



भारत सरकार

Government of India

I.S.O.: 9001: 2015

केन्द्रीय विद्युत प्राधिकरण

Central Electricity Authority

तापीय परियोजना नवीनीकरण एवं आधुनिकीकरण प्रभाग

Thermal Projects Renovation & Modernisation Division



CEA-JCOAL Workshop FY22

## Quarterly Review Report Renovation & Modernisation of Thermal Power Stations

Quarter: July-Sept., 2023

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## **Foreword**

Renovation & Modernization (R&M)/Life Extension (LE) has been recognized as one of the cost effective options for obtaining the additional generation and better outputs from the existing old thermal power units. The R&M of such units is very essential for performance improvement of the units as well as to comply the stricter environmental norms for improving environmental conditions. On the other hand, the Life Extension (LE) of the old thermal power units is carried out with an aim to extend their useful life 15 to 20 years beyond the original design economical life.

The Thermal Projects Renovation & Modernization (TPR&M) Division is entrusted with the responsibility of monitoring the progress of R&M/LE activities in thermal power generating units in the country under Section 73(f) of the Electricity Act, 2003. Based on the interaction and information received from various utilities, the Quarterly Review Report (QRR) is prepared highlighting the latest status of the physical progress of R&M/LE works at various thermal units.

R&M/LE works in 08 units of capacity of 1197 MW have been completed up to 30.09.2023.

A committee comprising representatives from NTPC, CEA, GSECL and BHEL was constituted to study various aspects of Life extension and R&M of coal based thermal power stations including guidelines for choosing candidate plants for R&M, objectives of R&M, viable business model, guiding principle for preparation of bidding document. The final report was approved by MOP and the same is ready for publication.

FY 2022 Clean Coal Technology (CCT) Training Program (Virtual) under Indo-Japan Cooperation has been organized between 31st Oct. 2022 to 2nd Nov., 2022. Under Indo-Japan Cooperation, a one-day Workshop on "Project on Efficiency and Environmental Improvement for Sustainable, Stable and Low-carbon Supply of Electricity" will be organized jointly by CEA and JCOAL on 13th Jan, 2022.

A MOU on India-Denmark Energy Cooperation was signed between the two governments in June 2020. TPRM Division, CEA is coordinating the following areas/activities under this cooperation: i. Transfer of technology for emission control from Thermal Power plants, ii. Waste heat recovery from Thermal power plants, iii. Flexibility in operation of power plants for RE integration. Flexible operation test has been successfully conducted in thermal generating units of Unit #7, 500MW Ramagundam TPS of NTPC and Unit #3, 210 MW Raichur TPS of KPCL under India-Denmark cooperation.

An MOU between CEA and IIT Delhi was signed on 12.12.2022 to survey ambient atmospheric SO<sub>2</sub> concentrations in different category of cities based on their vicinity to thermal power plants (TPPs). Further, an additional study (Phase II) on the direction of Hon'ble Minister where simultaneous measurements of ambient atmospheric SO<sub>2</sub> concentrations at two different locations in three different category of cities namely, Gautam Buddha Nagar, Kota and Lucknow based on their vicinity to coal based thermal power plants (TPPs) is to be conducted and the status of FGD installation in these TPPs.

A report on "Flexibilisation of coal fired power plants" a roadmap for achieving 40% technical minimum load has been published in February, 2023. Looking at the addition of renewables in future, the thermal power utilities will be required to play a very important role. The report will be beneficial for the utilities for understanding the need and implication of flexible operation of coal fired units. Further a SOP & training curriculum at 55% minimum technical load has been published in March, 2023 which will help utilities to prepare themselves for 55% load operation.

Finally, I would like to express my sincere thanks and gratitude to the Utilities and other stakeholders for obeying CEA's guidelines during implementation of R&M/LE works at old thermal power plant and furnishing status of R&M. I would also like to thank for timely submission of status of installation of FGD/ upgradations of ESP to comply with new environmental norms thus helping us to prepare & publish quarterly review report.

Dated: 30.09.2023



( B.C. Mallick )  
PCE (CEA)

## Highlights

### 1. LE/ R&M Achievements during 12<sup>th</sup> Plan (2012-17)

| Sl. No. | Particulars                            | State Sector |               | Central Sector |               | Total (State + Central) |               |
|---------|----------------------------------------|--------------|---------------|----------------|---------------|-------------------------|---------------|
|         |                                        | No. of units | Capacity (MW) | No. of units   | Capacity (MW) | No. of units            | Capacity (MW) |
| A)      | LE works                               |              |               |                |               |                         |               |
| 1.      | Completed during 12 <sup>th</sup> Plan | 10           | 1380          | 11             | 1261.76       | 21                      | 2641.76       |
| B)      | R&M works                              |              |               |                |               |                         |               |
| 2.      | Completed during 12 <sup>th</sup> Plan | 05           | 850           | 11             | 3710.5        | 16                      | 4560.5        |
|         | <b>TOTAL</b>                           | 15           | 2230          | 22             | 4972.26       | 37                      | 7202.26       |

### 2. LE / R&M Programme during (2017 - 22)

| Category       | LE/R&M works identified during 2017-22<br>No. of units & capacity (MW) |                | Total<br>(State Sector + Central Sector) |
|----------------|------------------------------------------------------------------------|----------------|------------------------------------------|
|                | State Sector                                                           | Central Sector |                                          |
| <b>LE</b>      | 34 (7570)                                                              | --             | 34 (7570)                                |
| <b>R&amp;M</b> | 30 (7135)                                                              | 07 (224)       | 37 (7359)                                |
| <b>Total</b>   | 64 (14705)                                                             | 07 (224)       | 71 (14929)                               |

### 3. Achievements of R&M and LE Projects upto 30.09.2023

| Sl. No. | Particulars | LE/R&M works completed No. of units & capacity (MW) |                | Total (State Sector + Central Sector)<br>MW |
|---------|-------------|-----------------------------------------------------|----------------|---------------------------------------------|
|         |             | State Sector                                        | Central Sector |                                             |
| 1       | LE          | 05(1020)                                            | --             | 05(1020)                                    |
| 2       | R&M         | --                                                  | 03(177)        | 03(177)                                     |
| Total   |             | 05(1020)                                            | 03(177)        | 8(1197)                                     |

## 4. Flexible Operation of Thermal Power Stations

A committee has been constituted in CEA under the chairmanship of Chief Engineer (TPRM) to find out the level of flexibilization required from thermal power stations and future roadmap for integration of 175 MW RES generation capacity into Indian grid by 2022. The committee has come up with the findings of the quantum of flexibilization, minimum thermal load, and ramp rate required in its interim report in June 2018. The final report of the committee was released by Secretary (Power) on 18th March 2019. The report has been shared with the stakeholders of power sector. A pilot test of 40% minimum load operation and 3% ramp up/ramp down (i.e. 15 MW/ Min) has been successfully conducted in Dadri TPS of NTPC. Study at Anpara-B TPS of UPRVUNL and Vindhyachal TPS of NTPC has been conducted by JCOAL to improve the flexibility of the plants. BHEL has conducted flexible operation pilot tests at Mauda TPS of NTPC, Sagardighi TPS of WBPCL and Ukai TPS, GSECL.

Flexible operation (up to 40% load) test has been conducted at DSTPS, Andal of DVC and MPL, Maithon (Unit-2) of TATA Power under IGEF from 22-23 July, 2021. Another test conducted between 28.03.2022 to 01.04.2022 at DSTPS, Andal of DVC under IGEF.

A report on flexible operation of coal fired power plants is being published. Looking at the addition of renewables in future, the thermal power utilities will be required to play a very important role. The report will be beneficial for the utilities for understanding the need and implication of flexible operation of coal fired units.

## 5. External Co-operation for R&M/LE of TPS

The status of activities under external co-operation for R&M/LE of TPS is furnished below: -

### **Indo-Japan Co-operation for Project on Efficiency & Environment Improvement for Sustainable, Stable and Low Carbon Supply of Electricity of Coal Fired Stations.**

Under Clean Coal Technology (CCT) Training Programme study tours to Japan have been organized in which representatives from MoP, CEA and different power utilities have participated. The participants visited the latest USC power stations and updated about various applicable technologies and equipment as well as O&M technique. During the FY22, 50 participants have undergone the Virtual CCT Training Programme from 31st Oct. 2022 to 2<sup>nd</sup> Nov., 2022.

Under Indo-Japan Cooperation, a one-day Workshop on “Project on Efficiency and Environmental Improvement for Sustainable, Stable and Low-carbon Supply of Electricity” will be organized jointly by CEA and JCOAL on 13<sup>th</sup> Jan, 2022.

Since 2018 when air pollution incurred by open biomass burning has come to be highlighted as one of the major environmental issues to be addressed, CEA and JCOAL embarked on a biomass utilization study under the Cooperation. A Viability Study on co-firing technology of Agricultural Waste and Coal was also conducted by JCOAL in Lehra Mohabbat, PSPCL (Punjab) for Air Pollution Control in India in Feb, 2020. In the report they have mentioned that up to 30% biomass co firing is found to be the most feasible by installation of biomass pelletizing technology, converting biomass into curl chip. The GCV of curl chip is about 4000 KJ/KG which is similar to Indian coal and generation cost is expected to roughly equal to the current generation cost of GHTP (Guru Hargobind Thermal Power Plant, Punjab).

# **Quarterly Review Report on Renovation, Modernisation and Life Extension of Thermal Power Plants**

## **1. Introduction**

At the time of independence, the total installed capacity in the power sector was 1362 MW of which steam power plants contributed 756 MW. The installed generation capacity has since grown manifold. The total installed capacity as on 30.09.2023 is 425406.47 of which thermal power plants contributed 239292.91 MW (56.25%) The contribution of Coal, Gas and Diesel based thermal power plants of total installed capacity is 48.66%, 5.88 % and 0.13 % respectively.

Renovation & Modernization (R&M) is seen as a cost-effective option for additional generation from the existing thermal power stations and better asset management due to its low cost and short gestation period. Besides generation improvement and improvement in availability, other benefits achieved from R&M / LE include life extension, improved safety, reliability & environmental conditions.

Many of the thermal power plants are not operating to their full potential and large numbers of thermal units including 200/210 MW units are old and outlived their normal economical design life. The 66 LMZ units of 200/210 MW Capacity are potential target for Energy Efficiency R&M (EE R&M).

## **2.0 Objective of R&M Programme**

The main objective of Renovation & Modernisation (R&M) of thermal generating units is to make the operating units well equipped with modified / augmented with latest technology with a view to improve their performance in terms of output, reliability, availability, reduction of outage time, ease of maintenance and minimizing inefficiencies.

## **3.0 Objective of Life Extension Programme**

The R&M programme is primarily aimed at generation sustenance and overcoming problems. The life extension (LE) programme on the other hand focuses on plant operation beyond their original design life after carrying out specific life assessment studies of critical components with an aim to increase the life beyond the design economic life of 25 years.

## **4.0 Renovation and Modernisation (R&M) and Life Extension Programme (LEP) from 7<sup>th</sup> Plan onwards till 12<sup>th</sup> Plan**

R&M Programme in a structured manner 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 Plan wise details are given below: -

| S. No. | Five Year Plan                        | Year                          | No. of TPS / No. of Units        | Capacity (MW)                | Additional Generation Achieved MU/ Annum* | Equivalent MW** |
|--------|---------------------------------------|-------------------------------|----------------------------------|------------------------------|-------------------------------------------|-----------------|
| 1      | 7 <sup>th</sup> Plan & 2 Annual Plans | 85-86 to 89-90 & 90-91, 91-92 | 34 / 163                         | 13570                        | 10000                                     | 2000            |
| 2      | 8 <sup>th</sup> Plan (R&M) (LEP)      | 1992 to 1997                  | 44 / 198<br>43/(194)<br>1/(4)    | 20869<br>(20569)<br>(300)    | 5085                                      | 763             |
| 3      | 9 <sup>th</sup> Plan (R&M) (LEP)      | 1997 to 2002                  | 37 / 152<br>29/ (127)<br>8/ (25) | 18991<br>(17306)<br>(1685)   | 14500                                     | 2200            |
| 4      | 10 <sup>th</sup> Plan (R&M) (LEP)     | 2002 to 2007                  | 9/25<br>5/(14)<br>4/(11)         | 3445<br>(2460)<br>(985)      | 2000                                      | 300             |
| 5      | 11 <sup>th</sup> Plan (R&M) (LEP)     | 2007 to 2012                  | 21/72<br>15/(59)<br>6/(13)       | 16146<br>(14855)<br>(1291)   | 5400                                      | 820             |
| 6      | 12 <sup>th</sup> Plan (R&M) (LEP)     | 2012 to 2017                  | 18/37<br>8/16<br>10/21           | 7202.5<br>4560.50<br>2641.76 | ----                                      | ----            |

\*Tentative figure.

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

## 5.0 R&M/ LE Programme during (2017 - 22)

The Summary of R&M/ LE Programme to be implemented during 2017-22 is given below. The status of implementation of the R&M/LE works at various units is furnished at Annexure-1.

| Category | LE/R&M works identified during 2017-22<br>No. of units & capacity (MW) |                | Total<br>(State Sector + Central Sector) |
|----------|------------------------------------------------------------------------|----------------|------------------------------------------|
|          | State Sector                                                           | Central Sector |                                          |
| LE       | 34 (7570)                                                              | --             | 34 (7570)                                |
| R&M      | 30 (7135)                                                              | 07 (224)       | 37 (7359)                                |
| Total    | 64 (14705)                                                             | 07 (224)       | 71 (14929)                               |

The Summary of achievements of R&M/ LE Projects is given below:

As on 30.09.2023

| Year    | LE<br>No. of units (MW) |         | R & M<br>No. of units (MW) |         | Total<br>(state + central)<br>No. of units (MW) |         | Total LE<br>and R&M<br>No. of<br>units<br>(MW) |
|---------|-------------------------|---------|----------------------------|---------|-------------------------------------------------|---------|------------------------------------------------|
|         | State                   | Central | State                      | Central | State                                           | Central |                                                |
| 2017-18 | 02(410)                 | --      | --                         | 02(67)  | 02(410)                                         | 02(67)  | 04(477)                                        |
| 2018-19 | 02(410)                 | --      | --                         | --      | 2(410)                                          | --      | 02(410)                                        |
| 2021-22 | --                      | --      | --                         | --      | --                                              | --      | --                                             |
| 2022-23 | 01(200)                 | --      | --                         | 01(110) | 01(200)                                         | 01(110) | 02(310)                                        |

|                                |                 |    |        |         |                 |         |          |
|--------------------------------|-----------------|----|--------|---------|-----------------|---------|----------|
| <b>Total No. of units (MW)</b> | 05(1020)        | -- | --     | 03(177) | 05(1020)        | 03(177) | 08(1197) |
|                                | <b>05(1020)</b> |    | 3(177) |         | <b>08(1197)</b> |         |          |

## 5.1 Details of Achievements of LE and R&M Programme during 2017-22 upto 30.09.2023.

|             | Name of the TPS | Unit No.  | Date of S/D | Capacity (MW) | Utility   | Sector  | Date of Achievement                               |
|-------------|-----------------|-----------|-------------|---------------|-----------|---------|---------------------------------------------------|
| 1. 2017-18  |                 |           |             |               |           |         |                                                   |
| LE          | Ukai TPS        | 4         | 07-12-2016  | 200           | GSECL     | State   | 17.05.2017                                        |
|             | Wanakbori TPS   | 3         | 25-07-2017  | 210           | GSECL     | State   | 27-11-2017                                        |
| R&M         | Kathalguri CCGT | 3         | 19-06-2017  | 33.5          | NEEPCO    | Central | 20-07-2018                                        |
|             | Kathalguri CCGT | 6         | 19-03-2018  | 33.5          | NEEPCO    | Central | 31-03-2018                                        |
| Sub Total   |                 | 4 (Units) |             | 477.00        |           |         |                                                   |
| 2. 2018-19  |                 |           |             |               |           |         |                                                   |
| LE          | Koradi TPS      | 6         | 25-08-2015  | 210           | MAHAGENCO | State   | 16-07-2018(oil firing)<br>20-08-2018(coal firing) |
|             | Obra TPS        | 12        | 01-10-2016  | 200           | UPRVUNL   | State   | 24-09-2018                                        |
| R&M         | --              | --        |             | --            | ---       | --      | --                                                |
| Sub Total   |                 | 02(unit)  |             | 410           |           |         |                                                   |
| 3. 2021-22  |                 |           |             |               |           |         |                                                   |
| LE          | ---             | --        | --          | --            | --        | --      | --                                                |
| R&M         |                 |           |             |               |           |         |                                                   |
| 4. 2022-23  |                 |           |             |               |           |         |                                                   |
| LE          | Obra TPS        | 13        | 16-05-2018  | 200           | UPRVUNL   | State   | 27-09-2022                                        |
| R&M         | Barauni TPS     | 6         | 15-11-2009  | 110           | NTPC      | Central | 31-05-2022                                        |
|             |                 |           |             |               |           |         |                                                   |
| Total LE    | 05 (1020)       | State     | 05(unit)    |               |           |         |                                                   |
|             |                 | Centre    | --          |               |           |         |                                                   |
| Total R&M   | 03 (177)        | State     | --          |               |           |         |                                                   |
|             |                 | Centre    | 03(unit)    |               |           |         |                                                   |
| Grand Total |                 | 08(units) |             | 1197.0        |           |         |                                                   |

Details of thermal power units where the R&M/ LE Works have been completed during 2017-22 up to 31.09.2023 are given at **Annexure 2& 3.**

The following thermal units from 13<sup>th</sup> plan are planned for deletion/retirement-

| State       | Name of Station | Unit NO | Yr. Of comm. | Capacity(MW) |
|-------------|-----------------|---------|--------------|--------------|
| Punjab      | Ropar           | 1       | 1984         | 210          |
| Punjab      | Ropar           | 2       | 1985         | 210          |
| Maharashtra | Koradi          | 7       | 1983         | 210          |
| Maharashtra | Bhusawal        | 2       | 1979         | 210          |
| Maharashtra | Parli           | 4       | 1985         | 210          |
| Maharashtra | Parli           | 5       | 1987         | 210          |
| W.Bengal    | Kolaghat        | 1       | 1990         | 210          |
| W.Bengal    | Kolaghat        | 2       | 1985         | 210          |
| U.P.        | Obra            | 7       | 1974         | 100          |

## 5.2 Status of R&M activities under Backward Region Grant Fund (BRGF) Scheme.

Under RSVY (now BRGF), Planning Commission in a meeting held on 10.05.2005 identified Barauni TPS, units 6&7 and Muzaffarpur TPS units 1&2 for carrying out Life Extension (LE) works. Subsequently, a five party agreement between the Government of India, Govt. of Bihar, BSEB, BHEL and NTPC was signed on 29.5.2006.

