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केन्द्रीय विद्युत प्राधिकरण

Central Electricity Authority

तापीय परियोजना नवीनीकरण एवं आधुनिकीकरण प्रभाग

Thermal Projects Renovation & Modernisation Division

CEA-JCOAL Workshop FY23

Quarterly Review Report
Renovation & Modernisation of Thermal Power Stations

Quarter: Jan-Mar., 2024

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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 with 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.

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 was circulated with soft and physical copies.

A MOU signed between the Central Electricity Authority (CEA) of India and the Japan Coal Frontier Organization (JCOAL) , aims to enhance efficiency and environmental standards in thermal power generation. The cooperation, initiated in 2010, focuses on implementing technological solutions for sustainable, stable, and low-carbon power supply. Key areas of collaboration include environmental technology, operational flexibility, biomass co-firing, and clean fuel exploration. Through joint studies, workshops, and training programs, both parties seek to advance clean coal technologies and address emerging challenges in the power sector.

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.

In Dec, 2015 the Ministry of Environment, Forest & Climate Change (MoEF&CC) had notified “Environment (Protection) Amendment Rules, 2015’’ for thermal power stations specifying new norms for stack emissions of SPM, NOx and SO2. TPRM Division is monitoring the implementation of pollution control equipment for compliance with the new norms.

A MOU between CEA and IIT Delhi was signed on 12.12.2022 to survey ambient atmospheric SO2 concentrations in different category of cities based on their vicinity to thermal power plants (TPPs). Phase I, Phase II and Phase III of the study has been completed. Final report is expected to be completed by May, 2024.

India aims to achieve 40% of installed renewable capacity by 2030, posing challenges to grid stability due to the intermittency of solar and wind power. Flexible operation of existing coal-fired plants becomes crucial for ensuring power supply security and grid stability while integrating renewable energy sources. With thermal generation constituting the majority of the country's energy output, flexibility in its operation is essential to manage the variability of renewables and meet energy demand reliably. In February 2023, a report on "Flexibilisation of coal-fired power plants" outlines a roadmap for achieving 40% technical minimum load was published. In March 2023, an SOP & training curriculum at 55% minimum technical load was published, aiding utilities in preparing for enhanced operational flexibility.

Finally, I would like to express my sincere thanks and gratitude to the Utilities and other stakeholders for following CEA’s guidelines during implementation of R&M/LE works at old thermal power plants, furnishing status of R&M activities, status of compliance of CEA regulations regarding flexibilization of thermal units and installation of FGD/upgradations of ESP to comply with new environmental norms thus helping us to prepare & publish quarterly review report.

Dated: 31.03.2024

(Narender Singh)
CE (TPRM,CEA)

Highlights

1. R&M/LE:

a. LE/ R&M Achievements during 12th 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 12th Plan**	10	1380	11	1261.76	21	2641.76
B)	**R&M works**						
2.	**Completed during 12th Plan**	05	850	11	3710.5	16	4560.5
	TOTAL	15	2230	22	4972.26	37	7202.26

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

Category	LE/R&M works identified during 2017-22 No. of units & capacity (MW)		Total (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)

c. Achievements of R&M and LE Projects during (2017 - 22) up to 31.03.2024

Sl. No.	Particulars	LE/R&M works completed No. of units & capacity (MW)		Total (State Sector + Central Sector) 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)

2. Flexible Operation:

a. Flexible Operation of Thermal Power Stations

The report ," Flexible operation of Thermal Power Plant for integration of Renewable Generation : was published in January 2019 , considering renewable installed capacity of 175 GW in the year 2021-22. The report suggested utilizing existing thermal capacity for flexible grid considering large perentration of RE in addition to other options like Pump Storage, Gas Based, Hydro , Battery Storage systems etc.

Another report titled, "Flexibilisation of Coal-Fired Power Plants: A roadmap for achieving 40% Technical Minimum Load" was released in February 2023, addressing the imperative need for thermal power plants to adapt to the anticipated operational changes, notably the shift towards an average minimum load of 40%. Led by a committee chaired by Sh. B. C. Mallick, Chief Engineer, TPRM Division, CEA, the report offers comprehensive guidelines for utilities, covering the necessity and challenges of flexibilisation. It delves into key requirements, operational procedures, necessary modifications, associated costs and impact on tariff, providing a roadmap for enhancing flexibility in thermal power plants. This report serves as a crucial resource for utilities navigating the evolving energy landscape, particularly in light of increasing renewable energy integration.

Subsequently , A report titled, "Operating Procedure and Training Curriculum at 55% Minimum Technical Load of Thermal Generating Units," was released in March 2023, emphasizing the critical need for flexible operation of existing coal-fired power plants to ensure grid stability amidst the integration of large-scale renewable energy sources. This report underscores the country's commitment to addressing technical challenges and developing operating manuals and training curriculum for thermal power plant personnel to achieve a technical minimum load of 55%. This initiative is vital for enhancing the reliability and security of power supply while maximizing renewable energy integration.

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 was conducted between 28.03.2022 to 01.04.2022 at DSTPS, Andal of DVC under IGEF. 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 in March , 2023.

3. 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: -

a. 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 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" organized jointly by CEA and JCOAL on 14th December, 2023.

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 GHTP(Guru Hargobind Thermal Power Plant, Punjab), 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 /

b. Indo-Denmark Co-operation

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.

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

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 31.03.2024 is 441969.55 MW of which thermal power plants contributed 243216.87MW (55.04%) The contribution of Coal, Gas and Diesel based thermal power plants of total installed capacity is 47.7%, 5.66 % 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 targets for Energy Efficiency R&M (EE R&M).

