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केन्द्रीय विद्युत प्राधिकरण

Central Electricity Authority

तापीय परियोजना नवीनीकरण एवं आधुनिकीकरण प्रभाग

Thermal Projects Renovation & Modernisation Division



CEA-JCOAL Workshop FY22

Quarterly Review Report Renovation & Modernisation of Thermal Power Stations

Quarter: Jan-Mar., 2023

I No.	Description	Page No.
	Highlights	01-02
1.0	Introduction	03
2.0	Objective of R&M programme	03
3.0	Objective of LE programme	03
4.0	R&M and LE programme from 7th Plan onwards till 12th Plan	04
5.0	LE/R&M Programme during (2017-22)	04
5.1	Achievement of LE/R&M Programme during the 2017-22 up to 31.03.2023	05
5.2	Details of thermal units under shut down for R&M and LE works	05
5.3	Status of R&M activities under BRGF Scheme	06
6	Phasing Plan for FGD installation/ ESP upgradation in respect of new Environmental Norms	07
7	Flexible Operation of Thermal Power Stations	07-11
8	Indo-Japan co-operation for study on Efficiency and Environmental improvement of Coal fired stations	11-12
Annexure-1	Status of units where Life Extension/ Renovation & Modernisation works have been taken up for implementation during 2017-22	13-24
Annexure-2	Details of Thermal Power Units where the Life Extension (LE) Works have been completed during 2017-22	25
Annexure-3	Details of Thermal Power Units where the Renovation & Modernisation (R&M) Works have been completed during 2017-22	25
Annexure-4	Details of Thermal Power Units where the Renovation & Modernisation (R&M)/ LE (Life Extension) Works have been completed during 12th Plan	26-27
Annexure-5	List of thermal power plants operating at 55% Minimum Technical Load is given in Annex-5	27-31

Foreword

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

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

R&M/LE works in 08 units of capacity of 1197 MW have been completed up to 31.03.2023.

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

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

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

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). Milestone I achieved as per the MoU.

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

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

Dated: 31-03-2023



(B.C. Mallick)
CE (TPR&M)

Highlights

1. 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 12 th Plan	10	1380	11	1261.76	21	2641.76
B)	R&M works						
2.	Completed during 12 th Plan	05	850	11	3710.5	16	4560.5
	TOTAL	15	2230	22	4972.26	37	7202.26

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

Category	LE/R&M works identified during 2017-22 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)

3. Achievements of R&M and LE Projects upto 31.03.2023

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)

4. Flexible Operation of Thermal Power Stations

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

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

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

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

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

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

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

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

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

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

1. Introduction

At the time of independence, the total installed capacity in the power sector was 1362 MW of which steam power plants contributed 756 MW. The installed generation capacity has since grown manifold. The total installed capacity as on 31.03.2023 is 412212.14 MW of which thermal power plants contributed 236468.91 MW (57.37%) The contribution of Coal, Gas and Diesel based thermal power plants of total installed capacity is 49.66%, 6.87 % and 0.13 % respectively.

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

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

2.0 Objective of R&M Programme

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

3.0 Objective of Life Extension Programme

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

4.0 Renovation and Modernisation (R&M) and Life Extension Programme (LEP) from 7th Plan onwards till 12th Plan

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

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

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

Category	LE/R&M works identified during 2017-22 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 achievements of R&M/ LE Projects is given below:

As on 31.03.2023

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)
2021-22	--	--	--	01(110)	--	01(110)	01(110)
2022-23	01(200)	--	--	--	01(200)	--	01(200)

Total No. of units (MW)	05(1020)	--	--	03(177)	05(1020)	03(177)	08(1197)
	05(1020)			3(177)	08(1197)		