Planning Commission vide their letter dated 16.11.2009 approved Rs. 1053 crores including consultancy charges under the Special Plan for Bihar for LE works of Barauni TPS (Unit 6&7) and Muzaffarpur TPS (Unit 1&2) as per details given below:

Barauni TPS Unit (6&7) : Rs. 554.16 crores  
Muzaffarpur TPS (1&2) : Rs. 471.80 Crores  
Consultancy charges to NTPC(for Barauni TPS only): Rs. 27.04 Crores

**TOTAL : Rs. 1053.00 Crores**

**Details of Funds released by Planning Commission upto 2014-15:**

i) BHEL : Rs. 725.07 crores  
ii) KBUNL : Rs. 180.00 crores  
iii) NTPC : Rs. 20.13 crores  
**Total : Rs. 925.18 crores**

The remaining amount of Rs. 127.80 Crs has been released by the Govt. of India to BSPGCL. Now BSPGCL is releasing money directly to the vendors.

(A) Balance Amount Rs. 127.80 Cr.

- i. BHEL: Rs. 838.92 Cr. – Rs. 725.07 Cr. = Rs. 113.85 Cr.
- ii. NTPC: Rs. 27.04 Cr. – Rs. 20.13 Cr. = Rs. 06.91 Cr.
- iii. KBUNL: Rs. 187.04 Cr. – Rs. 180 Cr. = Rs. 07.04 Cr

(B) Amount Released from Rs. 127.80 Cr. by BSPGCL:

- i. BHEL: Rs. 39,20,84,459/-
- ii. NTPC: Rs. 3,39,07,715/-

| Name of TPS     | Unit No. | Zero Date  | Contractual Completion Date | Anticipated Completion Date | Present physical status as on 30.09.2023                                                                                                                                                                                                                                                                                                      |
|-----------------|----------|------------|-----------------------------|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Barauni TPS     | 7        | 15.11.2009 | 15.11.2011                  | Completed                   | <b>Unit was synchronized on 03.08.2016.</b><br><br><i>COD of Unit no. 7 achieved on 04.11. 2016.. Unit # 7 resynchronised on 12 .05.2019 and generated 8.88MU in May. Available coal is exhausted. Load could not be raised above 60 MW due to Condenser Vacuum problem</i><br><b>First synchronization after takeover by NTPC 23.05.2020</b> |
|                 | 6        | 15.11.2009 | 31-05-2022                  | Completed                   | <i>14 days continuous run completed from 29.03.2022 to 12.04.2022. R&amp;M of Unit 6 was completed on 31.05.2022 and put on Bar on 01.06.2022 00:00 Hrs.</i>                                                                                                                                                                                  |
| Muzaffarpur TPS | 1        | 15.04.2010 | 15.04.2012                  | Completed                   | <b>Unit synchronised on 05.07.2013.</b>                                                                                                                                                                                                                                                                                                       |
|                 | 2        | 15.04.2010 | 15.08.2012                  | Completed                   | <b>Unit synchronised on 30.09.2014.</b>                                                                                                                                                                                                                                                                                                       |

### 5.3 New R&M Guidelines 2023

Ministry constituted a High level committee on 16.03.2022 to study the various aspects of R&M/LE works in coal based thermal power plants. A comprehensive report has been prepared with the contribution of committee members from various organizations. The committee report would guide and help all the stakeholders eg. central, state & private

utilities to plan and complete R & M activities in a much systematic and efficient way in thermal generating units.

The report comprises of total six chapters which tries to covers the various important issues in detail. The chapter-1 “Background”, which throws the light on need of new guidelines for giving impetus in R&M activities. The chapert-2 “Guidelines for choosing the candidate plants for R&M/LE” elaborates on the guidelines for selecting candidate thermal unit for R&M activities along with prerequisites. The chapter-3, “Objective of R&M and Viable business model” describes the objective of R&M activities to be carried out after selecting candidate thermal unit, guiding principles and viable business models for R&M works. The guiding principles for preparation of bidding documents of R&M works including commercial and technical aspects, time taken/schedule for completion of R&M works and do’s & don’ts in bidding process has been discussed in the chapter-4 “Preparation of Bidding Documents for R&M”. In chapter-5 “Case Study of Successful Implementation”, two recent cases of successful R&M activities completed in Unit #3 (200 MW) of NTPC, Ramagundam Stage-I and Unit #3 (210MW) of Wanakbori TPS, GSECL has been given along with showing substantial improvement achieved in the turbine heat rate (in the range of 150-300 Kcal/KWhr) with LE and uprating. The chapter-6 “Annexures” discusses in detail, various options for carrying out R&M and sector & year wise segregation of potential candidate thermal units identified for R&M from 2022 to 2030.

#### 5.4 Potential Thermal Generating Units for R&M and LE (2024-2033)

CEA has identified 148 units with total capacity of 38150MW as potential candidates for R&M/LE works. R&M/LE works in these units have to be implemented in three phases to avoid any major energy demand- supply gap.

Therefore, draft phasing plan of 148 units along with tentative timelines for implementation of R&M/LE intervention have been prepared and proposed to be implemented in three phases given as under:

| Phases    |          | Criteria for thermal units<br>(Age as on Dec.,2022) | Timeline             |
|-----------|----------|-----------------------------------------------------|----------------------|
| Phase I   | Phase IA | Age 35 years and older                              | 01.01.24 to 30.06.26 |
|           | Phase IB | Age 30 to 35 years                                  | 01.01.26 to 30.06.28 |
| Phase II  |          | Age 25 to 30 years                                  | 01.07.28 to 31.12.30 |
| Phase III |          | Age 20 to 25 years                                  | 01.01.31 to 30.06.33 |

| Draft Phasing Plan for R&M (Sector Wise) |                      |              |                      |              |                      |              |                      |              |
|------------------------------------------|----------------------|--------------|----------------------|--------------|----------------------|--------------|----------------------|--------------|
| Sector                                   | Phase I              |              |                      |              | Phase II             |              | Phase III            |              |
| Timeline<br>s                            | Phase-IA             |              | Phase-IB             |              | 01.07.28 to 31.12.30 |              | 01.01.31 to 30.06.33 |              |
|                                          | 01.01.24 to 30.06.26 |              | 01.01.26 to 30.06.28 |              |                      |              |                      |              |
|                                          | Units                | Capacity(MW) | Units                | Capacity(MW) | Units                | Capacity(MW) | Units                | Capacity(MW) |
| Central                                  | 20                   | 4930         | 22                   | 6940         | 11                   | 3180         | 8                    | 2840         |
| State                                    | 32                   | 6690         | 16                   | 3940         | 19                   | 4900         | 14                   | 2980         |
| Private                                  | 1                    | 500          | 0                    | 0            | 3                    | 750          | 2                    | 500          |
| <b>Total</b>                             | <b>53</b>            | <b>12120</b> | <b>38</b>            | <b>10880</b> | <b>33</b>            | <b>8830</b>  | <b>24</b>            | <b>6320</b>  |

## 6. Implementation of Phasing Plan for FGD installation/ ESP upgradation in respect of new Environmental Norms notified by MoEF&CC on 7<sup>th</sup> Dec. 2015.

Ministry of Environment, Forest & Climate Change (MoEF&CC) had notified “Environment (Protection) Amendment Rules, 2015” for thermal power stations on 07.12.2015. All existing thermal generating stations including new stations and stations under construction were required to comply with the new Standards within 2 years (i.e. by Dec. 2017). To review the various issues arising out of new environmental norms for thermal power stations, a meeting was held on 01.09.2017 in MoEF&CC among Secretary MOEF&CC, Secretary, MoP and Chairperson, CEA and it was decided that the action plan submitted by MoP to MOEF&CC extending up- to 2024 should commence from 2018 and to be implemented before 2022. The MOEF&CC gave its concurrence to the revised implementation plan for FGD installation/ESP upgradation vide letter no. F. No. Q-15017/40/2007-CPW dated 07.12.2017.

It is to mentioned that the timeline for meeting the new emission norms (Dec 2015) has been revised by MOEF&CC vide gazette notification dated 05.09.2022 which has categorized thermal power plants in three categories having different timelines along with the environment compensation for non-compliance as follows:

**Category A** - Within 10 km radius of NCR or cities having million plus population as per 2011 census of India. Completion timeline 31.12.2024

**Category B** - Within 10 km radius of critically polluted areas or Non-Attainment cities as defined by CPCB. Completion timeline 31.12.2025

**Category C** - Other than those included in category A and B. Completion timeline 31.12.2026

Based on the MOEF&CC notification dated 31<sup>st</sup> March 2021, a task force was constituted comprising of representatives from MOEF&CC, MOP, CEA and CPCB to categorize the thermal power plants in above mentioned three categories. CPCB vide its MoM dated 13.12.2021 categorized the 596 TPP units in category A, B & C of which 79 units (22949 MW) are under Category A, 68 units (23020 MW) are under Category B and 449 units (163561 MW) are under Category C. The timelines for implementation of FGD for Categories A, B and C are Dec-24, Dec-25 and Dec-26 respectively.

\*FGD status is updated monthly and is available on CEA’s website.

### General Summary (MW)

| S.N o. | Sect or  | Total (MW) | CFB C | Claims SO2 complia nce | Retir ed | Feasibi lity study not started | Feasibi lity Study started | Feasibli ty Study Comple ted | Tender specifica tion made | NIT issu ed | Bid open ed | Bid Award ed | FGD install ed |
|--------|----------|------------|-------|------------------------|----------|--------------------------------|----------------------------|------------------------------|----------------------------|-------------|-------------|--------------|----------------|
| 1      | Cent ral | 6725 0     | 750   | 0                      | 430      | 0                              | 210                        | 0                            | 0                          | 1110        | 2390        | 58710        | 3650           |
| 2      | State    | 6774 2.    | 107 5 | 0                      | 1004     | 0                              | 2438.                      | 10430                        | 5050                       | 1754 5      | 1149 0      | 18710        | 0              |
| 3      | Priva te | 7652 8     | 410 1 | 1430                   | 0        | 1370                           | 6430                       | 6395                         | 5730                       | 7240        | 1134 2      | 25540        | 6950           |
|        | Total    | 2115 20.   | 592 6 | 1430                   | 1434     | 1370                           | 9078.                      | 16825                        | 10780                      | 2589 5      | 2522 2      | 10296 0      | 10600          |

## General summary (No. of units)

| S.N o. | Sect or  | Total (No. of units) | CFB C | Claims SO2 complia nce | Retir ed | Feasibi lity study not started | Feasibi lity Study started | Feasibi lity Study Comple ted | Tender specifica tion made | NIT issu ed | Bid open ed | Bid Award ed | FGD install ed |
|--------|----------|----------------------|-------|------------------------|----------|--------------------------------|----------------------------|-------------------------------|----------------------------|-------------|-------------|--------------|----------------|
| 1      | Cent ral | 168                  | 4     | 0                      | 3        | 0                              | 2                          | 0                             | 0                          | 6           | 11          | 133          | 9              |
| 2      | State    | 221                  | 7     | 0                      | 7        | 0                              | 11                         | 38                            | 16                         | 65          | 29          | 48           | 0              |
| 3      | Priva te | 211                  | 42    | 6                      | 0        | 2                              | 24                         | 16                            | 13                         | 18          | 29          | 46           | 15             |
|        | Total    | 600                  | 53    | 6                      | 10       | 2                              | 37                         | 54                            | 29                         | 89          | 69          | 227          | 24             |

### 6.1 CEA-IIT D study-

CEA prepared a paper on location specific norms for thermal power plants and suggested a graded action plan for FGD implementation in TPP. To explore such a feasibility, the 24hr avg.(max) SO<sub>2</sub> ground based measured levels (CPCB, 2018 data) were categorized into 5 distinct levels:

- Level I : above 40 µg/m<sup>3</sup>
- Level II : 31-40 µg/m<sup>3</sup>
- Level III : 21-30 µg/m<sup>3</sup>
- Level IV : 11-20 µg/m<sup>3</sup>
- Level V: 0-10µg/m<sup>3</sup>.

An MOU between CEA and IIT Delhi was signed on 12.12.2022 to survey ambient atmospheric SO<sub>2</sub> concentrations in different category of cities based on their vicinity to thermal power plants (TPPs). Baseline survey of ambient SO<sub>2</sub> concentration will be conducted in three category of cities-

*Category-1:* City with no coal based TPP,

*Category-2:* City with a coal based TPP in which FGD has not been installed and the TPP is located within 10km from the city boundary

*Category-3:* City with a coal based TPP in which FGD has been installed and the TPP is located within a distance of 10km from the boundary of the city.

Further, an additional study (Phase II) on the direction of Hon'ble Minister where simultaneous measurements of ambient atmospheric SO<sub>2</sub> concentrations at two different locations in three different category of cities namely, Gautam Buddha Nagar, Kota and Lucknow based on their vicinity to coal based thermal power plants (TPPs) is to be conducted and the status of FGD installation in these TPPs.

### 6.2 Vendor Meet-

TPRM division held a meeting on 26.04.2022 with Vendor's (BHEL, GE, ISGEC, Tata Power, L&T, EPIL, ISGEC) & generating utilities to assess the realistic vendor's capacity and the following bottlenecks/constrained were identified during the discussion -

### 1. Limited vendors for FGD system equipment and materials

- About 525 (199 GW) out of 596 (209 GW) total number of thermal generating units has to install FGD system to comply with new emission norms.
- Further about 38 (27 GW) units under construction generating are also required to install FGD system.
- There is a limited vendor base for the FGD equipment and materials suppliers, making it difficult to get equipment deliveries on time due to high demand.

### 2. Change in procurement policy and stringent Pre-Qualification as per GoI guidelines

There is a change in procurement policy in line with the goal of “Aatma- Nirbhar Bharat”.

Due to these changes, price offers from prospective domestic suppliers has increased. Ordering cycle has also been badly affected, impacting both, the time and the cost of the project.

### 3. Pandemic induced factors

- Supply chain disruptions and migration of workforce: Many sub-contractors have gone under distress due to work disruptions during pandemic which badly affects work progress
- Various indigenous and foreign vendors have become stressed

### 4. Site execution challenges

- FGD orders envisage retrofitting of FGD components in brown field projects. Such jobs have their distinguished difficulties in terms of conceptualization & design challenges. Standardization could not be done as different sites have different requirement, space constraints, geography, orientation etc. Such jobs are more like Renovation & Modernisation kind of jobs & encounter frequent re-engineering issues.

- Lack of availability of drawings in old plants.

### 5. Proveness criteria in DPR limiting sub-vendors base as well as the goal of Aatma- Nirbhar Bharat

As per vendors, utilities are insisting on proveness criteria of successful operation in FGD applications for items such as agitators and wet ball mills although these items are operating in other application successfully in the country which limits the sub-vendor base.

Utilities are also insisting upon procuring steel from specific vendors such as SAIL and RINL resulting in cost escalation and delay in getting materials as mills have their own production plan and delivery periods.

### 6. Unexpected and unprecedented rise in commodity prices

The prices of base materials like steel, cement, nickel, aluminum and copper have seen a surge in prices: as a result of which items like tanks, ducts, pipe racks, supporting structures have undergone price escalation.