1.0 R&M/LE:

a. 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.

b. 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.

c. Renovation and Modernisation (R&M) and Life Extension Programme (LEP) from 7th Plan to 12th Plan and onwards

R&M Programme in a structured manner was initiated in 1984 as a centrally sponsored programme during

7th 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	7th Plan & 2 Annual Plans	85-86 to 89-90 & 90-91, 91-92	**34 / 163**	**13570**	10000	2000
2	8th Plan (R&M) (LEP)	1992 to 1997	**44 / 198** 43/(194) 1 /(4)	**20869** (20569) (300)	5085	763
3	9th Plan (R&M) (LEP)	1997 to 2002	**37 / 152** 29/ (127) 8/ (25)	**18991** (17306) (1685)	14500	2200
4	10th Plan (R&M) (LEP)	2002 to 2007	**9/25** 5/(14) 4/(11)	**3445** (2460) (985)	2000	300
5	11th Plan (R&M) (LEP)	2007 to 2012	**21/72** 15/(59) 6/(13)	**16146** (14855) (1291)	5400	820
6	12th Plan (R&M) (LEP)	2012 to 2017	**18/37** 8/16 10/21	**7202.5** 4560.50 2641.76	----	----

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

d. 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 No. of units & capacity (MW)		Total (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 R&M/ LE Projects is given below:

As on 31.03.2024

Year	LE No. of units (MW)		R & M No. of units (MW)		Total (state + central) No. of units (MW)		Total LE and R&M No. of units (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)
2019-22	--	--					
2022-23	01(200)	--	--	01(110)	01(200)	01(110)	02(310)
Total No. of units (MW)	05(1020)	--	--	03(177)	05(1020)	03(177)	08(1197)
	05(1020)		3(177)		**08(1197)**		

e. Details of completed LE and R&M Projects during 2017-22 upto 31.03.2024.

	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) 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)**	**1020**
		Centre	**--**	**--**
Total R&M	**03 (177)**	**State**	**--**	**--**
		Centre	**03(unit)**	**177**
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 31.12.2023 are given at **Annexure 2& 3**.

f. New R&M Guidelines 2023

Ministry of Power 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 biding 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.

g. 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 with age oder than 20 years as on December, 2022. 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 (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**	
Timelines	**Phase-IA**		**Phase-IB**					
	01.01.24 to 30.06.26		**01.01.26 to 30.06.28**		**01.07.28 to 31.12.30**		**01.01.31 to 30.06.33**	
	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
Total	**53**	**12120**	**38**	**10880**	**33**	**8830**	**24**	**6320**

2. Environment Compliance

Implementation of Phasing Plan for Compliance with New Environmental Norms notified by MoEF&CC on 7th 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). However, due to limited vendor capability and installation time of about 48 to 52 months as well as import challenges and exorbitant high prices the TPPs were unable to meet the timeline. Subsequently, MOEF&CC vide gazette notification dated 05.09.2022 has categorized thermal power plants in three categories having different timelines along with the environment compensation for non-compliance as follows:

Category	Location/area	Timelines for compliance (Non-retiring units)		Last date for retirement of units for exemption from compliance	
		Parameters other than SO2 emissions	SO2 emissions	Parameters other than SO2 emissions	SO2 emissions
A	With l0 km radius of National Capital Region or cities having million plus population	Up to Dec, 2022	Up to Dec, 2024	Up to Dec, 2022	Up to Dec, 2027
B	With l0 km radius of Critically Polluted Areas or Non-attainment cities	Up to Dec, 2023	Up to Dec, 2025	Up to Dec, 2025	
C	Other than those included in Category A and B	Up to Dec, 2024	Up to Dec, 2026	Up to Dec, 2025	

In case of non-compliance with the aforementioned timelines, MoEF&CC has mandated that penalty may be levied as per the table given below:

Non-Compliant operation beyond the Timeline	Environmental Compensation (Rs. per unit electricity generated)
0-180 days	0.20
l8l-365 days	0.30
366 days and beyond	0.40

a. 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) SO2 ground based measured levels (CPCB, 2018 data) were categorized into 5 distinct levels:
i. Level I : above 40 µg/m3
ii. Level II : 31-40 µg/m3
iii. Level III : 21-30 µg/m3
iv. Level IV : 11-20 µg/m3
v. Level V: 0-10µg/m3.

An MOU between CEA and IIT Delhi was signed on 12.12.2022 to survey ambient atmospheric SO2 concentrations in different category of cities based on their vicinity to thermal power plants (TPPs). Baseline survey of ambient SO2 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 SO2 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.

As per direction of Hon'ble Minister of Power in meeting dated 26.09.2023, IIT Delhi was asked to conduct further survey/study during Phase-III in same cities with addition to few comparable towns/cities with and without FGD in winter months (November, 2023 to February,2024) to clarify the actual impact of FGD after normalizing with other sources of SO2. The study is expected to be completed by Mar,2024

b. 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**
   a. 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.
   b. Further about 38 (27 GW) units under construction generating are also required to install FGD system.
   c. 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**

a. 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
b. Various indigenous and foreign vendors have become stressed

4. **Site execution challenges**

a. 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.

b. 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 1st phase and installation time is about 44 to 48 months. Thereafter 16 - 20 GW (33 to 39 units) every year (2nd/3rd/4th phase).

