedule and Project Cost

Tender was floated for all the Units on 15<sup>th</sup> March, 1996 for carrying out the R&M activities but the zero date of R&M of all the units was 07<sup>th</sup> August, 1999.

**a. Unit # 6**

- i. Scheduled Time:** The schedule time was fixed as per contract as 23 months bifurcated in Design and Supply (from zero date) -12 months, dismantling and erection- 10 months and start up and loading- 1 month. Thus, the scheduled time for dismantling, erection, start-up and loading was 11 months.
- ii. Actual time taken:** R&M work for Unit#6 was conducted during the period 02.10.2001 to 15.08.2002 i.e. 11 months. The lead period for unit-6 was 27 months.
- iii. Cost of Contract:** The cost as per the contract was Rs. 213.15/- Crores for Units # 5 and 6 and Rs. 106.58/- Crores per Unit on pro rata basis.
- iv. Actual Cost:** The actual cost incurred as on 25<sup>th</sup> May, 2005 was Rs. 379.12/- Crores for four Units and Rs. 94.78/- Crores per Unit on pro rata basis.



**Figure 4.2:** Project Schedule and Cost of Unit#6 of Kothagudem TPS

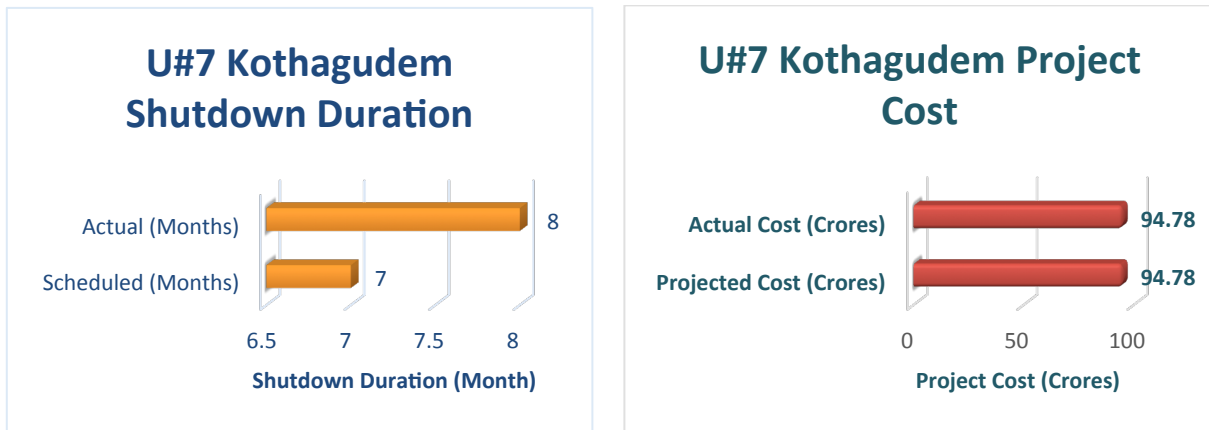
The work of R&M was awarded to BHEL for four Units of 110 MW each. For Unit#6, it was completed before schedule time and there was no cost overrun as also indicated in the above chart, which has been worked out for each unit on pro-rata basis.

**b. Unit # 7**

- i. Scheduled Time:** The schedule time was fixed as per contract as 13 months bifurcated in Design and Supply (from zero date) -7 months, dismantling and erection- 5 months and start up and loading- 1 month. Thus, the scheduled time for dismantling, erection, start-up and loading was 6 months.
- ii. Actual time taken:** R&M work for Unit#7 was conducted during the period 07.10.2003 to 16.05.2004 i.e. 8 Months. The lead period for unit-7 was 52 months.



- iii. **Cost of contract:** Rs. 379.12/- Crores for four Units (Individual cost of Unit was not provided by the utility) and Rs.94.78/- Crores per Unit on pro rata basis.

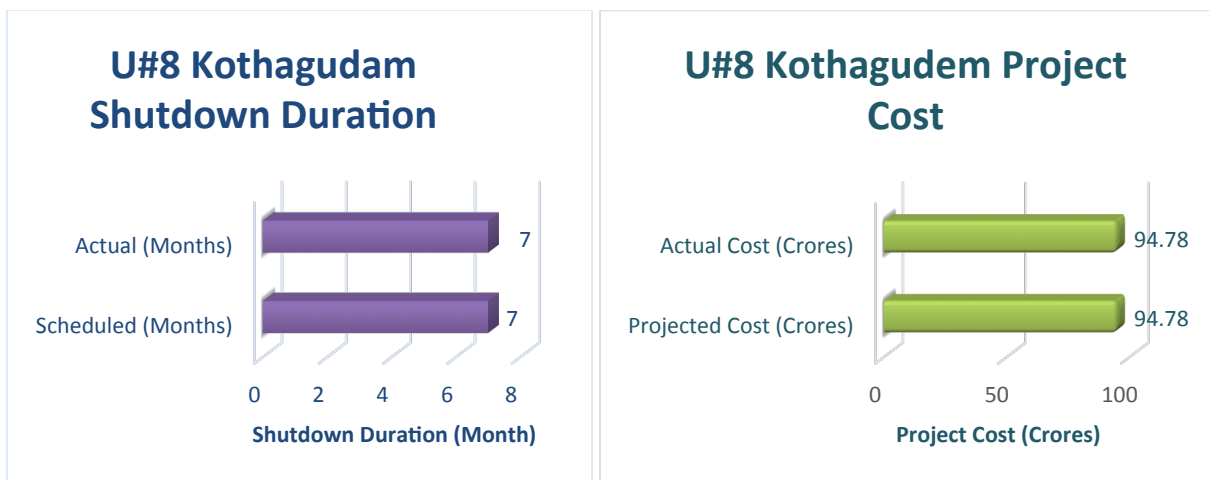


**Figure 4.3:** Project Schedule and Cost of Unit No #7 of Kothagudem TPS

The schedule period for completion of R&M works of Unit#7 was 7 Months, but was actually completed in 8 Months.

**c. Unit # 8**

- i. **Scheduled Time:** The schedule time was fixed as per contract as 13 months bifurcated in Design and Supply (from zero date) -7 months, dismantling and erection- 5 months and start up and loading- 1 month. Thus, the scheduled time for dismantling, erection, start-up and loading was 6 months.
- ii. **Actual time taken:** R&M work for Unit#8 was conducted during the period 04.08.2003 to 09.03.2004 i.e. 7 Months. The lead period for unit-8 was 49 months.
- iii. **Cost of contract:** Rs. 379.12/- Crores for four Units (Individual cost of Unit was not provided by the utility) and Rs.94.78/- Crores/Unit on pro rata basis.



**Figure 4.4:** Project Schedule and Cost of Unit # 8 of Kothagudem TPS

The scheduled period for completion of R&M works of Unit#8 was 7 Months and it was actually completed on schedule.

#### 4.2.4 Performance Guarantee Tests and Liquidated Damages

The main contractor and the subcontractor were to furnish a contract performance guarantee for 10% value of the total contract price as stipulated. The main contractor and the subcontractor were to guarantee the performance of the units after refurbishment, for a period of 12 calendar months commencing immediately on completion of successful PG testing of each unit.

Following are the Performance Guarantees which were asked by the utility from the contractor.

|                               |   |                       |
|-------------------------------|---|-----------------------|
| Turbo Generator MCR           | : | 120 MW                |
| Live Steam Flow               | : | 375 T/hr              |
| Turbine Heat Rate at 100% MCR | : | 1993.53 kCal/kWh      |
| Boiler Efficiency at 100% MCR | : | 86.46%                |
| Life extension of plant       | : | No less than 20 years |
| Plant Load Factor (PLF)       | : | 80% or better         |

The contractor was asked to deposit Performance Guarantee of 10% value of the total contract price to the employer in the form of Bank Guarantee. However, all the guaranteed parameters were achieved.

#### Liquidated Damages

The provision of LD was kept in the contract as Delay LD and Performance LD. In Delay LD, each equipment had to be made ready for operation not later than the date specified in the contract schedule. If the contractor failed to deliver any equipment covered under the contract by the date specified in contract then a sum was to be deducted from contract price equivalent to 0.5% of the contract price of each complete unit which could not be put into operation as a result of such delay in delivery of each calendar week of delay or part thereof unless the TPS extended the time schedule, subject to a maximum of 10% of the contract price. One more provision was included that if there was a delay in completion of any of the activities beyond the respective stipulated periods and if the delay was in excess of 15 weeks then it could cause the termination of the contract and forfeiture of the Performance Bond/Bank Guarantee. Such termination of contract had however not relieved the contractor of his liability to pay the LD which would have accrued had the supply been made on the date of termination of the contract.

Performance LD was set as upon completion of refurbishment of each unit, in case the prime contractor and/or contractor failed to achieve the guaranteed performance, penalty levied by the owner was as mentioned below. For deterioration of guaranteed parameters by 1%, the following penalties should be imposed.

|      |   |   |       |
|------|---|---|-------|
| i.   | For shortfall in Turbine Heat Rate            | : | 0.25% |
| ii.  | For shortfall in Boiler Efficiency            | : | 0.25% |
| iii. | For shortfall in output at Generator terminal | : | 0.20% |
| iv.  | For shortfall in Main Steam Flow Rate         | : | 0.10% |

|    |                               |   |              |
|----|-------------------------------|---|--------------|
| v. | For shortfall in availability | : | 0.20%        |
|    | <b>Total</b>                  | : | <b>1.00%</b> |

The penalty was to be calculated on weighted average deviation on total contract price. If the overall unit heat rate exceeded 2550 kCal/kWh then Final Acceptance Certificate (FAC) could not be issued and extra fuel (Coal & Oil) consumption was to be borne by the contractor till the efficiencies were rectified.

However, no Liquidated Damage was recovered since all the conditions were fulfilled by the contractor.

#### **4.2.5 Analysis of Bidding Process followed in selection/Procurement of Consultants/Suppliers. Review of key steps undertaken to ensure competitiveness and suggestion to improve the same.**

The tenders were of open tendering type in which any entity could participate after fulfilling the prequalification criteria fixed by the Kothagudem TPS authorities. The companies were evaluated on technical as well as on financial basis fixed by the TPS authorities. Also, as mentioned above EMD was submitted by every company participating in the bidding.

#### **4.2.6 Analysis of various factors affecting the procurement outcome & the Problems faced in finalizing the contracts**

From the discussion held with the concerned authorities of the plant and the detailed data made available by them, it was observed that there was not a big gap between the time of RLA studies & execution of R&M/LE works. Also since the work was executed by single agency i.e. BHEL, there was no delay in execution & work was completed within specified schedule and the units are also running satisfactorily after R&M/LE works till date.

In the opinion of the plant authorities, up gradation of the units during R&M did not give the rated output, because only Turbine & Generator ratings were upgraded, but other equipment/auxiliaries of the unit were not suitably modified or replaced to match the ratings. It was observed that there was not a big gap between the time of RLA studies & execution of R&M works. Also, since the work was executed by single agency i.e. BHEL, there was no delay in execution & work was completed within specified schedule and the Units were also running satisfactorily after R&M.

#### **4.2.7 Status of PG tests of Units # 6, 7 & 8**

- i. Unit # 6:** Boiler and turbine PG tests completed during 27/01/2003 to 05/02/2003. PG test reports were yet to be approved by APGENCO.
- ii. Unit # 7:** Boiler and Turbine PG tests were completed during 20.11.2004 to 30.11.2004. ESP PG test was completed during 11.01.2005 to 14.01.2005. Repeated PG tests of ESP were carried out on 10.07.2009 to 11.07.2009. Mill PG test was conducted during 11.02.2005 to 13.02.2005. All PG test reports were approved by APGENCO on 23.12.2010.
- iii. Unit # 8:** Boiler and Turbine PG tests were completed during 27.11.2004 to 04.12.2004. ESP PG test was completed during 11.01.2005 to 14.01.2005. Repeated PG tests of ESP was

carried out on 19.09.2008 to 20.09.2008. Mill PG test was conducted during 11.02.2005 to 13.02.2005. All PG test reports were approved by APGENCO on 23.12.2010.

### **4.3 Unit # 5 (1x210 MW) Bandel TPS, WBPDCCL, West Bengal**

WAPCOS Team of Experts visited Bandel Thermal Power Station (BTPS) and WBPDCCL headquarter from 28.01.2013 to 30.01.2013 & 05.10.2015 to 09.10.2015 and held discussions with the Chief Engineer, Superintending Engineer, Executive Engineer and their Subordinate Engineers of the plant and officers of utilities at corporate office regarding their Procurement Experience in awarding the R&M works. During discussions details about the Procurement Process and necessary/relevant data/information were obtained. It was informed that during R&M, uprating of the unit was to be carried out to 215 MW.

#### **4.3.1 Review of Procurement Experience**

RLA study of Boiler was done in December, 2006. At that time unit-5 was under long shutdown due to failure of Generator Transformer (shutdown period was from May, 2006 to July, 2007). DPR was approved in July-2008 based on observations during site survey in August-2007 by M/s. Evonik Energy Services. The Owner, WBPDCCL, appointed M/s Evonik Energy Services (formerly STEAG Encotec India) to provide comprehensive consultancy services for Renovation & Modernization (R&M) of 210 MW unit-5 under contract no. BTPS (4793 dated 12.07.2007). The services included under this contract were study of Thermal Power Plant for preparation of feasibility report with a view to improve the Heat Rate and Efficiency of the Plant in addition to up gradation of capacity, plant availability, reliable operation, residual life of the plant and to meet the requirements of environmental and safety standards. The tenders for R&M work was ICB based as per the World Bank guidelines.

The Zero Date of main plant package was 14<sup>th</sup> March, 2012. Hence, the Time Gap was nearly 44 months. Re-tendering of Main Plant Package prolonged the time gap.

#### **4.3.2 Names of Firms to whom bidding Document for R&M were sent**

Main plant package bidding documents were purchased by following vendors.

- i. Doosan Heavy Industries & Construction
- ii. NTPC-ALSTOM Power Services Pvt. Ltd.
- iii. BHEL
- iv. Energo Engineering Projects Ltd.
- v. GE Power Services (India) Pvt. Ltd.
- vi. Siemens Ltd.
- vii. Thermax Ltd.
- viii. Dongfang Electric (India) Pvt. Ltd.
- ix. OJSC Power Machines (India) Ltd.
- x. Toshiba India Pvt. Ltd.

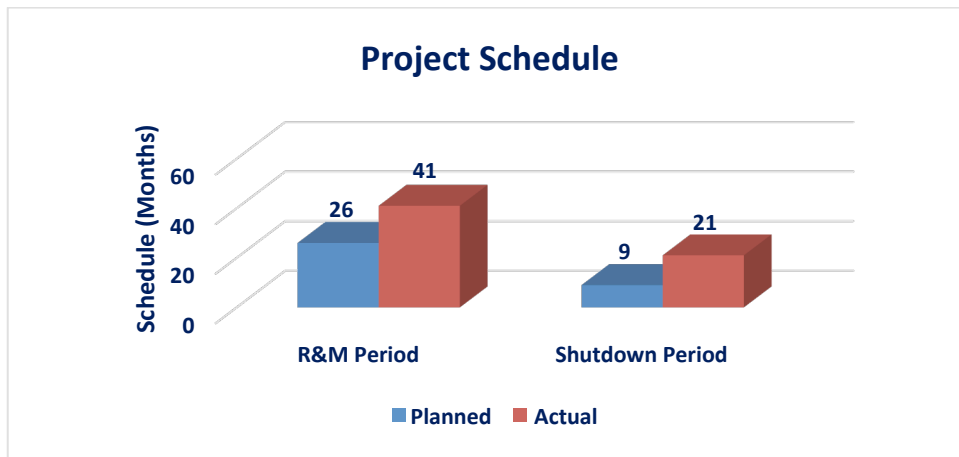
### 4.3.3 Project Cost and Terms of Payment

Based on the RLA study initial Project Cost was estimated to be Rs. 472.38/- Crore.

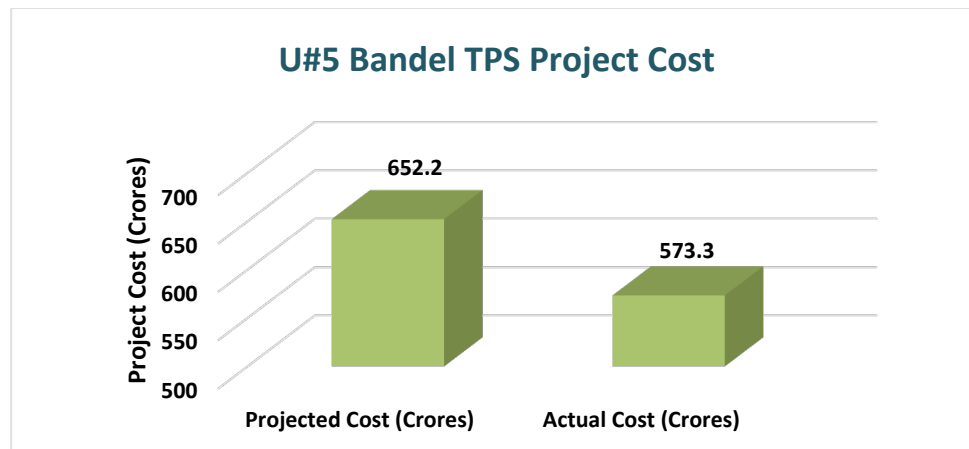
**Table 4.1:** Complete Cost of Bandel TPS Project

| Package             | Revised Contract price as on 22.09.2015 |                                     |                              |                                      |
|---------------------|---|-------------------------------------|------------------------------|--------------------------------------|
|                     | Offshore Supply Contract (In Euros)     | Onshore Supply Contract (In Rupees) | Service Contract (In Rupees) | Package wise total price (In Rupees) |
| Main plant package  | 37584887                                | 2562706165                          | 434937520                    |                                      |
| Coal Handling Plant | -                                       | 219788814                           | 47450729                     | 267239543                            |
| Electrical Package  | -                                       | 126784027                           | 40468932                     | 167252959                            |
| Ash Handling Plant  | -                                       | 39923000                            | 5755000                      | 45678000                             |

Note: Euro cost at 60 Rupees



**Figure 4.5:** Project Schedule of Unit # 5 of Bandel TPS



**Figure 4.6:** Project Cost of Unit # 5 of Bandel TPS

The schedule of completion of R&M works was 26 Months, but actually it was completed in 41 Months, mainly due to technical surprises and breach of contract for C&I works between M/s Siemens & M/s DOOSAN. Final cost of the project is not worked out due to some pending payments to be made. The planned lead period for the project was 16 months but in actual it was 19 months. Till now, extra payment was agreed for Rs. 10.03/- Crore approximately against the extra works in following areas:

- a) Supply and Installation of three numbers new HP Heaters
- b) Supply and Installation of Buck stay
- c) Supply and Installation of Diamond Spring

Claim of some other additional works have not yet been settled.

In respect of plant and equipment supplied from within the Employer's country, the following payments were agreed to be made.