Estimated Materials required for a typical FGD system for a 2x500 MW TPS

| Sl. No. | Major Materials          | Materials Requirement (in Metric Tonnes) |
|---------|--------------------------|------------------------------------------|
| i       | Cement                   | 25000                                    |
| ii      | Structural Steel         | 15000                                    |
| iii     | Reinforcement steel      | 5750-6000                                |
| iv      | Stainless steel & plates | 350-400                                  |

|      |                                                             |         |
|------|-------------------------------------------------------------|---------|
| v    | Aluminum                                                    | 50-70   |
| vi   | Casting and Forgings                                        | 200     |
| vii  | Casting and Forgings special alloy / Duplex stainless steel | 50      |
| viii | Tube & Pipes                                                | 600-800 |
| xi   | BQ Plates                                                   | 30      |
| x    | C276 clad/sheet for absorber                                | 350-375 |
| xi   | Titanium Gr2 for ducting                                    | 300-350 |

## 7. Import challenges

Critical item like Gypsum Dewatering, Agitators, Borosilicate and Clad Plates (C276 & Titanium) are mostly imported from China. The recent GOI notifications which restricts procurement from neighboring countries has had adverse impact on the procurement cost & timelines since these items have high lead time and limited supplier base.

## 8. Connectivity of FGD system with power plant

After installation of FGD equipment in the thermal power plant including new chimney, the same needs to be connected with existing thermal power plant. The flue gas of the existing power plant shall be rerouted through FGD system for desulfurization. The time required for connectivity is about 30 to 45 days and unit will be under shut down. Grid may not allow shutting down of more than 3-4 generating units in a month (annually 30 - 48 units) for this purpose otherwise the connectivity process may be planned at the time of annual overhauling of units.

## 9. Completion Cycle time:

As per the present status of implementation and Vendor's feedback the average time for completion is about 55 months. The overall execution cycle for FGD is on basis of past experience, limited vendor base, contingency (pandemic) and complexities in execution like R&M works. Therefore, time cycle for execution of FGDs may be considered as 43 months for a unit if 12 months delay is considered for Covid-19. Another 30-45 days time is required for successful synchronization of FGD system.

Further, the rubber lining of absorber is envisaged in case of Dadri FGD which normally takes execution period of 4 months more in comparison to other FGDs with absorber lining of Ti clad/ C276 etc. Hence in case of rubber lining of absorber, 4 months extra time may be considered for FGD erection & commissioning.

## 10. Realistic capacity per annum:

After analyzing the 65 GW capacity (134 units) in hand of Vendor's since the year,2018 for installation of FGD system in thermal power plants and present equipment manufacturing capability, availability of steel, cement, market scenario & connectivity time ( as provided below ) followings are suggested for smooth implementation:

- Total Vendor's capacity for FGD installation is about 16-20 GW (33 to 39 units) in 1<sup>st</sup> phase and installation time is about 44 to 48 months. Thereafter 16 - 20 GW (33 to 39 units) every year (2<sup>nd</sup>/3<sup>rd</sup>/4<sup>th</sup> phase).
- It is also suggested that 2<sup>nd</sup> phase FGD system installation may be initiated 3 years after commissioning of 1<sup>st</sup> phase which give a time for course of correction seeing the performance in 1<sup>st</sup> phase (stabilization period is 2-3 years).

| Summary of FGD Commissioning Timelines as per Vendors (Capacity in MW) |                         |      |          |      |          |      |          |      |          |
|------------------------------------------------------------------------|-------------------------|------|----------|------|----------|------|----------|------|----------|
| Sl. No.                                                                |                         | 2022 |          | 2023 |          | 2024 |          | 2025 |          |
|                                                                        |                         | No.  | Capacity | No.  | Capacity | No.  | Capacity | No.  | Capacity |
| 1                                                                      | FGD Units               | 12   | 7570     | 65   | 32640    | 52   | 24130    | 5    | 1130     |
| 2                                                                      | Min. (months)           | 41   |          | 40   |          | 29   |          | 50   |          |
| 3                                                                      | Max.(months)            | 60   |          | 76   |          | 79   |          | 71   |          |
| 4                                                                      | Avg. (months)           | 50   |          | 53   |          | 56   |          | 60   |          |
|                                                                        | Avg. of 2 years (units) | 39   | 20105    |      |          |      |          |      |          |
|                                                                        | Avg. of 3 years (units) | 43   | 21447    |      |          |      |          |      |          |
|                                                                        | Avg. of 4 years (units) | 34   | 16367    |      |          |      |          |      |          |

## 7.0 Flexible Operation of Thermal Power Stations

India's Intended Nationally Determined Contributions (INDCs) include a reduction in the emissions intensity of its GDP by 33 to 35 percent by 2030 from 2005 level, and to create an additional carbon sink of 2.5 to 3 billion tonnes of CO<sub>2</sub> equivalent. Generating power from renewable sources of energy is of cardinal importance if India is to meet its INDC targets. With the aim to ensure future security & reliability of power supply and stability of electricity grids while maximizing generation from renewables flexibilization of existing coal-fired power plants is an important measure.

**7.1** Another committee headed by Chief Engineer (TPRM), CEA was constituted to oversee the implementation of measures for flexible operation of TPPs on the basis of the pilot test. Based on the findings of CEA's flexibilisation report, the committee shall identify the thermal units in consultation of State/ Central utilities for the flexibilisation. The identified units shall undergo the pilot tests to ascertain their capability, do gap analysis and carry out modifications, if required. BHEL has conducted flexible operation pilot tests at Mauda TPS of NTPC and Sagardighi TPS of WBPDC. Another flexible operation study has been organized by CEA and carried out by BHEL at Ukai Thermal Power Station Unit # 6 (500MW), GSECL on 04.03.2020. Minimum load of 40% with ramp rate of 3% was successfully achieved. Flexible operation (up to 40% load) test has been conducted at Unit#2, 500MW MPL, Maithon (Unit-2) of JV DVC & TATA Power under IGEF from 22-23 July, 2021. Another test conducted between 28.03.2022 to 01.04.2022 at DSTPS, Andal of DVC under IGEF.

**7.2** With the anticipated 175 GW of RE Capacity, it has been targeted to adapt 60% of the installed fleet of Thermal power plants to operate at 55% Minimum Technical Load (MTL). The MoP (Ministry of Power) has set the targets for achieving the flexibility (55% MTL) of thermal power plants (Coal/Lignite) in a time bound manner.

The targets set by MoP are 20%, 30%, 45%, 50% and 60% of the total fleet compliant of 55% MTL from year 2020 to 2024.

Further CERC vide IEGC regulations 2016 has lowered and made mandatory the technical minimum limit to 55% and provided compensation to the Coal/Lignite based generating stations on account of partial loading of the units.

Under this key initiative the minimum load and ramp rates of thermal generating units are required to be improved. A committee has been constituted in CEA under chairmanship of Chief Engineer (TPRM) for flexible operation test of thermal power plant for smooth integration of intermittent RES generation.

### KPI Targets vis-à-vis Achievement as on 30.09.2023 :-

| S. N. | Initiative                                                                                         | Scheme /Program                                | Parameters                                                                                  | Requires change in law (yes/no)                                                                               | Unit of measurement           | Key Performance Indicators (KPI) |        |         |                |                                     |             |
|-------|----------------------------------------------------------------------------------------------------|------------------------------------------------|---------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|-------------------------------|----------------------------------|--------|---------|----------------|-------------------------------------|-------------|
|       |                                                                                                    |                                                |                                                                                             |                                                                                                               |                               | 2020                             | 2021   | 2022    | 2023           | 2024                                |             |
| 1     | <b>Flexible Generation:</b><br>Reduction in Technical minimum limits and improvement in Ramp rates | Flexibilisation of Thermal Power Plants by CEA | Modifications in Thermal Power Plants to achieve Technical minimum up to 55% and Ramp rates | Yes, the CERC regulation need changes to reimburse the additional costs to generators for flexible operations | % fleet of installed capacity | 20%                              | 30%    | 45%     | 50%            | 60%                                 | Target      |
|       |                                                                                                    |                                                |                                                                                             |                                                                                                               |                               | 20%                              | 30.4 % | 45.12 % | <b>50.29 %</b> | <b>54.91 %</b><br>(Upto 06.10.2023) | Achievement |

### Summary of Flexibilisation of Thermal power plants:-

| S. No                 | Utility                                            | Capacity which achieved 55% MTL (GW) | Achievement (%) |
|-----------------------|----------------------------------------------------|--------------------------------------|-----------------|
| 1                     | NTPC + JV                                          | 52.48                                | 25.0            |
| 2                     | Other Utilities (Period April 2020 to Sept 2020 )  | 7.64                                 | 3.63            |
| 3                     | Other Utilities (Period Oct 2020 to Dec 2020 )     | 4.84                                 | 2.30            |
| 4                     | Other Utilities (Period Jan 2021 to Mar 2021 )     | 8.18                                 | 3.89            |
| 5                     | Other Utilities (Period April 2021 to 06.10.2023 ) | 41.50                                | 20.09           |
| Total achievement (%) |                                                    |                                      | <b>54.91%</b>   |

\*List of thermal power plants operating at 55% Minimum Technical Load is given in **Annex-5**

### **“SOP and Training curriculum at 55% technical minimum load”**

A committee headed by chief engineer (TPRM), CEA was constituted in order to prepare the operating manual for attaining/operating at 55% minimum technical load of thermal power plant and a training curriculum for technical operators for the same.

The committee came up with standard operating procedures which addresses the challenges of flexibilization and achieve the target of minimum technical load.

The standard operating procedure specified the prerequisites for reducing minimum technical load stable load to 55%, procedure, operational issues faced by ball and tube mills, long term concerns and measures in detail. The committee identified that for 55% minimum load operation the ramp rates (up/down) shall be less than 2% for stable combustion. However, in future the proposed new regulation shall have to be followed regarding the ramp rates.

The committee also identified the simulator capacity and capability of different utilities in order to train and assess operators in plant operation such as start-up and shut-down, supervision, monitoring and control during normal, emergency situations and in safety procedures. It was also recommended that plant Operators/Trainers must train on the simulator for 55% Load operation with desired ramp rate and without oil support. The batch size and training duration is also specified with focus areas including cold and warm start up conditions, 55% Operation (Manual) –Ramp Up with ramp rate, 55% Operation (Manual) -Ramp down with ramp rate, 55% Operation (Auto) –Ramp Up with ramp rate, 55% Operation (Auto) -Ramp down with ramp rate, Emergencies & Malfunctions, Unit Stable Operation, Critical Equipment Changeover etc. A detailed training material was prepared by NPTI for both 500 MW and 210MW simulator for lower load operation at 55% modeling critical parameters in order to familiarize the operators.

**The final report has been published in March,2023. The gist of Report is given below-**

The Government of India has set an ambitious target of achieving 500 GW of renewable energy generation by 2029-30, with an interim target of 175 GW by the end of 2022. However, due to delays caused by the COVID-19 pandemic, it is projected that the short-term target may be achieved by the end of 2023. This delay has significant implications for the operation of thermal power plants, as they are expected to operate at an average minimum load of 40% in the near future.

To address this challenge, a committee was constituted under the leadership of Sh. B. C. Mallick, Chief Engineer, TPRM Division, Central Electricity Authority (CEA), with members from various organizations. The committee has prepared a comprehensive report with eleven chapters that cover various important issues in detail. These chapters include the need for flexibilization, key requirements for operation, studies conducted so far, challenges faced, operating procedures, modifications required, and cost considerations.

The report provides guidance to central, state, and private utilities on selecting thermal generating units and conducting low load tests to achieve flexibility in their operations. It also discusses the impact of flexibilization on plant life, operation, maintenance, efficiency, and operating procedures that need to be upgraded. Additionally, the report describes the procedures for low load tests, including parameters to be observed carefully during the test to identify measures for implementing in the generating unit. It also highlights various options for modification to improve performance and the associated costs for adopting these measures.

In summary, the committee's report aims to provide a comprehensive guide to help thermal power plants in India meet the changing demands of the power sector and achieve flexibility in their operations, considering the challenges posed by the delayed achievement of renewable energy targets and the need for low load operation.

### **Flexibilisation study/test:**

Central Electricity Authority (CEA) has constituted a committee under the Chairmanship of Chief Engineer, TPRM Division, for assessing flexible power and ramp rate to be required for integration of solar and wind capacity into grid. Accordingly a road map has to be prepared for integration of generation from RES in the year, 2030. The committee will also be assessing the ramp rate required for the integration of 500 GW to maintain secure and stable grid.

In the first meeting of the committee which was held in October, 2022, objectives and strategy was discussed. It was decided to collect the various data such as thermal capacity enhancement, hydro capacity addition, limiting factors in grid operation installed capacity of all types of generation, etc. which was to be collected from various divisions/organizations and forwarded to IRP, CEA for hourly generation projection of 365 days for the year 2030.

The salient outcome of the pilot tests are as follows:

**A) Mouda TPS, NTPC, Nagpur, Maharashtra:**

- i) Test Date : 29-05-2019
- ii) Unit No. : 2
- iii) Capacity : 500 MW
- iv) Following tests were conducted:

| <u>Test</u>                 | <u>Target</u> | <u>Achieved</u> |
|-----------------------------|---------------|-----------------|
| a. Minimum Load Test at 40% | 200MW         | 200MW           |
| b. Ramp up Test (3%)        | 3%/min        | ~ 1.14%/min     |
| c. Ramp down Test (3%)      | 3%/min        | ~ 1.68%/min     |
| d. Ramp up Test (1%)        | 1%/min        | ~ 0.85%/min     |
| e. Ramp down Test (1%)      | 1%/min        | ~ 0.9%/min      |

The list of important parameters was logged and taken by BHEL for further analysis and recommendation.

**B) Sagardighi TPS, WBPCL, Musheerabad, West Bengal:**

- i) Test Date : 27-06-2019
- ii) Unit No. : 3
- iii) Unit Capacity : 500 MW
- iv) Following tests were conducted:

| <u>Test</u>                 | <u>Target</u> | <u>Achieved</u> |
|-----------------------------|---------------|-----------------|
| a. Minimum Load Test at 40% | 200 MW        | 200 MW          |
| c. Ramp Down Test (3%)      | 3%/ min       | ~1.6%/min       |
| d. Ramp UpTest (3%)         | 3%/ min       | ~1.1%/min       |

The flexibilisation test was conducted by BHEL team and was witnessed by representative from TPRM Division, CEA. BHEL will submit the detailed report after analyzing the test result.

**C) Vindhyachal STPS, NTPC, Singrauli, Madhya Pradesh :**

JCOAL selected NTPC's Vindhyachal Super Thermal Power Station (VSTPS) for flexibilisation study, based on the recommendation of Ministry of Power and Central Electricity Authority. JERA Co., Inc and Mitsubishi Research Institute, Inc have investigated concerning improvement of operational flexibility of No.11 unit

- i) Test Date : 06-03-2019
- ii) Unit No. : 11
- iii) Capacity : 500 MW

Following tests were conducted:

| <b><u>Test</u></b>          | <b><u>Target</u></b> | <b><u>Achieved</u></b> |
|-----------------------------|----------------------|------------------------|
| a. Minimum Load Test at 40% | 200 MW               | 275 MW                 |
| b. Ramp Up Test (3%)        | 3%/ min              | ~1.25%/min             |
| c. Ramp Down Test (3%)      | 3%/ min              | ~1.67%/min             |
| d. Ramp UpTest (3%)         | 1.5%/ min            | ~1.0%/min              |
| e. Ramp Down Test (3%)      | 1.5%/ min            | ~0.7%/min              |

#### **D)Anpara B TPS, Sonbhadra, Uttar Pradesh :**

Study on Flexibilization has been carried out by JCOAL during the year 2018-19 at Anpara B (Unit 4&5 of 2\*500MW) power plant of UPRVUNL in the state of Uttar Pradesh as a model of the possibility of introducing a system that can improve the efficiency of electric power infrastructure in India by utilizing IoT / AI which demonstrated the superiority of Japanese technology. JCOAL team visited Anpara from 28th-30th May and 25th -27th Dec,2018

#### **E) Ukai Unit# 6 (500 MW),GSECL, Gujarat:**

Flexible operation study has been organized by CEA and carried out by BHEL at Ukai Thermal Power Station Unit # 6 (500MW), GSECL on 04.03.2020. Minimum load of 40% with ramp rate of 3% was successfully achieved. The list of important parameters was logged and taken by BHEL for further analysis and recommendation. The final analysis and recommendations are under finalization with BHEL.

- i) Test Date : 04-03-2020
- ii) Unit No. : 6
- iii) Capacity : 500 MW

Following tests were conducted:

| <b>Test</b>                 | <b>Target</b> | <b>Achieved</b> |
|-----------------------------|---------------|-----------------|
| i) Minimum Load Test at 40% | 200 MW        | 200 MW          |
| ii) Ramp Test (3%)          | 3%/ min       | 1.6%-2%/ min    |
| iii) Ramp Test (1%)         | 1%/ min       | ~1.0%/ min      |

#### **F) Maithon RBTPP Unit#2 (525 MW), MPL:**

Flexible operation test has been conducted by IGEF at 525 MW Unit #2, 525MW at Maithon RB TPP between 19-29<sup>th</sup> July,2021 targeting stable operation of unit on coal at 40% minimum load and higher ramp rate.