3. Flexible Operation of Thermal Power Stations

India's Intended Nationally Determined Contributions (INDCs) include a reduction in the emissions intensity of its GDP by 45 percent by 2030 from 2005 level, the target on cumulative electric power installed capacity from non-fossil fuel-based energy resources has been enhanced to 50% by 2030 and to create an additional carbon sink of 2.5 to 3 billion tonnes of CO2 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.

a. A 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 identified the thermal units in consultation with 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 WBPDCL. 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. Flexible operation (40%) 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 Indo –Denmark Cooperation.

b. With the anticipated 500 GW of RE Capacity by 2030, it has been targeted to adapt the total installed fleet of Thermal power plants to operate at 55% Minimum Technical Load (MTL). In this regard , CEA has notified a Regulation regarding Flexible operation of coal based Thermal Power Generating Units on 30.1.2023.As per the regulation :

1. The 55% minimum load and 2% ramp rate operating requirement shall have to be implemented by all thermal generating units (Central/State/Pvt) within one year of the notification of the regulation.

2. Power plants shall implement measures, if required, as per the phasing plans by the respective power plants owners to operate thermal unit at 40% minimum load with following ramp rate:

1% per minute - 40% to 55% and 55% to 40% load
2% per minute - 55% to 70% and 70% to 55% load
3% per minute - 70% to 100% and 100% to 70% load

3. The implementation of the flexible operation shall be as per the phasing plan already notified in the Gazette of India

c. CEA has also notified phasing plan for achieving 40% minimum technical load and same was published in Gazette of India on 15th December , 2023.

d. KPI Targets vis-à-vis Achievement as on 04.04.2024 :-

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	**Flexible Generation:** Reduction in Technical minimum limits and improvement in Ramp rates	Flexibilisation of Thermal Power Plants by CEA	Modifica-tions 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 %	50.29 **%**	**61.9%** (Upto 04.04.2024)	Achieve-ment

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 04.04.2024)	56.86	27.07
Total achievement (%) **61.9%**			

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

e. <u>"SOP and Training curriculum at 55% technical minimum load"</u>

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 in Mar,2023 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.

f. The Report titled " Flexibilisation of Coal Fired Power Plant : A roadmap for achieving 40% Technical Minimum Load " was published in February , 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 in Feb,2023. 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.

g. 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:

Test	Target	Achieved
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, WBPDCL, Musheerabad, West Bengal:

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

Test	Target	Achieved
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:

Test	Target	Achieved
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:

Test	Target	Achieved
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 19-29th 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

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

The ramp rates achieved were as follows:

	Upward direction	Downward direction
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) 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.

H) 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

Test		Target	Achieved
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

I) 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

Test		Target	Achieved
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

4. International Co-operation

a. CEA-JCOAL:

Japan-India Co-operation for Study on Efficiency and Environmental Improvement ofCoal 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 2nd 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 15th April, 2013.

The 3rd 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 22nd January, 2016.

The 4th MoU between CEA and JCOAL has been signed on 16th December, 2019 for Efficiency & Environment Improvement for Sustainable, Stable and Low Carbon Supply of Electricity Following activities to be carried out under 4th 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 , 12th Nov,2021 , 13th Jan , 2023 and 14th December , 2023 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 29th Oct., 2021. During the FY22, 50 participants have undergone the Virtual CCT Training Programme from 31st Oct. 2022 to 2nd 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" organized jointly by CEA and JCOAL on 14th December, 2023.

b. Indo-Denmark Co-operation

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.

Annexure-1

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

STATE SECTOR LE Works

(as on 31.03.2024)

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. **Unit- 12 is synchronized on 24-09-2018. (Runs nearly at 125 MW, ESP pass-B incomplete)** 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. 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 Boiler: 100% work completed. Turbine: 99% work completed. HP rotor blades to be replaced and likely to be dispatched from Haridwar by 1st week of Nov. Generator: 100% work completed. ESP: Pass A: 100%. Work completed. Pass B: 100% work completed. Electrical System: 100% work completed WTP: 99% work completed CHP: 94% work completed 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	ESP R&M: 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. **Turbine & Boiler R&M:** 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 **C&I Up-gradation: -** 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	**Ukai TPS Unit -4 was taken under S/D on 07-12-2016,**

S.No.	State	Name of Station	Unit No.	Year of Comm.	Cap. (MW)	Status
						unit lit up on 04-05-2017 and synchronised on 17.05.2017 and COD achieved on 24.05.2017. 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. **Boiler Back Pass Modification:** Order awarded to BHEL for availability & 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. **C&I Upgradation by utilizing R&M material of 2x120 MW GTPS unit no . 1&2**.: 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.
8.	Gujarat	Ukai	5	1985	200	**ESP R&M:** ESP retrofitting of Ukai unit-5 completed and unit lit up on 29-03-2017. PG test of ESP has been completed. **Turbine &Boiler R&M :**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
9.	Gujarat	Wanakbori	1	1982	210	For implementation of DeNOx system, GSECL is awaiting the results of pilot projects of NTPC. **ESP R&M:** 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 &2 completed and units lit up on 07-03-2017 and 07-04-2018 respectively. PG test of WTPS units#1&2 completed. **Turbine & Boiler R&M:** Turbine -Tender Floated 18.09.2022 Boiler Flexible Operation (-WTPS Unit No 1 & 2 Tender Floated on Dtd: 29.10.2022. **C&I Upgradation:** Energy efficiency Improvement done through up-gradation of C&I in unit#1&2. C&I work completed on 11-03-2017in unit#1 and 17-07-2012 in unit#2. **Boiler back pass Modification** work of UTPS unit#1&2 has been dropped. Pending work of Unit-1&2, Bus coupler will be carried out in available shutdown.
10.	Gujarat	Wanakbori	2	1983	210	