- i. 10% of total Ex-works amount was to be paid as advance payment within thirty days against receipt of invoice and an irrevocable advance payment security for the equivalent amount was to be made in favour of the employer.
- ii. 70% of total or pro-rata Ex-works amount upon Incoterm "Ex-works" were to be made through a bank transfer/cheque upon delivery to the carrier within forty five days after receipt of invoice and documents along with 100% Taxes and duties.
- iii. 10% of the total Ex-works amount were to be paid upon issue of the Completion Certificate within forty five days after receipt of original and two copies of signed invoices.
- iv. Balance 10% of the total Ex-works amount were to be paid upon issue of the Operational Acceptance Certificate within forty five days after receipt of original and two copies of signed invoices.
- v. In the event that the employer failed to make any payments on its respective due date, the employer was to pay to the contractor the interest on amount of such delayed payment at the rate of zero percent per month for the period of delay until payment had been in full.
- vi. 100% applicable taxes and duties which were payable by the employer under the contract were to be reimbursed to the contractor upon receipt of equipment/spares at site and on production of satisfactory documentary evidence by the contractor.

#### 4.3.4 Name of Packages with corresponding names of firms to whom Contracts were awarded

- i. Main Plant Package:** Doosan Heavy Industries & Construction Co. Ltd. for Offshore supply and Doosan Power Systems India Pvt. Ltd. for Onshore Supply and Service Contract
- ii. Coal Handling Plant Package:** Vinar Systems Pvt. Ltd. for both Supply and Service Contract
- iii. Electrical Package:** Alstom T&D India Ltd for both Supply and Service Contract
- iv. Ash Handling Plant Package:** Macwaber Beekay Pvt. Ltd. for both Supply and Service Contract

#### 4.3.5 Performance Guarantee Tests and Liquidated Damages for major Packages

**Table 4.2:** LD for non-achievement of Performance

| S. No. | Required Functional Guarantee  | Required Guaranteed Parameter | Acceptable shortfall limit with LD |
|--------|--|-------------------------------|------------------------------------|
| 1      | Unit Heat Rate   | 2345 kCal/kWh                 | (+) 0.5% of guaranteed value       |
| 2      | Power Output   | 215 MW                        | (-)0.5% of guaranteed value        |
| 3      | Auxiliary Power Consumption  | 13000 kW                      | (+)0.8% of guaranteed value        |
| 4      | ESP outlet dust concentration with one out of first four fields out of service in each gas path with worst coal firing under 100% BMCR | $\leq 90 \text{ mg/Nm}^3$     | $100 \text{ mg/Nm}^3$              |

Following equipments were considered to be running/operational while calculating Auxiliary Power Consumption.

- i. FD fan : 2 Numbers
- ii. ID fan : 2 Numbers
- iii. PA fan : 2 Numbers
- iv. Mills : 5 Numbers
- v. Seal Air Fan : 1 Number operational & another on standby
- vi. Coal Feeders : 5 Numbers
- vii. BFP : 2 Numbers
- viii. CEP : 2 Numbers
- ix. ESP : Total Electrical Load at 100% TMCR
- x. Drip Pump : 1 Number

#### 4.3.6 Failure in Performance Guarantees and Liquidated Damages

- i. **Failure to attain guaranteed Heat Rate:** Total aggregate LD for failure to attain the Guaranteed Unit Heat Rate would be Rs. 12,000,000/- for every kCal/kWh shortfall.
- ii. **Failure to attain guaranteed Power Output:** Total aggregate LD for failure to attain the Guaranteed Power Output would be Rs. 50,000/- for every kW shortfall.
- iii. **Failure to attain guaranteed Auxiliary Power Consumption:** Total aggregate LD across the following three contracts for failure to attain the Guaranteed Auxiliary Power Consumption would be Rs. 50,000/- for every kW shortfall.
- iv. **Failure to attain Guaranteed SPM:** Rupees corresponding to the 0.2% of total Contract price for every complete  $10\text{mg/Nm}^3$  of increase in dust concentration level over the guaranteed value.
- v. Total aggregate ceiling of Liquidated Damage was 10% of total contract price.



- vi. **For CHP Packages:** Required functional guarantee for Vibrator was 250 Ton/h with acceptable shortfall limit with LD was (-) 10% of guaranteed value. Failure to attain guaranteed value of each Vibrator capacity at the rate of 0.5% of total price of connected equipment as established in the contract per one percent deficiency or part thereof in guaranteed capacity/performance requirement, subject to a ceiling of 5% of the concerned equipment price.
- vii. **For AHP Packages:** Dry ash evacuation of fly ash from all ESP, AHP and Stack hoppers using each vacuum pump at 35 MT/h rate for a continuous period of 3 hours for each vacuum pump with acceptable shortfall limit with LD was (-) 2.5% of the guaranteed value. Failure to attain guaranteed value of Dry ash evacuation of fly ash from all ESP, AHP and Stack hoppers using each vacuum pump at the rate of 1.0 % of total price of connected equipment as established in the contract per 1.0% deficiency or part thereof in guaranteed capacity/performance requirement, subject to a ceiling of 5% of the concerned equipment price.
- viii. **For Electrical Packages:** For 2 MVA transformer guaranteed No-load loss at 75°C should be 3.9 kW and Load loss at 75°C should be 18.18kW with acceptable shortfall limit with LD should be (+) 0.5% of the guaranteed value for both the cases. Failure to attain guaranteed value of each No load loss and Load loss should be Rs. 38875/- for every 1kW increase in the guaranteed No load loss and Load loss separately, subject to a ceiling of 10% of contract price.
- ix. **Guaranteed Project schedule and associated Liquidated Damages:** The time for completion of the whole of the facilities should be 837 days from the effective date. Start day of shutdown is 628<sup>th</sup> day from effective date. All the shutdown activities under rehabilitation should be completed in the shutdown period of 180 days, so that at the end of shutdown period, the unit should run with any three pulverisers in service. Completion of remaining facilities and remaining testing & commissioning work including Reliability Run shall be completed in 30 days (included in 837days). PG test had to be completed within 60 days after those 837 days.
- a) LD for Delay in Completion of all facilities: Applicable rate for LD should be 0.1% of contract price per day of delay in successful completion of facilities as per the scope of work of the contractor.
- b) LD for Extension of unit shut-down time: Applicable rate for LD should be 0.25% of contract price for each day of extension in shutdown period of 180 days. In case the shutdown was extended due to reasons attributed to WBPDCCL, then the provision of LD for extension would not be applicable for corresponding period.

The LD mentioned above were independent of each other and were applicable separately. Maximum aggregate amount of deduction for LD under all the two applicable conditions mentioned above were fixed at 10% of total contract price. The Performance Guarantee (PG) tests will be conducted in November, 2016. The issue of recovery of Liquidated Damages have not been resolved yet.



**Nature of Contract:** Fixed Price contract was adopted

#### **4.3.7 Analysis of Bidding Process followed in selection/Procurement of Consultants/Suppliers. Review of key steps undertaken to ensure competitiveness and suggestion to improve the same**

- i. WBPDCCL undertook single stage bidding procedure in procurement of plant and installation. The evaluation criteria of Main Plant package included Project Schedule and Performance Parameters. In case of Main Plant Package, only two bids were received which were non responsive on the basis of specified evaluation criteria. WBPDCCL proposed to get clarification from both the bidders regarding major deviation but World Bank gave “No Objection” only to request the lowest priced bidder, to withdraw its single major deviation from required specifications. Hence, the same was followed. Preparation of Tendering Specification was started after submission of DPR in July, 2008. The tenders for R&M works were invited through International Competitive Bidding (ICB) 16<sup>th</sup> December, 2010. Re-tendering was done in Main Plant Package. Initial tender was Two Stage Bidding. In the first stage bidding, only one bidder was eligible, therefore, WBPDCCL appealed to the World Bank to annul the bidding process and to allow re-tendering. The total revised project cost was Rs. 652.2/- Crores. The main package BTG was awarded to M/s DHIC (Doosan Heavy Industries & Construction) Korea and M/s DPSI (Doosan Power System India) on 29.02.2012 at a cost of Rs. 531/- Crores i.e. Rs. 290.98 crore + 37.58 Million Euros. The package for CHP was awarded to M/s Vinar System Pvt. Ltd. on 31.01.2013 at a cost of Rs. 26.63/- Crores. The package for electrical works was awarded to M/s Alstom T&D India Ltd. on 28.12.2012 at a cost of Rs. 16.31 Crores. The work of Ash handling is still to be awarded, bids for which were opened on 27.12.2012 which are under evaluation. So there were total four packages in all.
- ii. It was felt that to adopt International Competitive Bidding (ICB) process for R&M procurement was a good attempt to get the competitive rates. Apart from this, the R&M work was divided in five different Packages (Main Plant i.e. BTG package, CHP package, Electrical Package, AHP package, and Air conditioning system of Control Room and associated areas of unit-5 of Bandel TPS) resulting in better coordination and inter-facing, which helped consequently in smoothening the speedy implementation of R&M works.

**Key steps taken to ensure competitiveness:** Tendering process was advertised in national newspaper. Information was given to consulates of different countries in New Delhi, Procurement was notified in UNDB. A total of ten companies purchased the bidding document.

#### **4.3.8 Analysis of various factors affecting the procurement outcome & the Problems faced in finalizing the contracts.**

##### **i. Problems faced during bidding process**

Out of five numbers plant and installation undertaken in the Pilot R&M Project, four were ‘prior review’ packages. Hence, Procurement Specialist of the World Bank had reviewed all major steps of procurement from bid document preparation to contract finalisation.

‘Air conditioning System of Control Room and associated areas of unit-5 of BTPS’ was only post review package. Hence, no major problems were faced by the utility except receipt of only two bids, as both bids were having deviation in “must meet” requirement and lowest bid price was more than estimated price of DPR.

**ii. Key steps undertaken to analyse the problems faced while finalizing the contract**

The two bids received (with deviations) were intimated to the World Bank. As per their recommendation, lowest evaluated bidder was asked to withdraw their deviations. Based on the declaration of the lowest evaluated bidder, that deviation was withdrawn and the contract was finalized.

**4.4 Unit-1&2 (2x120MW) Amarkantak TPS, MPPGCL, Madhya Pradesh**

Units-1&2 (now unit-3&4 of phase-2) were commissioned in September, 1977 and March, 1978, respectively. After completion of useful life of 19 to 20 years, it was decided that the comprehensive R&M works be carried out for keeping them further in operation with improved performance.

WAPCOS Team of Experts visited Amarkantak Thermal Power Station from 04.03.2013 to 05.03.2013 & from 21<sup>st</sup> to 25<sup>th</sup> September-2015 and held discussions with the Chief Engineer, Superintending Engineer, Executive Engineer and their Subordinate Engineers regarding their Procurement Experience in awarding the R&M works.

**DPR and RLA Study**

**Unit No# 1:** No DPR and feasibility reports were prepared. Only RLA study was taken as basis for R&M works. The date of start of R&M work was not available from the data provided but it was mentioned that after completion of works, the rolling of turbine was carried out a number of times but it could not be synchronized due to high eccentricity and high vibrations in HP Turbine. Hence, the unit was stopped on 20.09.2010. In view of the above capital over hauling work of TG of this unit was given to M/s. NASL and work was started on 10.11.2010. The work was finished on 24.03.2012 and unit was synchronized on 11.04.2012.

**Unit No# 2:** The date of start of R&M work was 29.07.2009. The R&M work was completed on 11.09.2010 and unit was synchronized on 26.08.2010.

**4.4.1 Procurement Procedure**

Tenders were invited through open tendering process for carrying out the R&M works in these units. The contract was awarded to M/s Ansaldo Energia SpA in August 1999 at the price of Rs. 184.80 Crores for comprehensive R&M works including RLA and condition assessment studies. The works were executed by the contractor on EPC turnkey basis for achieving several post R&M guaranteed parameters. As per terms of contract, the RLA studies were carried out by M/s Ansaldo through independent agency i.e. M/s Macon between April to August 2000.

However, on 21<sup>st</sup> June 2001, M/s Ansaldo declined to execute the contract alleging wrongly MPSEB for non-fulfilment of its contractual obligations and declared the contract expired

unilaterally without any progress in supply and installation. Consequently, MPSEB encashed the Bank Guarantees submitted by the Contractor towards Security Deposit as well as advanced payments.

The disputes were, subsequently, referred to Arbitral Tribunal by the contractor. The proceedings of Arbitration commenced in June 2000 and Arbitral Award was issued in September 2004. The Award of Tribunal was subsequently challenged in courts either by the contractor or by the owner. The matter is still pending for final disposal in Hon'ble Supreme Court. In the above circumstances, fresh tenders were again invited in March 2002 for major R&M works considering deteriorating conditions of the units. Looking to such higher cost, the scope of works was split into number of small packages and offers were again invited from the bidders through open competitive tendering process. Subsequently, the scope of work was reviewed by MPSEB based on interaction with the O&M personnel and work was split into following four main packages which were further subdivided into a number of small packages for different parts/components.

- a) R&M works of Boiler and Auxiliaries containing 6 packages
- b) R& M works of TG and Auxiliaries
- c) R&M works of Electrical Auxiliary containing various packages
- d) R&M works of Instrumentation and Control

After ensuring funds from PFC for implementing the above packages, NIT was again issued in February, 2004. Orders were placed from 2003 to 2007 at a total cost of Rs. 108.98/- Crores and these works were completed by March, 2012.

Regarding R&M works of TG, efforts were made to execute the R&M works through OEM i.e. M/s BHEL for two years but it became null and void. Subsequently, NIT was again issued in March 2006 inviting offer from the aspirant bidders through open tendering process for carrying out the R&M works. The contract was awarded to M/s NASL in June, 2007 with completion period of 28 months. As these units were in operation for more than 33 years, therefore, after dismantling of Turbine and Generators, many components were found in deteriorated/damaged conditions which were not covered under the scope of contract. These works were carried out by placing supplementary orders with additional time period for safe and trouble free operation of the machines as well as safety of O&M personnel. At last, unit-1&2 could be commissioned after completion of R&M of TG in September, 2010 & March, 2012 respectively.

#### **4.4.2 Qualification Requirement and Evaluation Criteria of Bidders**

The qualification requirement of the bidders was based on two criteria. One was technical requirement in which the bidder was required to be reputed manufacturers/authorized dealers having experience of supplying/installation of similar material to any two thermal power stations and were in successful operation from last two years. Bidders were also asked to submit the documentary evidence for establishing these conditions. The second requirement was of financial nature in which the bidders were required to submit the balance sheets for last five years.

The evaluation criteria including Project Schedule and Performance Parameters were moderate in nature which could be easily achieved by the participant bidders and their impact on the overall competition and price bid discovery was not significant.

#### 4.4.3 Project Executing Agency

- I. R&M of Coal Mills:
  - i. M/s. Alstom Project India Ltd, Nagpur: Supply of Mill spares i.e. classifier assembly, yoke assembly, spider assembly and air seal housing assembly
  - ii. M/s. Premium Energy Transmission Ltd, Nagpur: Supply of greaves brand Bavel and helical gear unit along with lubricating oil station
  - iii. M/s. Encon Enterprises Pvt. Ltd: Supply of Hydro Pneumatic/Nitrogen gas loading system control panel
- II. R&M of expansion joint of air and gas duct: M/s. Mech Well Industries (P) Ltd., Mumbai supplied, erected and commissioned fabric expansion joint of air and gas duct.
  - a) R&M of Pressure Parts:
    - i. M/s. Tyco Sanmar Ltd, New Delhi: Supply of various safety valves for Boiler along with accessories.
    - ii. M/s. G. B. Engineering Enterprises Pvt. Ltd, Tiruchirappalli: Manufacturing and supply of Boiler Pressure Parts (secondary Super heater coil, Primary super heater tubes, cage bypass, cage enclosure tubes, Reheater coil and furnace wall tubes).
    - iii. M/s. Baby Engineering Pvt. Ltd., Tiruchirappalli: Supply of Economizer coil.
    - iv. M/s. Powermech Project Pvt. Ltd., Vijayawada was responsible for erection of economizer coils.
  - b) R&M of Dampers: M/s. Baby Engineering Pvt. Ltd., Tiruchirappalli for supply of damper with actuators.
  - c) R&M of Air Pre-Heater:
    - i. M/s. Tata Steel Ltd, Indore: Supply of ERW steel tubes for APH
    - ii. M/s. Baby Engineering Pvt. Ltd., Tiruchirappalli: Supply of APH tube plates along with sling support and tie rod.
    - iii. M/s. Powermech Project Pvt. Ltd., Vijayawada was responsible for installation of Air Heater tube blocks.
- III. R&M of C&I was awarded to M/s Yagkakogawa India Ltd., Bangalore on 27.05.2005. However, some R&M works related to APH were carried out during years 2010-2011.
- IV. R&M works of Electrical equipments:
  - i. M/s. Easun Reyrolle Ltd, Hosur was responsible for replacement of relays.
  - ii. M/s. ABB, Vadodara was responsible for replacement of LT Transformers with Dry Type Transformers.
  - iii. M/s. Crompton Greaves, Nasik was responsible for replacement of 220/245 kV existing Circuit Breakers with SF<sub>6</sub> Circuit Breakers.

- V. Strengthening of structures: M/s. Powermech Project Pvt. Ltd., was responsible for repair and strengthening of steel structure of Boilers in Mill and ESP area including civil works, repair & strengthening of Coal Bunker house including its civil work and strengthening of internal surfaces of coal bunkers.

#### 4.4.4 Project Schedule and Cost

There were problems in contract during execution of the project by M/s. Ansaldo. Thereafter, decision for carrying out the R&M in multiple packages was taken and tendering, award of contract and execution of R&M works were carried out accordingly. Work was split into following four main packages which were further subdivided into a number of small packages for different parts/components except for TG and its associated auxiliaries. All these works were carried out during the period 2004 to 2011.

- i. R&M works of Boiler and Auxiliaries.
- ii. R&M works of TG and its associated auxiliaries.
- iii. R&M works of Electrical auxiliaries.
- iv. R&M works of Instrumentation and Control.