- i) Test Date : 22-27,July, 2021
- ii) Unit No. : 2
- iii) Capacity : 525 MW

| <u>Test</u>             | <u>Target</u> | <u>Achieved</u>                                                    |
|-------------------------|---------------|--------------------------------------------------------------------|
| Minimum Load Test (40%) | 210MW         | 210MW<br>190MW (36%)*<br>*achieved for short<br>duration of 10min. |
| Ramp Up/Down Test       | 1%/min        |                                                                    |

The ramp rates achieved were as follows:

|                 | <b>Upward direction</b> | <b>Downward direction</b> |
|-----------------|-------------------------|---------------------------|
| 290 MW – 525 MW | 0.95% / min             | 1.52% / min               |
| MW – 290 MW     | do                      | 0.95% / min               |
| 210 MW – 225 MW | do                      | 0.38% / min               |

#### **G) Ramagundum,TPS Unit#7 (500 MW) NTPC :**

DEA delegates visited Ramagundam , NTPC for low load trial in Aug , 2022 under which historical data , design data , coal data , water consumption data , etc. was collected and then analysed by them before the actual test. A virtual meeting was also held to discuss the preliminary findings.

- i) Test Date : 27.02.2023-02.03.2023
- ii) Unit No. : 7
- iii) Capacity : 500 MW

| <u>Test</u>                 | <u>Target</u> | <u>Achieved</u> |
|-----------------------------|---------------|-----------------|
| Minimum Load Test (40%)     | 200 MW        | 200 MW          |
| Ramp Up/Down Test (70-100%) | 3% / min      | 2.6 % / min     |
| (70-55%)                    | 2 % / min     | 1.6% / min      |
| (55-40%)                    | 1% / min      | 0.8% / min      |

#### **H) Raichur TPS, Unit#3 (210 MW) KPCL :**

DEA delegated visited Raichur , KPCL for low load trial in Aug , 2022 under which historical data , design data , coal data , water consumption data , etc. was collected and then analysed by them before the actual test. A virtual meeting was also held to discuss the preliminary findings

i) Test Date : 04.03.2023-07.03.2023  
 ii) Unit No. : 3  
 iii) Capacity : 210 MW

| <u>Test</u>                 | <u>Target</u> | <u>Achieved</u> |
|-----------------------------|---------------|-----------------|
| Minimum Load Test (40%)     | 84MW          | 84MW            |
| Ramp Up/Down Test (70-100%) | 3%/min        | 3.57 %/min      |
| (70-55%)                    | 2 %/min       | 0.88%/min       |
| (55-40%)                    | 1%/min        | 2.5%/min        |

#### **F) Durgapur Steel TPS Unit# 1 (500 MW) , DVC**

i) Test Date :28-01, Mar,2022  
 ii) Unit No. : 1  
 iii) Capacity : 500 MW

34% achieved (1.5hrs), 2% ramp up and 2% ramp down.

### **8. Japan-India Co-operation for Study on Efficiency and Environmental Improvement of Coal Fired Stations**

A MOU between Central Electricity Authority and Japan Coal Energy Centre (JCOAL) for preliminary study of Efficiency and Environment improvement study in coal fired power plants was signed on 30.4.2010 to carryout necessary diagnostic activities in few coal-fired power plants pertaining to Energy Efficient Renovation & Modernisation works and suggest measures to overcome barriers for promoting R&M, measurement for environmental improvement of coal-fired power plants in India

The 2<sup>nd</sup> Phase MOU between CEA and JCOAL was signed on 11.06.2012 for carrying out detail diagnostic study for energy efficiency oriented R&M activities in three nos. of units. JCOAL team visited Badarpur TPS and Unchahar TPS of NTPC during December, 2012. The final study report for energy efficiency oriented R&M activities was submitted on 15<sup>th</sup> April, 2013.

The 3<sup>rd</sup> Memorandum of Understanding (MoU) on India – Japan Cooperation for Project on Efficiency & Environment Improvement for Sustainable, Stable and Low Carbon Supply of Electricity was signed on 22<sup>nd</sup> January, 2016.

The 4<sup>th</sup> MoU between CEA and JCOAL has been signed on 16<sup>th</sup> December, 2019 for Efficiency & Environment Improvement for Sustainable, Stable and Low Carbon Supply of Electricity. Following activities to be carried out under 4<sup>th</sup> MoU:

- Update on the current and future policy trend in the Indian power sector and consideration of the identified issues/barriers to find out those which could be addressed through mutual collaboration.
- Identification of issues to be addressed regarding both existing and upcoming facilities, and also

operation and maintenance.

- Implementation of studies with priorities, but not limited to environmental technologies for coal fired power generation Flexibilization measures and biomass utilization are also of high priority
- Biomass study on Co firing of biomass pellets and Waste to Energy technologies and Coal GCV loss in power plant and its remedies
- Implementation of an annual workshop in India and CCT Training Programme in Japan
- Holding a joint meeting to discuss issues that have arisen or may arise in the course of implementation of the Cooperation

One-day workshop on " Project on Efficiency and Environmental Improvement for Sustainable, Stable and Low-carbon Supply of Electricity" was held on 11th Nov, 2016 , 10th Nov 2017, 10th Nov 2018 and 8th Nov 2019, 25th January 2021 and 12<sup>th</sup> Nov,2021 at New Delhi by CEA and JCOAL. Various stake holders from Central/State/Private in power sector participated in the workshop.

Under Clean Coal Technology (CCT) Training Programme study tours to Japan have been organized in which representatives from MoP, CEA and different power utilities have participated. The participants visited the latest USC power stations and updated about various applicable technologies and equipment as well as O&M technique. During the year 2020-21 also, one group of 10 participants have undergone the CCT Training Programme from 19th Jan 2021 to 21st Jan., 2021. In FY21, group participants have undergone the CCT Training Programme from 27th Oct. 2021 to 29<sup>th</sup> Oct., 2021. During the FY22, 50 participants have undergone the Virtual CCT Training Programme from 31st Oct. 2022 to 2<sup>nd</sup> Nov., 2022.

Efficiency test at Mouda Thermal Power Station, NTPC has been conducted between 06.01.2020 to 10.01.2020 under Indo Japan Energy Dialogue by TEPCO Power Grid Inc. and JERA under the observation of CEA. Thermal Efficiency at different loading conditions was obtained for Units #3 and #4. Performance test report was submitted.

Under Indo-Japan Cooperation, a one-day Workshop on "Project on Efficiency and Environmental Improvement for Sustainable, Stable and Low-carbon Supply of Electricity" will be organized jointly by CEA and JCOAL on 13th Jan, 2022.

**Status of units where Life Extension/ Renovation & Modernisation works have been taken up for implementation during 2017-22**

**STATE SECTOR LE Works**

(as on 30.09.2023)

| S.No. | State   | Name of Station | Unit No. | Year of Comm. | Cap. (MW) | Status                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-------|---------|-----------------|----------|---------------|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.    | U.P.    | Obra            | 12       | 1981          | 200       | LE Works started on 01.10.2016.<br><b>Unit- 12 is synchronized on 24-09-2018. (Runs nearly at 125 MW, ESP pass-B incomplete)</b><br><br>Due to fire incidence on 14-10-2018 in Obra TPS, unit #12 was under shut down. Restoration of the unit is done by BHEL. Synchronized on 22-01-2020.<br>Supply-227.02 Cr. Work-49.15 Cr. PG test not performed till date                                                                                                                                                                                                                                                                                                          |
| 2.    | U.P.    | Obra            | 13       | 1982          | 200       | R&M works started from 17-05-2018. Synchronized on 27-09-2022 after revival<br>Boiler: 100% work completed.<br>Turbine: 99% work completed. HP rotor blades to be replaced and likely to be dispatched from Haridwar by 1 <sup>st</sup> week of Nov.<br>Generator: 100% work completed.<br>ESP: Pass A: 100%. Work completed.<br>Pass B: 100% work completed.<br>Electrical System: 100% work completed<br>WTP: 99% work completed<br>CHP: 94% work completed<br>PG test not performed till date                                                                                                                                                                         |
| 3.    | U.P.    | Anpara TPS      | 1        | 1986          | 210       | Unit is more than 35 years old and will be retiring by 2030. No R&M plan. Management is planning to install new 2*800MW Super Critical Thermal Units at Anpara within 6-7 years                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 4.    | U.P.    | Anpara TPS      | 2        | 1987          | 210       | Unit is more than 35 years old and will be retiring by 2030. No R&M plan. Management is planning to install new 2*800MW Super Critical Thermal Units at Anpara within 6-7 years                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 5.    | U.P.    | Anpara TPS      | 3        | 1988          | 210       | Unit is more than 35 years old and will be retiring by 2030. No R&M plan. Management is planning to install new 2*800MW Super Critical Thermal Units at Anpara within 6-7 years                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 6.    | Gujarat | Ukai            | 3        | 1979          | 200       | <u>ESP R&amp;M:</u> ESP retrofitting of unit-3 has been completed and unit lit up on 26-04-2016.PG test has been carried out and guarantee parameter achieved.<br><b>Turbine &amp; Boiler R&amp;M:</b> Order awarded for subject work to M/s BHEL on 29.03.2023. Tender for Boiler Flexible operation floated on Dtd: 11.12.2021 Envelop-I Opened and under Scrutiny<br><b>C&amp;I Up-gradation: -</b><br>Tender re-invited for subject work, offers received. Technical scrutiny completed and price bid opened on 24-04-2019. Order awarded to M/s Mecgale Pneumatics Pvt. Ltd., Nagpur. Geo-technical survey completed and design engineering work is under progress. |
| 7.    | Gujarat | Ukai            | 4        | 1979          | 200       | <b>Ukai TPS Unit -4 was taken under S/D on 07-12-2016,</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

| S.No. | State   | Name of Station | Unit No. | Year of Comm. | Cap. (MW) | Status                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------|---------|-----------------|----------|---------------|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|       |         |                 |          |               |           | <p><b>unit lit up on 04-05-2017 and synchronised on 17.05.2017 and COD achieved on 24.05.2017.</b></p> <p>PG test for retrofitted ESP, Boiler after modification and retrofitted Turbine was completed on 17-06-2017, 23-08-2017 and 02-11-2017 respectively. Guaranty parameters achieved.</p> <p><b><u>Boiler Back Pass Modification:</u></b> Order awarded to BHEL for availability &amp; efficiency improvement through modification in Boiler Back Pass and replacement of APH. Work completed and unit lit up on 04-05-2017 and synchronized on 17-05-2017. PG test carried out and guaranty parameter achieved.</p> <p><b><u>C&amp;I Upgradation by utilizing R&amp;M material of 2x120 MW GTPS unit no. 1&amp;2:</u></b> Order awarded to BHEL on 18-06-2015. Work completed and unit lit up on 04-05-2017. Geo-technical survey completed and design engineering work is under progress.</p> |
| 8.    | Gujarat | Ukai            | 5        | 1985          | 200       | <p><b><u>ESP R&amp;M:</u></b> ESP retrofitting of Ukai unit-5 completed and unit lit up on 29-03-2017. PG test of ESP has been completed.</p> <p><b><u>Turbine &amp; Boiler R&amp;M</u></b></p> <p>:Order awarded for subject work to M/s BHEL on 29.03.2023. Tender for Boiler Flexible operation floated on Dtd: 11.12.2021 Envelop-I Opened and under Scrutiny</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 9.    | Gujarat | Wanakbori       | 1        | 1982          | 210       | For implementation of DeNOx system, GSECL is awaiting the results of pilot projects of NTPC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 10.   | Gujarat | Wanakbori       | 2        | 1983          | 210       | <p><b><u>ESP R&amp;M:</u></b> The order for retrofitting is issued to BHEL on 18.03.2016 and Zero date started from 14-01-2016. ESP retrofitting of unit-1 &amp;2 completed and units lit up on 07-03-2017 and 07-04-2018 respectively. PG test of WTPS units#1&amp;2 completed.</p> <p><b><u>Turbine &amp; Boiler R&amp;M:</u></b> Turbine -Tender Floated 18.09.2022 Boiler Flexible Operation (-WTPS Unit No 1 &amp; 2 Tender Floated on Dtd: 29.10.2022.</p> <p><b><u>C&amp;I Upgradation:</u></b> Energy efficiency Improvement done through up-gradation of C&amp;I in unit#1&amp;2. C&amp;I work completed on 11-03-2017 in unit#1 and 17-07-2012 in unit#2.</p> <p><b><u>Boiler back pass Modification</u></b> work of UTPS unit#1&amp;2 has been dropped.</p> <p>Pending work of Unit-1&amp;2, Bus coupler will be carried out in available shutdown.</p>                                    |

| S.No. | State       | Name of Station | Unit No. | Year of Comm. | Cap. (MW) | Status                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------|-------------|-----------------|----------|---------------|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 11.   | Gujarat     | Wanakbori       | 3        |               | 210       | <p><b>LE work completed and unit synchronised on 05-12-2017.</b></p> <p><b>ESP Retrofitting work</b><br/>Shutdown of WTPS Unit No. 3 is commenced from 25.07.2017. ESP retrofitting unit -3 completed and unit lit up on 27-11-2017. PG test completed and guaranty parameters achieved.</p> <p><b>Turbine R&amp;M:-</b> Order awarded to M/s NASL Noida on 29-04-2015 and zero date started from 10.03.2015. Guaranteed parameters achieved.</p> <p><b>Boiler Back Pass Modification:</b> - Order awarded to M/s BHEL for availability &amp; efficiency improvement through modification in Boiler back pass and replacement of APH. PG test carried out on 09-03-2018 and guaranteed parameters achieved.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 12.   | Maharashtra | Koradi          | 6        | 1982          | 210       | <p><b>LE work completed and unit synchronised on 16-07-2018 with oil &amp; 20-08-2018 with coal.</b></p> <p>The unit is being taken up by WB funded project. The total cost of the project including IDC is 636.93 crores.</p> <p><b>BTG Package:</b> Overall (physical progress) 99% work of BTG package completed. Approximately 98.34% of the material (on Amount basis) is supplied by BHEL at site &amp; further supply is in progress. Civil work of ESP 98% completed.</p> <p><b>C&amp;I/Electrical System:</b> UPS- 98% completed. 24V charger &amp; battery work is 95% completed &amp; Pre-commissioning of system/ auxiliaries</p> <p><b>Electrical Package:</b> Overall 92% work of Electrical package completed. Approximately 92% of the material (on Amount basis) is supplied by M/s ABB at site &amp; further supply is in progress.</p> <p><b>BOP Package:</b> BOP Package work is completed except minor works of Ash Handling plant.</p> <p><b>DM Plant &amp; Pre-Treatment System Package</b><br/>Need based refurbishment of 2 streams of DM Plant is carried out from various agencies with order value of @Rs. 87.27 Lakh.</p> <p>Design Engg. work is completed of <b>Ash Handling Plant</b>. Work has been completed. For <b>Fire Detection, Protection &amp; Inert Gas System Package</b>, overall material supplied at site is 100% and Installation and civil works completed. Dump Test of Inert Gas System at PCR (as required by FA&amp;CFO) is balance.</p> |
| 13.   | Maharashtra | Koradi          | 7        | 1983          | 210       | <b>This unit is permanently decommissioned on 03.08.2021</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 14.   | Maharashtra | Bhusawal        | 2        | 1979          | 210       | <b>This unit is permanently decommissioned on 01-04-2017.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 15.   | Maharashtra | Bhusawal        | 3        | 1982          | 210       | RLA/ Feasibility study for EER&M has not been carried out.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 16.   | Maharashtra | Nashik          | 3        | 1979          | 210       | MSPGCL Board directed that no other R&M work shall be taken up without monitoring results of Koradi U-6.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 17.   | Maharashtra | Nashik          | 4        | 1980          | 210       | MSPGCL Board directed that no other R&M work shall be taken up without monitoring results of Koradi U-6.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 18.   | Maharashtra | Nashik          | 5        | 1981          | 210       | MSPGCL Board directed that no other R&M work shall be taken up without monitoring results of Koradi                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