S.No.	State	Name of Station	Unit No.	Year of Comm.	Cap. (MW)	Status
11.	Gujarat	Wanakbori	3		210	**LE work completed and unit synchronised on 05-12-2017.** **ESP Retrofitting work** Shutdown of WTPS Unit No. 3 is commenced form 25.07.2017. ESP retrofitting unit -3 completed and unit lit up on 27-11-2017. PG test completed and guaranty parameters achieved. **Turbine R&M:-** Order awarded to M/s NASL Noida on 29-04-2015 and zero date started from 10.03.2015. Guaranteed parameters achieved. **Boiler Back Pass Modification: -** Order awarded to M/s BHEL for availability & efficiency improvement through modification in Boiler back pass and replacement of APH. PG test carried out on 09-03-2018 and guaranteed parameters achieved.
12.	Maharashtra	Koradi	6	1982	210	**LE work completed and unit sychronised on 16-07-2018 with oil & 20-08-2018 with coal.** The unit is being taken up by WB funded project. The total cost of the project including IDC is 636.93 crores. **BTG Package:** Overall (physical progress) 99% work of BTG package completed. Approximately 98.34% of the material (on Amount basis) is supplied by BHEL at site & further supply is in progress.Civil work of ESP 98% completed. **C&I/Electrical System:** UPS- 98% completed. 24V charger& battery work is 95% completed & Pre-commissioning of system/ auxiliaries **Electrical Package:** Overall 92% work of Electrical package completed. Approximately 92% of the material (on Amount basis) is supplied by M/s ABB at site & further supply is in progress. **BOP Package:** BOP Package work is completed except minor works of Ash Handling plant. **DM Plant & Pre-Treatment System Package** Need based refurbishment of 2 streams of DM Plant is carried out from various agencies with order value of @Rs. 87.27 Lakh. Design Engg. work is completed of **Ash Handling Plant**. Work has been completed. For **Fire Detection, Protection & Inert Gas System Package,** 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&CFO) is balance.
13.	Maharashtra	Koradi	7	1983	210	**This unit is permanently decommissioned on 03.08.2021**
14.	Maharashtra	Bhusawal	2	1979	210	**This unit is permanently decommissioned on 01-04-2017.**
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	**This unit is permanently decommissioned on 30.11.2019.**
20.	Maharashtra	Parli	5	1987	210	**. This unit is permanently decommissioned on 30.11.2019.**
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	**BTPS has been transferred to NTPC on 15-12-2018.** 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	**Unit decommissioned from FY 21-22**
29.	W.Bengal	Kolaghat	2	1985	210	**Unit decommissioned from FY 21-22**
30.	W.Bengal	Kolaghat	3	1984	210	Estimated cost of L.E.of Unit# 1,2&3: 1090 Crs There is no scope of works under Boiler & TG system for KTPS U#1, #2, #3, #5 under R&M/LE ESP: U #3- PG Test of ESP carried out on 17.06.2021 and operational acceptance issued. AHP: Commissioning done in wet manual mode. Commissioning of PLC is under process for the same in auto mode. Project end date 31/3/2024. 80% payment done. 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. **U# 4, 5 & 6 :** Only 1 package for ESP ESP Package: LOA is placed on M/s Soil & Enviro Industries Pvt. Ltd to achieve ESP O/L dust burden to 50mg/Nm^3 from 200mg/Nm^3 by replacement of controller/ TR Set and addition of filter column. **ESP#6-** Payment of Rs. 7.43 crore was made for AHP till 31-12-2019.. Hot gas commissioning was done on 11-09-2019. **R&M not done.** **De SOx (dry FGD/ DSI) project job is going on. Progress status : Engineering 95%, Ordering 88%, Site activity 50% & Payment 25%. Schedule completion April 2024. Agency : M/S ISGEC Heavy Engineering Ltd. Total cost of the project : 190 Cr.**
32.	Karnataka	Raichur	1	1985	210	LE works to be carried out in following two phases: Phase 1: BTG, Retrofitting of ESP & Electrical package Phase-2: BOP- Non BHEL package. Replacement of APH module, TG (C&I) and station (C&I) works completed. After finalization of DPR, KPCL will take decision on comprehensive R&M Works of unit 1&2 according to the recommendations of DPR. **FGD tender** was published in Karnataka e-portal website on 21-12-2018 and 09.03.2019. LoA issued on 14.08.2020 **R&M of unit #1&2:** Letter of award for retrofitting of 03Nos. Microprocessor Controller based Rotary Type
33.	Karnataka	Raichur	2	1986	210	

S.No.	State	Name of Station	Unit No.	Year of Comm.	Cap. (MW)	Status
						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 and the manufacturing work is under progress. Expected completion date- 15 Dec 2024
34.	Karnataka	Raichur	3	1991	210	
Sub Total State Sector (LE)			**34**		**7570**	

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. – **Boiler:** 100% work completed. **TG:** 100% work completed.. **Electrical +& Instrumentation:** 100% work completed. **BOP:** 100% work completed.. 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	**Retired from 01-01-2018**
5.	Punjab	Ropar	2	1985	210	
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. 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. Estimated cost: 840 Cr. 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. - 11 nos of works fully completed. - 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. - Installation of Vacuum pump is under progress, placed to M/s. Millennium Impex Pvt. Ltd. - 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	