**Table 4.3: Package-wise Cost of Amarkantak TPS**

| S. No.   | Particulars   | Order Value (Rs) |
|----------|---|------------------|
| <b>A</b> | <b>R&amp;M works of Boiler and Auxiliaries.</b>   |                  |
| i.       | Supply of Fabric Expansion Joints.  | 4838223          |
| ii.      | Dismantling of existing, Erection & Commissioning of newly supplied Fabric Expansion Joints of Air and Flue Gas Ducts.                                | 2156980          |
| iii.     | Supply of economizer coils.   | 25905306         |
| iv.      | Supply of Boiler pressure parts (Secondary Super Heater Coils, Primary SH Tubes, Cage Bypass & Enclose Tubes, Reheater Coils and Furnace Wall Tubes). | 121023200        |
| v.       | Supply of various high and low pressure motorized valves.   | 10753892         |
| vi.      | Supply of various high and low pressure motorized valves.   | 9456276          |
| vii.     | Erection Testing & Commissioning of various high and low pressure motorized valves.   | 2248080          |
| viii.    | Supply of various high pressure and low pressure motorized valves.  | 24908433         |
| ix.      | Supply of various Safety Valves, for Boilers along with accessories.  | 8631175          |
| x.       | Supply of various Dampers with Actuators.   | 17877800         |
| xi.      | Supply of one number Ash Slurry Pump Motor Set.   | 4646840          |
| xii.     | Supply of hydro pneumatic N <sub>2</sub> gas loading system control for renovation of ABL coal mills.   | 2747808          |
| xiii.    | Procurement of Mill spares for 2x120 MW Units of ATPS-Chachai   | 55298759         |
| xiv.     | Procurement of Gear Box along with lube. Oil system for ABL coal mills of 2x120 MW Boiler of ATPS, Chachai  | 24194560         |

|          |  |                   |
|----------|--|-------------------|
| xv.      | Procurement of steel tubes for Air Preheaters of ABL make 120 MW boiler of ATPS, Chachai   | 24455981          |
| xvi.     | Replacement of Economizer Coils, Secondary S/H Coils, S/H Top Bank, Reheat Coils Bottom Bank, Cage Bypass and Cage Encloser          | 9326154           |
| xvii.    | Replacement of HP Valves.  | 153177            |
| xviii.   | Complete overhauling of Mills along with replacement.  | 965126            |
| xix.     | Dismantling of existing Dampers and Erection, Commissioning & Testing of new Flap type Dampers.                                      | 1485474           |
| xx.      | Complete removal of old APH tube block and Installation & Commissioning with associated work of Air Preheater.                       | 4025602           |
| xxi.     | Repairing and strengthening of steel structure of Coal Bunker house.   | 2310843           |
| xxii.    | Repairing and strengthening of Boiler Mill and ESP area of PH II.  | 1452784           |
| xxiii.   | Supply of Air Preheater Tube Plates along with Sling support.  | 9546028           |
| xxiv.    | Strengthening of internal surfaces of coal bunkers   | 1574591           |
|          | <b>Sub Total</b>   | <b>369983092</b>  |
| <b>B</b> | <b>R&amp;M works of TG and its associated auxiliaries.</b>   |                   |
| i.       | R&M and overhauling of TG and its associated auxiliaries.  | 597952309         |
|          | <b>Sub total</b>   | <b>597952309</b>  |
| <b>C</b> | <b>R&amp;M works of Electrical auxiliaries.</b>  |                   |
| i.       | Supply of 72 nos. 6.6 kV Breakers along with associated fittings/panels.   | 21825471          |
| ii.      | Dismantling, Erection, Testing & Commissioning including civil work of 6.6 kV switch gear.   | 1555925           |
| iii.     | Supply of 8 nos. Dry type Transformers.  | 5000665           |
| iv.      | Erection, Testing & Commissioning of Dry type Transformers.  | 299860            |
| v.       | Supply of numerical relays for Motors, Generator, Generator Transformers and Station Transformers.                                   | 5500527           |
| vi.      | Erection and Commissioning of numerical relays for Motors, Generator Transformers and Station Transformers.                          | 102000            |
| vii.     | Erection, Testing & Commissioning of 6.6 kV SF <sub>6</sub> Breakers.  | 413600            |
| viii.    | Supply and replacement of 8 numbers 415V MCC. Retrofitting of 9 numbers 415V switchgears & replacement of 1 numbers Distribution Box | 43664653          |
|          | <b>Sub total</b>   | <b>78362701</b>   |
| <b>D</b> | <b>R&amp;M works of Instrumentation and Control.</b>   |                   |
| i.       | Supply of controls and instrumentation.  | 31792360          |
| ii.      | Erection, Testing & Commissioning of control and instrumentation.  | 667200            |
|          | <b>Sub total</b>   | <b>32459560</b>   |
|          | <b>Grand total</b>   | <b>1078757662</b> |



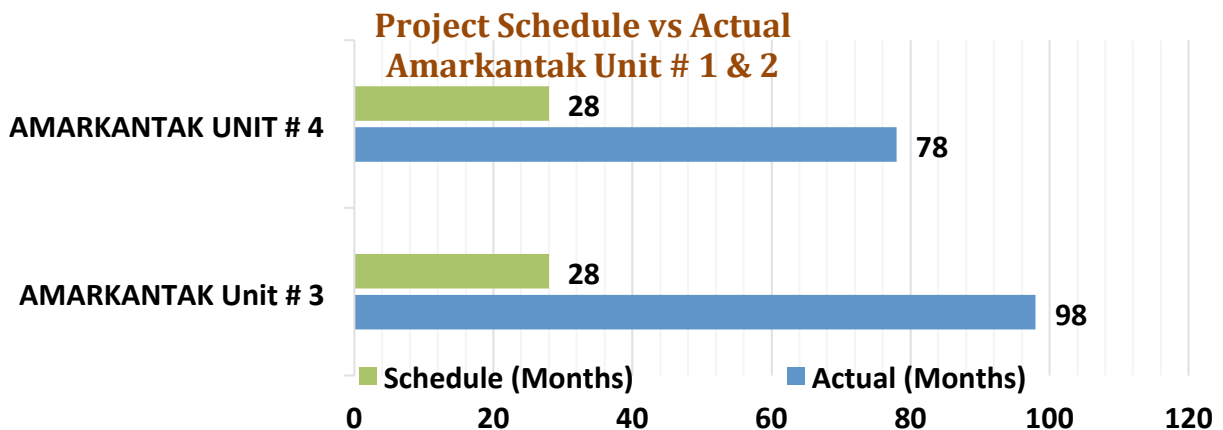


Figure 4.7: Project Schedule of Unit#1&2 of Amarkantak TPS

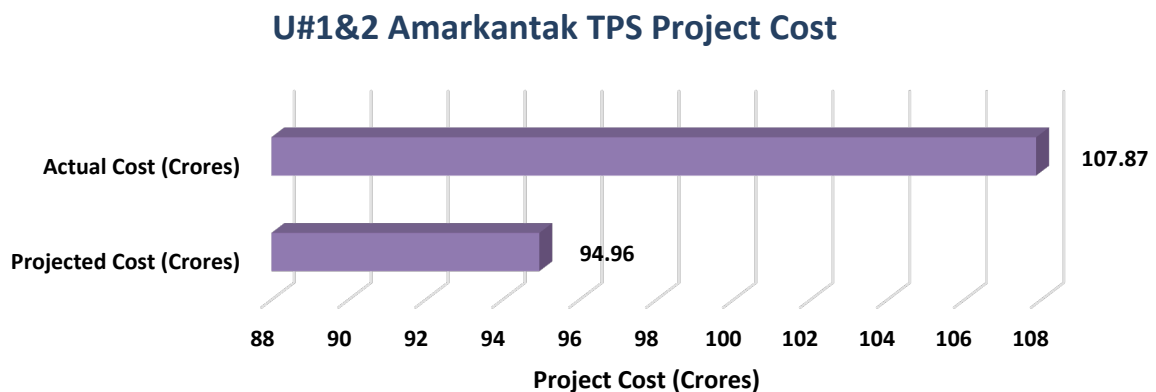


Figure 4.8: Project Cost of Unit-1&2 of Amarkantak TPS

The actual time taken for R&M works for Units-1&2 was 98&78 months, respectively, as against schedule time of 28 months for each unit. The actual cost on the project worked out to be Rs.107.8/- Crores for both units-1&2 as against projected cost of Rs.94.96/- Crores.

#### 4.4.5 Liquidated Damages and Performance Guarantees

The work was executed under several small packages by number of contractors. As such, the guarantee of the items included in individual packages was envisaged in the contracts in standard terms of guarantee and there was no guarantee categorically envisaged in the contracts in terms of improved performance of the unit such as PLF, Heat Rate, and Specific Coal Consumption etc. The bidders were required to deposit 10% amount as Security Deposit for satisfactory execution of order and to cover the performance guarantee period of 12 months after commissioning or 24 months after supply whichever was earlier. The stipulated guarantee was confined to any defect discovered in the supplied material during guarantee period due to faulty material or bad workmanship. The same were required to be replaced or rectified free of cost in a reasonable time by the contractor.



However, any levy of penalty/LD on account of performance guarantee was not envisaged. The performance Guarantees and rates of LD were fixed as under:

**a) Liquidated Damages for Delay:**

In the event of any delay in project completion of one or more units due to any fault attributable to the contractor alone, the contractor was liable to pay liquidated damages for the concerned unit at the rate of 0.5% of the unit price per week of delay or part thereof, subject to the cumulative liquidated damages being limited to 10% of the contract value. The said liquidated damages to be sole and exclusive remedy for said failure.

**b) Performance and Guarantees:**

- i. Contractor was to deliver a performance bond in the sum of 10% of the total contract price to Owner within fifteen days from the CDC which might be drawn in the event that contractor did not perform the activities towards faithful fulfilment of all the terms and conditions of the agreement. The validity, of this bank guarantee, was to expire upon the earlier of (a) six months from taking over the plant (b) termination of contract of agreement (c) upon submission of Guarantee Bond.
- ii. Contractor was to deliver to owner a Bank Guarantee of 10% of the contract price not later than the taking over of the plant which might be drawn only in the event of Guarantee conditions during Guarantee Period were not met with respect to scope of works. The said Bank Guarantees were sole and exclusive remedy for failure to achieve guarantee conditions. The validity of such bank guarantee was to expire at the end of the Guarantee period or termination of agreement due to owner's default, whichever was earlier plus six months towards claim period.

#### **4.4.6 Key steps taken to ensure competitiveness**

Open tenders were called by way of publishing the NIT in leading newspapers having circulation at country level and state level. The copy of NITs was also sent to reputed bidders of that field and OEMs.

#### **4.4.7 Analysis of various factors affecting the procurement outcome & the Problems faced in finalizing the contracts**

**❑ Problem faced during Bidding Process:**

- Energic SPA declined to execute the contract for Comprehensive R&M of 2x120MW & declared the contract expired unilaterally. The dispute was referred to Arbitrator Tribunal and litigation is pending with Honourable Supreme Court at present.
- After decision of carrying out R&M works in different packages, tender for Electrical equipments and BTG were invited. Offers were not considered Techno-economically viable as quoted price were high hence dropped.
- Thereafter Open Competitive bidding process was adopted. Scope of work was split into number of small packages and orders were placed from 2003 to 2007 at a total cost of Rs. 108.98 Crore. The work was completed by March 2012.

- By splitting Comprehensive contract into multiple packages, lower rates observed but time period for entire activity was prolonged. Also due to multiple packages the performance guarantees for the unit as a whole could not be obtained.

#### 4.4.8 Resolutions

The Utility had adopted International Competitive Bidding (ICB) process for R&M procurement to get the competitive rates. Apart from this the R&M works of different equipments were executed through different vendors staggered over a period of time.

#### 4.5 Unit# 6 (1x210MW) Koradi TPS, MSPGCL, Maharashtra

WAPCOS Team of Experts visited Koradi Thermal Power Station (KTPS) from 21.03.20123 to 23.03.2013 & from 26.10.2015 to 30.10.2015 and held discussions with the Chief Engineer, Superintending Engineer, Executive Engineer and their subordinate engineers regarding their procurement experience in awarding the R&M works. The DPR preparation was started in November 2007 however, it was only completed by April, 2008 at a cost of Rs. 1.86 crores. The availability of unit shut down for RLA study was the major hurdle in completing the study. The load of the unit were to be made stable between 160 to 180 MW (i.e. 80%) to carry out energy audit. The zero date of R&M works was said to be of BTG start date i.e. 03<sup>rd</sup> March, 2014, thereby the time gap between the DPR and R&M work was 4 years and 9 months.

##### 4.5.1 Procurement Experience in awarding R&M Works

The Ministry of Power, Government of India and the World Bank under the Policy and Human Resources Development (PHRD) grant provided support to Maharashtra State Power Generation Co. Ltd. (MAHAGENCO) for Rehabilitation of unit-6 (210 MW) of Koradi Thermal Power Station. MAHAGENCO. Evonik India, now Steag Energy Services (India) Pvt. Ltd. was appointed to provide comprehensive consultancy services for Renovation & Modernization of 210 MW unit-6 under contract no. KTPS/GM-III/R&M/U-6/PHRD/7773 dated 13.11.2007.

The scope of work included Energy Audit, Baseline Mapping and Remnant Life Assessment/ Condition Assessment. The Detailed Project Report was required to compare different options for upgrading the plant and equipment and extending its life by 20 years complying, also, with Indian Environmental Standards. Necessary investigations were conducted on the sub-systems of the plant including Boiler, Turbine, regenerative system, Condenser, BFP, CEP, CW system, Fans, milling system, water system, Coal Handling plant, Ash Handling Plant and civil structures. The investigations included hot and cold walk down surveys, residual life assessment and performance testing of equipment. Online data available for the plant were also utilized to carry out simulation studies by offline mapping.

Brief details of DPR included the project cost which was estimated for Rs. 486/- Crores for implementation of project. Enhancement of plant capacity to 215MW by installing new Turbine with reaction blading without replacement of Generator but with rotor modification and Boiler re-engineering to suit existing Coal quality of 3400-3800 kCal/kg, as against designed coal of 5000 kCal/kg.

Since the R&M was covered under World Bank (IBRD) Loan and Grant, therefore, the general procurement procedure was followed as per the Procurement Guidelines of World Bank for International Competitive Bidding (ICB) and National Competitive Bidding (NCB). For R&M, following three ICB tenders were floated.

- a. Main Plant (BTG) Package
- b. Electrical System Package
- c. Balance of Plant (BOP) Package

Following firms purchased the bidding document and later were awarded the contract.

**A. Electrical package:**

Tender document was purchased by following companies.

- i. M/s BHEL Noida
- ii. M/s NASL Noida
- iii. M/s AGM –Corporate development Gurgaon
- iv. M/s Toshiba India Pvt Ltd Gurgaon
- v. M/s ABB Bangalore

Bids were submitted by following parties.

- i. M/s BHEL (L2)
- ii. M/s ABB (L1)

Both were qualified technically. But contract was awarded to M/s. ABB on 19.03.2012.

**B. Balance of Plant Package:**

Tender document was purchased by following companies.

- i. M/s. Technofab Engg Ltd New Delhi.
- ii. M/s. U.B.Engg Ltd, Pune
- iii. M/s. Tecpro System Ltd Chennai
- iv. M/s. Unity Infraprojects Ltd, Mumbai
- v. M/s. Energo Engineering Projects Ltd New Delhi
- vi. M/s. OSM Engg Pvt. Ltd, Faridabad.
- vii. M/s. Doshion Ltd. Mumbai
- viii. M/s. Sunil Hi-tech Engg. Ltd, Nagpur
- ix. M/s. SPML INFRA Ltd, Mumbai
- x. M/s BHEL Noida
- xi. M/s Indure Ltd. New Delhi
- xii. M/s Turbomachinery Infra Projects Pvt. Ltd. Hyderabad
- xiii. M/s GTL Ltd. Pune

Bid was submitted by following companies.

- i. M/s Energo Engineering Projects Ltd New Delhi. –L2
- ii. M/s. Sunil Hi-tech Engg Ltd, Nagpur – L3
- iii. M/s. Tecpro System Ltd Chennai – L1
- iv. M/s Indure Ltd. New Delhi – L4
- v. M/s Turbomachinery Ltd. Hyderabad. - Rejected

M/s Turbomachinery did not qualify, all others who submitted bids were qualified.

Turbomachinery's bid was rejected due to following reasons.

- i. The bidder has not submitted the written power of attorney as required under the Bid

- ii. The validity period of the Bid Security submitted by the Bidder is 89 days which is not as per requirement of (180+28) days.

Contract was awarded to M/s Tecpro Ltd Chennai. However, M/s Tecpro could not execute the contract due to financial crisis in their company. The contract was terminated in March 2015. The plant study was done in the year 2009, tender was floated in 2011 and order terminated in 2015. During this time many major changes occurred in plant condition and hence while floating the tender some changes were made. To save the time single order execution of DM plant, AHP, CT fans and Fabric Filter package, tender was floated on 23<sup>rd</sup> September, 2015 for e-procurement. Re-tendering was in process for following packages.

- a. Cooling tower package (LOA-06<sup>th</sup> August 2016)
- b. Ash Handling Plant package (LOA-30<sup>th</sup> July 2016)
- c. DM Plant package
- d. Fire Detection, Protection and Inert gas system package (LOA-30<sup>th</sup> July 2016)

### C. Main Plant (BTG) Package:

Tender was purchased by following parties.

- i. M/s EM services Nagpur
- ii. M/s Energo Engg Projects Ltd. New Delhi
- iii. M/s Evonik Eng. Services Noida
- iv. M/s Siemens Gurgaon
- v. M/s Swati Energy Projects Mumbai
- vi. M/s GE Power Services Gurgaon
- vii. M/s NASL Noida
- viii. M/s BHEL Noida
- ix. M/s Doosan Heavy Industries Ltd. Gurgaon
- x. M/s Dongfang Elec. Corp. China

Bids were submitted by following companies

- i. 1. M/s BHEL - L-1
- ii. 2. M/s NASL - L2
- iii. M/s Doosan - L3
- iv. M/s Dongfang - Non responsive.

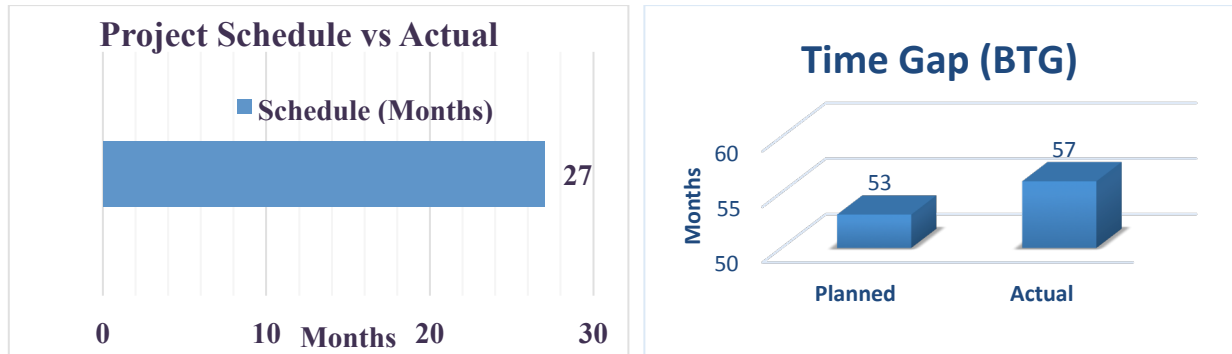
All bidders qualified except M/s Dongfang. M/s Dongfang's bid disqualified in 2<sup>nd</sup> stage bidding due to following reasons.

- i. Not meeting the parameters criteria required for Functional Guarantees offered by the bidders regarding Unit Heat Rate
- ii. Not responding to the conditions of Memorandum issued with invitation of 2<sup>nd</sup> stage bid

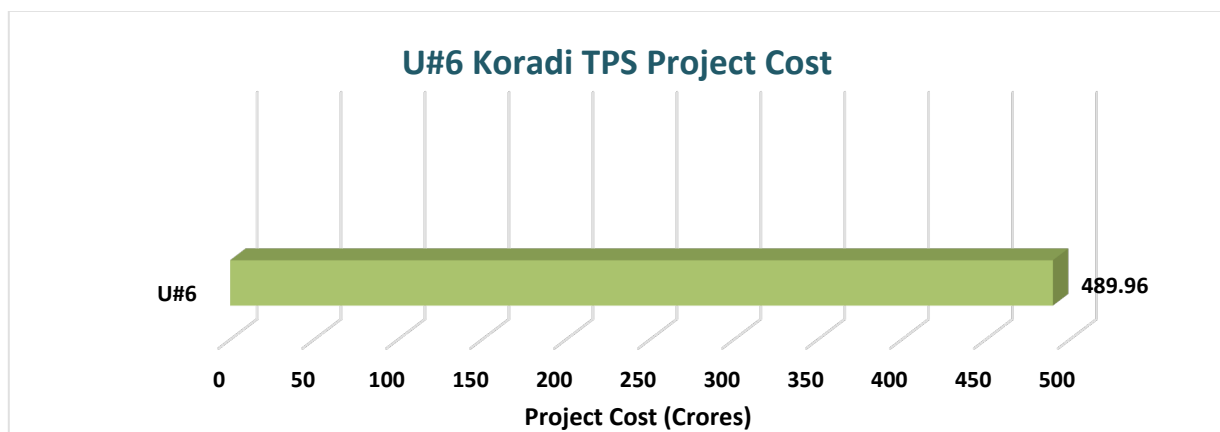
Contract was awarded to M/s BHEL on 31.05.2013.

