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केन्द्रीय विद्युत प्राधिकरण

Central Electricity Authority

तापीय परियोजना नवीनीकरण एवं आधुनिकीकरण प्रभाग

Thermal Projects Renovation & Modernisation Division

4th MoU between CEA and JCOAL signed on 16th Dec, 2019

Quarterly Review Report
Renovation & Modernisation of Thermal Power Stations

Quarter: July-Sept., 2022

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 07 units of capacity of 997 MW have been completed upto 30.09.2022. At present, 1 coal based generating units with capacity of 200 MW is under shut down for carrying out the R&M/LE works.

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. The purpose of this MoU is to address issues and barriers in expediting sustainable, stable and low carbon thermal power development by means of studies, training program and knowledge-sharing activities, outcomes of which are to be conducive to overall power development in India as well as to expedite relevant policy implementation by the Government of India. Biomass co-firing (up to 30%) study at Ropar thermal power plant, Punjab has been conducted by JCOAL under the Indo-Japan Co-operation.

FY 2021 Clean Coal Technology (CCT) Training Program (Virtual) under Indo-Japan Cooperation has been organized between 27-29 Oct.,2021. A virtual workshop has also been organized on 12.11.2021 comprising participants from major Japanese and Indian utilities/manufacturers.

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 is being conducted in thermal generating units of NTPC and KPCL under India-Denmark cooperation.

MoEF&CC has issued Gazette notification on 31.03.2021 in which thermal generating units were to be categorized into category A, B & C for implementation of FGD. TPR&M Division, in consultation with RPCs & utilities prepared a draft categorization of TPPs and the same was submitted to the Task force constituted by MOEF&CC for finalizing the Categorization. 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.

A committee has been constituted under the aegis of CEA to oversee pilot tests for flexible operation of coal- fired power plant. BHEL has conducted flexible operation pilot tests at Mauda TPS of NTPC and Sagardighi TPS of WBPDCL. Further, the flexibilisation study has also been conducted at Vindhyachal STPS, NTPC and at Anpara B TPS, UPRVUNL by JCOAL, Japan. Further, flexible operation study at Unit # 6 (500 MW), Ukai Thermal Power Station, GSECL was arranged by CEA and the same was carried out by BHEL on 04.03.2020.An efficiency test at Mouda Thermal Power Station, NTPC has been conducted between 06.01.2020 to 10.01.2020 by TEPCO Power Grid Inc. and JERA, Japan under the observation of CEA. 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 19-29 July, 2021. Further, Unit#7, Ramagundam TPS, NTPC and Unit#3, Raichur TPS,KPCL are under flexibe operation study/test in association with Denmark. Another test conducted between 28.03.2022 to 01.04.2022 at DSTPS, Andal of DVC under IGEF.

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

Dated: 30-09-2022

(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 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

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 30.09.2022

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	04(820)	--	04(820)
2	R&M	--	03(177)	03(177)
Total		04(820)	03(177)	7(997)

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 WBPDCL 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.

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, Stableand 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 FY21, group participants have undergone the CCT Training Programme from 27th Oct. 2021 to 29th Oct., 2021.

Under Indo-Japan Cooperation, a one-day Workshop (Virtual) on “Project on Efficiency and Environmental Improvement for Sustainable, Stable and Low-carbon Supply of Electricity” has been organized jointly by CEA and JCOAL on Monday, 12th Nov., 2021.

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 HargGobind Thermal Power Plant, Punjab).

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

1. Introduction

At the time of independence, the total installed capacity in the power sector was 1362 MW of which steam power plants contributed 756 MW. The installed generation capacity has since grown manifold. The total installed capacity as on 30.09.2022 is 407796.57 MW of which thermal power plants contributed 236086.07 MW (58.89%) The contribution of Coal, Gas and Diesel based thermal power plants of total installed capacity is 50.04%, 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	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.

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 30.09.2022

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)
Total No. of units (MW)	04(820)	--	--	03(177)	04(820)	03(177)	07(997)
	04(820)		3(177)		**07(997)**		

5.1 Details Achievements of LE and R&M Programme during 2017-22 upto 30.09.2022.

	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

Total LE	**04 (820)**	**State**	**04(unit)**	**820**
		Centre	**--**	**--**
Total R&M	**03 (177)**	**State**	**--**	**--**
		Centre	**03(unit)**	**177**
Grand Total			**07(units)**	**997.00**

Details of thermal power units where the R&M/ LE Works have been completed during 2017-22 up to 30.09.2022 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 Details of thermal units under shut down for R&M and LE works

The following unit is under shut down for R&M and Life Extension works.