5.1 Details Achievements of LE and R&M Programme during 2017-22 upto 31.03.2023.

	Name of the TPS	Unit No.	Date of S/D	Capacity (MW)	Utility	Sector	Date of Achievement
1. 2017-18							
LE	Ukai TPS	4	07-12-2016	200	GSECL	State	17.05.2017
	Wanakbori TPS	3	25-07-2017	210	GSECL	State	27-11-2017
R&M	Kathalguri CCGT	3	19-06-2017	33.5	NEEPCO	Central	20-07-2018
	Kathalguri CCGT	6	19-03-2018	33.5	NEEPCO	Central	31-03-2018
Sub Total		4 (Units)		477.00			
2. 2018-19							
LE	Koradi TPS	6	25-08-2015	210	MAHAGENCO	State	16-07-2018(oil firing) 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	Barauni TPS	6	15-11-2009	110	NTPC	Central	31-05-2022
3. 2022-23							
LE	Obra TPS	13	16-05-2018	200	UPRVUNL	State	27-09-2022
R&M	--						
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 31.03.2022 are given at Annexure 2& 3.

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

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

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

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

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

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

TOTAL : Rs. 1053.00 Crores

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

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

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

(A) Balance Amount Rs. 127.80 Cr.

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

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

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

Name of TPS	Unit No.	Zero Date	Contractual Completion Date	Anticipated Completion Date	Present physical status as on 31.03.2023
Barauni TPS	7	15.11.2009	15.11.2011	Completed	Unit was synchronized on 03.08.2016. <i>COD of Unit no. 7 achieved on 04.11. 2016.. Unit # 7 resynchronised on 12 .05.2019 and generated 8.88MU in May. Available coal is exhausted. Load could not be raised above 60 MW due to Condenser Vacuum problem</i> First synchronization after takeover by NTPC 23.05.2020
	6	15.11.2009	31-05-2022	Completed	<i>14 days continuous run completed from 29.03.2022 to 12.04.2022. R&M of Unit 6 was completed on 31.05.2022 and put on Bar on 01.06.2022 00:00 Hrs.</i>
Muzaffarpur TPS	1	15.04.2010	15.04.2012	Completed	Unit synchronised on 05.07.2013.
	2	15.04.2010	15.08.2012	Completed	Unit synchronised on 30.09.2014.

6. Implementation of Phasing Plan for FGD installation/ ESP upgradation in respect of 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). To review the various issues arising out of new environmental norms for thermal power stations, a meeting was held on 01.09.2017 in MoEF&CC among Secretary MOEF&CC, Secretary, MoP and Chairperson, CEA and it was decided that the action plan submitted by MoP to MOEF&CC extending up- to 2024 should commence from 2018 and to be implemented before 2022. The MOEF&CC gave its concurrence to the revised implementation plan for FGD installation/ESP upgradation vide letter no. F. No. Q-15017/40/2007-CPW dated 07.12.2017.

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

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

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

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

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

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

General Summary (MW)

S.N o.	Sect or	Total (MW)	CF BC	Claims SO2 complia nce	Retir ed	Feasibi lity study not started	Feasibi lity Study started	Feasibli ty Study Comple ted	Tender specifica tion made	NIT issu ed	Bid open ed	Bid Award ed	FGD install ed
1	Cent ral	67250	750	0	430	0	210	0	0	1110	2390	60030	2330
2	State	68266.5	1075	0	584	0	4722.5	9090	5050	19545	13340	14860	0
3	Priva te	76003	4101	1430	0	1370	5905	6395	5730	7240	11342	25540	6950
	Total	211519.5	5926	1430	1014	1370	10837.5	15485	10780	27895	27072	100430	9280

General summary (No. of units)

S.N o.	Sect or	Total (No. of units)	CF BC	Claims SO2 complia nce	Retir ed	Feasibi lity study not started	Feasibi lity Study started	Feasibli ty Study Comple ted	Tender specifica tion made	NIT issu ed	Bid open ed	Bid Award ed	FGD install ed
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1	Central	168	4	0	3	0	2	0	0	6	11	135	7
2	State	222	7	0	5	0	19	33	16	70	34	38	0
3	Private	210	42	6	0	2	23	16	13	18	29	46	15
	Total	600	53	6	8	2	44	49	29	94	74	219	22

6.1 CEA-IIT D study-

CEA prepared a paper on location specific norms for thermal power plants and suggested a graded action plan for FGD implementation in TPP. To explore such a feasibility, the 24hr avg.(max) SO₂ ground based measured levels (CPCB, 2018 data) were categorized into 5 distinct levels:

- Level I : above 40 µg/m³
- Level II : 31-40 µg/m³
- Level III : 21-30 µg/m³
- Level IV : 11-20 µg/m³
- Level V: 0-10µg/m³.