All the above three packages were of price escalation type of contract. A total of 400 to 500 queries were received during bidding process which were resolved before the bid submissions. M/s. Techpro could not execute the contract due to their financial problem. Therefore, its contract was terminated and tender was re-floated. Price escalation problem arose for Electrical due to delay in awarding of contract of BTG package. BOP package was split into four tenders for better reliability and healthy competition. Amicable solution of Electrical package was

arrived at and amendment in the contract was done and was issued to M/s. ABB with fixed price for remaining contract period with modification in work completion schedule. This avoided retendering of Electrical package.



**Figure 4.9:** Project Schedule of Unit# 6 of Koradi TPS



**Figure 4.10:** Project Cost of Unit# 6 of Koradi TPS

The contract price of BTG was Rs. 450.194/- Crores, Electrical was Rs. 10.69/- Crores and that of BOP was Rs. 29.080/- Crores with a project orderd cost at Rs. 489.964/- Crores.

Zero date of Electrical package was 25<sup>th</sup> May, 2012, for BOP Package it was 10<sup>th</sup> August, 2014 and for BTG package it was 03<sup>rd</sup> March, 2014.

Time taken in framing the tenders was 10 months.

#### 4.5.2 Performance Guarantees and Liquidated Damages:

Contract performance Bank guarantee was kept at 10% with maximum ceiling for liquidated damage was kept as 10% of the contract value. The guaranteed project schedule was as follows.

- a) Synchronization : 22<sup>nd</sup> April 2016
- b) Trial operation : 22<sup>nd</sup> May 2016
- c) P. G. Test : 20<sup>th</sup> August 2016

The associated rate of liquidated damages was kept at 0.5% per week with maximum ceiling limit to 10% of contract value for delay in contract. The project is under implementation and is delayed by 12 months due to delay in supply and delay in sub-contractor finalisation by BTG contractor.

**A. Main Plant (BTG) Package:**

The functional guarantees subject to compliance with the foregoing preconditions, the guarantees were as follows.

**Table 4.4: LD for Shortfall in Functional Guarantees**

| S. No. | Required Functional Guarantee  | Value of Functional Guarantee   | Acceptable shortfall limit with LD                     |
|--------|--|---|--|
| 1      | Maximum Unit Heat Rate   | 2333 kCal/kWh at 3% Make up   | (+) 0.5% of the guaranteed unit gross heat rate        |
| 2      | Minimum power output of Turbine Generator at rated steam conditions at CW inlet temperature of 33°C with 3% makeup         | 228.153 MW (Rated output at 3% Makeup)  | (-) 0.5% of the guaranteed TG Output                   |
| 3      | Maximum Auxiliary Power Consumption (in percentage of power output defined at sr. no. 2)                                   | 5.74% of the rated output   | (+) 0.9% of the guaranteed auxiliary power consumption |
| 4      | Maximum Particulate Matter (SPM) along with/without Ammonia injection at 215MW one out of first four fields out of service | 70 mg/Nm <sup>3</sup> without Ammonia injection at TMCR with worst coal, with first field out of service  | (+) 30 mg/Nm <sup>3</sup>                              |
| 5      | Maximum APH outlet temperature of flue gases   | 135°C   | (+) 10°C   |
| 6      | Maximum weighted average unburnt carbon in the ash (15% bottom ash, 80% fly ash, 3% economizer hopper and 2% APH hopper)   | 1.2% (Total)  | (+) 0.8%   |
| 7      | Minimum load at which steam generator can be operated continuously with complete flame, stability without oil support      | 50% of TMCR with any combination of adjacent mills (loaded to not less than 50% of mill capacity in service as the coals specified are of inferior grade and from furnace safety point of view) | (+) 10% of TMCR  |

In addition, the bidders were asked to offer following declaration for indicative purposes only and were not part of functional guarantees and would not attract any Liquidated Damages.

**Table 4.5: Desired Performance Parameters**

| S. No. | Parameter                   | Declared value indicated   |
|--------|-----------------------------|----------------------------|
| 1      | Indicated Boiler Efficiency | 86.5% at TMCR- Design Coal |
| 2      | Turbine Heat Rate           | 2018 kCal/kWh at 3% MU     |

**Failure in Guarantees and Liquidated Damages:**

If the performance Guarantee parameters attained in the guarantee test pursuant, were higher than the guaranteed figure but were within the accepted shortfall limit with LD and the Contractor had the option to elect to pay liquidated damages to the Employer in lieu of making changes, modifications and/or additions to the Facilities, then the Contractor were to pay liquidated damages at the rates indicated in table below.

**Table 4.6: Rate of LD Payable against Performance Shortfall**

| S. No. | Condition of Performance Shortfall                              | Rate of LD Payable   |
|--------|---|--|
| 1      | Failure to attain guaranteed unit Heat Rate                     | Rs. 8 Million for every complete 1kCal/kWh of the increase in unit Heat Rate, or at a proportionately reduced rate for any deficiency, or part thereof, of less than a complete 1kCal/kWh  |
| 2      | Failure to attain guaranteed Power output                       | Rs. 50 Million for every complete 1MW of the deficiency in the unit Power output, or at a proportionately reduced rate for any deficiency, or part thereof, of less than a complete 1MW  |
| 3      | Failure to attain guaranteed Auxiliary Power Consumption        | Rs. 0.05 Million for every complete 1kW of the deficiency in the unit Auxiliary Power Consumption (for average value of 72 hours monitoring), or at a proportionately reduced rate for any deficiency, or part thereof, of less than a complete 1kW                              |
| 4      | Failure to attain guaranteed SPM                                | 0.2% amount of total contract value for every complete 10mg/Nm <sup>3</sup> of the increase in SPM level, or at a proportionately reduced rate for any increase, or part thereof, of less than a complete 10mg/Nm <sup>3</sup>   |
| 5      | Failure to attain flue gas temperature at APH outlet            | 0.2% amount of total contract value for every complete 1°C deviation in outlet temperature, or at a proportionately reduced rate for any increase, or part thereof, of less than a complete 1°C  |
| 6      | Failure to attain unburnt carbon loss                           | 0.2% amount of total contract value for every complete 0.1% increase in unburnt amount of carbon, or at a proportionately reduced rate for any increase, or part thereof, of less than a complete 0.1%   |
| 7      | Failure to attain steam generator operation without oil support | 0.2% amount of total contract value for every complete increase in 5% of the TMCR condition (without oil support) specified in the original data sheet, or at a proportionately reduced rate for any increase, or part thereof, of less than a complete 5% of the TMCR condition |



If the performance requirements for respective equipments could not be demonstrated in the guarantee test, contractor had to carryout suitable corrections/modifications till such performance requirements were attained or replace the equipment. In case of failure to do so employer was having the right to reject the equipment.

### Limitation of Liability

- a) In case during the Performance Guarantee Test(s) if it was found that equipments/ system had failed to meet the guarantees, the contractor were to carry out necessary modifications and or replacements to make the equipment /system comply with the guaranteed requirements at no extra cost to the owner and re-conduct the performance guarantee test(s) with the owner's consent. In case specified performance guarantee(s) were still not met but were achieved within the shortfall limits, owner would accept the equipment/plant/system after levying liquidated damages as per above table. The Contractor's aggregate liability to pay liquidated damages for failure to attain the functional guarantees, within the acceptable shortfall limits, not to exceed ten percent (10 %) of the Contract price.
- b) However, if the demonstrated functional performance parameters continued to fall short of the stipulated acceptable limits even after the above modifications/ replacements, then the employer had the right to undertake measures. For all the other equipments for which functional guarantees were not specified as above, contractor had to supply the equipments as per certifications of the Test carried out at the manufacturing shop as per the Test procedures specified, witnessed and accepted by the owner's representative.
- c) The Liquidated damages for the shortfall in guaranteed parameters and for delay in completion were independent of each other and to be levied separately and concurrently. Thus, the total limit of liability for Liquidated damages summed together for the shortfall in guaranteed parameters and for delay in completion was not to exceed 20% of the Contract price.

### B. Balance of Plant Package

Subject to compliance with the foregoing preconditions, the Contractor guarantees were as follows.

**Table 4.7:** Acceptable Shortfall Limit for Required Functional Guarantee

| S. No. | Required Functional Guarantee                  | Value of Functional Guarantee | Acceptable shortfall limit with LD |
|--------|--|-------------------------------|------------------------------------|
| 1      | Rise in cooling range of cooling tower         | 9°C                           | (-) 0.5°C                          |
| 2      | Maximum Auxiliary Consumption of the equipment | 2752 kW                       | (+) 5% than the guaranteed figure  |

- a) If the functional guarantee as specified in the offer were higher than the guaranteed figure but within the acceptable shortfall limit with LD as specified above and the contractor had the option to pay LD to the employer in lieu of making changes, modifications and/or additions, then the contractor were to pay LD at the rates indicated in the table below.

**Table 4.8: Rate of LD Payable**

| S. No. | Condition of Performance Shortfall   | Rate of Liquidated Damages Payable  |
|--------|--|---|
| 1      | Failure to achieve the guaranteed rise in the cooling range of Cooling Tower | Rs. 1.0 Million for every 0.1°C deficiency                                    |
| 2      | Failure to attain the guaranteed auxiliary consumption                       | Rs. 0.05 Million for every 1kW rise than the guaranteed Auxiliary Consumption |

- b) If the performance as specified for respective equipments could not be demonstrated in the guarantee test, contractor had to carryout suitable corrections/ modifications till such performance requirements were attained or replace the equipment. In case of failure to do so, employer had the right to undertake measures. The performance requirements are highlighted below.

**Table 4.9: Performance Requirement**

| S. No. | Equipment/System                       | Performance Requirement  |
|--------|--|--|
| 1      | Cooling tower and cooling water system | 14 CT cells were to meet the CW cooling requirement of one unit at 215MW load with one cell out of service. The fans/fills for cooling tower were to be designed to meet worst operating condition at the site. The system would be suitable for 46°C temperature of the system at the condenser outlet with 3.5°C TTD for cooling water outlet temperature, the total water flow through all the cooling towers would be 29400 m <sup>3</sup> /h and the range of the CT would be 9°C to 28°C WBT and dry bulb temperature to be 36°C with an approach of 5°C.        |
| 2      | Raw water system                       | The pump would be able to deliver design capacity of 8000 m <sup>3</sup> /h while the system would be operating at under frequency of 47.5Hz and rated head of 1.5m.   |
| 3      | DM Plant and Pre Treatment System      | All the supplied and erected material were to be new and manufactured/supplied by the authorized manufacturers/suppliers. All the materials supplied should be as per the scope of supply & works and technical specifications. As result of replacements/retrofits carried out the design DM plant capacity of 100 m <sup>3</sup> /h per stream and design output between the Regeneration (OBR) which was 1800m <sup>3</sup> /h for Cation, WB Anion, SB Anion exchangers and 5400 m <sup>3</sup> /h for MB Exchanger would be the same or improved than the design. |

### C. Electrical Package

The functional guarantees subject to compliance with the foregoing preconditions, the guarantees were as follows.

**Table 4.10:** Required Functional Guarantees with LD for Unit Transformer

| Sr. No. | Required Functional Guarantees | Value of functional guarantees | Acceptable shortfall limit with LD    |
|---------|--------------------------------|--------------------------------|---------------------------------------|
| 1       | No load loss at 75°C           | 14kW maximum                   | (+) 5% of the guaranteed No load loss |
| 2       | Load loss at 75°C              | 115kW maximum                  | (+) 5% of the guaranteed load loss    |

For all other equipments for which the functional guarantees were not specified as above, contractor had to supply the equipments as per certifications of the tests carried out at the manufacturing shop as witnessed and accepted by the owner’s representatives.

If the functional guarantee parameters found higher than the guaranteed figures but within the acceptable shortfall limit with LD and the contractor had to pay liquidated damages to the employer in lieu of making changes, modifications and/or additions, then the contractor would pay liquidated damages at the rates mentioned in Table 4.11. If the performance requirements as specified for respective equipments could not be demonstrated in the guarantee test then contractor had to carryout suitable corrections/ modifications till such performance requirements were attained. In case of failure to do so employer had the right to reject the equipment.

**Table 4.11:** Rate of LD Payable

| S. No. | Condition of Performance Shortfall        | Rate of LD Payable   |
|--------|---|--|
| 1      | Failure to attain guaranteed No Load Loss | Rs. 0.3 Million for every complete 1kW increase in guaranteed No Load Loss |
| 2      | Failure to attain guaranteed Load Loss    | Rs. 0.3 Million for every complete 1kW increase in guaranteed Load Loss    |

**Limitations of Liabilities:**

In case during PG test(s) it was found that equipments/system had failed to meet the guarantees, the contractor had to carryout necessary modifications and/or replacement to make the equipment/system comply with the guaranteed requirements at no extra cost to the owner and re-conduct the PG test(s) with owner’s consent. In case the specified guarantees still did not meet but were achieved within the shortfall limits, owner would accept the equipment/system after levying LD as per above table. The contractor’s aggregate liability to pay LD for failure to attain the functional guarantees, within the acceptable shortfall limits, were not to exceed 10% of the Contract price. However, if the demonstrated functional performance parameters continue to fall short of the stipulated acceptable limits even after the above modifications/ replacements, then the employer had the right to undertake measures. The liquidated damages for the shortfall in guaranteed parameters and for delay in completion were independent of each other and were to be levied separately and concurrently.

### 4.5.3 Evaluation Criteria and the impact of these on the overall level of competition

#### Technical Evaluation of First Stage Technical Proposals

The Employer were to carry out a detailed evaluation of the first stage technical proposals in order to determine whether the technical aspects were in compliance with the Bidding Document. In order to reach such a determination, the Employer were to examine and compare the technical proposals on the basis of the information supplied by the bidders, taking into account the following.

- a) Overall completeness and compliance with the Employer's Requirements; the technical merits of alternatives offered; conformity of the Plant and Installation Services offered with specified performance criteria, including conformity with the specified minimum (or maximum, as the case may be) requirement corresponding to each functional guarantee, as indicated in the Specification and in Evaluation and Qualification Criteria; suitability of the Plant and Installation Services offered in relation to the environmental and climatic conditions prevailing at the site; and quality, function and operation of any process control concept included in the bid.
- b) Compliance with the time schedule called for in the corresponding the Contract Agreement and any alternative time schedules offered by bidders, as evidenced by a milestone schedule provided in the technical proposal.
- c) Type, quantity and long-term availability of mandatory and recommended spare parts and maintenance services.
- d) Any deviations to the commercial and contractual provisions stipulated in the bidding documents.

The Employer would also review complete alternative technical proposals, if any, offered by the Bidder, to determine whether such alternatives would constitute an acceptable basis for a Second Stage bid to be submitted on its own merits.

#### Evaluation of Second Stage Bids

The Employer used the criteria and methodologies indicated in this Clause. No other evaluation criteria or methodologies were permitted.

#### Technical Evaluation

The Employer carried out a detailed evaluation of the Second Stage bids not previously rejected to determine whether the technical aspects concerning the modifications to the technically acceptable base or alternative bid detailed in the Memorandum entitled "Changes Required Pursuant to First Stage Evaluation", were properly addressed and were substantially responsive to the requirements set forth in the Bidding Document.

#### Economic Evaluation

To evaluate a bid, the Employer considered the following.

- a) The bid price, excluding provisional sums and the provision, if any, for contingencies in the Price Schedules.
- b) Price adjustment for correction of arithmetic errors in accordance with the Bid Document.
- c) Price adjustment due to discounts offered in accordance with the Bid Document.

- d) Price adjustment due to quantifiable nonmaterial nonconformities in accordance with the Bid Document.
- e) Converting the amount resulting from applying (a) to (c) above, if relevant, to a single currency in accordance with the Bid Document.
- f) The evaluation factors indicated in Section- III, Evaluation and Qualification Criteria under the Bid Document.

If price adjustment was allowed in accordance with the Bid Document, the estimated effect of the price adjustment provisions of the Conditions of Contract, applied over the period of execution of the Contract, were not to be taken into account in bid evaluation.

If this Bidding Document allows Bidders to quote separate prices for different lots (contracts), and award to a single Bidder of multiple lots (contracts), the methodology to determine the lowest evaluated price of the lot (contract) combinations, including any discounts offered in the Letter of Bid, was specified in Section-III, Evaluation and Qualification Criteria under the Bid Document.

If the bid, which results in the lowest Evaluated Bid Price, is seriously unbalanced or front loaded in the opinion of the Employer, the Employer may require the Bidder to produce detailed price analyses for any or all items of the Price Schedules, to demonstrate the internal consistency of those prices with the methods and time schedule proposed. After evaluation of the price analyses, taking into consideration the terms of payments, the Employer may require that the amount of the performance security be increased at the expense of the Bidder to a level sufficient to protect the Employer against financial loss in the event of default of the successful Bidder under the Contract.

#### **4.5.4 Analysis of Bidding Process followed in selection/Procurement of Consultants/Suppliers**

Review of key steps undertaken to ensure competitiveness and suggestion to improve the same. Bids for various R&M Works were invited through Global Tender. There were 3 packages i.e. Main Plant package, BOP package and Electrical package. For Electrical packages, bids were submitted by M/s BHEL and M/s ABB. The contract has been awarded to M/s ABB. For BOP package 5 nos. of firms submitted their offers i.e. M/s Energo Engineering Projects, New Delhi, M/s Sunil Hi-Tech Engg. Ltd., Nagpur, M/s Techpro System Ltd. Chennai, M/s Indure Ltd., New Delhi and M/s Turbomachinery Infra Projects Ltd., Hyderabad. The contract has been awarded to Techpro System Ltd., Chennai. The Electrical and BOP packages were single stage bidding. All bidder's queries were addressed with point wise clarifications, required amendments were carried out before submission of the bids. More than sufficient time was given to the bidders and extensions were granted time to time as per requests from the bidders.

In case of BTG package (2 stage bidding), large number of deviations of the bidders in 1<sup>st</sup> stage were tried to be reduced to minimum by convincing them to withdraw it by making point-wise clarifications through correspondence and discussions in bidder wise meetings. Remaining deviations (acceptable in the limit of performance requirement) were tried to be accommodated by making suitable amendments and notifying to all bidders for 2<sup>nd</sup> stage invitation. Further remaining non-acceptable deviations were notified to the individual bidders as memorandum with 2<sup>nd</sup> stage bid invitation. This kept competition alive in the 2<sup>nd</sup> stage bidding.

#### 4.5.5 Analysis of various factors affecting the Procurement outcome & the Problems faced in finalizing the contracts

##### Problems:

- i. Due to lack of bidder awareness, offers received were not systematic even after conducting pre-bid meetings thereby increasing the time for evaluation of offers. There were number of deviations in both commercial and technical. Even after written clarifications the deviations were very high.
- ii. M/s. BHEL had offered the GCV of worst coal as 3400 kCal/kg. One anonymous complaint regarding one bidder was registered and its investigation took three months.
- iii. A lot of time was consumed during two stage bidding in the clarification process. Although it was a World Bank Standard commercial document, bidders came up with very large number of deviations in the 1<sup>st</sup> stage (as large as 300 to 400) as they knew that in 1<sup>st</sup> stage bidding they were not going to be disqualified on the basis of deviations offered. To settle this matter satisfactorily before submission of the 2<sup>nd</sup> stage bidding and keeping them in the competition also, was a herculean task to be done. Time consumed was the main disadvantage.
- iv. BOP rendering was in process. The offered prices for three packages i.e. Cooling Tower, AHP and Fire Fighting package were on higher side than estimated cost.