Sl.No.	Name of Project	Utility	State	Unit No.	Capacity (MW)	Shutdown Date
1	Obra TPS	UPRVUNL	U.P.	13	200	16-05-2018

5.3 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 Croes
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 directlyto 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 CompletionDate**	**Anticipated CompletionDate**	**Present physical status as on 30.09.2022**
Barauni TPS	7	15.11.2009	15.11.2011	Completed	**Unit was synchronized on 03.08.2016.** *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 Vacuumproblem* ***First synchronization after takeover by NTPC 23.05.2020***
	6	15.11.2009	31-05-2022	Completed	*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.*
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 31.03.2021 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 31.12.2022

Category B - Within 10 km radius of critically polluted areas or Non-Attainment cities as defined by CPCB. Completion timeline 31.12.2023

Category C - Other than those included in category A and B. Completion timeline 31.12.2024

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-22, Dec-23 and Dec-24 respectively.

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

General Summary (MW)

S.No.	Sector	Total (MW)	CFBC	Claims SO2 compliance	Retired	Feasibility study not started	Feasibility Study started	Feasiblity Study Completed	Tender specification made	NIT issued	Bid opened	Bid Awarded	FGD installed
1	Central	67250	750	0	220	0	420	0	0	1110	2390	60530	1830
2	State	68266.5	1075	0	270	0	5331.5	12240	6440	19215	15120	8260	0
3	Private	76003	4089	1430	0	1370	5692	6395	4950	15700	10412	19060	6950
	Total	211519.5	5914	1430	490	1370	11443.5	18635	11390	36025	27922	87850	8780

General summary (No. of units)

S.No.	Sector	Total (No. of units)	CFBC	Claims SO2 compliance	Retired	Feasibility study not started	Feasibility Study started	Feasiblity Study Completed	Tender specification made	NIT issued	Bid opened	Bid Awarded	FGD installed
1	Central	168	4	0	2	0	3	0	0	6	11	136	6
2	State	222	7	0	2	0	22	45	23	67	33	23	0
3	Private	210	41	6	0	2	24	16	12	33	28	34	15
	Total	600	52	6	4	2	49	61	35	106	72	193	21

6.1 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:

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).

Summary of FGD Commissioning Timelines as per Vendors (Capacity in MW)

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

7.0 Flexible Operation of Thermal Power Stations

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

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 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.

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: -

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%	47.32 % (Upto 14.09.2022)		Achieve-ment

Summary of Flexibilisation of Thermal power plants:-

S. No	Utility	Capacity which achieved 55% MTL (GW)	Achievement (%)
1	NTPC + JV	52.48	25.33
2	Other Utilities (Period April 2020 to Sept 2020)	7.64	3.68
3	Other Utilities (Period Oct 2020 to Dec 2020)	4.84	2.33
4	Other Utilities (Period Jan 2021 to Mar 2021)	8.18	3.94
5	Other Utilities (Period April 2021 to 14.09.2022)	25.09	12.05
		Total achievement (%)	47.32

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

55% MTL SOP and Training Module

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.

Committee for assessment of Flexible power and ramp rate to be required in the year 2030 for integration of 500 GW non-fossil fuel Capacity.

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

Initiated operational and design data analysis before actual low load test at site

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

Initiated operational and design data analysis before actual low load test at site

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 on30.4.2010 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 ElectricityFollowing 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. During the FY21, group participants have undergone the CCT Training Programme from 27th Oct. 2021 to 29th Oct., 2021.

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.

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 30.09.2022)

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
2.	U.P.	Obra	13	1982	200	R&M works started from 17-05-2018. Unit is under s/d from 16-05-2018. 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: 99% 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
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. Work completed and unit lit up on 04-05-2017 and synchronized on 17-05-2017. PG test carried out and

S.No.	State	Name of Station	Unit No.	Year of Comm.	Cap. (MW)	Status
						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** 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. **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 & boiler R&M work of UTPS Unit#1&2 has been dropped. **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	
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 &

S.No.	State	Name of Station	Unit No.	Year of Comm.	Cap. (MW)	Status
						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 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

S.No.	State	Name of Station	Unit No.	Year of Comm.	Cap. (MW)	Status
						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.
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:** Nearly 85% work completed. **TG:** Nearly 85% work completed. **Electrical +& Instrumentation:** Nearly 85% work completed. **BOP:** Nearly 85% work completed. -Utility decided to carry out Feasibility Study to meet the environmental norms.
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
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. 1. Augmentation, Renovation & Up-gradation of ESPs to maintain the stack Emission level 50mg/Nm^3 — **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 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.
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 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

S.No.	State	Name of Station	Unit No.	Year of Comm.	Cap. (MW)	Status
						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 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.