Further, 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). 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.

Milestone I achieved as per the MoU.

6.2 Vendor Meet-

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

1. Limited vendors for FGD system equipment and materials

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

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

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

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

3. Pandemic induced factors

- 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:

- i. 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).
- ii. It is also suggested that 2nd phase FGD system installation may be initiated 3 years after commissioning of 1st phase which give a time for course of correction seeing the performance in 1st phase (stabilization period is 2-3 years).

7.0 Flexible Operation of Thermal Power Stations

India's Intended Nationally Determined Contributions (INDCs) include a reduction in the emissions intensity of its GDP by 33 to 35 percent by 2030 from 2005 level, and to create an additional carbon sink of 2.5 to 3 billion tonnes of 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

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

supply and stability of electricity grids while maximizing generation from renewables flexibilization of existing coal-fired power plants is an important measure.

- 7.1** Another committee headed by Chief Engineer (TPRM), CEA was constituted to oversees the implementation of measures for flexible operation of TPPs on the basis of the pilot test. Based on the findings of CEA's flexibilisation report, the committee shall identify the thermal units in consultation of State/ Central utilities for the flexibilisation. The identified units shall undergo the pilot tests to ascertain their capability, do gap analysis and carryout modifications, if required. BHEL has conducted flexible operation pilot tests at Mauda TPS of NTPC and Sagardighi TPS of WBPDC. Another flexible operation study has been organized by CEA and carried out by BHEL at Ukai Thermal Power Station Unit # 6 (500MW), GSECL on 04.03.2020. Minimum load of 40% with ramp rate of 3% was successfully achieved. Flexible operation (up to 40% load) test has been conducted at Unit#2, 500MW MPL, Maithon (Unit-2) of JV DVC & TATA Power under IGEF from 22-23 July, 2021. Another test conducted between 28.03.2022 to 01.04.2022 at DSTPS, Andal of DVC under IGEF.
- 7.2** With the anticipated 175 GW of RE Capacity, it has been targeted to adapt 60% of the installed fleet of Thermal power plants to operate at 55% Minimum Technical Load (MTL). The MoP (Ministry of Power) has set the targets for achieving the flexibility (55% MTL) of thermal power plants (Coal/Lignite) in a time bound manner.
- The targets set by MoP are 20%, 30%, 45%, 50% and 60% of the total fleet compliant of 55% MTL from year 2020 to 2024.
- Further CERC vide IEGC regulations 2016 has lowered and made mandatory the technical minimum limit to 55% and provided compensation to the Coal/Lignite based generating stations on account of partial loading of the units.
- Under this key initiative the minimum load and ramp rates of thermal generating units are required to be improved. A committee has been constituted in CEA under chairmanship of Chief Engineer (TPRM) for flexible operation test of thermal power plant for smooth integration of intermittent RES generation.

KPI Targets vis-à-vis Achievement as on 31.03.2023 :-

Summary of Flexibilisation of Thermal power plants:-

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	Modifications in Thermal Power Plants to achieve Technical minimum up to 55% and Ramp rates	Yes, the CERC regulation need changes to reimburse the additional costs to generators for flexible operations	% fleet of installed capacity	20%	30%	45%	50%	60%	Target
						20%	30.4 %	45.12 %	50.29 %		Achievement

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 15.02.2023)	32.49	15.47
Total achievement (%)			50.29%