#### 4.5.6 Technical Surprises:

- i. Fuel Oil line rerouting done.
- ii. Problem in Coal mill Bowl/gear box/ foundation.
- iii. Existing coal mill reject system silos dismantled for new seal air fan foundation.
- iv. Existing ESP Service Transformer overhaul undertaken.
- v. The rating of cooling tower transformers needed to be reviewed in view of increased fan motors rating due to increase in cooling range from 6°C to 9°C.
- vi. Automatic Turbine Rolling System (ATRS) system valves replaced.

#### 4.5.7 Resolutions:

- i. The procurement packages which were smaller in size like Electrical and Balance of Plant attracted more response than the large size package of BTG. However, care was taken while formulating the Qualifying Requirements of all the packages so that it could be more inclusive rather than exclusive, of course not making much compromise with the requirements. In case of BOP package subcontracting was allowed in the QR which could attract large response irrespective of diverse sub packages involved. In case of BTG package basically the bidders are limited with experience of R&M, care was taken not to formulate un-practicable experience criteria (R&M experience of 50 MW and above was permitted for 210 MW Unit's R&M). Experience years were also amended during tenderization procedure as a response to the bidder's request (last 5 years was amended to last 10 years).



- ii. Meetings were held in the months of July and August, 2011 for bid clarification and thereafter, the deviations were minimised.
- iii. The contacts for three packages i.e. Cooling Tower, AHP and Fire Fighting package were awarded at the higher cost only.
- iv. It was a good attempt to adopt International Competitive Bidding (ICB) process for R&M procurement to get the competitive rates. Apart from this the R&M Works have been divided in three different Packages to have better coordination and inter-facing. R&M of complete station is to be done instead of a single unit.

#### 4.6 Unit# 4 & 5 (2x210MW) Badarpur TPS, NTPC, New Delhi

WAPCOS Team of Experts visited Badarpur Thermal Power Station (BTPS) and NTPC Corporate office, Noida and held discussions with the concerned Corporate Authorities regarding their Procurement Experience in awarding the R&M works. During discussions it was revealed that they have already completed the Switchyard works.

Badarpur Thermal Power Station (BTPS) was set up by The Government of India for meeting the growing demand of power in capital city of Delhi. The BTPS was designed and engineered by erstwhile CWPC (Central Water and Power Commission) now CEA (Central Electricity Authority). The plant was operated by CEA till March 1978 when the Govt. Of India decided to entrust the Management of Badarpur Thermal Power Station to National Thermal Power Corporation Ltd. New Delhi, herein after called “NTPC Ltd.” on Management Contract Basis, w.e.f. 01-04-1978. The total installed capacity of BTPS is 3x95MW+2x210MW. Further BTPS was transferred to NTPC from 01<sup>st</sup> June 2006. BTPS unit-4&5 (2x210 MW) were commissioned in 1978-1979 and has completed more than 1,80,000 running hours. In view of the above, NTPC had opted to go in for Renovation & Modernization/Life Extension of these units for achieving the following objectives.

- i. Life Extension of units for 15-20years.
- ii. Sustain availability of units.
- iii. Overcome Technological Obsolescence.
- iv. Meet Statutory & Environmental norms.

M/s. BHEL has carried out RLA on unit-4 Generator in Feb-2000. Some of the problems reported with the generator and auxiliary system are as under-

- a) Axial type seal oil system provided in generator is sensitive to axial displacement of rotor and frequent oil leakages have been experienced.
- b) On line dew point meters has not been provided in the existing system for measuring the dew point temperature of gas.
- c) Core temperature detectors are not working.
- d) Hot spots in the core
- e) Choking in stator water flow through the stator winding in the flow path.

##### 4.6.1 Procurement Experience in awarding R&M Works

CEA clearance was accorded on 22<sup>nd</sup> February, 2008 for stage-II R&M of unit-4&5 at a cost of Rs. 428.64/- Crores excluding taxes and duties, after adding taxes, duties, contingencies and IDC, the board approval was for Rs. 564.53/- Crores. But excluding IDC and Contingency, it was Rs. 504/-



Crores (This figure includes taxes & duties). The tenders for all the packages were invited through ICB. While implementing the packages were divided as site, regional and corporate packages.

The broad scope of work envisaged in the R&M proposal of main plant are:

- a) Replacement of existing HP, IP and LP Turbine modules with new modules of recent design.
- b) Supply & installation of Turbine Vibration Monitoring System, Installation of Condenser On Load Tube Cleaning System, refurbishment of HP-LP Bypass system, replacement of valves etc.
- c) Renovation/Up-gradation of existing coal pulveriser & feeder, replacement of pressure parts, Refurbishment of Air Pre-Heater, replacement of Coal & Oil burners and burner tilt mechanism, replacement of identified expansion joints, dampers and flue gas duct, replacement of flame scanners, FSSS, fuel oil measurement etc.
- d) Supply and Replacement of neutral grounding system for 6.6 KV Aux. Power Supply system, replacement of 6.6 kV HT Switchgear etc.
- e) Installation of new DDCMIS, SWAS system, UPS, measuring instruments etc.

In addition to the above, various other R&M proposals have been formulated after detail study in view of life extension of the unit-4&5 for another 15 years and also reap the benefits of the latest technologies advancement available and achieve incidental increase in unit output and improvement in unit efficiency.

#### 4.6.2 Name of firms to whom bidding documents for R&M works were sent

##### a) ESP:

- NIT was issued on 31<sup>st</sup> March, 2009
- Ten firms participated by purchasing the bids which are as follows.
  - i. HITACHI Japan
  - ii. NASL
  - iii. BHEL
  - iv. Thermax
  - v. FISAI Babcock
  - vi. Long king China
  - vii. Energo MESH, Ukraine
  - viii. BSL engineers
  - ix. KC Cottrell
  - x. Lodge Cottrell

Tender submission: Tender was submitted by following three firms.

- i. Hitachi
- ii. BHEL
- iii. KC Cottrell

Techno commercial opening: 05<sup>th</sup> October, 2009

Awarded to KC Cottrell & Work order issued on 14-March'11. ESP R&M of Unit-4 completed in April 2014 and work of unit-5 ESP was completed in April, 2015.

**b) Switchyard:**

- NIT was issued on 02<sup>nd</sup> January, 2008.
- Following three firms participated by purchasing the bids.
  - i. ABB
  - ii. AREVA
  - iii. Techno Electric Engineering

Tender submitted: Following two firms submitted the tenders.

- i. ABB
- ii. AREVA

Techno commercial bid was opened on 05<sup>th</sup> October, 2008. Awarded to ABB & Work order issued on 25<sup>th</sup> May, 2009.

**c) Control & Instrumentation:**

- NIT issued: 21<sup>st</sup> January, 2015
- Firms participated by purchasing the bids: 9 firms
  - i. L&T
  - ii. SIEMENS
  - iii. BHEL
  - iv. ABB
  - v. Honeywell
  - vi. Emerson
  - vii. Yokogawa
  - viii. Shanghai Xinhua
  - ix. Doosan HF control corporation

Tender was submitted by following nine firms.

- i. L&T
- ii. SIEMENS
- iii. BHEL
- iv. ABB
- v. Honeywell
- vi. Emerson
- vii. Yokogawa
- viii. Shanghai Xinhua
- ix. Doosan HF control corporation

Techno commercial opening date was 18<sup>th</sup> March, 2015.

NTPC team revisited the plant after considering power purchase scenario. NTPC was not interested to invest in R&M of main plant. So, price bids were not opened.

**(d) Main Plant Package:**

The bids of Main Plant Package were invited on 13<sup>th</sup> June, 2008 under International Competitive Bidding (ICB) procedure on two stage bidding basis. The Techno-Commercial bids were opened on 22<sup>nd</sup> December, 2009. Out of six parties who purchased the bidding documents, the bids were received from three parties as under.

- i. BHEL, New Delhi
- ii. NTPS Alstom Power Services Pvt Ltd., Delhi in association with Alstom Projects India Ltd, Mumbai and Alstom Power Ltd., UK (NASL-APIL-APL)
- iii. Doosan Heavy Industries & Construction Company Ltd., Korea in association with Skoda Power a.s., Czech Republic (Doosan-Skoda)

The specifications originally envisaged uprating of the TG capacity from 210 to 216MW. All the bidders submitted the bid security money in the form of Bank Guarantee. After evaluation of technical bids, price bids were opened. The bids were expiring on 22<sup>nd</sup> August, 2011. Hence, bidders were asked to extend the bid validity. After repeated requests, BHEL extended the bid validity up to 22<sup>nd</sup> February, 2012 without extending the corresponding bid security beyond 26<sup>th</sup> October, 2011. As the bidder had not given the extension, it was decided to annul these bids and go for retendering.

Subsequently, in 2012, the package was split into TG R&M as a corporate package and Boiler R&M in many smaller site packages and specifications were prepared accordingly. NTPC team revisited the R&M requirement after considering the power purchase scenario. At this stage, as the main plant R&M was not taken up, price bid for C&I package also was not opened. This tendering process has been kept on hold. The Ministry of Power, Govt. of India informed that no more R&M will be taken up in Badarpur and only minimal need based sustenance work will be done through O&M mode.

#### **4.6.3 Qualification requirements of bidders given for Technical & Financial bids (DDCMIS-C&I R&M package of stage II units)**

In addition to satisfactory fulfilment of the requirements stipulated under Section ITB (Instructions to Bidder), the following were also applicable.

- a) Engineered, Manufactured, Supplied, Erected & Commissioned, Distributed Digital Control, Monitoring & Information system (DDCMIS) / Distributed Control System (DCS), which should have been in successful operation in at least one (1) unit of a coal fired station having unit rating of 200 MW or above for a period of not less than one (1) year prior to the date of Techno-Commercial bid opening.
- b) Executed an order/orders of DDCMIS/DCS whose control system is either same or of the same series as being offered for this package & which should have been in successful operation in at least one (1) unit of coal fired station having unit rating of 200 MW or above for a period of not less than one (1) year prior to the date of Techno Commercial bid opening.

#### **4.6.4 Financial Criteria of Bidder (DDCMIS- C&I R&M package of stage II units)**

- i. The average annual turnover of the Bidder, in the preceding three (3) financial years as on the date of Techno-Commercial bid opening, should not be less than INR 100 Million (Indian Rupees One Hundred million Only) or in equivalent foreign currency.
- ii. The Net Worth of the Bidder as on the last day of the preceding financial year should not be less than 25% of its paid-up share capital.

- iii. In case the Bidder was not able to furnish its audited financial statements on standalone entity basis, the unaudited unconsolidated financial statements of the Bidder could be considered acceptable provided the Bidder further furnished the following documents for substantiation of its qualification:
- Copies of the unaudited unconsolidated financial statements of the Bidder along with copies of the audited consolidated financial statements of Holding Company.
  - A Certificate from the CEO/CFO of the Holding Company, as per the format enclosed with the bidding documents, stating that the unaudited unconsolidated financial statements form part of the consolidated financial Statements of the Holding Company. In case where audited results for the preceding financial year were not available, certification of financial statements from a practicing Chartered Accountant were also to be considered acceptable.
- iv. In case a Bidder did not satisfy the financial criteria, stipulated under the Bid Document, its Holding Company was required to meet the stipulated turnover requirements stipulated under the Bid Document, provided that the net worth of such Holding Company as on the last day of the preceding financial year was at least equal to or more than the paid-up share capital of the Holding Company. In such an event, the Bidder was required to furnish along with its Techno-Commercial bid, a Letter of Undertaking from its Holding Company, supported by Board Resolution of the Holding Company, as per the format enclosed in the bidding documents, pledging unconditional and irrevocable financial support for the execution of the Contract by the Bidder in case of award.

#### **4.6.5 Financial Criteria of Collaborator/ Associate (DDCMIS- C&I R&M package of stage II units)**

For Bidder seeking qualification through relevant clause, the average annual turnover of its Collaborator / Associate in the preceding three (3) financial years as on the date of Techno-Commercial bid opening, should not be less than INR 26Million (Indian Rupees Twenty Six million Only) or in equivalent foreign currency.

The Net Worth of the collaborator/associate as on the last day of the preceding financial year should not be less than 25% of its paid-up share capital. In case the collaborator/associate was not able to furnish its audited financial statements on standalone entity basis, the unaudited unconsolidated financial statements of the collaborator/associate could be considered acceptable provided the Collaborator/Associate further furnished the following documents for substantiation of its qualification.

#### **4.6.6 Financial Guarantees & Associated Liquidate Damages (LD)**

**ESP:**

**LD for Delay in completion:**

Project schedule was 18 months from work order date. The LD for delay is as follows.

- 4200 USD for each day of delay for successful completion of facilities
- 0.5% on price of undelivered spares per week or part thereof maximum 5% of price of all spares.



- The total amount of Liquidated Damages for delay under the Contract was subject to a maximum of five percent (5%) of the Contract Price.

#### **LD for unit shutdown**

- 4200 USD for each day of extension for shutdown

#### **LD for guaranteed parameter**

- For shortfall in guaranteed ESP efficiency the rate of LD was 107,426 USD for every 0.01% decrease in the dust collection of each ESP. a shortfall limit with LD of (-) 0.03% was accepted.
- For increase in Auxiliary Power Consumption in kW from guaranteed value as per the requirements of the Contract the rate of LD was 4218 USD for every 1kW increase in Auxiliary Power Consumption of ESP.
- Each of the LD specified above were independent of each other and were to be levied concurrently in case of shortfall in guaranteed parameters. The above values were on pro-rata basis. The aggregate liability of the contractor to pay LD for failure to meet the guarantee was fixed at a maximum of 10% of the Contract Price.

#### **Switchyard:**

##### **LD for Delay in completion:**

24 months from work order date. LD @ 0.5% per week up to 5% of work. There was not any parameter on which LD was not asked for. The nature of Contract was a price escalation type. Price variation formula was adopted as per as per IEEMA guidelines.

#### **4.6.7 Problems faced during bidding process**

No major problems for ESP and Switchyard packages. Pre bid meeting was organized, Pre bid queries asked by firms were replied by NTPC.

Techno commercial bid of all participating firms opened for Control & Instrumentation project. After considering power purchase scenario, at this point of time, as the main plant R&M was not taken up, price bid of the C&I package also was not opened.

The information/data regarding the key steps undertaken to ensure competitiveness in the bidding process.

- Leniency in technical eligibility criteria so that more firms can participate in the bidding process
- Leniency in financial eligibility criteria so that more firms can participate in the bidding process

#### **4.6.8 Equipment Performance Guarantee**

The Performance Guarantee Parameters are given as under:-

**Table 4.12: Performance Guarantee Parameters of Badarpur TPS**

| S. No. | Performance Guarantees Parameters | Unit No. 4 | Unit No. 5 |
|--------|-----------------------------------|------------|------------|
| (i)    | Plant Availability (%)            | 82         | 82         |
| (ii)   | Heat Rate(kCal/kWh)               | 2825       | 2825       |
| (iii)  | Auxiliary Consumption (%)         | 9.5        | 9.5        |
| (iv)   | Oil Consumption(ml/kWh)           | 1          | 1          |
| (v)    | Emission Level (ESP)              | 50mg       | 50mg       |

- i. Contractor's aggregate liability to pay liquidated damages for failure to attain the functional guarantee not to exceed ten percent (10%) of the Contract Price.
- ii. Liquidated damages for shortfalls in fractions lesser than those specified above to be prorated.

**4.6.9 Analysis of Bidding Process followed in selection/Procurement of Consultants/Suppliers. Review of key steps undertaken to ensure competitiveness and suggestion to improve the same**

For R&M works (except BTG), NTPC made 13 Nos. of small packages apart from 1 Package for ESP. For this tenders were invited from the list of approved contractors & most of these contracts have been awarded. The cost for these 13 Nos. Packages is Rs. 504.16Crores including Taxes & Duties. Thus adequate measures have been taken to ensure competitiveness. The main plant R&M tender is not being pursued further, as no more R&M is to be taken up at Badarpur.

**4.6.10 Analysis of various factors affecting the procurement outcome & the Problems faced in finalizing the contracts.**

The main plant R&M tender is not being pursued further, as no more R&M is to be taken up at Badarpur. The other R&M Works have been split in Packages including 1 for ESP.

**4.6.11 Resolutions**

R&M Works were divided in smaller number of Packages to ensure competitiveness.

**4.7 Unit# 3 (1x210MW) Nasik TPS, MSPGCL, Maharashtra**

WAPCOS Team of Experts visited Nasik Thermal Power Station (NTPS) from 02.05.2013 to 04.05.2013 and held discussions with the Chief Engineer, Superintending Engineer, Executive Engineer and their subordinate engineers regarding their procurement experience in awarding the R&M works. During discussions, it was learnt that they had not yet started the Bidding Process for procurement. Earlier they had framed the Scope of Work for R&M considering the Calorific Value of Coal as 3700 kCal/kg but the Coal being received at the Plant is of around 3000 kCal/kg. As such they are considering to redesign the parameters at 3200 kCal/kg and accordingly recast the Scope of R&M Works.

Nasik TPS have got conducted Feasibility Study, Hot Walk Down Survey, Generator Testing, RLA of Boiler & Turbine, Energy Audit in June, 2009 for R&M works of 210 MW Unit 3. The



contract for these studies was awarded to M/s Evonik Energy Services (India) Pvt. Ltd., Noida. The work was awarded through CEA, New Delhi on 20.11.2008 as per the consulting contract between Ministry of Power, Central Electricity Authority (Employer) and consortium of Evonik Energy Services GmbH, Essen, Germany and Vottenfoll Europe Power Consultant GmbH Vetchan, Germany (Consultant). The final DPR for the R&M works was submitted in March, 2011. The total estimated cost of work is Rs. 481.06 crores. The proposed scope of works has been divided into three packages namely BTG Package, BOP Package and Electrical Package

MAHAGENCO appointed STEAG Energy Services (India) as implementation support consultant. The tender documents for procurement of the executive agency for BTG Package were prepared and put up for MSPGCL Board approval. The Board approval to the tender document was awaited. Board directed that R&M work shall be taken up without monitoring results of Koradi Unit-6. Further procurement process has not been initiated.

#### **4.7.1 Procurement Experience in awarding R&M Works**

Procurement process has not been initiated for R&M of unit 3 of Nashik TPS.



## Chapter-5

### Analysis of Procurement Experience

The objective of this study is to study and analyze procurement procedure followed by different utilities in bidding and finalizing the contracts and the problems/drawbacks encountered during the procurement process and to suggest the steps required to avoid such shortcomings in the procurement process which has an important bearing on the overall completion time of R&M works.

#### 5.1 Time Gap

The Time Gap is defined as the gap between completion of RLA and Zero Date for R&M works. It has been observed that the Bidding Documents for supply of material and erection are finalized at a much later stage after the completion of RLA. The following table illustrates the actual time taken at various thermal power stations covered under the present review.