<table>
<tr><th>S.No.</th><th>State</th><th>Name of Station</th><th>Unit No.</th><th>Year of Comm.</th><th>Cap. (MW)</th><th>Status</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td>- Replacement of existing BHEL make Procontrol P-13 SG-TG system of unit#5.
-Supply and ETC of variable frequency drive on ID fan motor(4nos.) of unit#6&7
- Supply, Design, installation, testing and commissioning of online energy accounting and management system of KSTP .Material received , installation under progress.</td></tr>
<tr><td>13.</td><td>Rajasthan</td><td>Suratgarh TPS</td><td>1</td><td>1998</td><td>250</td><td rowspan="4">All 4 unit are partial shutdown for R&M works.
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
Total 16 activities sanctioned for R&M/ LE works.
- 14 activities have been completed.
- Old NIT is dropped & New NIT will be floated for providing Dense Phase Conveying System from existing intermediate Silo System of ESP.
-Modification in ACW system of Unit 1& 2 has been completed on 28.01.2017.
-Augmentation of DMCCW system of Unit 1 &2 completed in September, 2016
-Blow down system for cooling Tower of Unit 2,3, 4&5 completed in 2015.
-Replacement of LR beam of ESO on Unit-1 completed in financial year 2018-19.
-SOx, NOx & CO Analyser for Unit 2,3 &4 has been completed on 15.02.2017
-Upgradation of HMI system of unit 2 completed on 06.09.2016.
-Upgradation of workshop completed.</td></tr>
<tr><td>14.</td><td>Rajasthan</td><td>Suratgarh TPS</td><td>2</td><td>2000</td><td>250</td></tr>
<tr><td>15.</td><td>Rajasthan</td><td>Suratgarh TPS</td><td>3</td><td>2001</td><td>250</td></tr>
<tr><td>16.</td><td>Rajasthan</td><td>Suratgarh TPS</td><td>4</td><td>2002</td><td>250</td></tr>
<tr><td>17.</td><td>Chhattisgarh</td><td>Korba (West)</td><td>1</td><td>1983</td><td>210</td><td rowspan="4">All 4 units are currently running.
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.
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 & Up-gradation of ESPs to maintain the stack Emission level 50mg/Nm^3</td><td>Unit No.2: R&M work has been completed, PG Test is to be carried out.
Unit No. 1: R&M work of CD Pass has been completed and erection work of 1 AB Pass is under progress.
Unit No. 3: Civil work has been completed & erection of new ESP is under progress.
Unit No. 4: 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 & 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 & 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></td></tr>
<tr><td>18.</td><td>Chhattisgarh</td><td>Korba (West)</td><td>2</td><td>1984</td><td>210</td></tr>
<tr><td>19.</td><td>Chhattisgarh</td><td>Korba (West)</td><td>3</td><td>1985</td><td>210</td></tr>
<tr><td>20.</td><td>Chhattisgarh</td><td>Korba (West)</td><td>4</td><td>1986</td><td>210</td></tr>
</table>

S.No.	State	Name of Station	Unit No.	Year of Comm.	Cap. (MW)	Status
						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	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&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 & other equipment in April 2018. Recommendation cum DPR submitted by consultant. Has been accepted by MPPGCL. Technical and commercial specification are under preparation.. 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. ii) TG- Replacement of HP, IP and LP Turbine modules with new improved design. 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. iv) Electrical and CI-Retrofitting of old 6.6kV SF_6 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&I system to DCS from old analog system. No R&M/LE activity has been carried out in U#1&2 during 2017-22 The Need based R&M of 2*210 MW Units is is being carried out by availing Special Allowance (i.e, Rs 9.5lakh/MW/year))under the provision of MPERC Regulation 2020
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	1st and 2nd RLA already completed. Under partial shutdown for R&M works. T.G.: -.. All diaphragm in HP, IP & LP had been renewed & work completed during 2009-10. Electrical & C&I: - Existing 3 nos. single phase GT were replaced by new one during 2012-13. BOP: -Replacement of complete ESP internals. Modification of APH sealing system by double sealing completed during 2009-10. 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. Retrofitting of condenser-Work completed on 23.10.2019

S.No.	State	Name of Station	Unit No.	Year of Comm.	Cap. (MW)	Status
						Distributed Digital Control Monitoring and Information System (DDCMIS-Erection works completed on 23.12.2020 and commissioned on 24.12.2020. ESP retrofitting proposal is withheld at present. After watching the performance of FGD, further action will be taken 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. Replacement of unit auxiliary transformer in unit 1&2 - Administrative approval proposal is under process. 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. Replacement of 2nos. 15MVA, 15.75 KV/7KV UAT.. Re- tender to be floated. Under process. <u>R&M work common to Station</u> - 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 - 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 - 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 20.11.202t1 Clarification received from CEIMTS/HQ on 04.12.2021. - 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 - R&M of ESP: After watching the peformance 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.
27.	Tamil Nadu	Tuticorin TPS	2	1980	210	Following R&M Works to be carried out during 2017-22 at unit#2. - Strengthening of weak insulation of Boiler work completed during 2018-19. - Replacement of unit Auxiliary Transformer (2019-20) Tender specification with modified BQR sent to HQ on 23.12.2019 - Replacement of existing Journal bearing FD fan 3 Nos. motorsin to antifriction bearing fan motors in boiler (2021-22) - Upgradation of operating system along with PGP and computer. (2019-20) - Replacement of existing HT Mill motors by Energy efficient motors (7 NOS). (2021-22). - Augmentation of ESP to meet the new environmental norms of MoEF&CC.(2020-21) - Erection of 1 no 1000 MT Ash Silo at Unit1, 2 &3 1