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

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

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

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

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

The committee also identified the simulator capacity and capability of different utilities in order to train and assess operators in plant operation such as start-up and shut-down, supervision, monitoring and control during normal, emergency situations and in safety procedures. It was also recommended that plant Operators/Trainers

must train on the simulator for 55% Load operation with desired ramp rate and without oil support. The batch size and training duration is also specified with focus areas including cold and warm start up conditions, 55% Operation (Manual) –Ramp Up with ramp rate, 55% Operation (Manual) -Ramp down with ramp rate, 55% Operation (Auto) –Ramp Up with ramp rate, 55% Operation (Auto) -Ramp down with ramp rate, Emergencies & Malfunctions, Unit Stable Operation, Critical Equipment Changeover etc. A detailed training material was prepared by NPTI for both 500 MW and 210MW simulator for lower load operation at 55% modeling critical parameters in order to familiarize the operators.

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

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

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

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

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

Flexibilisation study/test:

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

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

The salient outcome of the pilot tests are as follows:

A) Mouda TPS, NTPC, Nagpur, Maharashtra:

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

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

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

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

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

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

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

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

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

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

Following tests were conducted:

<u>Test</u>	<u>Target</u>	<u>Achieved</u>
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

<u>Test</u>	<u>Target</u>	<u>Achieved</u>
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:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

The 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 and 12th Nov,2021 at New Delhi by CEA and JCOAL. Various stake holders from Central/State/Private in power sector participated in the workshop.

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

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

STATE SECTOR LE Works

(as on 31.03.2023)

S.No.	State	Name of Station	Unit No.	Year of Comm.	Cap. (MW)	Status
1.	U.P.	Obra	12	1981	200	LE Works started on 01.10.2016. 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 1 st 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	LE works yet to be decided by the utility
4.	U.P.	Anpara TPS	2	1987	210	LE works yet to be decided by the utility
5.	U.P.	Anpara TPS	3	1988	210	LE works yet to be decided by the utility
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: Tender for turbine R&M is floated on 06.09.2021 and is under scrutiny. Tender for Boiler Flexible operation is under preparation 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, 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.

S.No.	State	Name of Station	Unit No.	Year of Comm.	Cap. (MW)	Status
						Work completed and unit lit up on 04-05-2017 and synchronized on 17-05-2017. PG test carried out and guaranty parameter achieved. <u>C&I Upgradation by utilizing R&M material of 2x120 MW GTPS unit no. 1&2.</u> : 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	<u>ESP R&M:</u> ESP retrofitting of Ukai unit-5 completed and unit lit up on 29-03-2017. PG test of ESP has been completed. <u>Turbine & Boiler R&M</u> Tender for turbine R&M is floated on 06.09.2021 and is under scrutiny . Tender for Boiler Flexible operation is under preparation
9.	Gujarat	Wanakbori	1	1982	210	For implementation of DeNOx system, GSECL is awaiting the results of pilot projects of NTPC. <u>ESP R&M:</u> 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. <u>Turbine & Boiler R&M:</u> Turbine & boiler R&M work of UTPS Unit#1&2 has been dropped. <u>C&I Upgradation:</u> Energy efficiency Improvement done through up-gradation of C&I in unit#1&2. C&I work completed on 11-03-2017 in unit#1 and 17-07-2012 in unit#2. <u>Boiler back pass Modification</u> 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	
11.	Gujarat	Wanakbori	3		210	<u>LE work completed and unit synchronised on 05-12-2017.</u> <u>ESP Retrofitting work</u> Shutdown of WTPS Unit No. 3 is commenced from 25.07.2017. ESP retrofitting unit -3 completed and unit lit up on 27-11-2017. PG test completed and guaranty parameters achieved. <u>Turbine R&M:-</u> Order awarded to M/s NASL Noida on 29-04-2015 and zero date started from 10.03.2015. Guaranteed parameters achieved. <u>Boiler Back Pass Modification:</u> - 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	<u>LE work completed and unit synchronised on 16-07-2018 with oil & 20-08-2018 with coal.</u> The unit is being taken up by WB funded project. The total

S.No.	State	Name of Station	Unit No.	Year of Comm.	Cap. (MW)	Status
						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 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	Demolition has been proposed
29.	W.Bengal	Kolaghat	2	1985	210	Demolition has been proposed
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