**Table 5.1:** Time duration between RLA & Zero Date of R&M

| S. No. | Utility/Unit              | Completion of RLA/DPR  | Zero Date of R&M works  | Time Duration Between RLA/DPR & Zero Date of R&M (Months) |
|--------|---------------------------|------------------------|---|---|
| 1      | Unit 1, Panipat TPS       | 12/2001                | 31/07/2006  | 67  |
| 2      | Unit 6,7&8 Kothagudem TPS | 6/1995                 | 07/08/1999  | 50  |
| 4      | Unit 5, Bandel TPS        | 07/2008 (DPR Approval) | 14/03/2012  | 44  |
| 5      | Unit 3, Amarkantak TPS    | 04/2001                | As the contract was awarded in multiple packages and were not awarded in one through, therefore, time gap/time taken cannot be given accurately |   |
| 6      | Unit 4, Amarkantak TPS    | 08/2001                |   |   |
| 7      | Unit 6, Koradi TPS        | 06/2009 (DPR Approval) | 03/03/2014  | 57  |

Thus, the Time Gap for unit-5 of Bandel TPS was 44 Months and that of the unit-6 of Koradi TPS was 57 months from the date of DPR approval to Zero Date for R&M works, which is too high. This resulted into following problems:

- i. Further deterioration of both healthy and other over-stressed equipments /auxiliaries
- ii. Delay in Project Schedule

## 5.2 Qualification Requirements, Performance Guarantees and Project Schedule

Following were the qualifying requirements, performance guarantees and project schedule followed at various thermal power stations.

### 5.2.1 Qualifying Criteria/Requirements (for goods, works, and non-consulting services)

The qualification requirement of the bidders was based on two criteria. One was technical requirement in which the bidder was required to be reputed manufacturers/authorized dealers having experience of supplying/installation of similar material to any two Thermal Power Stations and were in successful operation from last two years. Bidders were also asked to submit the documentary evidence for establishing these conditions. The second requirement was of financial nature in which the bidders were required to submit the balance sheets for last five years. In addition to the above, following criteria was also looked for:

- a. Profile of the company
- b. Net worth of the company
- c. Latest audited balance sheet
- d. Reference list giving details of similar works carried out
- e. Methodology of execution
- f. Completion period
- g. Source of procurement of additional equipment and spare
- h. Assessment of modification works that had to be carried out
- i. Loan schedules and schedule for submission of financial information indicating the amount in percentage for local and foreign loans

### 5.2.2 Performance Guarantees

- a) In most cases PG test could not be performed because unit did not achieve the targeted values. It has also been observed that time gap between RLA studies and Zero Date is very high.
- b) The splitting of R&M works in a number of small packages have not only resulted into larger time overrun but has also not given the desired output.

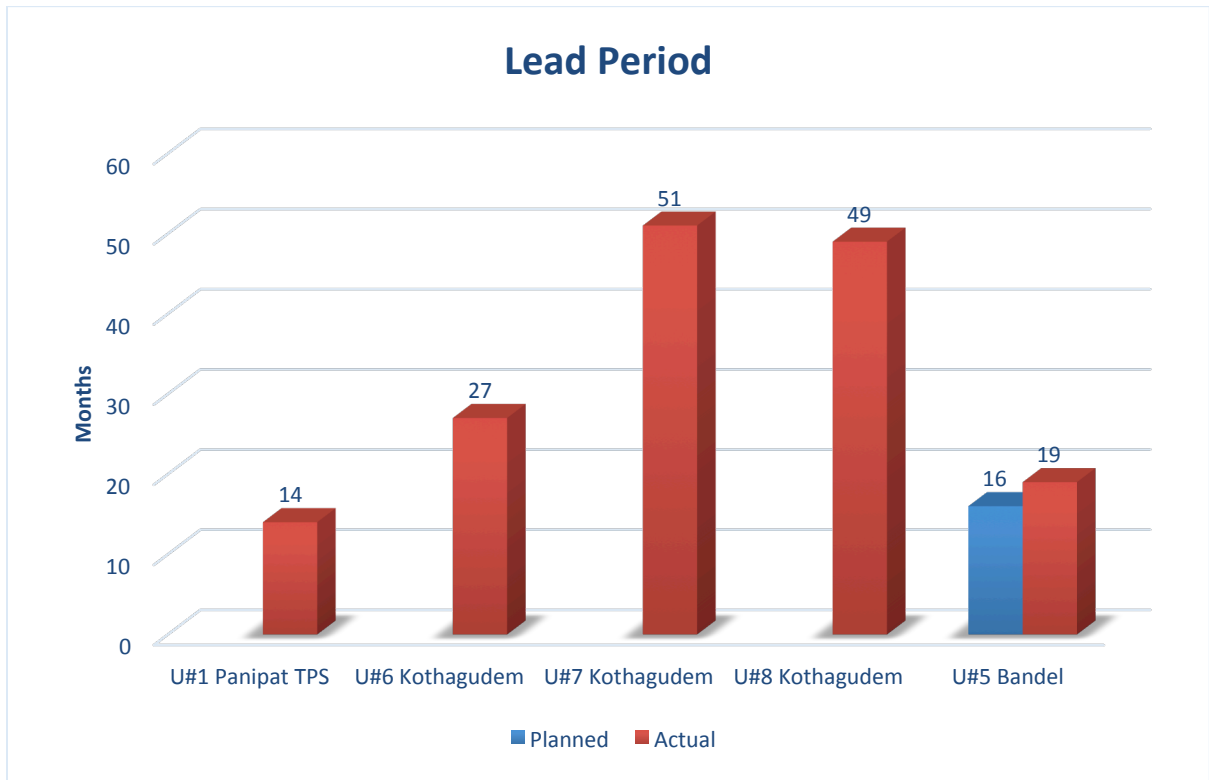
The following Table indicates the level of Performance Guarantees provided under the Bid Documents issued by various Thermal Power Stations.

**Table 5.2: Performance Guarantees for Different Utilities**

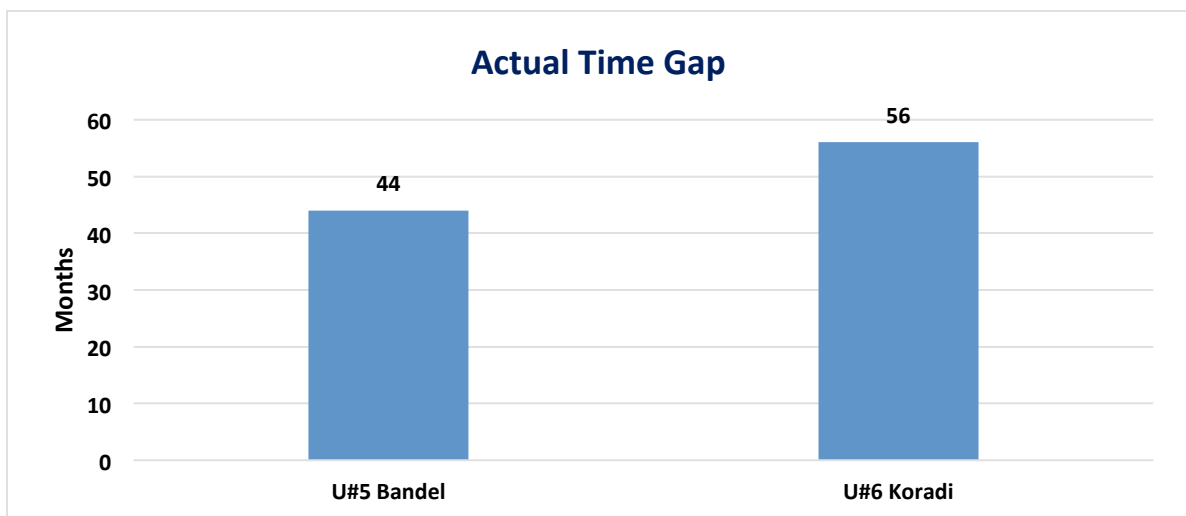
| TPS                    | Turbine Generator MCR (MW) | Boiler MCR capacity (T/hr.) | Boiler Efficiency (%) | Unit Availability (%) | Turbine Heat rate (kCal/kWh) |
|------------------------|----------------------------|-----------------------------|-----------------------|-----------------------|------------------------------|
| Panipat Unit#1         | 120                        | 375                         | 86                    | 90                    | 2018                         |
| Kothagudam Units#6,7&8 | 120                        | 375                         | 86.46                 |                       | 1993.53                      |
| Bandel Unit#5          | 215                        |                             |                       |                       | 2456                         |
| Amarkantak Units#1&2   | 120                        |                             |                       |                       |                              |

### 5.2.1 Project Schedule

Project Schedule mainly depends upon the R&M Tasks to be covered. The chart given below shows the project schedule vis-à-vis the actual.



**Figure 5.1:** Comparative Lead Period of Different Utilities



**Figure 5.2:** Actual Time Gap of utilities

It has generally been seen from the above chart that actual time taken in procurement has been more than more than the schedule time resulting into delay in the completion of R&M project. The Project Schedules should therefore be decided on realistic basis, after analyzing and reviewing the facts.

### 5.2.2 Liquidated Damages [LD]

The below Bar Chart shows the Rate of Liquidated Damages for Delay adopted at various thermal power stations under the present review. Such Liquidated Damages continue to be levied as long as the delay persists subject to certain limit laid down in the contract.

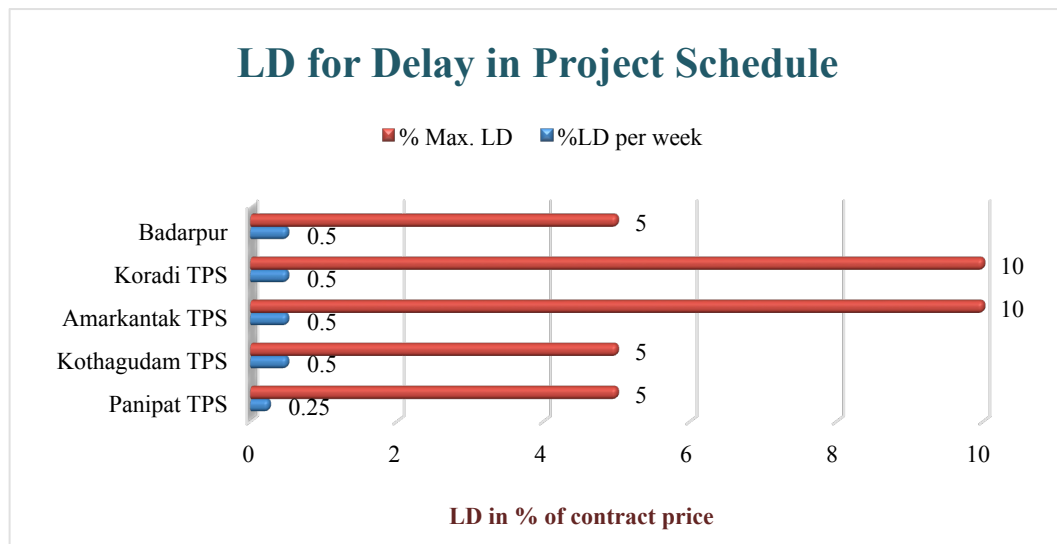


Figure 5.3: Liquidated Damages for Delay in Project Schedule

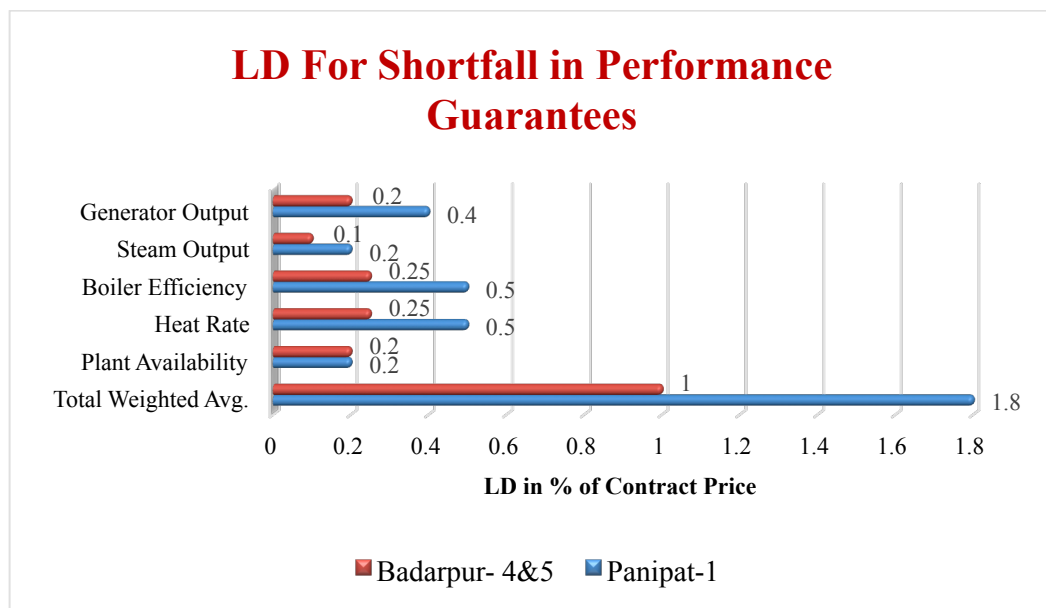


Figure 5.4: Liquidated Damages for Shortfall in Performance Guarantees

The above Bar Chart shows the Liquidated Damages for shortfall in performance [%weighted average deviation from the guaranteed performances as per the values specified under Technical Specification and scope of supply]. Liquidated Damages for shortfall in performance to be recoverable from the R&M Contractor @2.5% of the Contract Price for each one percent (1%) weighted average deviation subject to maximum of 5%.

### **5.3 Analysis of bidding process followed in selection and procurement of consultants/suppliers to undertake the required R&M interventions**

The Power Utilities are following the below noted Bidding Process.

- i. Quality and Cost Based Selection (QCBS)
- ii. International Competitive Bidding (ICB)-Global Tender
- iii. Domestic Competitive Bidding (DCB)
- iv. Open Tender
- v. Single Tender on OEM (Original Equipment Manufacturer)

It is observed that there is good response against all the Bidding Modes noted above. The Power Utilities are getting technically qualified Firms/Suppliers/Consultants who meet Qualification Requirements as well as the Evaluation criteria. However, all care should be taken while preparing the Qualifying criteria with special emphasis on the past experience and recent financial position for selection of Consultants/ Suppliers / Contractors.

### **5.4 Key steps undertaken to ensure competitiveness**

- a) Some of the Power Utilities have awarded the Contract on Turnkey basis whereas others have split the Contract into 3 to 4 Main Packages such as Main Plant, BoP, Electrical, C&I and Civil. In certain cases the R&M works have been split in smaller Packages, say 13 to 14 Packages such as Main Plant, Electrical & C&I and various smaller Packages of auxiliary Systems of the Plant.
- b) Some Power Utilities have given the contract jointly for Supply & Erection whereas in some cases the contract has been split into separate Supply & Erection Packages.

The competitiveness in the Bidding Process can be further improved by adopting the following measures:

- i. Laying down stringent Technical & Financial Qualifying Requirements.
- ii. Laying down stringent Technical & Financial Evaluation Criteria.
- iii. Laying down improved Performance Parameters
- iv. Provision of Performance/Functional Guarantees along with LD [Liquidated Damages] Clause.
- v. Provision of Project Schedule along with LD [Liquidated Damages] Clause.
- vi. In case of any deviations, LD [Liquidated Damages] Clause should be invoked in strict compliance of the provisions.
- vii. Award of Contract with firm prices as the implementation period is very small, say about 6 Months



- viii. The time gap between preparation of DPR & Zero date of R&M should be minimum. (approx. one year)
- ix. The bidders should be reputed manufacturer/authorised dealer only, having experience of supplying/installation of similar equipments/material to any 2 thermal Power Station with successful operator since last two years.
- x. Bidder should be required to submit the balance sheet for the last five years
- xi. The scope of work, specifications & terms of reference should be clearly defined in tender documents to avoid any ambiguity or misconception during bidding process.
- xii. Contractual conflicts may be caused by some serious flaws in the contract. It is essential that while preparing contract documents special care should be exercised to clearly define each & every clause to minimize the problems of Contract Execution stage

### 5.5 Various other factors affecting the procurement outcome

There is no standard Bidding Procedure for awarding the contract for engagement of Consultants and R&M Works. Different Utilities/Project Authorities are following different procedures based on their individual past practices for awarding the contract for Procurement of Material and execution of R&M works. Due to this there can be problems/difficulties during the execution stage as happened in case of Panipat TPS. M/s ABB were engaged for both conducting the studies and execution of R&M Works as well during 1998. However they left the work in-between reportedly, due to some breach of contractual provisions and the matter is under arbitration. Consequently the Unit No # 2 of Panipat TPS remained under shut down for a very long period of about 5 years.

- Some serious flaws in the contract may cause such contractual conflicts. In some TPS, the cost of project had increased, as the contractors demanded extra payments on account of petty items/works, which were not clearly defined in the purchase orders/work orders. It is therefore very essential that while preparing the Contract Documents, special care should be exercised to clearly define each and every clause to avoid problems at the execution stage.
- When the Contract for different Packages is awarded to different Firms, there is high probability of difficulty in co-ordination/interfacing of the concerned equipment. This may lead to problem in achieving the Performance Parameters. To avoid problems in co-ordination and inter-facing, the R&M works should be split into minimum possible small Packages such as Main Plant, BoP, Electrical, C&I and Civil etc. The R&M contract can be awarded in single package or multiple packages.

The advantages and disadvantages of single and multiple packages are as below:

- **Single Package:** Following are the advantages and disadvantages of this system.
  - a. Advantages
    - i. The total responsibility of R&M rests with one contractor

- ii. The problem of interfacing works between various major equipments such as boiler, turbine, generator, electrical, C&I etc. does not arise as they are handled by same contractor
    - iii. For delay/deficiency in performances, liquidated damages will have to be paid by the contractor based upon total contract value
  - b. Disadvantages
    - i. Single package contract may result in high contract price
    - ii. The discretion for selection of suppliers/vendors for sub-packages are generally be with main contractor
- o **Multiple packages:** Following are the advantages and disadvantages of this system.
  - a. Advantages
    - i. This gives lower contract price
    - ii. There are more specialized suppliers/vendors available for respective areas
    - iii. Better monitoring and control of different works is possible
  - b. Disadvantages
    - i. It is more difficult to lay responsibility for overall R&M works on a single contractor
    - ii. There is likelihood of mismatching between various system/equipments being handled by different contractors
    - iii. There is difficulty in deciding the amount of liquidated damages to be charged from different contractors
- LD Clauses for Delay in the Project Schedule as well as shortfall in Performance Guarantees should be properly provided in the R&M Contracts. However it may also be incorporated in the contract that no LD shall be recoverable if the Delay is due to either unforeseen reasons attributed to the Plant Authorities or the Executing Agencies.
- In case of Bandel TPS, it was felt that to adopt International Competitive Bidding (ICB) process for R&M procurement was a good attempt to get the competitive rates. Apart from this the R&M work was divided in five different Packages (Main Plant i.e. BTG package, CHP package, Electrical Package, AHP package, and Air conditioning system of Control Room and associated areas of Unit-5 of Bandel TPS) resulting in better coordination and inter-facing, which helped consequently in smoothening the speedy implementation of R&M works.
- In case of Koradi TPS, the packages which were smaller in size like Electrical and Balance of Plant attracted more response than the large size packages of BTG. However, care was taken while formulating the Qualifying Requirements of all the packages so that it could be more inclusive rather than exclusive. Due to lack of bidder awareness, offers received were not systematic even after conducting pre-bid meetings thereby increasing the time for evaluation of offers. A lot of time was consumed during two stage bidding in the





clarification process. Apart from this, the R&M Works have been divided in three different Packages to have better coordination and interfacing

#### **5.6 Conclusion:**

- To avoid problems in coordination & interfacing, the R&M works should be split into minimum possible small packages
- As far as possible, joint contract for both Supply & Service may be awarded.