| S.No. | State       | Name of Station | Unit No. | Year of Comm. | Cap. (MW) | Status                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------|-------------|-----------------|----------|---------------|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|       |             |                 |          |               |           | U-6.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 19.   | Maharashtra | Parli           | 4        | 1985          | 210       | <b>This unit is permanently decommissioned on 30.11.2019.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 20.   | Maharashtra | Parli           | 5        | 1987          | 210       | <b>. This unit is permanently decommissioned on 30.11.2019.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 21.   | Maharashtra | Chandrapur      | 3        | 1983          | 210       | RLA/Feasibility study for EER&M not carried out.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 22.   | Maharashtra | Chandrapur      | 4        | 1984          | 210       | RLA/Feasibility study for EER&M not carried out                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 23.   | Maharashtra | Chandrapur      | 5        | 1983          | 500       | Feasibility study for EER&M not carried out.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 24.   | Maharashtra | Chandrapur      | 6        | 1984          | 500       | Feasibility study for EER&M not carried out.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 25.   | Maharashtra | Khaperkheda     | 1        | 1989          | 210       | RLA/Feasibility study for EER&M not carried out.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 26.   | Maharashtra | Khaperkheda     | 2        | 1990          | 210       | RLA/Feasibility study for EER&M not carried out.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 27.   | Bihar       | Barauni         | 6        | 1983          | 110       | <b>BTPS has been transferred to NTPC on 15-12-2018.</b> R&M of Unit 6 is completed on 31.05.2022 and put on Bar on 01.06.2022 00:00 Hrs.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 28.   | W.Bengal    | Kolaghat        | 1        | 1990          | 210       | <b>Unit decommissioned from FY 21-22</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 29.   | W.Bengal    | Kolaghat        | 2        | 1985          | 210       | <b>Unit decommissioned from FY 21-22</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 30.   | W.Bengal    | Kolaghat        | 3        | 1984          | 210       | Estimated cost of L.E.of Unit# 1,2&3: 1090 Crs<br>There is no scope of works under Boiler & TG system for KTPS U#1, #2, #3, #5 under R&M/LE<br>ESP: U #3- PG Test of ESP carried out on 17.06.2021 and operational acceptance issued.<br>AHP: Commissioning done in wet manual mode. Commissioning of PLC is under process for the same in auto mode.<br>AHP b for wet ashing system is in progress                                                                                                                                                                                                                                                                                                                         |
| 31.   | W.Bengal    | Kolaghat        | 5        | 1991          | 210       | Estimated cost of LE of Unit#4, 5&6 is 25 Crs.<br><b>U# 4, 5 &amp; 6</b> : Only 1 package for ESP<br>ESP Package: LOA is placed on M/s Soil & Enviro Industries Pvt. Ltd to achieve ESP O/L dust burden to 50mg/Nm <sup>3</sup> from 200mg/Nm <sup>3</sup> by replacement of controller/ TR Set and addition of filter column.<br><b>ESP#6-</b> Payment of Rs. 7.43 crore was made for AHP till 31-12-2019.. Hot gas commissioning was done on 11-09-2019. <b>R&amp;M not done.</b>                                                                                                                                                                                                                                         |
| 32.   | Karnataka   | Raichur         | 1        | 1985          | 210       | LE works to be carried out in following two phases:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 33.   | Karnataka   | Raichur         | 2        | 1986          | 210       | Phase 1: BTG, Retrofitting of ESP & Electrical package<br>Phase-2: BOP- Non BHEL package.<br>Replacement of APH module, TG (C&I) and station (C&I) works completed.<br>After finalization of DPR, KPCL will take decision on comprehensive R&M Works of unit 1&2 according to the recommendations of DPR.<br><b>FGD tender</b> was published in Karnataka e-portal website on 21-12-2018 and 09.03.2019.<br>LoA issued on 14.08.2020<br><b>R&amp;M of unit #1&amp;2:</b> Letter of award for retrofitting of 03Nos. Microprocessor Controller based Rotary Type Gravimetric Coal Feeder for RTPS, 2X210 MW issued on 01-03-2019. Letter of award has been issued for R&M works of Unit-3 Turbine for heat rate improvement. |
| 34.   | Karnataka   | Raichur         | 3        | 1991          | 210       | Therefore, offers were obtained from CEA empaneled                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

| S.No.                              | State | Name of Station | Unit No.  | Year of Comm. | Cap. (MW)   | Status                                                                                                                                                                                                                                              |
|------------------------------------|-------|-----------------|-----------|---------------|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                    |       |                 |           |               |             | agencies for conducting RLA/ CA studies of BTG etc. The offers are under scrutiny.<br>NIT issued on 22.12.2020 for R&M works for Unit Heat Rate improvement.<br>Bid evaluation is under progress for R&M works of Turbine for heat rate improvement |
| <b>Sub Total State Sector (LE)</b> |       |                 | <b>34</b> |               | <b>7570</b> |                                                                                                                                                                                                                                                     |

**STATE SECTOR  
(R&M Programme)**

| S.No. | State     | Name of Station    | Unit No. | Year of Comm. | Cap. (MW) | Status                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------|-----------|--------------------|----------|---------------|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.    | U.P.      | Obra               | 7        | 1974          | 100       | Retired                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 2.    | U.P.      | Anpara'B           | 4        | 1993          | 500       | R&M works is being executed by BHEL & M/s MITSUI & Toshiba OEM, Japan. –<br><b>Boiler:</b> 100% work completed.<br><b>TG:</b> 100% work completed..<br><b>Electrical +&amp; Instrumentation:</b> 100% work completed.<br><b>BOP:</b> 100% work completed..<br>Date of completion of R&M works- 31.03.2019. PG test yet to be done.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 3.    | U.P.      | Anpara'B           | 5        | 1994          | 500       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 4.    | Punjab    | Ropar              | 1        | 1984          | 210       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 5.    | Punjab    | Ropar              | 2        | 1985          | 210       | <b>Retired from 01-01-2018</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 6.    | Punjab    | Ropar              | 5        | 1992          | 210       | RLA/CA Study already stands conducted. The consultant M/S NTPC had prepared the DPR on the basis of RLA/CA study & submitted it to GGSSTP, Rupnagar. Further GGSSTP has submitted the same to the erstwhile PSEB for approval of the major R&M/LE Works.<br>Breakers have been fitted & commissioned in the 220KV Switch yard. All the requisitioned valves have been retrofitted & commissioned. The electro Mechanical Vibratory Feeders at ERH in CHP has been installed & commissioned in units 3 to 6. Upgradation of wagon Trippler No.3 in coal handling plant of GGSSTP, magnetic separators on conveyors in CHP has been installed & commissioned. Replacement of High impedance bus bar protection with numerical type relays.. Phase-II Migration of WDPF System to Ovation system on Unit-5 completed.Replacement of Fire Detection &. Replacement of MCC Panels & Control Desks of 3 Nos. of stacker Reclaimers of CHP would be carried out in 2021-22. Procurement, Installation and commissioning of Air Born Dust Suppression system based on water mist technology for Wagon trippler 1&2 will taken up in 2021-22. Erection & commissioning of cooling water supply system for Air Compressors installed for dry fly ash handling system & to provide DM water will be taken up in 2022 |
| 7.    | Punjab    | Ropar              | 6        | 2001          | 210       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 8.    | Punjab    | GH TPS (Leh. Moh.) | 1        | 1997          | 210       | FGD: Order for consultancy for preparation of tender specification has been placed on NTPC, Noida on 18-10-2018. Consultant has submitted DPR and on this basis agenda is being prepared for the administrative approval of BODs.<br>Estimated cost: 840 Cr.<br>R&M- No activity has been carried out so far during 2017-22                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 9.    | Punjab    | GH TPS (Leh. Moh.) | 2        | 1997          | 210       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 10.   | Rajasthan | Kota               | 3        | 1988          | 210       | Total 14 activities sanctioned for R&M. Estimated cost of R&M is Rs. 356.13 crores. Expenditure incurred till date is Rs.196 Crs.<br>- 11 nos of works fully completed.<br>- R&M work of CHP system is under progress. Order placed to M/s. Energo Engineering Projects Ltd. is terminated. Preparation of NIT is in progress for balance work of CHP- R&M.<br>- Installation of Vacuum pump is under progress, placed to M/s. Millennium Impex Pvt. Ltd.<br>- 01 no. work of Air Compressor replacement has been dropped due to technical reasons.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 11.   | Rajasthan | Kota               | 4        | 1989          | 210       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 12.   | Rajasthan | Kota               | 5        | 1994          | 195       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

| S.No. | State                                                                                                     | Name of Station                                                                                                                                                                                                                                                                                                                                                                      | Unit No. | Year of Comm. | Cap. (MW) | Status                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |    |                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                      |    |                        |                                                                                                                                                               |    |                                                                  |                                                                                                               |
|-------|-----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|---------------|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|----|------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|
|       |                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                      |          |               |           | - Replacement of existing BHEL make Procontrol P-13 SG-TG system of unit#5.<br>-Supply and ETC of variable frequency drive on ID fan motor(4nos.) of unit#6&7<br>- Supply, Design, installation, testing and commissioning of online energy accounting and management system of KSTP .Material received , installation under progress.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |    |                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                      |    |                        |                                                                                                                                                               |    |                                                                  |                                                                                                               |
| 13.   | Rajasthan                                                                                                 | Suratgarh TPS                                                                                                                                                                                                                                                                                                                                                                        | 1        | 1998          | 250       | All 4 unit are partial shutdown for R&M works.<br>Estimated cost of RLA of Boilers of unit 1-5 is .291 Crs.. Executing agency is IRC Engineering Services India Pvt. Ltd., New Delhi. RLA studies has been carried out<br>Total 16 activities sanctioned for R&M/ LE works.<br>- 14 activities have been completed.<br>- Old NIT is dropped & New NIT will be floated for providing Dense Phase Conveying System from existing intermediate Silo System of ESP.<br>-Modification in ACW system of Unit 1& 2 has been completed on 28.01.2017.<br>-Augmentation of DMCCW system of Unit 1 &2 completed in September, 2016<br>-Blow down system for cooling Tower of Unit 2,3, 4&5 completed in 2015.<br>-Replacement of LR beam of ESO on Unit-1 completed in financial year 2018-19.<br>-SOx, NOx & CO Analyser for Unit 2,3 &4 has been completed on 15.02.2017<br>-Upgradation of HMI system of unit 2 completed on 06.09.2016.<br>-Upgradation of workshop completed.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |    |                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                      |    |                        |                                                                                                                                                               |    |                                                                  |                                                                                                               |
| 14.   | Rajasthan                                                                                                 | Suratgarh TPS                                                                                                                                                                                                                                                                                                                                                                        | 2        | 2000          | 250       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |    |                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                      |    |                        |                                                                                                                                                               |    |                                                                  |                                                                                                               |
| 15.   | Rajasthan                                                                                                 | Suratgarh TPS                                                                                                                                                                                                                                                                                                                                                                        | 3        | 2001          | 250       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |    |                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                      |    |                        |                                                                                                                                                               |    |                                                                  |                                                                                                               |
| 16.   | Rajasthan                                                                                                 | Suratgarh TPS                                                                                                                                                                                                                                                                                                                                                                        | 4        | 2002          | 250       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |    |                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                      |    |                        |                                                                                                                                                               |    |                                                                  |                                                                                                               |
| 17.   | Chhattisgarh                                                                                              | Korba (West)                                                                                                                                                                                                                                                                                                                                                                         | 1        | 1983          | 210       | All 4 units are currently running.<br>CSPGCL has taken-up need based R&M for life extension on the basis of R&LA studies and also taken up R&M plan for compliance of new environmental norms. The CSERC in its order dated 1-03-2016 has approved such scheme under capital investment plan for financial year 2016-17 to 2020-21.<br>RLA studies done by M/s Evonik. Scope of work of Boiler, Turbine, Electrical Instrumentation, Civil and BOP is being finalised. <table><tr><td>1.</td><td>Augmentation, Renovation &amp; Up-gradation of ESPs to maintain the stack Emission level 50mg/Nm<sup>3</sup></td><td><b>Unit No.2:</b> R&amp;M work has been completed, PG Test is to be carried out.<br/><b>Unit No. 1:</b> R&amp;M work of CD Pass has been completed and erection work of 1 AB Pass is under progress.<br/><b>Unit No. 3:</b> Civil work has been completed &amp; erection of new ESP is under progress.<br/><b>Unit No. 4:</b> Civil work has been completed. Erection of new ESP is under progress.</td></tr><tr><td>2.</td><td>Augmentation of DDCMIS</td><td>Detailed order issued to BHEL for supply &amp; services. Detailed Engineering work is under progress. Supply commenced site mobilization started from 29-08-2019.</td></tr><tr><td>3.</td><td>Fire Protection System of Transformer &amp; Oil handling tanks areas</td><td>LOI has been issued on 03-04-2019. Detailed order has been issued on dated 04-05-2019.Retendering to be done.</td></tr></table> | 1. | Augmentation, Renovation & Up-gradation of ESPs to maintain the stack Emission level 50mg/Nm <sup>3</sup> | <b>Unit No.2:</b> R&M work has been completed, PG Test is to be carried out.<br><b>Unit No. 1:</b> R&M work of CD Pass has been completed and erection work of 1 AB Pass is under progress.<br><b>Unit No. 3:</b> Civil work has been completed & erection of new ESP is under progress.<br><b>Unit No. 4:</b> Civil work has been completed. Erection of new ESP is under progress. | 2. | Augmentation of DDCMIS | Detailed order issued to BHEL for supply & services. Detailed Engineering work is under progress. Supply commenced site mobilization started from 29-08-2019. | 3. | Fire Protection System of Transformer & Oil handling tanks areas | LOI has been issued on 03-04-2019. Detailed order has been issued on dated 04-05-2019.Retendering to be done. |
| 1.    | Augmentation, Renovation & Up-gradation of ESPs to maintain the stack Emission level 50mg/Nm <sup>3</sup> | <b>Unit No.2:</b> R&M work has been completed, PG Test is to be carried out.<br><b>Unit No. 1:</b> R&M work of CD Pass has been completed and erection work of 1 AB Pass is under progress.<br><b>Unit No. 3:</b> Civil work has been completed & erection of new ESP is under progress.<br><b>Unit No. 4:</b> Civil work has been completed. Erection of new ESP is under progress. |          |               |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |    |                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                      |    |                        |                                                                                                                                                               |    |                                                                  |                                                                                                               |
| 2.    | Augmentation of DDCMIS                                                                                    | Detailed order issued to BHEL for supply & services. Detailed Engineering work is under progress. Supply commenced site mobilization started from 29-08-2019.                                                                                                                                                                                                                        |          |               |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |    |                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                      |    |                        |                                                                                                                                                               |    |                                                                  |                                                                                                               |
| 3.    | Fire Protection System of Transformer & Oil handling tanks areas                                          | LOI has been issued on 03-04-2019. Detailed order has been issued on dated 04-05-2019.Retendering to be done.                                                                                                                                                                                                                                                                        |          |               |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |    |                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                      |    |                        |                                                                                                                                                               |    |                                                                  |                                                                                                               |
| 18.   | Chhattisgarh                                                                                              | Korba (West)                                                                                                                                                                                                                                                                                                                                                                         | 2        | 1984          | 210       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |    |                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                      |    |                        |                                                                                                                                                               |    |                                                                  |                                                                                                               |
| 19.   | Chhattisgarh                                                                                              | Korba (West)                                                                                                                                                                                                                                                                                                                                                                         | 3        | 1985          | 210       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |    |                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                      |    |                        |                                                                                                                                                               |    |                                                                  |                                                                                                               |
| 20.   | Chhattisgarh                                                                                              | Korba (West)                                                                                                                                                                                                                                                                                                                                                                         | 4        | 1986          | 210       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |    |                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                      |    |                        |                                                                                                                                                               |    |                                                                  |                                                                                                               |

| S.No. | State                      | Name of Station                                                                                                                                | Unit No. | Year of Comm. | Cap. (MW) | Status                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |    |                            |                                                                                                                                                |
|-------|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|----------|---------------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
|       |                            |                                                                                                                                                |          |               |           | <table><tr><td>4.</td><td>Installation of FGD System</td><td>DPR prepared. Detailed order has been issued to M/S. DCPL, as consultant for preparation of Tender Specifications. NIT Expected by 20-10-2019.</td></tr></table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 4. | Installation of FGD System | DPR prepared. Detailed order has been issued to M/S. DCPL, as consultant for preparation of Tender Specifications. NIT Expected by 20-10-2019. |
| 4.    | Installation of FGD System | DPR prepared. Detailed order has been issued to M/S. DCPL, as consultant for preparation of Tender Specifications. NIT Expected by 20-10-2019. |          |               |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |    |                            |                                                                                                                                                |
| 21.   | M.P.                       | Sanjay Gandhi                                                                                                                                  | 1        | 1993          | 210       | <p>The BoD of MPPGCL in its meeting on 23.12.2019 has decided that LE of around 10 years may be carried out in Unit no 1 and 2 of SGTPS through R&amp;M based on necessary feasibility study with new CEA’s guideline. M/s FICHTNER consulting Engineers (India) Ltd. appointed as consultant to carry out feasibility study and preparation of tender document for installation of FGD &amp; other equipment in April 2018. Recommendation cum DPR submitted by consultant. Has been accepted by MPPGCL. Technical and commercial specification are under preparation..</p> <p>i) Boiler- Replacement of Pendent Reheater coils and APH tubes with plates, replacement of all safety valves and hangers, re-insulation work after replacement/repairing of boiler pressure parts.</p> <p>ii) TG- Replacement of HP, IP and LP Turbine modules with new improved design.</p> <p>iii) BOP- Replacement of Hydrogen Generation Plant, Complete rehabilitation of almost one non-working stream and refurbishment of damaged parts of one working stream in Ash Handling System, rehabilitation of Fire Fighting system piping, CW System, ACW System, Raw Water System and Fuel oil handling system etc.</p> <p>iv) Electrical and CI-Retrofitting of old 6.6kV SF<sub>6</sub> CB, SFU of LT boards with draw based protection etc. Replacement of 6.6kV energy efficient motors for coal mills and PA Fans. Replacement of complete of complete C&amp;I system to DCS from old analog system.</p> <p>No R&amp;M/LE activity has been carried out in U#1&amp;2 during 2017-22</p> <p>The Need based R&amp;M of 2*210 MW Units is proposed to be carrying out by availing Special Allowance (i.e, Rs 9.5lakh/MW/year))under the provision of MPERC Regulation 2020</p> |    |                            |                                                                                                                                                |
| 22.   | M.P.                       | Sanjay Gandhi                                                                                                                                  | 2        | 1994          | 210       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |    |                            |                                                                                                                                                |
| 23.   | Maharashtra                | Chandrapur                                                                                                                                     | 7        | 1997          | 500       | RLA/Feasibility study for EER&M not carried out. The unit is currently running.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |    |                            |                                                                                                                                                |
| 24.   | Maharashtra                | Khaperkheda                                                                                                                                    | 3        | 2000          | 210       | RLA/Feasibility study for EER&M not carried out. The unit is currently running                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |    |                            |                                                                                                                                                |
| 25.   | Maharashtra                | Khaperkheda                                                                                                                                    | 4        | 2001          | 210       | RLA/Feasibility study for EER&M not carried out. The unit is currently running.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |    |                            |                                                                                                                                                |
| 26.   | Tamil Nadu                 | Tuticorin TPS                                                                                                                                  | 1        | 1978          | 210       | <p>1st and 2nd RLA already completed. Under partial shutdown for R&amp;M works.</p> <p>T.G.: -.. All diaphragm in HP, IP &amp; LP had been renewed &amp; work completed during 2009-10.</p> <p>Electrical &amp; C&amp;I: - Existing 3 nos. single phase GT were replaced by new one during 2012-13.</p> <p>BOP: -Replacement of complete ESP internals. Modification of APH sealing system by double sealing completed during 2009-10.</p> <p>Complete replacement of economizer coils assembly, LTSH supply tubes and straight tubes panels for super heater rear wall near economizer. Works completed on 22-08-2019.</p> <p>Retrofitting of condenser-Work completed on 23.10.2019</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |    |                            |                                                                                                                                                |