S.No.	State	Name of Station	Unit No.	Year of Comm.	Cap. (MW)	Status
						no at unit 4&5. - Budgetary offer received from 3firms proposal for getting Administrative approval under preparation. - Main Condensate Pump Motor 220 KW/6.6KV (2021-22) R&M of ESP: Adm. approval accorded on 03-07-2019. After watching the peformance of FGD further action will be taken
28.	Tamil Nadu	Tuticorin TPS	3	1982	210	1st and 2nd RLA already completed. Under partial shutdown for R&M works. Following R&M Works to be carried out during 2017-22 at unit#3. 1. Strengthening of weak insulation of Boiler work completed during 2017-18. 2. 3rd RLA study of Boiler -(2020-21) 3. Augmentation of ESP to meet the new environmental norms of MoEF&CC. (2020-21) - Administrative approval accorded on 29-12-2018 for Augmentation of ESP. Tender specification sent to HQ on 04-03-2019 for BLTC approval 4. Complete replacement of platen water wall tubes and bends in boiler (2020-21) 5. Retrofitting of condenser (2020-21) 6. Augmenting the capacity of air evacuation system of condensers by replacing the existing steam ejectors by vacuum pumps (2020-21) 7. Retrofitting of HP/IP/LP rotor in 210 mw LMW Turbine" (2020-21) 8. Provision of Flue Gas Desulphurization Plant (FGD) (2020-21) 9. Replacing of 3 nos 1100KW, 6.6KV FD fan motors. (2019-20) 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. Administrative approval accorded for Replacement of 2 nos of Primary Air Fan .Price bid open on 20-02-2019. Tender evaluation is under progress.
29	Tamil Nadu	Tuticorin TPS	4	1992	210	Following R&M Works to be carried out during 2017-22 at unit#4. Unit is presently running. 1. Modification of SWAS System.(2021-22) 2. Replacement of existing outdated static type FSSS and SBC (Soot Blower Controls) system and its allied components into latest version system (2020-21) 3. Upgradation of Pro- control system (STC, SADC, PRDS& EAST) & Iskamatic (Turbine Control System).(2020-21) 4. Complete replacement of Hot Re- heater Coil (2019-20)- P.O. Placed to BHEL, Chennai on 30-05-2019. 5. RLA study of Hot Reheater in Boiler (2019-20) 6. Augmentation of ESP to meet the new environmental norms of MoEF &CC (2020-21) 7. Provision of Flue Gas Desulphurization Plant (FGD) (2021-22)
30.	Tamil Nadu	Tuticorin TPS	5	1991	210	Ist RLA completed. Under shutdown for R&M works. Following R&M Works to be carried out during 2017-

S.No.	State	Name of Station	Unit No.	Year of Comm.	Cap. (MW)	Status
						22 at unit#5. Work of retrofitting of 6.6 KV MOCB by SF6 breaker at AHP Stage-I has been completed and commissioned on16-07-2018. 1. Modernization of raw coal feeder system (2020-21) 2. Modernization of FSSS, SBC, SADC, PRDS& Scanners. (2019-20) 3. Replacement of Steam Water Analysis System.(2019-Retender floated and lodged on 25-02-2019. Retender floated and opened on 10-07-2019. . Chemical cleaning of boiler (2020-21) 2nd RLA study of Boiler & Turbine(2020-21) Augmentation of ESP to meet the new environmental norms of MoEF&CC.(2021-22) Retrofitting of 6.6KV HT breaker system with new advanced Breaker.(2020-21) Complete replacement of Hot Reheater coil (2020-21 P.O. placed on BHEL, Chennai, on 30-05-2019. Complete replacement of Hot Re-heater Assembly. Administrative approval accorded vide (Per) CMD TANGEDCO Proceedings No.5B Dated: 04.05.2021. Draft tender specification has been sent to HQ on 06.12.2021 for BLTC approval.
Sub Total State Sector (R&M)				30	**7135**	
	Total State Sector (LE+R&M)			64	**14705**	

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. (b)Vibration monitoring system of GT Unit 1 commissioned in 19th June, 2019 (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. 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 (b): Vibration monitoring system of GT Unit 2 commissioned in 20th June, 2019 (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. 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 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. (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.

						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. Up gradation of AVR (Automatic Voltage Regulation) system to DVAR already commissioned on 26.09.18 upgradation of Vibration and Temperature monitoring system completed in Sept, 2019 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. Replacement of SF6 CB is completed on 25/12/2021. 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 Upgradation of AVR (Automatic Voltage Regulation) system to DVAR was placed on 23.11.2018. Commissioned in April, 2019 Replacement of SF6 CB completed on 23/12/2021
7		Kathalguri CCGT	ST-3	1998	30.00	Upgradation of Vibration and Temperature monitoring system already completed in October, 2019 Up gradation of AVR (Automatic Voltage Regulation) system to DVAR already commissioned on 11.09.18 The SF6 CB was completed 18/03/2021.
Total Central Sector- Gas (R&M)			**7**		**224**	
Total R&M/LE (State+ Centre)			**71**		**14929**	

Annexure-2

As on 31.03.2024

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 Synchroni-sation 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	MAHAGENC O	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 31.03.2024

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

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Total (Central) - 03 Unit 177.00 MW

Annexure IV

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

	NTPC Coal Stations	Commercial Capacity MW	Capacity achieving 55% MTL
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
	NTPC COAL TOTAL	**45640**	**45640**

	JV Coal Stations	**Commercial Capacity MW**	**Capacity achieving 55% MTL**
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
	JV COAL TOTAL	**6840**	**6840**
	NTPC+JV Total* **	**52480**	**52480**

** 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.	**Region**	**State**	**Sector**	**Organisation**	**Name of Project**	**Location District**	**Fue**	**Uni**	**Total**

No.							lUsed	tNo	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	Orrisa	State Sector	OPGC	IB VALLEY TPS	Jhasuguda	Coal	3	660
18	ER	Orrisa	State Sector	OPGC	IB VALLEY TPS	Jhasuguda	Coal	4	660
19	SR	Andhra Pradesh	Private Sector	SEIL	PAINAMPURAM TPP	SPSR Nellore	Coal	1	660
20	SR	Andhra	Private Sector	SEIL	PAINAMPURAM TPP	SPSR Nello	Co	2	660