S.No.	State	Name of Station	Unit No.	Year of Comm.	Cap. (MW)	Status
						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. 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.
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 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.
33.	Karnataka	Raichur	2	1986	210	
34.	Karnataka	Raichur	3	1991	210	Therefore, offers were obtained from CEA empaneled agencies for conducting RLA/ CA studies of BTG etc. The offers are under scrutiny. NIT issued on 22.12.2020 for R&M works for Unit Heat Rate improvement. Bid evaluation is under progress for R&M works of Turbine for heat rate improvement
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	
5.	Punjab	Ropar	2	1985	210	Retired from 01-01-2018
6.	Punjab	Ropar	5	1992	210	
7.	Punjab	Ropar	6	2001	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
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
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. - Replacement of existing BHEL make Procontrol P-13 SG-TG system of unit#5.
11.	Rajasthan	Kota	4	1989	210	
12.	Rajasthan	Kota	5	1994	195	

S.No.	State	Name of Station	Unit No.	Year of Comm.	Cap. (MW)	Status												
						-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.												
13.	Rajasthan	Suratgarh TPS	1	1998	250	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.												
14.	Rajasthan	Suratgarh TPS	2	2000	250													
15.	Rajasthan	Suratgarh TPS	3	2001	250													
16.	Rajasthan	Suratgarh TPS	4	2002	250													
17.	Chhattisgarh	Korba (West)	1	1983	210	All 4 units are currently running. 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/Nm³</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><tr><td>4.</td><td>Installation of FGD System</td><td>DPR prepared. Detailed order has been issued to M/S. DCPL, as consultant for preparation of Tender Specifications. NIT Expected by 20-10-2019.</td></tr></table>	1.	Augmentation, Renovation & Up-gradation of ESPs to maintain the stack Emission level 50mg/Nm³	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.	2.	Augmentation of DDCMIS	Detailed order issued to BHEL for supply & services. Detailed Engineering work is under progress. Supply commenced site mobilization started from 29-08-2019.	3.	Fire Protection System of Transformer & Oil handling tanks areas	LOI has been issued on 03-04-2019. Detailed order has been issued on dated 04-05-2019.Retendering to be done.	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.
1.	Augmentation, Renovation & Up-gradation of ESPs to maintain the stack Emission level 50mg/Nm³	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.																
2.	Augmentation of DDCMIS	Detailed order issued to BHEL for supply & services. Detailed Engineering work is under progress. Supply commenced site mobilization started from 29-08-2019.																
3.	Fire Protection System of Transformer & Oil handling tanks areas	LOI has been issued on 03-04-2019. Detailed order has been issued on dated 04-05-2019.Retendering to be done.																
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.																
18.	Chhattisgarh	Korba (West)	2	1984	210													
19.	Chhattisgarh	Korba (West)	3	1985	210													
20.	Chhattisgarh	Korba (West)	4	1986	210													
21.	M.P.	Sanjay Gandhi	1	1993	210	The BoD of MPPGCL in its meeting on 23.12.2019 has												

S.No.	State	Name of Station	Unit No.	Year of Comm.	Cap. (MW)	Status
22.	M.P.	Sanjay Gandhi	2	1994	210	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 SF₆ 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. The Need based R&M of 2*210 MW Units is proposed to be carrying out by availing Special Allowance (i.e, Rs 9.5lakh/MW/year))under the provision of MPERC Regulation 2020
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 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

S.No.	State	Name of Station	Unit No.	Year of Comm.	Cap. (MW)	Status
						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 20.11.2021t 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 performance of FGD further action will be taken. Installation of Semi Dry Flue Gas Desulphurization (FGD)- Due date of tender opening extended up to 31.01.2022.
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 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 performance of FGD further action will be taken

S.No.	State	Name of Station	Unit No.	Year of Comm.	Cap. (MW)	Status
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 2017-22 at unit#5. Work of retrofitting of 6.6 KV MOCB by SF6 breaker at AHP Stage-I has been completed and commissioned on 16-07-2018. 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-