| S.No. | State      | Name of Station | Unit No. | Year of Comm. | Cap. (MW) | Status                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-------|------------|-----------------|----------|---------------|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|       |            |                 |          |               |           | <p>Distributed Digital Control Monitoring and Information System (DDCMIS-Erection works completed on 23.12.2020 and commissioned on 24.12.2020.</p> <p>ESP retrofitting proposal is withheld at present. After watching the performance of FGD, further action will be taken</p> <p>Administrative approval accorded for Replacement of 2 nos of Primary Air Fan .1 No. Motor erected on 10.12.2020 and commissioned on 23.12.2020.</p> <p>Replacement of unit auxiliary transformer in unit 1&amp;2</p> <ul style="list-style-type: none"> <li>- Administrative approval proposal is under process.</li> </ul> <p>Replacement of existing 6.6KV PILC cables into latest version 6.6KV XLPE FRLS cable for HT motors and HT transformers. P O issued on 05-03-2019. Materials received on 29-07-2019. Erection under progress.</p> <p>Replacement of 2nos. 15MVA, 15.75 KV/7KV UAT..</p> <p>Re- tender to be floated. Under process.</p> <p><u>R&amp;M work common to Station</u></p> <ul style="list-style-type: none"> <li>- Installation of 10 MLD Desalination plant: DPR prepared by M/s. Fichner, Chennai on 19-07-2018 which is under scrutiny Letter has been sent to CE/Project UHQ for requesting early action of getting clearance from TNCZMA on 27.09.2021</li> <li>- Retrofitting of HP/ IP/ LP rotor of 210 MW LMW turbine: Proposal sent to HQ for approval on 22-04-2019. Certain clarification requested from HQ on 20.11'2021</li> <li>- Common effluent treatment Plant: Consultancy work commenced on 03.11.2020 and Detailed Project report received from M/s.TWIC, Chennai on 11.02.2021. Based on the DPR received from M/s'TWIC, Chennai proposal has been sent to Head Quarters for getting administrative approval on 20.11.2021t Clarification received from CEIMTS/HQ on 04.12.2021.</li> <li>- Erection of 1000 MT Ash Silo unit#1 to 5: Budgetary offers received from 3 firms. Revised proposal sent to HQ on 03-05-2019 for approval, which under progress. Again Budgetary offer called for from M/s'Fichtner consulting engineers (I) Pvt Ltd., Chennai on 19.12.2021</li> <li>- R&amp;M of ESP: After watching the performance of FGD further action will be taken. Installation of Semi Dry Flue Gas Desulphurization (FGD)- Due date of tender opening extended up to 31.01.2022.</li> </ul> |
| 27.   | Tamil Nadu | Tuticorin TPS   | 2        | 1980          | 210       | <p>Following R&amp;M Works to be carried out during 2017-22 at unit#2.</p> <ul style="list-style-type: none"> <li>- Strengthening of weak insulation of Boiler work completed during 2018-19.</li> <li>- Replacement of unit Auxiliary Transformer (2019-20) Tender specification with modified BQR sent to HQ on 23.12.2019</li> <li>- Replacement of existing Journal bearing FD fan 3 Nos. motorsin to antifriction bearing fan motors in boiler (2021-22)</li> <li>- Upgradation of operating system along with PGP and computer. (2019-20)</li> <li>- Replacement of existing HT Mill motors by Energy efficient motors ( 7 NOS). (2021-22).</li> <li>- Augmentation of ESP to meet the new environmental norms of MoEF&amp;CC.(2020-21)</li> <li>- Erection of 1 no 1000 MT Ash Silo at Unit1, 2 &amp;3 1 no at unit 4&amp;5.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

| S.No. | State      | Name of Station | Unit No. | Year of Comm. | Cap. (MW) | Status                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------|------------|-----------------|----------|---------------|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|       |            |                 |          |               |           | <ul style="list-style-type: none"> <li>- Budgetary offer received from 3 firms proposal for getting Administrative approval under preparation.</li> <li>- Main Condensate Pump Motor 220 KW/6.6KV (2021-22)</li> </ul> <p>R&amp;M of ESP: Adm. approval accorded on 03-07-2019. After watching the performance of FGD further action will be taken</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 28.   | Tamil Nadu | Tuticorin TPS   | 3        | 1982          | 210       | <p>1st and 2nd RLA already completed. Under partial shutdown for R&amp;M works.</p> <p>Following R&amp;M Works to be carried out during 2017-22 at unit#3.</p> <ol style="list-style-type: none"> <li>1. Strengthening of weak insulation of Boiler work completed during 2017-18.</li> <li>2. 3<sup>rd</sup> RLA study of Boiler -(2020-21)</li> <li>3. Augmentation of ESP to meet the new environmental norms of MoEF&amp;CC. (2020-21)</li> <li>- Administrative approval accorded on 29-12-2018 for Augmentation of ESP. Tender specification sent to HQ on 04-03-2019 for BLTC approval</li> <li>4. Complete replacement of platen water wall tubes and bends in boiler (2020-21)</li> <li>5. Retrofitting of condenser (2020-21)</li> <li>6. Augmenting the capacity of air evacuation system of condensers by replacing the existing steam ejectors by vacuum pumps (2020-21)</li> <li>7. Retrofitting of HP/IP/LP rotor in 210 mw LMW Turbine” (2020-21)</li> <li>8. Provision of Flue Gas Desulphurization Plant (FGD) (2020-21)</li> <li>9. Replacing of 3 nos 1100KW, 6.6KV FD fan motors. (2019-20)</li> <li>10. Administrative approval accorded vide TANGEDCO Perm. (CMD) Proceedings No: 117, dt.05.05.2020. Tender Specification on approved by BLTC on 26.02.2021. Enquiry floated vide Enq.No:2966-5. Techno commercial bid opened on 31.08.2021. Evaluation of tender is on progress.</li> </ol> <p>Administrative approval accorded for Replacement of 2 nos of Primary Air Fan .Price bid open on 20-02-2019. Tender evaluation is under progress.</p> |
| 29    | Tamil Nadu | Tuticorin TPS   | 4        | 1992          | 210       | <p>Following R&amp;M Works to be carried out during 2017-22 at unit#4. Unit is presently running.</p> <ol style="list-style-type: none"> <li>1. Modification of SWAS System.(2021-22)</li> <li>2. Replacement of existing outdated static type FSSS and SBC (Soot Blower Controls) system and its allied components into latest version system (2020-21)</li> <li>3. Upgradation of Pro- control system (STC, SADC, PRDS&amp; EAST) &amp; Iskamatic (Turbine Control System).(2020-21)</li> <li>4. Complete replacement of Hot Re- heater Coil (2019-20)- P.O. Placed to BHEL, Chennai on 30-05-2019.</li> <li>5. RLA study of Hot Reheater in Boiler (2019-20)</li> <li>6. Augmentation of ESP to meet the new environmental norms of MoEF &amp;CC (2020-21)</li> <li>7. Provision of Flue Gas Desulphurization Plant (FGD) (2021-22)</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 30.   | Tamil Nadu | Tuticorin TPS   | 5        | 1991          | 210       | <p>1st RLA completed. Under shutdown for R&amp;M works.</p> <p>Following R&amp;M Works to be carried out during 2017-22 at unit#5.</p> <p>Work of retrofitting of 6.6 KV MOCB by SF6 breaker</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

| S.No.                                   | State                                  | Name of Station | Unit No. | Year of Comm. | Cap. (MW)    | Status                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-----------------------------------------|----------------------------------------|-----------------|----------|---------------|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                         |                                        |                 |          |               |              | <p>at AHP Stage-I has been completed and commissioned on 16-07-2018.</p> <ol style="list-style-type: none"> <li>1. Modernization of raw coal feeder system (2020-21)</li> <li>2. Modernization of FSSS, SBC, SADC, PRDS &amp; Scanners. (2019-20)</li> <li>3. Replacement of Steam Water Analysis System. (2019- Retender floated and lodged on 25-02-2019. Retender floated and opened on 10-07-2019.</li> </ol> <ul style="list-style-type: none"> <li>Chemical cleaning of boiler (2020-21)</li> </ul> <p>2nd RLA study of Boiler &amp; Turbine (2020-21)</p> <p>Augmentation of ESP to meet the new environmental norms of MoEF&amp;CC. (2021-22)</p> <p>Retrofitting of 6.6KV HT breaker system with new advanced Breaker. (2020-21)</p> <p>Complete replacement of Hot Reheater coil (2020-21)</p> <p>P.O. placed on BHEL, Chennai, on 30-05-2019.</p> <p>Complete replacement of Hot Re-heater Assembly.</p> <p>Administrative approval accorded vide (Per) CMD TANGEDCO Proceedings No.5B Dated: 04.05.2021.</p> <p>Draft tender specification has been sent to HQ on 06.12.2021 for BLTC approval.</p> |
| <b>Sub Total State Sector (R&amp;M)</b> |                                        |                 |          | 30            | <b>7135</b>  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|                                         | <b>Total State Sector (LE+R&amp;M)</b> |                 |          | 64            | <b>14705</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

**CENTRAL SECTOR R&M (Gas Based)**

| S.No. | Utility | Name of Station | Unit No. | Year of Comm. | Cap. (MW) | Status                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------|---------|-----------------|----------|---------------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | NEEPCO  | Kathalguri CCGT | GT-1     | 1995          | 33.50     | (a) The commissioning of M/s MHI make MEGAC V, Diasys Netmation System for Up gradation and replacement of old controllers MACTUS 620 sequencer and MEGAC III analog Governor completed on 15.02.17.<br>(b)Vibration monitoring system of GT Unit 1 commissioned in 19th June, 2019<br>(c)Work Order for Compressor Rotor refurbishment (CRR) and Comprehensive Rotor Inspection (CRI) for unit # 1 to # 4 already placed with the OEM, M/s MHI, Japan vide order No W-8(A)/205 dated 28.05.2013 and this unit is planned in 2023-24 as per maintenance schedule of the OEM.<br>Inverter & charger were completed on 12/05/2018 and SF6 CB is completed on 13/02/2021.                                                                                                                                                                                                                                                                |
| 2     |         | Kathalguri CCGT | GT-2     | 1995          | 33.50     | (a) Order for supply and commissioning of M/s MHI make MEGAC V, Diasys Netmation System for Up gradation and replacement of old controllers MACTUS 620 sequencer and MEGAC III analog Governor was placed with the OEM, M/s MHI, Japan on 26.03.15. The upgradation of Controller commissioned on 31.07.16<br>(b): Vibration monitoring system of GT Unit 2 commissioned in 20th June, 2019<br>(c) Order for Compressor Rotor refurbishment (CRR) and Comprehensive Rotor Inspection (CRI) for unit # 1 to # 4 already placed with the OEM, M/s MHI, Japan vide order No W-8(A)/205 dated 28.05.2013 and the works started w.e.f. 07/03/2022 and completed 14/04/2022. The old rotor of GT # 2 dispatched to MHI works, Japan at the end of July, 2022 for refurbishment. The refurbished rotor shall be reached at site on June-July 2024.<br>Inverter & charger were completed on 12/05/2018 and SF6 CB is completed on 13/02/2021. |
| 3     |         | Kathalguri CCGT | GT-3     | 1995          | 33.50     | a) Already Completed. GTG # 3: 12.11.2013<br>b) Order for R&M of GT unit # 1 to # 4 already placed with the OEM, M/s MHI, Japan vide order No NEEPCO/AGBP/HOP/2013-14/W-8(A)/205 dated 28.05.2013. The rotor after CRR/CRI in Japan reached the Plant site and the above works for GT unit 3 executed w.e.f. 19/06/2017 and completed on 20/07/2017.<br>(c) The procurement of new vibration monitoring system already done and installed in July, 2017 along with major overhauling of Gas Turbine in July, 2017.<br>Battery bank 125V completed on 17/07/2017 and SF6 CB is completed on 18/03/2021.                                                                                                                                                                                                                                                                                                                                |
| 4     |         | Kathalguri CCGT | GT-6     | 1996          | 33.5      | Up gradation of Mark IV control system of M/s BHEL make Gas Turbine Unit 6 with Mark VIe Control system completed on 31.03.2018. The SF6 CB was completed 27/02/2021. Materials required for upgradation of AVR to DAVR received at site and upgradation works completed on 03.09.2021.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 5     |         | Kathalguri CCGT | ST-1     | 1998          | 30.00     | Upgradation of SK-06 Programmer/EPROM writer already completed.<br>Up gradation of AVR (Automatic Voltage Regulation) system to DVAR already commissioned on 26.09.18<br>upgradation of Vibration and Temperature monitoring system completed in Sept, 2019<br>Up gradation of existing DCS system for the combine cycle module#1 and the Governor of the STG#1 has already completed in April 22.<br>Replacement of SF6 CB is completed on 25/12/2021.<br>Spare Refurbished Rotor reached at site on 07.10.2022 from BHEL Hyderabad. Repairing cost 4.37 crore.                                                                                                                                                                                                                                                                                                                                                                      |
| 6     |         | Kathalguri CCGT | ST-2     | 1998          | 30.00     | Upgradation of Vibration and Temperature monitoring system is completed. Unit commissioned on 12/12/2020<br>Upgradation of AVR (Automatic Voltage Regulation) system to DVAR was placed on 23.11.2018. Commissioned in April, 2019<br>Replacement of SF6 CB completed on 23/12/2021                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 7     |         | Kathalguri      | ST-3     | 1998          | 30.00     | Upgradation of Vibration and Temperature monitoring system already                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

|                                            |  |      |           |  |                                                                                                                                                                             |
|--------------------------------------------|--|------|-----------|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                            |  | CCGT |           |  | completed in October, 2019<br>Up gradation of AVR (Automatic Voltage Regulation) system to<br>DVAR already commissioned on 11.09.18<br>The SF6 CB was completed 18/03/2021. |
| <b>Total Central Sector- Gas (R&amp;M)</b> |  |      | <b>7</b>  |  | <b>224</b>                                                                                                                                                                  |
| <b>Total R&amp;M/LE (State+ Centre)</b>    |  |      | <b>71</b> |  | <b>14929</b>                                                                                                                                                                |

## **Annexure-2**

**As on 30.09.2023**

### **Details of Thermal Power Units where the Life Extension (LE) Works have been Completed During 2017-22**

| Sl. No. | Name of the TPS | Unit No. | Capacity MW | Utility   | State/Central Sector | Date of Synchronisation after LE Works |
|---------|-----------------|----------|-------------|-----------|----------------------|----------------------------------------|
| 1       | Ukai            | 4        | 200         | GSECL     | State Sector         | 17-05-2017                             |
| 2       | Wanakabori      | 3        | 210         | GSECL     | State Sector         | 27-11-2017                             |
| 3       | Koradi          | 6        | 210         | MAHAGENCO | State Sector         | 20-08-2018                             |
| 4       | Obra            | 12       | 200         | UPRVUNL   | State Sector         | 24-09-2018                             |
| 5       | Obra            | 13       | 200         | UPRVUNL   | State Sector         | 27-09-2022                             |