## Chapter-6

### Recommendations

There is no standard procurement procedure for awarding the contract for supply of materials and execution of R&M Works. Different Power Utilities are following different procedures based on their individual past practices for procurement of material and execution of R&M works. Earlier, the consolidated contracts for both procurement of material as well as execution of R&M works were being awarded to OEM's (Original Equipment Manufacturers) largely on Single Tender on nomination basis which has limited competition in the market and has acted as major deterrent for entry of various suppliers. However, the scenario has now changed due to the presence of national and international players, which are also bidding either directly or through joint ventures with the domestic player. As of now the Power Utilities have started adopting Open Tendering for procurement.

WAPCOS circulated the Questionnaire amongst Power Utilities/Thermal Power Stations for collection of data/information related to procurement and subsequently visited various Power Stations under the study and held interactions with the Power Station Authorities. Thereafter WAPCOS examined the data/information so collected on the procurement process adopted by the Power Utilities. The bidding documents made available such as Qualification Requirements, Performance Guarantees, Project Schedule and Evaluation Criteria etc. were studied. The key steps undertaken to ensure competitiveness in the bidding process and various other factors having impact on the procurement outcome were also examined. Apart from this, the problems faced while finalizing the contract(s) were also studied. Accordingly, following recommendations are made:

1. It has been observed that the Time Gap between completion of DPR/RLA Studies and Zero Date-for R&M Project has been quite large and varies from one thermal power station to the other. It varied from 44 Months (Unit #5, Bandel TPS) to 99 Months (Unit # 8, Kothagudem TPS). This Gap is large and unwanted for following reasons:
  - i. Cost escalation of R&M works takes place due to increase in prices, which are not controllable.
  - ii. Since most of the components/systems of the thermal unit have already served their designed life, any further delay in their revival shall lead to their frequent outages besides more wear and tear, resulting into loss of generation both in terms of quantity and cost.
  - iii. This shall also lead to further deterioration of both healthy and other over-stressed equipments / components.
  - iv. It shall cause delay in Project Schedule.

Based on individual experience of the Utilities/Projects and also keeping in view the above factors, it is recommended that the Time Gap between completion of RLA Studies/DPR and Zero Date for R&M Project should not exceed one year as selection of bidders for execution of R&M works would require around one year.



2. The Scope of Work, Specifications & Terms of Reference should be clearly defined in the Tender Documents to avoid any ambiguity or misconception during bidding process. The scope should be clearly defined based on condition assessment and RLA studies before preparing Tender Document for Life Extension/R&M Projects.
3. Some serious flaws in the contract may cause contractual conflicts. It is therefore very essential that while preparing the contract documents, special care should be exercised to clearly define each and every clause to minimize the problems at the contract execution stage.
4. Price increase for supply of the equipment will only be allowed beyond the original delivery date unless covered by an extension of time awarded by the employer under the terms of contract. No price increase be allowed for periods beyond delay for which the supplier is responsible. The employer will, however, be entitled to the benefit of any price decrease occurring during such periods of delay.
5. In case of comprehensive R&M of Boiler & Turbine islands, the International Competitive Bidding (ICB) be preferred over awarding of R&M works on nomination basis to get better price discovery through enhanced competition.

# Appendix-I

## Terms of Reference

### 1. Background

- 1.1 India currently has an installed generation 173,626 MW (as on 31.03.2011), of which 93918 MW (54 percent) is coal-fired contributing major share of total generation. While much of the 1970s (and older) vintage units have been or need to be retired, many of the coal-fired power plants (NTPC as well as state utility owned plants) that were commissioned in and before early 1980s are now due for rehabilitation and life extension.
- 1.2 CEA has prepared a National Perspective Plan for facilitating the R&M (Renovation & Modernization) and L.E. (Life Extension) works at various thermal power stations in the country. Through the Perspective Plan, efforts would be made to facilitate rehabilitation of the old thermal plants with an objective of efficiency enhancement, life extension, up-rating and reduction in Greenhouse Gases emissions by repair, replacement, modification and technology up gradation. Fifty three (53) units with a total capacity of 7318 MW of Life Extension (LE) works & seventy six (76) units with a total capacity of 18965 MW for R&M works have been identified for the 11th Plan. Similarly for the 12th Plan, LE works on seventy two (72) thermal units of total capacity 16532 MW and R&M works on twenty three (23) units of total capacity 4971 MW have been identified under the above National Perspective Plan.
- 1.3 The World Bank has financed the “Coal-Fired Generation Rehabilitation Project” for demonstrating energy efficient rehabilitation and modernization (EE R&M) of coal fired generation units through rehabilitation of 640 MW of capacity across three states- West Bengal, Haryana and Maharashtra. The project would also address critical barriers to large scale EE R&M in India. The project would be funded through IBRD loan of US\$ 180 million and GEF grants of US\$ 45.4 million. The project has two components:-

#### **Component-1: Energy Efficiency R&M Pilots Using US \$ 180 million of IBRD loan and US \$ 37.9 million of GEF grants:**

This component would fund Energy Efficient R&M of 640 MW capacity comprising Bandel TPS Unit-5(210 MW) of WBPDC, Koradi TPS Unit-6(210 MW) of Mahagenco and Panipat TPS Unit-3&4 (2x110 MW) of HPGCL. The World Bank has earmarked US\$ 180 million of IBRD loan and US \$ 37.9 million of GEF grants for the Component-1.

#### **Component-2: Technical Assistance to address Critical Barriers to EE R&M:**

The World Bank has earmarked US \$ 7.5 million GEF Grant for the Component-2. The sub-components for the technical assistance program would cover:

- i. Support for design of Energy Efficient R&M projects.
- ii. Support for implementation of demonstration of EE R&M investments funded under Component-1 of the project.
- iii. Support for addressing barriers to EE R&M projects.
- iv. Support for strengthening of institutional capacities of utilities.

- 1.4 Under the sub-component (iii) of the component-2 (Technical Assistance) around US\$ 1.1 million of GEF Grants are being made available to provide technical support to CEA aimed at addressing barriers to implementation of R&M in India. This component would be implemented through the Central Electricity Authority through appointments of Consultants including Implementation Support Consultant (ISC) to carry out following studies –
- i) Review of Institutional Capacity and Implementation of Capacity Strengthening Interventions at CEA
  - ii) Reduction of barriers to R&M interventions in thermal power plants in India;
  - iii) Developing markets for implementation of R&M scheme in thermal power stations in India;
  - iv) Review of experience from Pilot R&M interventions in thermal power stations in India.
- 1.5 Ministry of Power, GOI vide letter No. 10/1/2009-IC dated 07.01.2009 have conveyed in-principle approval for the above proposed project under the title "National Programme for R&M". CEA has been identified as the Project Implementing Agency for sub-component (iii) of Component -2 for Technical Assistance. The sub-component (iii) would be implemented under the title **“Technical Assistance to CEA for Addressing the Barriers to Energy Efficiency R&M of Coal Fired Generating Units in India”**.
- 1.6 CEA has already appointed Implementation Support Consultant who is assisting CEA in appointing the Consultants for the above four studies and in co-ordination amongst CEA & various Consultants and monitoring of Consultant’s works & Pilot R&M projects funded by World Bank.
- 1.7 The World Bank is supporting pilot energy efficiency focused R&M interventions at Unit-5 of Bandel TPS, Unit-6 of Koradi TPS (Maharashtra State Power Generation Company Limited) and Units 3 & 4 of Panipat TPS. In addition, similar pilots are also being taken up under KfW funding at Nasik TPS (Maharashtra), Bokaro ‘B’ TPS (Damodar Valley Corporation) and Kolaghat TPS (West Bengal) under Energy Efficiency R&M Programme under Indo-German Energy Forum. The National Electricity Policy envisages that Renovation & Modernization (R&M) for achieving higher efficiency levels needs to be pursued vigorously and all existing generation capacity should be brought to minimum acceptable standard. Hence, the Pilot energy efficiency focused R&M projects have been facilitated to gain an experience from these Pilot R&M projects and to implement the same at other thermal power stations in India.

## **2. Assignment & Broad Scope of Work**

The main objective of the assignment is to procure Consultant who inter-alia would review the experience of the activities which have been carried out in the Pilot R&M Projects during different stages of preparation and implementation of these projects and would prepare reports for dissemination of the experience across Utilities in India. The consultant will also review the implementation experience at other R&M projects taken up by the utilities during 11<sup>th</sup> Plan and 12<sup>th</sup> Plan.

The main task of the Consultant would be to facilitate CEA in sharing of experience on Pilot R&M projects and other R&M/LE projects taken up during 11<sup>th</sup> plan and 12<sup>th</sup> plan.

For this, CEA would require support from the Consultants in the following manner but not limited to:

- a) Review of Procurement Experience including preparation of DPR, Bidding documents, etc.;
- b) Review of R&M Implementation Experience;
- c) Review of Experience in Strengthening of O&M Practices;
- d) Review of Post-R&M Experience in O&M;
- e) Dissemination of Learnings from Pilot R&M Interventions.

### 3. Detailed Description of Tasks

Work would be undertaken in the manner as given below:

#### 3.1 Review of Procurement Experience for Pilot R&M Projects

- a) The Consultant shall analyse and review the procurement experience in awarding R&M works for Pilot R&M projects funded by the World Bank and KfW. The Consultant shall, especially, look into the DPR, Bidding documents, Qualification Requirements, Performance Guarantees and Project Schedule. The Consultant shall also review the Evaluation Criteria including Project Schedule and Performance Parameters and the impact of these on the overall level of competition and price bid discovery. For review of the procurement experience, the Consultant shall cover all the R&M related procurement activities completed till May 2014 at the identified thermal power stations as part of study.
- b) The Consultant shall carry out analysis of bidding process followed by the power generating companies in selection and procurement of consultants/suppliers to undertake the required R&M interventions. The Consultant shall also analyse and review the key steps undertaken to ensure competitiveness in the bidding process and suggest the possible options to improve the competitiveness in the bidding process.
- c) The Consultant shall examine the various other factors that may have affected the procurement outcome at the Pilot R&M Projects of World Bank and KfW; and also analyse the problems faced while finalizing the contract(s) for Pilot R&M Projects.
- d) The Consultant is required to visit the selected thermal power stations to collect and compile the relevant information and document to undertake the desired review and analysis.
- e) The Consultant shall prepare and submit a report on learnings from the procurement experience from the Pilot R&M Projects of the World Bank and KfW projects for dissemination purposes for future R&M projects.
- f) The review exercise will be limited to the thermal power stations as mentioned in the **attached list of projects as Annexure I.**

#### 3.2 Review of R&M Implementation Experience

- a) The Consultant shall review the available R&M Implementation Experience at thermal units in various thermal power stations as **mentioned in Annexure-II.**

Broadly, the review would include inter-alia the time and cost aspects, technical surprises, contractual arrangements and the performance achieved. The Consultant shall cover R&M Implementation Experience available at the above mentioned thermal power stations till two months before the scheduled timeline for submission of Draft Final Report on this activity.

- b) The review of the R&M Implementation experience shall also include the analysis of project management process and identify the areas where the actual project implementation deviated from desired objectives and analyse the reasons for such deviations.
- c) The Consultant is required to visit the selected thermal power stations to collect and compile the relevant information & documents to undertake the desired review and analysis.
- d) Based on the review of R&M implementation experience, the Consultant shall prepare a report on R&M/LE Implementation Experience which may be helpful to the generating companies for carrying out the R&M works in future.

### **3.3 Review of Experience in Strengthening O&M Practices**

- a) The Consultant shall review the interventions of Operations & Maintenance (O&M) strengthening practices undertaken by the concerned power generating companies – WBPDC, MSPGCL and HPGCL.
- b) The Consultant shall review the strengthening interventions undertaken by the utilities for enhancing O&M practices across the various facets including technology, O&M planning, conditional monitoring, preventive maintenance, O&M procedures, enhancement in technical & managerial skills of O&M personnel and infrastructure/facilities improvement etc.
- c) The Consultant shall indicate the benefits accrued on account of the various strengthening interventions in O&M practices undertaken at these thermal power stations.
- d) The Consultant shall list out the drawbacks/shortcomings faced in the O&M practices followed by power generating companies after implementation of the strengthening interventions and suggest possible measures for further improvements.
- e) The Consultant may be required to undertake visits of above mentioned power generating companies for the purpose of the review of the experience in strengthening O&M practices.
- f) Based on the review and discussion with the generation utilities, the Consultant shall prepare a report on strengthening of Operation & Maintenance (O&M) practices followed by these power generating companies for the purpose of sharing the learnings/experience.

### **3.4 Review of Post - R&M Experience in O&M**



- a) The Consultant shall review and share the Post - R&M Experience in O&M after the plant has been in operation for a considerable time (say about six months) after completion of R&M works at the thermal power stations as **mentioned in Annexure III**. The review will include Post -R&M review of the operational performance of the generating units where R&M interventions have been undertaken **till eight months before the scheduled timeline for submission of Draft Final Report** and indicate the improvements in their operational performance.
- b) The Consultant shall list out the problems/challenges faced in O&M of thermal unit after implementation of the R&M interventions and suggest suitable measures for further improvements in the units.
- c) The Consultant may be required to make visits to listed thermal power stations for the purpose of review of the Post- R&M experience in O&M.
- d) Based on the review of O&M experience, the Consultant shall prepare a report on Post R&M experience in O&M at the listed thermal power stations for the purpose of sharing the experience for future R&M units.

### **3.5 Dissemination of Learning from Pilot R&M Interventions and other R&M Projects**

- a) The Consultant in association with CEA will conduct One (01) workshop in Delhi for sharing of experience with different stakeholders on R&M activities carried out at Pilot R&M projects and other R&M Projects.
- b) The Consultant shall submit Fifty (50) copies and soft copies in CD's of all Final Reports to CEA for sharing experience with the future R&M projects.

## **4. Deliverables and Tentative Time Schedule for completion of task**

- 4.1. The contents and break-up of the deliverables/reports will have to be agreed with CEA. The assignment is likely to commence in May 2012 and the tentative time schedule for completing the various activities is as under:

| <b>S.No</b> | <b>Deliverable</b>   | <b>Timeline (Tentative)</b> |
|-------------|--|-----------------------------|
| 1.          | Inception Report   | June 2012                   |
| 2.          | Draft Report on review of procurement experience (available till the timeline) at Pilot R&M Projects                               | December 2012               |
| 3.          | Draft Report on review of Experience (available till the timeline) in Strengthening O&M practices                                  | July 2013                   |
| 4.          | Draft Report on review of R&M Implementation experience (available till the timeline) at Pilot R&M Projects and other R&M projects | December 2013               |

|     |  |                |
|-----|--|----------------|
| 5.  | Draft Report on review of Post - R&M experience in O&M of the thermal power stations                       | April 2014     |
| 6.  | Draft Final Report on review of procurement experience available at Pilot R&M Projects <sup>1</sup>        | June 2014      |
| 7.  | Draft Final Report on review of Experience in Strengthening O&M practices <sup>2</sup>                     | June 2014      |
| 8.  | Draft Final Report on review of R&M Implementation experience available at Pilot R&M Projects <sup>3</sup> | July 2014      |
| 9.  | Draft Final Report on review of Post - R&M experience in O&M of listed thermal power stations <sup>4</sup> | July 2014      |
| 10. | Conduct Workshop for sharing of experience on Pilot R&M Projects with Stakeholders                         | September 2014 |
| 11. | Final Report on review of procurement experience available at Pilot R&M Projects                           | October 2014   |
| 12. | Final Report on review of Experience in Strengthening O&M practices  | October 2014   |
| 13. | Final Report on review of R&M Implementation experience available at Pilot R&M Projects                    | October 2014   |
| 14. | Final Report on review of Post R&M experience in O&M of the listed thermal power stations                  | October 2014   |

**Note:**

- 1 The Draft Report shall include the experience in procurement available at the R&M projects till the indicated timeline. The rest of the experience in procurement at the R&M projects available during the period between submission of the Draft Report and Draft Final Report shall be included in the Draft Final report.
- 2 The Draft report shall include the experience in strengthening O&M practices available at the R&M projects till the indicated timeline. The rest of the experience in strengthening O&M practices at the R&M projects available during the period between submission of the Draft Report and Draft Final Report shall be included in the Draft Final Report.
3. The Draft report shall include the experience in implementation available at the R&M projects till the indicated timeline. The rest of the experience in implementation at these R&M projects available during the period between submission of the Draft Report and Draft Final Report shall be included in the Draft Final Report.
- 4 The Draft report shall include the Post- R&M experience in O&M till the indicated timeline. The rest of the experience in the Post- R&M experience in O&M available during the period between submission of the Draft Report and Draft Final Report shall be included in the Draft Final Report.

- 4.2. The Consultant will be required to submit monthly and quarterly progress reports to CEA.
- 4.3. The Consultant shall submit 10 copies of Inception Report, 10 copies of all Draft Report, 10 copies of all Draft Final Report and 50 copies of all Final Reports.
- 4.4. All deliverables/reports shall be prepared in hard form and also in electronic form (Word, Excel, Power Point, pdf files etc.). The reports shall be submitted on A4 Size paper with adequate size of alphabets/symbol & line spacing.

## **5. Support/Inputs to be provided by CEA**

- 5.1. CEA will be the Employer of the Consultant and will nominate a Project Manager. Project Manager will act as liaison officer to the Consultant's team. He will be the point of contact and initial addressee for all aspects of the works.
- 5.2. The CEA will provide all existing information, data, reports and maps as available and will assist the Consultant in obtaining relevant information and materials from government institutions and state authorities to the extent possible.
- 5.3. CEA will not provide any space for office.
- 5.4. Personal Computers, Laptops, printers, photocopier, stationery items etc. will be arranged by the consultant.