		Pradesh				re	al		
21	SR	Andhra Pradesh	State Sector	APGENCO	RAYALASEEMA TPS	YSR Kadapa	Coal	6	600
22	SR	Andhra Pradesh	State Sector	APPDCL	DAMODARAM SANJEEVAIAH TPS	SPSR Nellore	Coal	1	800
23	SR	Andhra Pradesh	State Sector	APPDCL	DAMODARAM SANJEEVAIAH TPS	SPSR Nellore	Coal	2	800
24	NR	Uttar Pradesh	Private Sector	LPGCL	LALITPUR TPS	Lalitpur	Coal	1	660
25	NR	Uttar Pradesh	Private Sector	LPGCL	LALITPUR TPS	Lalitpur	Coal	2	660
26	NR	Uttar Pradesh	Private Sector	LPGCL	LALITPUR TPS	Lalitpur	Coal	3	660
27	NR	Uttar Pradesh	Private Sector	BEPL	BARKHERA TPS	Pilibhit	Coal	1	45
28	NR	Uttar Pradesh	Private Sector	BEPL	BARKHERA TPS	Pilibhit	Coal	2	45
29	NR	Uttar Pradesh	Private Sector	BEPL	KHAMBARKHERA TPS	Kheri	Coal	1	45
30	NR	Uttar Pradesh	Private Sector	BEPL	KHAMBARKHERA TPS	Kheri	Coal	2	45

31	NR	Uttar Pradesh	Private Sector	BEPL	KUNDARKI TPS	Gonda	Coal	1	45
32	NR	Uttar Pradesh	Private Sector	BEPL	KUNDARKI TPS	Gonda	Coal	2	45
33	NR	Uttar Pradesh	Private Sector	BEPL	MAQSOODPUR TPS	Shahjahanpur	Coal	1	45
34	NR	Uttar Pradesh	Private Sector	BEPL	MAQSOODPUR TPS	Shahjahanpur	Coal	2	45
35	NR	Uttar Pradesh	Private Sector	BEPL	UTRAULA TPS	Balrampur	Coal	1	45
36	NR	Uttar Pradesh	Private Sector	BEPL	UTRAULA TPS	Balrampur	Coal	2	45
~~37~~	~~NR~~	~~Uttar Pradesh~~	~~State Sector~~	~~UPRVUNL~~	~~PARICHHA TPS~~	~~Jhansi~~	~~Coal~~	~~1~~	~~110~~
~~38~~	~~NR~~	~~Uttar Pradesh~~	~~State Sector~~	~~UPRVUNL~~	~~PARICHHA TPS~~	~~Jhansi~~	~~Coal~~	~~2~~	~~110~~
40	NR	Uttar Pradesh	State Sector	UPRVUNL	PARICHHA TPS	Jhansi	Coal	3	210
41	NR	Uttar Pradesh	State Sector	UPRVUNL	PARICHHA TPS	Jhansi	Coal	4	210
42	NR	Uttar Prade	State	UPRVUNL	PARICHHA TPS	Jhansi	Co	5	250

		sh	Sector				al		
43	NR	Uttar Pradesh	State Sector	UPRVUNL	PARICHHA TPS	Jhansi	Coal	6	250
44	WR	Gujarat	State Sector	GSECL	WANAKBORI TPS	Kutch	Coal	4	210
45	WR	Gujarat	State Sector	GSECL	WANAKBORI TPS	Kutch	Coal	5	210
46	NR	Uttar Pradesh	State Sector	UPRVUNL	ANPARA TPS	Sonbhadra	Coal	1	210
47	NR	Uttar Pradesh	State Sector	UPRVUNL	ANPARA TPS	Sonbhadra	Coal	2	210
48	NR	Uttar Pradesh	State Sector	UPRVUNL	ANPARA TPS	Sonbhadra	Coal	3	210
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	TSPL	TALWANDI SABO TPP	Mansa	Co	1	660.

			Sector				al		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	HARDUAGANJ TPS	Aligarh	Coal	7	105.00

74	NR	Uttar Pradesh	State Sector	UPRVUNL	HARDUAGANJ TPS	Aligarh	Coal	8	250.00
75	NR	Uttar Pradesh	State Sector	UPRVUNL	HARDUAGANJ TPS	Aligarh	Coal	9	250.00
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	MAHAGENCO	CHANDRAPUR(MH.) TPS	Chandrapur	Coal	5	500.00
81	WR	Gujarat	Private Sector	CGPL	MUNDRA UMTPP	Kutch	Coal	1	800.00
82	WR	Gujarat	Private Sector	CGPL	MUNDRA UMTPP	Kutch	Coal	2	800.00
83	WR	Gujarat	Private Sect	CGPL	MUNDRA UMTPP	Kutch	Coa	3	800.00

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84	WR	Gujarat	Private Sector	CGPL	MUNDRA UMTPP	Kutch	Coal	4	800.00
85	WR	Gujarat	Private Sector	CGPL	MUNDRA UMTPP	Kutch	Coal	5	800.00
86	NR	Uttar Pradesh	Private Sector	PPGCL	Prayagraj TPP	Allahabad	Coal	2	660.00
87	WR	Maharashtra	State Sector	MAHAGENCO	Khaperkheda TPS	Nagpur	Coal	1	210.00
88	WR	Maharashtra	State Sector	MAHAGENCO	Khaperkheda TPS	Nagpur	Coal	2	210.00
89	WR	Maharashtra	State Sector	MAHAGENCO	Khaperkheda TPS	Nagpur	Coal	3	210.00
90	WR	Maharashtra	State Sector	MAHAGENCO	Khaperkheda TPS	Nagpur	Coal	4	210.00
91	WR	Maharashtra	State Sector	MAHAGENCO	Khaperkheda TPS	Nagpur	Coal	5	500.00
92	WR	Maharashtra	State Sector	MAHAGENCO	Koradi TPS	Nagpur	Coal	8	660.00
94	ER	West Bengal	Central Sector	DVC	Mejia TPS	Bankura	Coal	7	500.00
9	ER	West	Cent	DVC	Mejia TPS	Bankura	C	8	50