**Total (State) - 05 Units 1020.00 MW**

## **Annexure-3**

**As on 30.09.2023**

### **Details of Thermal Power Units where the R&M Works have been Completed During 2017-22**

| Sl. No. | Name of the TPS | Unit No. | Capacity MW | Utility | State/Central Sector | Date of completion of R&M works |
|---------|-----------------|----------|-------------|---------|----------------------|---------------------------------|
| 1       | Kathalguri CCGT | 6        | 33.5        | NEEPCO  | Central              | 31-03-2018                      |
| 2.      | Kathalguri CCGT | 3        | 33.5        | NEEPCO  | Central              | 20-07-2018                      |
| 3.      | Barauni TPS     | 6        | 110         | NTPC    | Central              | 31-05-2022                      |

**Total (Central) - 03 Unit 177.00 MW**

**Annexure-4****Details of Thermal Power Units where the Renovation & Modernisation (R&M)/Life Extension (LE) Works have been Completed During 12<sup>th</sup> Plan**

| Sl. No.                                                                             | Name of the TPS | Unit No. | Capacity MW | Utility | State/Central Sector           | Date of Synchroni-<br>sation after LE Works |
|-------------------------------------------------------------------------------------|-----------------|----------|-------------|---------|--------------------------------|---------------------------------------------|
| Units where Life Extension Works completed during 12 <sup>th</sup> Plan             |                 |          |             |         |                                |                                             |
|                                                                                     | Bathinda        | 3        | 110         | PSPCL   | State Sector                   | 05.08.2012                                  |
|                                                                                     | Kawas           | GT-1A    | 106         | NTPC    | Central Sector                 | 21.01.2013                                  |
|                                                                                     | Parichha        | 2        | 110         | UPRVUNL | State Sector                   | 05.05.2013                                  |
|                                                                                     | Muzafarpur      | 1        | 110         | KBUNL   | Joint venture of BSPGCL & NTPC | 05.07.2013                                  |
|                                                                                     | Kawas           | GT-1B    | 106         | NTPC    | Central Sector                 | 28.08. 2013                                 |
|                                                                                     | Gandhar         | GT – 3   | 131         | NTPC    | Central Sector                 | 29.09. 2013                                 |
|                                                                                     | Kawas           | GT-2B    | 106         | NTPC    | Central Sector                 | 05.03.2014                                  |
|                                                                                     | Bathinda        | 4        | 110         | PSPCL   | State Sector                   | 10.07. 2014                                 |
|                                                                                     | Muzafarpur      | 2        | 110         | KBUNL   | Joint venture of BSPGCL & NTPC | 30.09.2014                                  |
|                                                                                     | Auraiya         | GT-1     | 111.19      | NTPC    | Central Sector                 | 22.06. 2014                                 |
|                                                                                     | Gandhar         | GT-1     | 131         | NTPC    | Central Sector                 | 06.07.2014                                  |
|                                                                                     | Kawas           | GT-2A    | 106         | NTPC    | Central Sector                 | 22.08.2014                                  |
|                                                                                     | Auraiya         | GT-2     | 111.19      | NTPC    | Central Sector                 | 28.10.2014                                  |
|                                                                                     | Auraiya         | GT-3     | 111.19      | NTPC    | Central Sector                 | 25.12.2014                                  |
|                                                                                     | Auraiya         | GT-4     | 111.19      | NTPC    | Central Sector                 | 02.03.2014                                  |
|                                                                                     | Harduaganj      | 7        | 110         | UPRVUNL | State Sector                   | 01.05. 2015                                 |
|                                                                                     | Bandel          | 5        | 210         | WBPDC   | State Sector                   | 21.09.2015                                  |
|                                                                                     | Gandhar         | GT-2     | 131         | NTPC    | Central Sector                 | 15.04.2015                                  |
|                                                                                     | Obra            | 10       | 200         | UPRVUNL | State Sector                   | 08.04.2016                                  |
|                                                                                     | Barauni         | 7        | 110         | BSPGCL  | State Sector                   | 03.08.2016                                  |
|                                                                                     | Obra            | 11       | 200         | UPRVUNL | State Sector                   | 31.12.2016                                  |
| Total State Sector                                                                  |                 | 10 units | 1380.00 MW  |         |                                |                                             |
| Total Central Sector                                                                |                 | 11 units | 1261.76 MW  |         |                                |                                             |
| Total LE (Central +State)                                                           |                 | 21 units | 2641.76 MW  |         |                                |                                             |
| Units where Renovation & Modernisation Works completed during 12 <sup>th</sup> Plan |                 |          |             |         |                                |                                             |
|                                                                                     | DPL             | 6        | 110         | WBPDC   | State Sector                   | 07.05.2012                                  |
|                                                                                     | Patratu         | 10       | 110         | JSEB    | State Sector                   | 24.05.2012                                  |
|                                                                                     | Anpara 'A       | 1        | 210         | UPRVUNL | State Sector                   | 21.03.2013                                  |

|                            |             |                 |                |         |                |             |
|----------------------------|-------------|-----------------|----------------|---------|----------------|-------------|
|                            | Anpara' A   | 2               | 210            | UPRVUNL | State Sector   | 21.03.2013  |
|                            | Anpara' A   | 3               | 210            | UPRVUNL | State Sector   | 21.03.2013  |
|                            | Tanda       | 2               | 110            | NTPC    | Central Sector | 15.09.2012  |
|                            | Kathalguri  | GT-3            | 33.5           | NTPC    | Central Sector | 31.03.2014  |
|                            | Kathalguri  | GT-4            | 33.5           | NTPC    | Central Sector | 31.03.2014  |
|                            | Kathalguri  | GT-5            | 33.5           | NTPC    | Central Sector | 31.03.2014  |
|                            | Simhadri    | 1               | 500            | NTPC    | Central        | 31.03.2016  |
|                            | Simhadri    | 2               | 500            | NTPC    | Central        | 31.03.2016  |
|                            | Ramagundam  | 4               | 500            | NTPC    | Central        | March, 2017 |
|                            | Ramagundam  | 5               | 500            | NTPC    | Central        | March, 2017 |
|                            | Ramagundam  | 6               | 500            | NTPC    | Central        | March, 2017 |
|                            | Rihand STPS | 1               | 500            | NTPC    | Central        | March, 2017 |
|                            | Rihand STPS | 2               | 500            | NTPC    | Central        | March, 2017 |
| Total R&M State Sector     |             | 05 units        | 850.00 MW      |         |                |             |
| Total R&M Central Sector   |             | 11 units        | 3710.50 MW     |         |                |             |
| Total R&M (Central +State) |             | 16 units        | 4560.50 MW     |         |                |             |
| <b>Total (R&amp;M+LE)</b>  |             | <b>37 units</b> | <b>7202.26</b> |         |                |             |

**List of NTPC & JV thermal plants operating at 55% Minimum Technical Load:**

|    | <b>NTPC Coal Stations</b> | <b>Commercial Capacity<br/>MW</b> | <b>Capacity achieving<br/>55% MTL</b> |
|----|---------------------------|-----------------------------------|---------------------------------------|
| 1  | Singrauli                 | 2000                              | 2000                                  |
| 2  | Rihand                    | 3000                              | 3000                                  |
| 3  | Unchahar                  | 1550                              | 1550                                  |
| 4  | Tanda                     | 1100                              | 1100                                  |
| 5  | Dadri coal                | 1820                              | 1820                                  |
| 6  | Mouda                     | 2320                              | 2320                                  |
| 7  | Korba                     | 2600                              | 2600                                  |
| 8  | Vindhyachal               | 4760                              | 4760                                  |
| 9  | Sipat                     | 2980                              | 2980                                  |
| 10 | Ramagundam                | 2600                              | 2600                                  |
| 11 | Simhadri                  | 2000                              | 2000                                  |
| 12 | Farakka                   | 2100                              | 2100                                  |
| 13 | Kahalgaon                 | 2340                              | 2340                                  |
| 14 | Barh                      | 1320                              | 1320                                  |
| 15 | Talcher kaniha            | 3000                              | 3000                                  |
| 16 | Bongaigaon                | 750                               | 750                                   |
| 17 | Kudgi                     | 2400                              | 2400                                  |
| 18 | Solapur                   | 1320                              | 1320                                  |
| 19 | Gadarwara                 | 1600                              | 1600                                  |
| 20 | Lara                      | 1600                              | 1600                                  |
| 21 | Barauni                   | 360                               | 360                                   |
| 22 | Darlipalli                | 800                               | 800                                   |
| 23 | Khargone                  | 1320                              | 1320                                  |
|    | <b>NTPC COAL TOTAL</b>    | <b>45640</b>                      | <b>45640</b>                          |

|   | <b>JV Coal Stations</b> | <b>Commercial Capacity<br/>MW</b> | <b>Capacity achieving<br/>55% MTL</b> |
|---|-------------------------|-----------------------------------|---------------------------------------|
| 1 | Bhilai PP III           | 500                               | 500                                   |
| 2 | Kanti**                 | 610                               | 610                                   |
| 3 | Jhajjar                 | 1500                              | 1500                                  |
| 4 | Vallur                  | 1500                              | 1500                                  |
| 5 | BRBCL                   | 750                               | 750                                   |
| 6 | NPGCL                   | 660                               | 660                                   |
| 7 | Meja                    | 1320                              | 1320                                  |
|   | <b>JV COAL TOTAL</b>    | <b>6840</b>                       | <b>6840</b>                           |
|   | <b>NTPC+JV Total***</b> | <b>52480</b>                      | <b>52480</b>                          |

\*\* Kanti Stage 1, comprising of two units of 110 MW capacity, is unable to achieve 1% Ramp up & down.

\*\*\* JV Captive Coal plants totaling 314 MW are not considered

**List of thermal plants (Non NTPC) operating at 55% Minimum Technical Load:**

| Sr. No. | Region | State          | Sector         | Organisation | Name of Project    | Location District | Fuel Used | Unit No | Total Capacity |
|---------|--------|----------------|----------------|--------------|--------------------|-------------------|-----------|---------|----------------|
| 1       | NR     | Rajasthan      | State Sector   | RRVUNL       | CHHABRA TPP        | Baran             | Coal      | 5       | 660            |
| 2       | NR     | Rajasthan      | State Sector   | RRVUNL       | CHHABRA TPP        | Baran             | Coal      | 6       | 660            |
| 3       | NR     | Rajasthan      | State Sector   | RRVUNL       | KOTA TPS           | Kota              | Coal      | 1       | 110            |
| 4       | NR     | Rajasthan      | State Sector   | RRVUNL       | KOTA TPS           | Kota              | Coal      | 2       | 110            |
| 5       | WR     | Gujarat        | State Sector   | GSECL        | UKAI TPS           | Tapi              | Coal      | 6       | 500            |
| 6       | WR     | Chhattisgarh   | Private Sector | JPL          | OP JINDAL TPS      | Raigarh           | Coal      | 2       | 250            |
| 7       | WR     | Chhattisgarh   | Private Sector | JPL          | OP JINDAL TPS      | Raigarh           | Coal      | 4       | 250            |
| 8       | WR     | Chhattisgarh   | Private Sector | JPL          | TAMNAR TPP         | Raigarh           | Coal      | 1       | 600            |
| 9       | WR     | Madhya Pradesh | Private Sector | JHAPL        | SEIONI TPP         | Seoni             | Coal      | 1       | 600            |
| 10      | SR     | Tamil Nadu     | Private Sector | ITPCL        | ITPCL TPP          | Cuddalore         | Coal      | 1       | 600            |
| 11      | SR     | Tamil Nadu     | Private Sector | ITPCL        | ITPCL TPP          | Cuddalore         | Coal      | 2       | 600            |
| 12      | SR     | Tamil Nadu     | Private Sector | CEPL         | MUTHIARA TPP       | Thoothukudi       | Coal      | 1       | 600            |
| 13      | SR     | Tamil Nadu     | Private Sector | CEPL         | MUTHIARA TPP       | Thoothukudi       | Coal      | 2       | 600            |
| 14      | SR     | Tamil Nadu     | Central Sector | NTPL         | TUTICORIN (JV) TPP | Thoothukudi       | Coal      | 1       | 500            |
| 15      | SR     | Tamil Nadu     | Central Sector | NTPL         | TUTICORIN (JV) TPP | Thoothukudi       | Coal      | 2       | 500            |
| 16      | ER     | Jharkhand      | Central Sector | DVC          | KODERMA TPP        | Koderma           | Coal      | 1       | 500            |
| 17      | ER     | Orissa         | State Sector   | OPGC         | IB VALLEY TPS      | Jharsuguda        | Coal      | 3       | 660            |
| 18      | ER     | Orissa         | State Sector   | OPGC         | IB VALLEY TPS      | Jharsuguda        | Coal      | 4       | 660            |
| 19      | SR     | Andhra Pradesh | Private Sector | SEIL         | PAINAMPU RAM TPP   | SPSR Nellore      | Coal      | 1       | 660            |
| 20      | SR     | Andhra Pradesh | Private Sector | SEIL         | PAINAMPU RAM TPP   | SPSR Nellore      | Coal      | 2       | 660            |
| 21      | SR     | Andhra Pradesh | State Sector   | APGENCO      | RAYALASE EMA TPS   | YSR Kadapa        | Coal      | 6       | 600            |
| 22      | SR     | Andhra         | State          | APPDCL       | DAMODAR            | SPSR Nellore      | Coal      | 1       | 800            |

|    |    |                |                |         |                                      |              |      |   |     |
|----|----|----------------|----------------|---------|--------------------------------------|--------------|------|---|-----|
|    |    | Pradesh        | Sector         |         | AM<br>SANJEEVAI<br>AH TPS            |              |      |   |     |
| 23 | SR | Andhra Pradesh | State Sector   | APPDCL  | DAMODAR<br>AM<br>SANJEEVAI<br>AH TPS | SPSR Nellore | Coal | 2 | 800 |
| 24 | NR | Uttar Pradesh  | Private Sector | LPGCL   | LALITPUR<br>TPS                      | Lalitpur     | Coal | 1 | 660 |
| 25 | NR | Uttar Pradesh  | Private Sector | LPGCL   | LALITPUR<br>TPS                      | Lalitpur     | Coal | 2 | 660 |
| 26 | NR | Uttar Pradesh  | Private Sector | LPGCL   | LALITPUR<br>TPS                      | Lalitpur     | Coal | 3 | 660 |
| 27 | NR | Uttar Pradesh  | Private Sector | BEPL    | BARKHERA<br>TPS                      | Pilibhit     | Coal | 1 | 45  |
| 28 | NR | Uttar Pradesh  | Private Sector | BEPL    | BARKHERA<br>TPS                      | Pilibhit     | Coal | 2 | 45  |
| 29 | NR | Uttar Pradesh  | Private Sector | BEPL    | KHAMBAR<br>KHERA TPS                 | Kheri        | Coal | 1 | 45  |
| 30 | NR | Uttar Pradesh  | Private Sector | BEPL    | KHAMBAR<br>KHERA TPS                 | Kheri        | Coal | 2 | 45  |
| 31 | NR | Uttar Pradesh  | Private Sector | BEPL    | KUNDARKI<br>TPS                      | Gonda        | Coal | 1 | 45  |
| 32 | NR | Uttar Pradesh  | Private Sector | BEPL    | KUNDARKI<br>TPS                      | Gonda        | Coal | 2 | 45  |
| 33 | NR | Uttar Pradesh  | Private Sector | BEPL    | MAQSOOD<br>PUR TPS                   | Shahjahanpur | Coal | 1 | 45  |
| 34 | NR | Uttar Pradesh  | Private Sector | BEPL    | MAQSOOD<br>PUR TPS                   | Shahjahanpur | Coal | 2 | 45  |
| 35 | NR | Uttar Pradesh  | Private Sector | BEPL    | UTRAULA<br>TPS                       | Balrampur    | Coal | 1 | 45  |
| 36 | NR | Uttar Pradesh  | Private Sector | BEPL    | UTRAULA<br>TPS                       | Balrampur    | Coal | 2 | 45  |
| 37 | NR | Uttar Pradesh  | State Sector   | UPRVUNL | PARICHHA<br>TPS                      | Jhansi       | Coal | 4 | 110 |
| 38 | NR | Uttar Pradesh  | State Sector   | UPRVUNL | PARICHHA<br>TPS                      | Jhansi       | Coal | 2 | 110 |
| 40 | NR | Uttar Pradesh  | State Sector   | UPRVUNL | PARICHHA<br>TPS                      | Jhansi       | Coal | 3 | 210 |
| 41 | NR | Uttar Pradesh  | State Sector   | UPRVUNL | PARICHHA<br>TPS                      | Jhansi       | Coal | 4 | 210 |
| 42 | NR | Uttar Pradesh  | State Sector   | UPRVUNL | PARICHHA<br>TPS                      | Jhansi       | Coal | 5 | 250 |
| 43 | NR | Uttar Pradesh  | State Sector   | UPRVUNL | PARICHHA<br>TPS                      | Jhansi       | Coal | 6 | 250 |
| 44 | WR | Gujarat        | State Sector   | GSECL   | WANAKBO<br>RI TPS                    | Kutch        | Coal | 4 | 210 |
| 45 | WR | Gujarat        | State Sector   | GSECL   | WANAKBO<br>RI TPS                    | Kutch        | Coal | 5 | 210 |
| 46 | NR | Uttar Pradesh  | State Sector   | UPRVUNL | ANPARA<br>TPS                        | Sonbhadra    | Coal | 1 | 210 |
| 47 | NR | Uttar Pradesh  | State Sector   | UPRVUNL | ANPARA<br>TPS                        | Sonbhadra    | Coal | 2 | 210 |
| 48 | NR | Uttar Pradesh  | State Sector   | UPRVUNL | ANPARA<br>TPS                        | Sonbhadra    | Coal | 3 | 210 |