## **6. Consultant Skill Sets and Team Composition**

The Consultant team should have an appropriate mix of experience and expertise in India and abroad in respect of Renovation & Modernisation of thermal power plants and Power Sector Policy /Regulations. The Key Professional Staff in the Consultant team are expected to be from technical background and also having the knowledge of Indian Power Sector, especially with regard to Operation & Maintenance of thermal power stations and R&M/LE programme implementation. The team of the Consultant shall comprise a Team Leader, one R&M Expert, one O&M Expert, one Commercial Expert & one Environment Expert. The Key Professionals would be spending their time depending on requirement of the assignment during the entire duration of the assignment. The Consultant should have an in depth knowledge of the current R&M/LE guidelines/policies and regulatory frameworks for thermal power plants in India. The Consultant should also have expertise in assessing environmental impact/benefits of the R&M/LE projects. The Consultant may propose additional members in their team to provide required expert services in other areas / tasks identified by them. The required qualification & experience is given in the table below:

| S. No. | Key Position       | Minimum Qualification and Experience                |   |
|--------|--------------------|---|---|
| 1.     | Team Leader        | B.E. /<br>B. Tech                                   | Team Leader shall have minimum fifteen years (15 years) professional experience in Power Sector including ten years' experience in O&M / R&M of coal fired thermal power stations having units of capacity of 110 MW and above.             |
| 2.     | R&M Expert         | B.E. /<br>B. Tech.                                  | R&M specialist should have minimum ten years (10 years) experience in Power sector including two years' experience in R&M of coal fired thermal power stations having units of capacity of 110 MW and above.                                |
| 3.     | O&M Expert         | B.E. /<br>B. Tech.                                  | O&M specialist should have minimum ten years (10 years) experience in Power sector including five years' experience in O&M/ R&M of coal fired thermal power stations having units of capacity of 110 MW and above.                          |
| 4.     | Commercial Expert  | MBA/B.E.<br>/<br>B. Tech.                           | Commercial expert should having minimum ten years (10 years) experience in contract management in Infrastructure sector including three years (3 years ) experience on contract management in R&M/O&M of coal fired thermal power stations. |
| 5.     | Environment Expert | Graduation / Post Graduation Degree in Environment. | Environment Expert should have minimum ten years (10 years) experience in assessing the environmental aspects of infrastructure projects.   |

**ANNEXURE-I**

**List of Units to be considered for review of Procurement Experience  
for Pilot R&M projects**

| Sl No | Unit No  | Capacity (MW)   | Name of Thermal Power Station (TPS) | Name of Utility/State   | Executing Agency           | Completion of LE Works/Status |
|-------|----------|-----------------|-------------------------------------|-------------------------|----------------------------|-------------------------------|
| 1     | 6        | 1X210           | Koradi TPS                          | MSPGCL/Maharashtra      | Yet to be awarded          | DPRs are under finalisation   |
| 2     | 5        | 1 x 210         | Bandel TPS                          | WBPDC/ West Bengal      | Yet to be awarded          | DPRs are under finalisation   |
| 3     | 1, 3 & 4 | 2x110,<br>1x110 | Panipat                             | HPGCL/ Haryana          | BHEL,<br>Yet to be decided | DPRs are under finalisation   |
| 4     | 4 & 5    | 2x210           | *Badarpur                           | NTPC                    | Yet to be awarded          | DPRs are under finalisation   |
| 5     | 6,7&8    | 3x110           | *Kothagudem                         | APGENCO, Andhra Pradesh | Yet to be awarded          | DPRs are under finalisation   |
| 6     | 3        | 1x210           | Nasik TPS                           | MSPGCL/Maharashtra      | Yet to be awarded          | DPRs are under finalisation   |
| 7     | 1 & 2    | 2x120           | *Amarkantak                         | MPPGCL                  | Yet to be awarded          | DPRs are under finalisation   |

\* As per the meeting held at CEA on November 08, 2012 and Minutes of Meeting communicated by CEA vide their letter no. 2/52/TRM/CEA/2012/1888 dated 21.11.2012, Chandrapur TPS Units 1&2(1x210MW), Parli TPS Units 2&3 (1x 210 MW) and Kolaghat TPS Unit 3 (1x 210MW) have been replaced by Badarpur TPS Units 4&5 (2x210MW), Kothagudem TPS Units 6,7 and 8 (3x110MW) and Amarkantak TPS Units 1,2 (2x120 MW) respectively for Review of Procurement Experience for Pilot R&M projects (completed till May 2014).

**ANNEXURE-II**

**List of Units to be considered for review of R&M Implementation Experience**

| SI No | Unit No  | Capacity (MW)   | Name of Thermal Power Station (TPS) | Name of Utility/State  | Executing Agency                             | Completion of LE Works/Status   |
|-------|----------|-----------------|-------------------------------------|------------------------|--|---|
| 1     | 1 & 2    | 2x120           | Ukai TPS                            | GSECL/Gujarat          | BHEL   | <b>Unit 1</b> - Unit was synchronized on 24 May 2008 after LE works<br><b>Unit 2</b> - Unit was synchronized on 24 February 2010 after LE works   |
| 2     | 9 & 10   | 1 X210          | Obra                                | UPRUVNL/ Uttar Pradesh | BHEL   | <b>Unit 9</b> - Synchronized in September 2010. Unit is under stabilization after R&M<br><b>Unit 10</b> -Shut down is expected in October 2011. LE works to be completed in 2012-13           |
| 3     | 3 & 4    | 2 x 110         | Bhatinda TPS                        | PSPCL/Punjab           | Unit 3 - BHEL,                               | <b>Unit 3</b> - Unit is expected to be Synchronized by November 2011<br><b>Unit 4</b> - LE works to be taken after stabilization of Unit-3  |
| 4     | 1        | 1x110           | Muzaffurpur                         | KBUNL/Bihar            | BHEL   | Expected date of Completion November 2011 after LE works  |
| 5     | 5        | 1 x 210         | Bandel TPS                          | WBPDC/ West Bengal     | Yet to be awarded                            | DPRs are under finalisation   |
| 6     | 1        | 1X210           | **Talcher TPS                       | Odisha                 | Yet to be awarded                            | DPRs are under finalisation   |
| 7     | 1, 3 & 4 | 2x110,<br>1x110 | Panipat                             | HPGCL/ Haryana         | Unit 1- BHEL,<br>Unit 3&4- Yet to be awarded | <b>Unit 1</b> - Unit was synchronized on 4 November 2008 after LE works<br><b>Unit 3</b> - DPRs for LE works is under finalisation<br><b>Unit 4</b> - DPRs for LE works is under finalisation |

\*\* As per the meeting held at CEA on November 08, 2012 and Minutes of Meeting communicated by CEA vide their letter no. 2/52/TRM/CEA/2012/1888 dated 21.11.2012, Koradi TPS Unit 6 (1x 210 MW) has been replaced by Talcher TPS Unit 1 (1x 210 MW) for review of R&M Implementation Experience.

**ANNEXURE-III**

**List of Units to be considered for Review of Post-R&M Experience in O&M**

| S<br>I<br>N<br>o | Unit<br>No | Capacity<br>(MW) | Name of<br>Thermal<br>Power<br>Station<br>(TPS) | Name of<br>Utility/State  | Executing<br>Agency  | Completion of LE<br>Works/Status  |
|------------------|------------|------------------|---|---------------------------|----------------------|---|
| 1                | 1& 2       | 2x120            | Ukai TPS  | GSECL/Gujarat             | BHEL                 | <b>Unit 1-</b> Unit was synchronized on 24 May 2008 after LE works<br><b>Unit 2 -</b> Unit was synchronized on 24 February 2010 after LE works                                      |
| 2                | 1 & 2      | 2x120            | Amarkantak<br>Exten TPS                         | MPPGCL/Madhya<br>Pradesh  | BHEL                 | <b>Unit 1-</b> Expected date of Completion by October 2011<br><b>Unit 2 -</b> Unit was synchronized on 26 October 2010  |
| 3                | 9 & 10     | 1 X210           | Obra  | UPRUVNL/ Uttar<br>Pradesh | BHEL                 | <b>Unit 9-</b> Synchronized in September 2010. Unit is under stabilization after R&M<br><b>Unit 10 -</b> Shut down is expected in October 2011. LE works to be completed in 2012-13 |
| 4                | 3 & 4      | 2 x 110          | Bhatinda TPS                                    | PSPCL/Punjab              | Unit 3 -BHEL,        | <b>Unit 3-</b> Unit is expected to be Synchronized by November 2011<br><b>Unit 4-</b> LE works to be taken after stabilization of Unit-3  |
| 5                | 1          | 1x110            | Muzaffarpur                                     | KBUNL/Bihar               | BHEL                 | Expected date of Completion is November 2011 after LE works   |
| 6                | 7          | 1x110            | Barauni TPS                                     | BESB/Bihar                | BHEL                 | Completion of LE works is expected in 2012-13   |
| 7                | 5          | 1 x 210          | Bandel TPS                                      | WBPDC/ West<br>Bengal     | Yet to be<br>awarded | DPRs are under finalization   |
| 8                | 6          | 1X210            | Koradi TPS                                      | MSPGCL/Maharas<br>htra    | Yet to be<br>awarded | DPRs are under finalization   |



## APPENDIX-II



Government of India  
Central Electricity Authority  
Thermal Renovation & Modernisation Division  
Sewa Bhawan, 9<sup>th</sup> Floor, North Wing  
R. K. Puram, New Delhi -11 00 66

Fax: 011-2618 6904

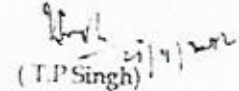


No. 2/52/TRM/CEA/2012/ 1808

Dated: 21.11.2012

**Subject:** Minutes of the meeting held at CEA on November 08, 2012 to discuss the progress of various consultancy assignments awarded under the Project "Technical Assistance to CEA for Addressing the Barriers to Energy Efficient R&M of Coal Fired Generating Units in India" funded by World Bank. reg.

Enclosed please find herewith the Minutes of the Meeting held at CEA on November 08, 2012 to discuss the progress of various consultancy assignments awarded under the Project "Technical Assistance to CEA for Addressing the Barriers to Energy Efficient R&M of Coal Fired Generating Units in India" funded by World Bank.

  
( T.P. Singh )  
Chief Engineer (TRM) Div.

To

S/Shri

- C. Subramaniam, Senior Power Engineer, South Asia Sustainable Development-Energy, The World Bank, Hindustan Times House, 18-20, Kasturba Gandhi Marg, New Delhi-110001, Fax NO. 49247639
- Mr. Suresh Gehani, Director, ABPS Infrastructure Advisory Pvt. Ltd., 309, A-Wing, Kohinnor City, Kiroi Road, OFF LBS Marg, Kurla (West), Mumbai - 400 070. (Fax-022 - 61240499)

- 
- Mr. Vivek Srivastava, Technical Director, KPMG Advisory Services Pvt. Ltd., Building No 10, 8th Floor, Tower-B, DLF Cyber City, Phase-II, Gurgaon - 122002(India). (Fax: 0124-2549101)
  - Mr. Anish De, Chief Executive Officer, AF - MERCADOS EMI, 1202, Millennium Plaza, Tower B, Sector - 27, Gurgaon(Haryana) - 122 002. (Fax : 0124-424-1751)
  - Ms. M. Vanisree, Dy. Chief Engineer (Elect-I), WAPCOS Limited, 76-C, Sector - 18,Gurgaon (India), Pincode -122 015. (Fax: 0124-2349449)

**Copy for information to :**

1. SA to Chairman, CEA
2. SA to Member (Thermal), CEA
3. SA to Member (E&C),CEA

Minutes of the Review meeting held at CEA on November 08, 2012 to discuss the progress of various consultancy assignments awarded under the Project "Technical Assistance to CEA for Addressing the Barriers to Energy Efficient R&M of Coal Fired Generating Units in India" funded by World Bank.

A meeting was held on November 08, 2012 at CEA to discuss the progress of various consultancy assignments awarded under the Project "Technical Assistance to CEA for addressing the barriers to Energy Efficient R&M of Coal Fired Generating Units in India" funded by World Bank.

At the outset, Chief Engineer (TRM), CEA, Shri T.P Singh welcomed the representatives of World Bank and representatives from Consultancy Organisations.

**Present:**

The following representatives attended the meeting:

**CEA:**

- Sh. T.P Singh Chief Engineer (TRM) Div.
- Sh. Bhai Lal, Director, (E and R&M) Div.
- Sh. J. N. Prasad, Dy. Director, TRM Div.
- Sh. Anis Ahmad, Dy. Director, TRM Div.

**World Bank:**

- Sh. B. John Hamso, Senior Energy Economist
- Sh. C. Subramaniam, Senior Power Engineer
- Smt. Mani Khurana, Energy Economist

**ISC (ABPS Infra):**

- Sh. Suresh Gehani, Director
- Sh. Himanshu Agarwal, Deputy Manager

**Mercados Energy Markets (India) Pvt. Ltd**

- Sh. Anish De, Chief Executive Officer
- Sh. Vikas Gaba, Senior Manager
- Sh. Saurabh Gupta, Senior Consultant
- Sh. Rajarishi Goswami, Consultant

**KPMG Advisory Services Pvt. Ltd. :**

- Sh. Ashutosh Kumar, Manager
- Sh. Gaurav Goyal, Consultant

**WAPCOS**

- Smt. M. Vanisree, Addl. Chief Engineer, Power
- Sh. N.S Chauhan, Consultant

The summary of the discussions held during the meeting are as follows:

1. **Progress Review of Study on "Review of Institutional Capacity and Implementation of Capacity Strengthening Interventions at CEA"**
  - a. The representatives of M/s KPMG Advisory Services Pvt. Ltd. briefed about the status of Study on "Review of Institutional Capacity and Implementation of Capacity Strengthening Interventions at CEA" and submitted that Focussed Group Discussions with the Wing Nodal Officers and Special Assistants to the Members of 29 divisions of CEA have been undertaken as required for submission of report on Assessment of Institutional Capacity of CEA. Further, the Draft Questionnaire for undertaking the customer expectation surveys has been prepared and circulated to the Wing Nodal Officers and Special Assistants to the Members for comments. In this regard, World Bank representatives suggested KPMG to circulate Questionnaire to World Bank once it is finalised after incorporating the comments on the questionnaire.
  - b. M/s KPMG also discussed the list of stakeholders for undertaking customer expectation survey. With regard to the list of stakeholders, World Bank suggested to include SJVNL (Satluj Jal Vidyut Nigam Limited), Torrent Power and CESC (Calcutta Electric Supply Corporation) as a backup, in case consent for survey from any of the listed stakeholders is not obtained.
  - c. World Bank representatives further suggested that the CEA shall provide the letter addressed to Ministry of Power, Planning Commission, Ministry of Coal, Ministry of Environment & Forest etc. either of Member/Chairman of CEA to M/s KPMG Advisory Services Pvt. Ltd. to obtain the good response from customers.



**2. Progress Review of Study on "Reduction of barriers to R&M interventions in thermal power plants in India"**

- a. The representatives of M/s Mercados Energy Markets (India) Pvt. Ltd. briefed about the status of Study on "Reduction of barriers to R&M interventions in thermal power plants in India" and submitted that the following Draft guidelines have already been submitted to CEA:
- Draft Guidelines for Risk Identification and Mitigation in R&M Projects
  - Draft Guidelines for Early Identification of Potential Technical Surprises in R&M Projects and ways of addressing them.
- b. M/s Mercados submitted that the next deliverable of "Draft Report on study for identifying the potential reduction in Green House Gas (GHG) emissions on account of R&M and suggesting possible framework for monetizing the GHG reduction" will be submitted during the week starting November 19, 2012.
- c. M/s Mercados further requested CEA to extend the date of submission of "Draft Report on study of International best practices in R&M projects" as they are planning to visit some of the R&M projects implemented in other countries to obtain the first-hand international experience of Pilot R&M projects. M/s Mercados suggested to submit the Draft report on the same by first week of January. World Bank and CEA both agreed for the request and suggested M/s Mercados to submit report by first week of January.
- d. World Bank suggested that the Draft Guidelines prepared by M/s Mercados should be sent to major Suppliers/Consultants/Utilities/Funding Agencies, which are playing vital role in R&M of thermal power stations for their comments, before these are discussed in the Task Force Meeting.

**3. Progress Review of "Study for Developing Markets for Implementation of R&M scheme in thermal power stations in India"**

- a. The representatives of M/s Mercados Energy Markets (India) Pvt. Ltd. briefed about the status of "Study for Developing Markets for Implementation of R&M scheme in thermal power stations in India" and submitted that the Draft Excel based model for estimating the R&M Potential Assessment of coal based thermal power stations in India is almost prepared. M/s Mercados further informed that their team would like to have a discussion with CEA on the Model during the week starting November 19,

2012. Accordingly, based on discussions the Draft Report for the "Study with the aim of developing markets to meet the impending demand of R&M in India" will be submitted to CEA.

- b. M/s Mercados further informed that they are planning to have Workshops/Road Shows on the draft report during the month of January 2013. Thereafter, the final Report for "Study with the aim of developing markets to meet the impending demand of R&M in India" will be submitted to CEA.

4. Progress Review of Study on "Review of Experience from Pilot R&M Interventions in Thermal Power Stations in India"

- a. M/s WAPCOS Ltd. briefed that the revised Inception Report has been submitted to CEA and it will be finalised after incorporating CEA's comments on the same. Further M/s WAPCOS informed that site visit to Panipat Thermal Power Plant has been conducted.
- b. During the meeting, the list of Plants selected for reviewing the various experience of R&M was discussed and it was decided to make the following replacements in the list of Power Plants selected for review of the "Procurement Experience for Pilot R&M Projects (completed till May 2014)" and "R&M Implementation Experience" considering the fact that desired experience may not be available at the power plant during the course of the study.

Table: List of the Power Plants to be replaced

| S.No.  | Existing Power Plants in the List                 | Replaced New Power Plants in the list                |
|--|---|--|
| <b>Procurement Experience for Pilot R&amp;M Projects (completed till May 2014)</b> |   |  |
| 1.   | Chandrapur TPS, Units 1&2 (1x210 MW), Maharashtra | Badarpur TPS, Units 4 & 5 (2 x 210 MW), NTPC         |
| 2.   | Parli TPS, Units 2&3 (1x210 MW) Maharashtra       | Kothagudem TPS, Units 6, 7 & 8 (3 x 110 MW), APGENCO |
| 3.   | Kolaghat TPS, Unit 3 (1x210 MW), West Bengal      | Amarkantak TPS, Units 1,2 (2 x 120 MW), MPPGCL       |
| <b>R&amp;M Implementation Experience</b>   |   |  |
| 1.   | Koradi TPS, Unit 6 (1x210 MW) Maharashtra         | Talcher TPS, Units I (1x210 MW)                      |

#### 5. Task Force Meeting

It was discussed to schedule the next meeting of Task Force for Promoting Renovation & Modernisation(R&M) of Thermal Power Stations in India to December 17, 2012. Further it was discussed that during the next Task Force meeting, major Utilities/Suppliers/Consultants those are active in the field of R&M of thermal power stations, should also be invited to discuss the Guidelines prepared under the study Reduction of Barriers, i.e., "Draft Report and Guidelines for Risk Identification and Mitigation in R&M Projects" and "Draft Guidelines for Early Identification of Potential Technical Surprises in R&M Projects and ways of addressing them".

#### 6. Hosting on Draft Guidelines on CEA Website

It was discussed that CEA may host "Draft Guidelines for Risk Identification and Mitigation in R&M Projects" and "Draft Guidelines for Early Identification of Potential Technical Surprises in R&M Projects and ways of addressing them" on its website for obtaining the comments of various stakeholders.

The meeting ended with a vote of thanks to the Chair.

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## QUESTIONNAIRE

### Appendix III

Kindly supply the required additional information on the following points in respect of your plant, to reinforce the final draft report on Procurement of materials for R & M works.

- i) Name of firm who carried DPR/Feasibility study
- ii) Brief details of these reports
- iii) Name of firms to whom Bidding documents for R&M works were sent
- iv) Qualification requirements of Bidders may be given as per both technical and financial bids.
- v) Name of packages with corresponding names of firms to whom contracts were awarded.
- vi) What were financial Guarantees & Associated Liquidated Damages for major packages
- vii) Guaranteed project schedule and associated liquidated damages
- viii) Performances parameters asked for with no LDs
- ix) Nature of contract, whether fixed price or with price escalation
- x) Problems faced during bidding process, if any
- xi) Key steps undertaken to analyze the problems faced while finalizing the contracts(s) for Pilot R&M projects may be elaborated suitably.
- xii) The information/data regarding the key steps undertaken to ensure competitiveness in the bidding process.
- xiii) Complete Cost of Project with possible breakups. Whether it was as stipulated or was high/low. The reasons for the same.
- xiv) Technical surprises if any, encountered during the execution of R&M works, with their cost.