S.No.	State	Name of Station	Unit No.	Year of Comm.	Cap. (MW)	Status
						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 Nov-Dec, 2023. 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	ST-3	1998	30.00	Upgradation of Vibration and Temperature monitoring system already

		CCGT			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 31.03.2023

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

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

Total (State) - 05 Units 1020.00 MW

Annexure-3
As on 31.03.2023

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

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

Total (Central) - 03 Unit 177.00 MW

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

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

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

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

23	SR	Andhra Pradesh	State Sector	APPDCL	DAMODAR AM SANJEEVAI AH 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	KHAMBAR KHERA TPS	Kheri	Coal	1	45
30	NR	Uttar Pradesh	Private Sector	BEPL	KHAMBAR KHERA 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	MAQSOOD PUR TPS	Shahjahanpur	Coal	1	45
34	NR	Uttar Pradesh	Private Sector	BEPL	MAQSOOD PUR 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 Pradesh	State Sector	UPRVUNL	PARICHHA TPS	Jhansi	Coal	5	250
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 Sector	TSPL	TALWANDI SABO TPP	Mansa	Coal	1	660.00
64	NR	Punjab	Private Sector	TSPL	TALWANDI SABO TPP	Mansa	Coal	2	660.00
65	NR	Punjab	Private Sector	TSPL	TALWANDI SABO TPP	Mansa	Coal	3	660.00
66	SR	Karnataka	State Sector	KPCL	BELLARY TPS	Bellary	Coal	1	500.00
67	SR	Karnataka	State Sector	KPCL	BELLARY TPS	Bellary	Coal	2	500.00
68	SR	Karnataka	State Sector	KPCL	BELLARY TPS	Bellary	Coal	3	700.00
69	ER	Jharkhand	Private Sector	MPL	MAITHON RB TPP	Dhanbad	Coal	1	525.00
70	ER	Jharkhand	Private Sector	MPL	MAITHON RB TPP	Dhanbad	Coal	2	525.00
71	ER	West Bengal	Private Sector	HEL	HALDIA TPP	Purba Medinipur	Coal	1	300.00
72	ER	West Bengal	Private Sector	HEL	HALDIA TPP	Purba Medinipur	Coal	2	300.00
73	NR	Uttar Pradesh	State Sector	UPRVUNL	HARDUAG ANJ TPS	Aligarh	Coal	7	105.00
74	NR	Uttar Pradesh	State Sector	UPRVUNL	HARDUAG ANJ TPS	Aligarh	Coal	8	250.00
75	NR	Uttar Pradesh	State Sector	UPRVUNL	HARDUAG ANJ TPS	Aligarh	Coal	9	250.00
76	WR	Gujarat	State Sector	GMDCL	AKRIMOTALIG TPS	Kutch	Lignite	1	125.00