S.No.	State	Name of Station	Unit No.	Year of Comm.	Cap. (MW)	Status
						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 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

S.No.	State	Name of Station	Unit No.	Year of Comm.	Cap. (MW)	Status
						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	**Gt#1** (a) Order for supply of M/s MHI make MEGAC V, Diasys Netmation System for Up gradation and replacement of old controller MACTUS 620 sequencer and MEGAC III analog Governor already placed with the OEM, M/s MHI, Japan on 26.03.2015. Work completed on 15-02-2017. **(b)** Vibrating monitoring system of GT, unit#1 has been commissioned on 19-06-2019. **(c)** Order for Compressor Rotor Refurbishment (CRR) and Comprehensive Rotor Inspection (CRI) for unit#1 to unit #4 have already been placed with the OEM, M/s MHI, Japan on 28.05.2013 and unit is planned in 2022-23 as per the maintenance schedule of OEM.
2		Kathalguri CCGT	GT-2	1995	33.50	**GT#2 :** a) Order for supply and commissioning of M/s MHI make MEGAC VThe upgradation of controller already commissioned on 31-07-2016. **(b)** Vibrating monitoring system of GT, unit#1 has been commissioned on 20-06-2019. **(c)** Order for Compressor Rotor Refurbishment (CRR) and Comprehensive Rotor Inspection (CRI) for unit#1 to unit #4 have already been placed with the OEM, M/s MHI, Japan on 28.05.2013 and this GT of unit#2 is planned in FY 2022-23
3		Kathalguri CCGT	GT-3	1995	33.50	Compressor Rotor Refurbishment (CRR) executed w.e.f. 19-06-2017 and completed on 20-07-2017. The order for procurement of new vibration monitoring system is already placed and installed in July 2017 along with major overhauling of Gas Turbine in July 2017.
4		Kathalguri CCGT	GT-6	1996	33.5	**Upgradation and replacement of Mark IV control system M/s. BHEL make Gas Turbine Unit 6 with Mark Vie Control System has been completed on 31-03-2018.**
5		Kathalguri CCGT	ST-1	1998	30.00	a) Upgradation of Programmer/ EPROM writer for Procontrol-13 Control System: already completed. b) Upgradation of AVR (Automatic Voltage Regulator): LOI for upgradation of AVR is placed on M/s.ABB. Upgradation of AVR to DVAR completed and commissioned on 26-09-2018. c) P.O. for upgradation of Vibration and Temperature monitoring System placed on 22-11-2018. Material received. Commissioned September 2019. d) Up gradation of Electro-hydraulic governor (SR-IV) e)Upgradation of existing DCS system has started wef 08.03.2022
6		Kathalguri CCGT	ST-2	1998	30.00	Upgradation of 3300-series, BENTLEY-NEVADA- make vibration system: P.O. for upgradation of Vibration and Temperature monitoring System placed on 22-11-2018. Commissioned in Oct,2019 P.O. placed on 23-11-2018 for Upgradation of AVR (Automatic Voltage Regulator) to to DVAR. Commissioned in April 2019. Process for Upgradation of Vibration and Temperature monitoring system completed on 12.12.2020.
7		Kathalguri CCGT	ST-3	1998	30.00	a) Upgradation of 3300-series, BENTLEY-NEVADA- make vibration system: Commissioned in October 2019. b) PO placed for upgradation of AVR onM/s.ABB. Upgradation of AVR (Automatic Voltage Regulator) to to DVAR is completed and commissioned on 11-09-2018.
Total Central Sector- Gas (R&M)			**7**		**224**	
Total R&M/LE (State+ Centre)			**71**		**14929**	

Annexure-2

As on 30.09.2022

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	MAHAGENCO	State Sector	20-08-2018
4	Obra	12	200	UPRVUNL	State Sector	24-09-2018

Total (State) - 04 Units 820.00 MW

Annexure-3

As on 30.09.2022

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 ofR&M works
1	Kathalguri CCGT	6	33.5	NEEPCO	Central	31-03-2018
2.	Kathalguri CCGT	3	33.5	NEEPCO	Central	20-07-2018

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Total (Central) - 02 Unit 67.00

Annexure-4

Details of Thermal Power Units where the Renovation & Modernisation (R&M)/Life Extension (LE) Works have beenCompleted During 12th Plan

Sl. No.	Name of the TPS	Unit No.	Capacity MW	Utility	State/Central Sector	Date of Synchroni-sation after LE Works
Units where Life Extension Works completed during 12th 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	WBPDCL	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 12th Plan						
	DPL	6	110	WBPDCL	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**			

Annexure-5

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	PAINAMPURAM TPP	SPSR Nellore	Coal	1	660
20	SR	Andhra Pradesh	Private Sector	SEIL	PAINAMPURAM TPP	SPSR Nellore	Coal	2	660
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	State	APPDCL	DAMODAR	SPSR	Coal	2	800

		Pradesh	Sector		AM SANJEEVAIAH TPS	Nellore			
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	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	DIPL	DHARIWAL	Chandrapur	Coal	1	300.00

			Sector		TPP				
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 Sector	CGPL	MUNDRA UMTPP	Kutch	Coal	3	800.00
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
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	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