5		Bengal	ral Sector				oal		0.00
96	ER	West Bengal	Central Sector	DVC	Koderma TPS	Koderma	Coal	2	500.00
97	ER	West Bengal	Central Sector	DVC	DURGAPUR STEEL TPS	Barddhaman	Coal	1	500.00
98	ER	West Bengal	Central Sector	DVC	DURGAPUR STEEL TPS	Barddhaman	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	MAHAGENCO	Koradi TPS	Nagpur	Coal	9	660.00
101	WR	Maharashtra	State Sector	MAHAGENCO	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
11	SR	Tamil Nadu	State	TANGEDCO	METTUR TPS-II	Salem	Co	1	600.

6			Sector				al		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 Sector	TANGEDCO	NORTH CHENNAI TPS	Thiruvallur	Coal	1	210
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 Prade	State Sect	MPPGCL	SHREE SINGAJI TPP	Khandwa	Coa	1	600

		sh	or				l		
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 Sect	TANGEDCO	NORTH CHENNAI TPS	Thiruvallur	Coa	5	600.

			or				l		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 Beng	State Sect	WBPDC	BAKRESWAR TPS	Birbhum	Coa	5	210.

		al	or				l		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	Maharashtr	Private Sect	APL	TIRORA TPS	Gondia	Coa	3	660.

		a	or				l		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
148	WR	Maharashtra	Private Sector	APL	TIRORA TPS	Gondia	Coal	2	660.00
149	WR	Chhattisgarh	State Sector	CSPGCL	MARWA TPS	Janjgir Champa	Coal	2	500.00
150	WR	Maharashtra	Private Sector	APL	TIRORA TPS	Gondia	Coal	1	660.00
151	WR	Chhattisgarh	Private Sector	GCEL/ADANI	RAIKHEDA TPP	Raipur	Coal	2	685.00

152	WR	Chhattisgarh	Private Sector	GCEL/ADANI	RAIKHEDA TPP	Raipur	Coal	1	685.00
153	WR	Gujarat	State Sector	GSECL	WANAKBORI TPS	Kutch	Coal	8	800.00
154	WR	Gujarat	State Sector	GSECL	UKAI TPS	Tapi	Coal	3	200.00
155	WR	Maharashtra	State Sector	MAHAGENCO	BHUSAWAL TPS	Bhusawal	Coal	5	500.00
156	WR	Maharashtra	State Sector	MAHAGENCO	BHUSAWAL TPS	Bhusawal	Coal	4	500.00
157	ER	Bihar	Central Sector	NTPC	BARH I	Patna	Coal	1	660.00
158	ER	Bihar	Central Sector	NTPC	NABINAGAR STPP	Aurangabad	Coal	2	660.00

159	ER	Odisha	Private Sector	JITPL	DERANG TPP	Angul	Coal	1	600.00
160	NR	Haryana	Private Sector	JhPL(HR)	MAHATMA GANDHI TPS	Jhajjar	Coal	1	660.00
161	NR	Haryana	Private Sector	JhPL(HR)	MAHATMA GANDHI TPS	Jhajjar	Coal	2	660.00
162	WR	Madhya Pradesh	State Sector	MPPGCL	SATPURA TPS	Betul	Coal	11	250.00
163	WR	Gujarat	State Sector	GSECL	SIKKA REP. TPS	Jamnagar	Coal	3	210.00
169	WR	Gujarat	Private Sector	APL	MUNDRA TPS	Kutch	Coal	9	660.00
170	WR	Gujarat	Private Sector	APL	MUNDRA TPS	Kutch	Coal	8	660.00

171	WR	Gujarat	Private Sector	APL	MUNDRA TPS	Kutch	Coal	7	660.00
172	WR	Madhya Pradesh	State Sector	MPPGCL	SATPURA TPS	Betul	Coal	10	250.00
173	WR	Chhattisgarh	Private Sector	KWPCL	AVANTHA BHANDAR	Raigarh	Coal	1	600.00
174	WR	Madhya Pradesh	State Sector	MPPGCL	AMARKANTAK EXT TPS	Anuppur	Coal	3	210.00
175	WR	Madhya Pradesh	Private Sector	MBPMPL	ANUPPUR TPP	Anuppur	Coal	2	600.00
176	WR	Madhya Pradesh	Private Sector	MBPMPL	ANUPPUR TPP	Anuppur	Coal	1	600.00
177	WR	Maharashtra	State Sector	MAHAGENCO	CHANDRAPUR(MAHARASHTRA) STPS	Chandrapur	Coal	9	500.00

178	NR	Uttar Pradesh	Private Sector	PPGCL (Jaypee)	PRAYAGRAJ TPP	Allahabad	Coal	1	660.00
179	NR	Uttar Pradesh	Private Sector	PPGCL (Jaypee)	PRAYAGRAJ TPP	Allahabad	Coal	3	660.00
180	SR	Andhra Pradesh	Private Sector	SEIL	SGPL TPP	SPSR Nellore		2	660.00