77	WR	Gujarat	State Sector	GMDCL	AKRIMOTA LIG TPS	Kutch	Lignite	2	125.00
78	WR	Maharashtra	Private Sector	DIPL	DHARIWAL TPP	Chandrapur	Coal	1	300.00
79	WR	Maharashtra	Private Sector	DIPL	DHARIWAL TPP	Chandrapur	Coal	1	300.00
80	WR	Maharashtra	State Sector	MAHAGEN CO	CHANDRAPUR(MH.) TPS	Chandrapur	Coal	5	500.00
81	WR	Gujarat	Private Sector	CGPL	MUNDRA UMTTP	Kutch	Coal	1	800.00
82	WR	Gujarat	Private Sector	CGPL	MUNDRA UMTTP	Kutch	Coal	2	800.00
83	WR	Gujarat	Private Sector	CGPL	MUNDRA UMTTP	Kutch	Coal	3	800.00
84	WR	Gujarat	Private Sector	CGPL	MUNDRA UMTTP	Kutch	Coal	4	800.00
85	WR	Gujarat	Private Sector	CGPL	MUNDRA UMTTP	Kutch	Coal	5	800.00
86	NR	Uttar Pradesh	Private Sector	PPGCL	Prayagraj TPP	Allahabad	Coal	2	660.00
87	WR	Maharashtra	State Sector	MAHAGEN CO	Khaperkheda TPS	Nagpur	Coal	1	210.00
88	WR	Maharashtra	State Sector	MAHAGEN CO	Khaperkheda TPS	Nagpur	Coal	2	210.00
89	WR	Maharashtra	State Sector	MAHAGEN CO	Khaperkheda TPS	Nagpur	Coal	3	210.00
90	WR	Maharashtra	State Sector	MAHAGEN CO	Khaperkheda TPS	Nagpur	Coal	4	210.00
91	WR	Maharashtra	State Sector	MAHAGEN CO	Khaperkheda TPS	Nagpur	Coal	5	500.00
92	WR	Maharashtra	State Sector	MAHAGEN CO	Koradi TPS	Nagpur	Coal	8	660.00
94	ER	West Bengal	Central Sector	DVC	Mejia TPS	Bankura	Coal	7	500.00
95	ER	West Bengal	Central Sector	DVC	Mejia TPS	Bankura	Coal	8	500.00
96	ER	West Bengal	Central Sector	DVC	Koderma TPS	Koderma	Coal	2	500.00
97	ER	West Bengal	Central Sector	DVC	DURGAPUR STEEL TPS	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	MAHAGEN CO	Koradi TPS	Nagpur	Coal	9	660.00
101	WR	Maharashtra	State Sector	MAHAGEN CO	Koradi TPS	Nagpur	Coal	10	660.00
102	ER	Jharkhand	Central Sector	DVC	CHANDRAPURA(DVC) TPS	Bokaro	Coal	7	250.00
103	ER	West Bengal	Central Sector	DVC	Raghunathpur	Purulia	Coal	1	600.00

104	NR	Haryana	State Sector	HPGCL	YAMUNA NAGAR TPS	Yamuna Nagar	Coal	1	300.00
105	NR	Haryana	State Sector	HPGCL	YAMUNA NAGAR TPS	Yamuna Nagar	Coal	2	300.00
106	NR	Haryana	State Sector	HPGCL	RAJIV GANDHI TPS	Hisar	Coal	1	600.00
107	NR	Haryana	State Sector	HPGCL	RAJIV GANDHI TPS	Hisar	Coal	2	600.00
108	WR	Maharashtra	Private Sector	RATTANIN DIA	Amravati TPS	Amravati	Coal	1	270.00
109	WR	Maharashtra	Private Sector	RATTANIN DIA	Amravati TPS	Amravati	Coal	2	270.00
110	WR	Maharashtra	Private Sector	RATTANIN DIA	Amravati TPS	Amravati	Coal	3	270.00
111	WR	Maharashtra	Private Sector	RATTANIN DIA	Amravati TPS	Amravati	Coal	4	270.00
112	WR	Maharashtra	Private Sector	RATTANIN DIA	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	RAGHUNA THPUR TPP	Purulia	Coal	2	600.00
116	SR	Tamil Nadu	State Sector	TANGEDCO	METTUR TPS-II	Salem	Coal	1	600.00
117	WR	Madhya Pradesh	State Sector	MPPGCL	SHREE SINGAJI TPP	Khandwa	Coal	3	660.00
118	WR	Gujarat	Private Sector	TOR. POW. (UNOSUGEN)	SABARMA TI (D-F STATIONS)	Ahmedabad	Coal	2	120.00
119	WR	Gujarat	Private Sector	TOR. POW. (UNOSUGEN)	SABARMA TI (D-F STATIONS)	Ahmedabad	Coal	3ta	121.00
120	WR	Gujarat	Private Sector	TOR. POW. (UNOSUGEN)	SABARMA TI (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 Pradesh	State Sector	MPPGCL	SHREE SINGAJI TPP	Khandwa	Coal	1	600
126	WR	Chhattisgarh	Private	JPL	TAMNAR TPP	Raigarh	Coal	3	600

			Sector						
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