|    |    |               |                |          |                   |                 |      |    |        |
|----|----|---------------|----------------|----------|-------------------|-----------------|------|----|--------|
|    |    | Pradesh       | Sector         |          | TPS               |                 |      |    |        |
| 49 | NR | Uttar Pradesh | State Sector   | UPRVUNL  | ANPARA TPS        | Sonbhadra       | Coal | 4  | 500    |
| 50 | NR | Uttar Pradesh | State Sector   | UPRVUNL  | ANPARA TPS        | Sonbhadra       | Coal | 5  | 500    |
| 51 | NR | Uttar Pradesh | State Sector   | UPRVUNL  | ANPARA TPS        | Sonbhadra       | Coal | 6  | 500    |
| 52 | NR | Uttar Pradesh | State Sector   | UPRVUNL  | ANPARA TPS        | Sonbhadra       | Coal | 7  | 500    |
| 53 | NR | Punjab        | Private Sector | NPL      | RAJPURA TPP       | Patiala         | Coal | 1  | 700    |
| 54 | NR | Punjab        | Private Sector | NPL      | RAJPURA TPP       | Patiala         | Coal | 2  | 700    |
| 55 | WR | Maharashtra   | Private Sector | TATA PCL | TROMBAY TPS       | Mumbai          | Coal | 5  | 500    |
| 56 | NR | Uttar Pradesh | State Sector   | UPRVUNL  | OBRA TPS          | Sonbhadra       | Coal | 9  | 200    |
| 57 | NR | Uttar Pradesh | State Sector   | UPRVUNL  | OBRA TPS          | Sonbhadra       | Coal | 10 | 200    |
| 58 | NR | Uttar Pradesh | State Sector   | UPRVUNL  | OBRA TPS          | Sonbhadra       | Coal | 11 | 200    |
| 59 | SR | Karnataka     | State Sector   | RPCL     | Yermarus TPS      | Raichur         | Coal | 1  | 800    |
| 60 | SR | Karnataka     | State Sector   | RPCL     | Yermarus TPS      | Raichur         | Coal | 2  | 800    |
| 61 | WR | Gujarat       | State Sector   | GSECL    | WANAKBORI TPS     | Kutch           | Coal | 6  | 210.00 |
| 62 | WR | Gujarat       | State Sector   | GSECL    | WANAKBORI TPS     | Kutch           | Coal | 7  | 210.00 |
| 63 | NR | Punjab        | Private Sector | TSPL     | TALWANDI SABO TPP | Mansa           | Coal | 1  | 660.00 |
| 64 | NR | Punjab        | Private Sector | TSPL     | TALWANDI SABO TPP | Mansa           | Coal | 2  | 660.00 |
| 65 | NR | Punjab        | Private Sector | TSPL     | TALWANDI SABO TPP | Mansa           | Coal | 3  | 660.00 |
| 66 | SR | Karnataka     | State Sector   | KPCL     | BELLARY TPS       | Bellary         | Coal | 1  | 500.00 |
| 67 | SR | Karnataka     | State Sector   | KPCL     | BELLARY TPS       | Bellary         | Coal | 2  | 500.00 |
| 68 | SR | Karnataka     | State Sector   | KPCL     | BELLARY TPS       | Bellary         | Coal | 3  | 700.00 |
| 69 | ER | Jharkhand     | Private Sector | MPL      | MAITHON RB TPP    | Dhanbad         | Coal | 1  | 525.00 |
| 70 | ER | Jharkhand     | Private Sector | MPL      | MAITHON RB TPP    | Dhanbad         | Coal | 2  | 525.00 |
| 71 | ER | West Bengal   | Private Sector | HEL      | HALDIA TPP        | Purba Medinipur | Coal | 1  | 300.00 |
| 72 | ER | West Bengal   | Private Sector | HEL      | HALDIA TPP        | Purba Medinipur | Coal | 2  | 300.00 |
| 73 | NR | Uttar Pradesh | State Sector   | UPRVUNL  | HARDUAG ANJ TPS   | Aligarh         | Coal | 7  | 105.00 |
| 74 | NR | Uttar Pradesh | State Sector   | UPRVUNL  | HARDUAG ANJ TPS   | Aligarh         | Coal | 8  | 250.00 |
| 75 | NR | Uttar Pradesh | State Sector   | UPRVUNL  | HARDUAG ANJ TPS   | Aligarh         | Coal | 9  | 250.00 |

|    |    |               |                |            |                     |            |         |   |        |
|----|----|---------------|----------------|------------|---------------------|------------|---------|---|--------|
|    |    | Pradesh       | Sector         |            | ANJ TPS             |            |         |   |        |
| 76 | WR | Gujarat       | State Sector   | GMDCL      | AKRIMOTA LIG TPS    | Kutch      | Lignite | 1 | 125.00 |
| 77 | WR | Gujarat       | State Sector   | GMDCL      | AKRIMOTA LIG TPS    | Kutch      | Lignite | 2 | 125.00 |
| 78 | WR | Maharashtra   | Private Sector | DIPL       | DHARIWAL TPP        | Chandrapur | Coal    | 1 | 300.00 |
| 79 | WR | Maharashtra   | Private Sector | DIPL       | DHARIWAL TPP        | Chandrapur | Coal    | 1 | 300.00 |
| 80 | WR | Maharashtra   | State Sector   | MAHAGEN CO | CHANDRAPUR(MH.) TPS | Chandrapur | Coal    | 5 | 500.00 |
| 81 | WR | Gujarat       | Private Sector | CGPL       | MUNDRA UMTTP        | Kutch      | Coal    | 1 | 800.00 |
| 82 | WR | Gujarat       | Private Sector | CGPL       | MUNDRA UMTTP        | Kutch      | Coal    | 2 | 800.00 |
| 83 | WR | Gujarat       | Private Sector | CGPL       | MUNDRA UMTTP        | Kutch      | Coal    | 3 | 800.00 |
| 84 | WR | Gujarat       | Private Sector | CGPL       | MUNDRA UMTTP        | Kutch      | Coal    | 4 | 800.00 |
| 85 | WR | Gujarat       | Private Sector | CGPL       | MUNDRA UMTTP        | Kutch      | Coal    | 5 | 800.00 |
| 86 | NR | Uttar Pradesh | Private Sector | PPGCL      | Prayagraj TPP       | Allahabad  | Coal    | 2 | 660.00 |
| 87 | WR | Maharashtra   | State Sector   | MAHAGEN CO | Khaperkheda TPS     | Nagpur     | Coal    | 1 | 210.00 |
| 88 | WR | Maharashtra   | State Sector   | MAHAGEN CO | Khaperkheda TPS     | Nagpur     | Coal    | 2 | 210.00 |
| 89 | WR | Maharashtra   | State Sector   | MAHAGEN CO | Khaperkheda TPS     | Nagpur     | Coal    | 3 | 210.00 |
| 90 | WR | Maharashtra   | State Sector   | MAHAGEN CO | Khaperkheda TPS     | Nagpur     | Coal    | 4 | 210.00 |
| 91 | WR | Maharashtra   | State Sector   | MAHAGEN CO | Khaperkheda TPS     | Nagpur     | Coal    | 5 | 500.00 |
| 92 | WR | Maharashtra   | State Sector   | MAHAGEN CO | Koradi TPS          | Nagpur     | Coal    | 8 | 660.00 |
| 94 | ER | West Bengal   | Central Sector | DVC        | Mejia TPS           | Bankura    | Coal    | 7 | 500.00 |
| 95 | ER | West Bengal   | Central Sector | DVC        | Mejia TPS           | Bankura    | Coal    | 8 | 500.00 |
| 96 | ER | West Bengal   | Central Sector | DVC        | Koderma TPS         | Koderma    | Coal    | 2 | 500.00 |
| 97 | ER | West Bengal   | Central Sector | DVC        | DURGAPUR STEEL TPS  | Bardhaman  | Coal    | 1 | 500.00 |
| 98 | ER | West Bengal   | Central Sector | DVC        | DURGAPUR STEEL TPS  | Bardhaman  | Coal    | 2 | 500.00 |
| 99 | ER | West Bengal   | Central Sector | DVC        | BOKARO TPS 'A' EXP  | BOKARO     | Coal    | 1 | 500.00 |

|     |    |                |                |                      |                          |              |      |     |        |
|-----|----|----------------|----------------|----------------------|--------------------------|--------------|------|-----|--------|
| 100 | WR | Maharashtra    | State Sector   | MAHAGEN CO           | Koradi TPS               | Nagpur       | Coal | 9   | 660.00 |
| 101 | WR | Maharashtra    | State Sector   | MAHAGEN CO           | Koradi TPS               | Nagpur       | Coal | 10  | 660.00 |
| 102 | ER | Jharkhand      | Central Sector | DVC                  | CHANDRAPURA(DVC) TPS     | Bokaro       | Coal | 7   | 250.00 |
| 103 | ER | West Bengal    | Central Sector | DVC                  | Raghunathpur             | Purulia      | Coal | 1   | 600.00 |
| 104 | NR | Haryana        | State Sector   | HPGCL                | YAMUNA NAGAR TPS         | Yamuna Nagar | Coal | 1   | 300.00 |
| 105 | NR | Haryana        | State Sector   | HPGCL                | YAMUNA NAGAR TPS         | Yamuna Nagar | Coal | 2   | 300.00 |
| 106 | NR | Haryana        | State Sector   | HPGCL                | RAJIV GANDHI TPS         | Hisar        | Coal | 1   | 600.00 |
| 107 | NR | Haryana        | State Sector   | HPGCL                | RAJIV GANDHI TPS         | Hisar        | Coal | 2   | 600.00 |
| 108 | WR | Maharashtra    | Private Sector | RATTANINDIA          | Amravati TPS             | Amravati     | Coal | 1   | 270.00 |
| 109 | WR | Maharashtra    | Private Sector | RATTANINDIA          | Amravati TPS             | Amravati     | Coal | 2   | 270.00 |
| 110 | WR | Maharashtra    | Private Sector | RATTANINDIA          | Amravati TPS             | Amravati     | Coal | 3   | 270.00 |
| 111 | WR | Maharashtra    | Private Sector | RATTANINDIA          | Amravati TPS             | Amravati     | Coal | 4   | 270.00 |
| 112 | WR | Maharashtra    | Private Sector | RATTANINDIA          | Amravati TPS             | Amravati     | Coal | 5   | 270.00 |
| 113 | WR | Chhattisgarh   | Private Sector | JPL                  | OP JINDAL TPS            | Raigarh      | Coal | 1   | 250.00 |
| 114 | WR | Chhattisgarh   | Private Sector | JPL                  | OP JINDAL TPS            | Raigarh      | Coal | 3   | 250.00 |
| 115 | ER | West Bengal    | Central Sector | DVC                  | RAGHUNATHPUR TPP         | Purulia      | Coal | 2   | 600.00 |
| 116 | SR | Tamil Nadu     | State Sector   | TANGEDCO             | METTUR TPS-II            | Salem        | Coal | 1   | 600.00 |
| 117 | WR | Madhya Pradesh | State Sector   | MPPGCL               | SHREE SINGAJI TPP        | Khandwa      | Coal | 3   | 660.00 |
| 118 | WR | Gujarat        | Private Sector | TOR. POW. (UNOSUGEN) | SABARMATI (D-F STATIONS) | Ahmedabad    | Coal | 2   | 120.00 |
| 119 | WR | Gujarat        | Private Sector | TOR. POW. (UNOSUGEN) | SABARMATI (D-F STATIONS) | Ahmedabad    | Coal | 3ta | 121.00 |
| 120 | WR | Gujarat        | Private Sector | TOR. POW. (UNOSUGEN) | SABARMATI (D-F STATIONS) | Ahmedabad    | Coal | 4   | 121.00 |
| 121 | WR | Chhattisgarh   | Private Sector | JPL                  | TAMNAR TPP               | Raigarh      | Coal | 2   | 600    |
| 122 | SR | Tamil Nadu     | State          | TANGEDCO             | NORTH                    | Thiruvallur  | Coal | 1   | 210    |

|     |    |                |                |           |                   |                |      |   |        |
|-----|----|----------------|----------------|-----------|-------------------|----------------|------|---|--------|
|     |    |                | Sector         |           | CHENNAI TPS       |                |      |   |        |
| 123 | SR | Tamil Nadu     | State Sector   | TANGEDCO  | NORTH CHENNAI TPS | Thiruvallur    | Coal | 4 | 600    |
| 124 | WR | Chhattisgarh   | Private Sector | DBPCL     | BARADARHA TPS     | Janjgir Champa | Coal | 1 | 600    |
| 125 | WR | Madhya Pradesh | State Sector   | MPPGCL    | SHREE SINGAJI TPP | Khandwa        | Coal | 1 | 600    |
| 126 | WR | Chhattisgarh   | Private Sector | JPL       | TAMNAR TPP        | Raigarh        | Coal | 3 | 600    |
| 127 | SR | Tamil Nadu     | State Sector   | TANGEDCO  | NORTH CHENNAI TPS | Thiruvallur    | Coal | 2 | 210    |
| 128 | WR | Madhya Pradesh | State Sector   | MPPGCL    | SHREE SINGAJI TPP | Khandwa        | Coal | 2 | 600.00 |
| 129 | WR | Madhya Pradesh | State Sector   | MPPGCL    | SHREE SINGAJI TPP | Khandwa        | Coal | 4 | 660.00 |
| 130 | WR | Chhattisgarh   | Private Sector | DBPCL     | BARADARHA TPS     | Janjgir Champa | Coal | 2 | 600.00 |
| 131 | WR | Chhattisgarh   | Private Sector | JPL       | TAMNAR TPP        | Raigarh        | Coal | 4 | 600.00 |
| 132 | SR | Tamil Nadu     | State Sector   | TANGEDCO  | NORTH CHENNAI TPS | Thiruvallur    | Coal | 5 | 600.00 |
| 133 | WR | Madhya Pradesh | Private Sector | ESSARPMPL | MAHAN TPP         | Singrauli      | Coal | 2 | 600.00 |
| 134 | WR | Madhya Pradesh | Private Sector | ESSARPMPL | MAHAN TPP         | Singrauli      | Coal | 1 | 600.00 |
| 135 | WR | Chhattisgarh   | Private Sector | TRNE      | NAWAPARA TPP      | Raigarh        | Coal | 2 | 300.00 |
| 136 | ER | West Bengal    | State Sector   | WBPDC     | BAKRESWAR TPS     | Birbhum        | Coal | 1 | 210.00 |
| 137 | ER | West Bengal    | State Sector   | WBPDC     | BAKRESWAR TPS     | Birbhum        | Coal | 2 | 210.00 |

|     |    |             |                |       |                 |                |      |   |        |
|-----|----|-------------|----------------|-------|-----------------|----------------|------|---|--------|
| 138 | ER | West Bengal | State Sector   | WBPDC | BAKRESWAR TPS   | Birbhum        | Coal | 3 | 210.00 |
| 139 | ER | West Bengal | State Sector   | WBPDC | BAKRESWAR TPS   | Birbhum        | Coal | 5 | 210.00 |
| 140 | ER | West Bengal | State Sector   | WBPDC | SAGARDIGHI TPS  | Murshidabad    | Coal | 3 | 500.00 |
| 141 | ER | Bihar       | Central Sector | NPGCL | NABINAGAR STPP  | Aurangabad     | Coal | 3 | 660.00 |
| 141 | ER | Bihar       | Central Sector | NPGCL | NABINAGAR STPP  | Aurangabad     | Coal | 4 | 250.00 |
| 142 | ER | West Bengal | Private Sector | CESC  | BUDGE BUDGE TPS | South Parganas | Coal | 3 | 250.00 |
| 143 | WR | Maharashtra | Private Sector | APL   | TIRORA TPS      | Gondia         | Coal | 5 | 660.00 |
| 144 | WR | Maharashtra | Private Sector | APL   | TIRORA TPS      | Gondia         | Coal | 4 | 660.00 |
| 145 | WR | Maharashtra | Private Sector | APL   | TIRORA TPS      | Gondia         | Coal | 3 | 660.00 |
| 146 | NR | Rajasthan   | Private Sector | APL   | KAWAI TPS       | Baran          | Coal | 1 | 660.00 |
| 147 | NR | Rajasthan   | Private Sector | APL   | KAWAI TPS       | Baran          | Coal | 2 | 660.00 |

