



भारत सरकार

I.S.O.: 9001: 2008

Government of India
केन्द्रीय विद्युत प्राधिकरण

Central Electricity Authority

तापीय परियोजना नवीनीकरण एवं आधुनिकीकरण प्रभाग

Thermal Projects Renovation & Modernisation Division



R&M of Unit-6 (210 MW) of Koradi TPS of MAHAGENCO

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

Quarter: July-September, 2017

C O N T E N T S

Sl No.	Description	Page No.
	Highlights	01-03
1.0	Introduction	04
2.0	Objective of R&M programme	04
3.0	Objective of LE programme	04
4.0	R&M and LE programme from 7th Plan onwards till 12th Plan	04-05
5.0	LE/R&M Programme during (2017-22)	05
5.1	Achievement of LE/R&M Programme during the 2017-22 up to 30th September,2017	06
5.2	Details of thermal units under shut down for R&M and LE works	06
5.3	Status of R&M activities under BRGF Scheme	06-07
6.0	Phasing Plan for FGD installation/ ESP upgradation in respect of new Environmental Norms	07
7.0	External Co-operation for R&M of TPS	08
7.1	Development of Tender Procedure and Model Contract for R&M of Fossil fuel based Power Plant	08-09
7.2	Coal Fired Generation Rehabilitation programme funded by World Bank	09-12
7.3	Indo-Japan co-operation for study on Efficiency and Environmental improvement of Coal fired stations	12-13
Annexure-1	Status of units where Life Extension/ Renovation & Modernisation works have been taken up for implementation during 2017-22	14-25
Annexure-2	Details of Thermal Power Units where the Life Extension (LE) Works have been completed during 2017-22	26
Annexure-3	Details of Thermal Power Units where the Renovation & Modernisation (R&M) Works have been completed during 2017-22	27
Annexure-4	Details of Thermal Power Units where the Renovation & Modernisation (R&M)/ LE (Life Extension) Works have been completed during 12th Plan	28-29
Annexure-5	Summary of implementation for phasing plan for FGD installation/ESP Upgradation	30

Foreword

Renovation & Modernization (R&M) 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 01 unit of capacity of 200 MW has been completed during 1st quarter of 2017-18. At present, 4 coal based generating units with aggregate capacity of 620 MW are under shut down for carrying out the R&M/LE works.

CEA has carried out the technical studies related to R&M for addressing barriers to Energy Efficiency R&M in India as a part of Coal Fired Generation Rehabilitation Project funded by the World Bank. Study reports on “*Reduction of Barriers to R&M Interventions in TPS in India*” and “*Developing Markets for Implementation of R&M Schemes in TPS in India*” submitted by Mercados Energy Markets India Pvt. Ltd. have been circulated to the various stakeholders for their reference and guidance during the implementation of R&M projects. Also, the reports on Review of Procurement Experience, Implementation Experience, Strengthening O&M Practices & Post R&M Experience have been prepared. Further, to facilitate the implementation of R&M projects model tender documents for R&M of fossil fuel based power plants in India have been prepared under Indo-German Energy Forum (IGEF). The above mentioned reports and tender documents have been shared with stakeholders in Power Sector. Further, all reports are also available in CEA website.

Under the Indo-Japan Co-operation, 3rd Phase MoU between CEA and JCOAL, Japan has been signed on 22nd January, 2016. The Diagnostic activities have been carried out by JCOAL, Japan at unit-3 (210 MW) of Dadri TPS, NTPC. A study on replacement of old units of Badarpur TPS by highly efficient super critical units of higher size has been carried out by JCOAL, Japan as a generic study. The feasibility study for replacement of Singrauli STPS Stg. I & II units (5x200 MW+2x200 MW) of NTPC has been carried out during December 2016 to March 2017. JCOAL has also submitted report on Environmental Study through Combustion Test of Talcher Coal. A study on O&M enhancement of existing unit no.-1 of DTPS, DVC is being carried out by JCOAL.

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 for preparation of quarterly review report.

Dated: 20-12-2017

(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 during 2017-18

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	01(200)	--	01(200)
2	R&M	--	--	--
	Total	01(200)	--	01(200)

4. 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) notified “Environment (Protection) Amendment Rules, 2015” for thermal power stations on 07.12.2015. All existing stations are required to comply with the new Standards within 2 years (i.e. by Dec. 2017) and the new stations including all station presently under construction are required to meet the new norms by 06-12-2017.

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 implemented before 2022.

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:-

(A) Phase-II Activity: Development of Tender Procedure and Model Contracts for R&M of Fossil Fuel Based Power Plants in India – funded by KfW.

Lahmeyer International (India) Ltd. was appointed as a Consultant for ‘Development of Tendering Procedures and Model Contract document for R&M of Fossil Fuel Based Power Plants in India’. The Phase-II Activity Report and final Model Documents have been submitted by Lahmeyer under the consultancy. The Documents have been accepted by CEA and uploaded to CEA website.

(B) ‘Technical Assistance to CEA’ funded by World Bank under the umbrella project “Coal Fired Generation Rehabilitation Project-India”

The consultants for carrying out the following studies under the above project have been appointed. The status of progress is given below :-

a) Study on Reduction of Barriers to R&M Interventions in TPS in India

Mercados Energy Market India was appointed as a consultant on 02.04.2012. The Study Report submitted by Mercados EMI has been accepted by CEA in January, 2014 and sent to various stakeholders in the power sector.

b) Study on Developing Markets for Implementation of R&M in TPS in India

Mercados Energy Market India was appointed as a consultant on 14.05.2012. The Study Report submitted by Mercados EMI has been accepted by CEA in January, 2014 and sent to various stakeholders in the power sector.

c) Review of Institutional Capacity and Capacity Strengthening Interventions in CEA

KPMG has been appointed to carry out the study on 16-07-2012. KPMG has already submitted reports on As-Is Assessment of Institutional Capacity of CEA and Customer Expectation Survey. The revised Capacity Strengthening plan was submitted by KPMG on 2nd February 2017. A meeting chaired by Chairperson (CEA) was held on 22nd March 2017 for discussion on the Capacity Strengthening Plan for CEA prepared by KPMG. Based on the discussion KPMG has been asked to revise the plan. The revised Capacity Strengthening Plan is still awaited from KPMG. The letters/reminders have been sent to KPMG. In this regard a meeting between KPMG, ABPS and CEA was held on 01-08-2017. KPMG has requested vide letter dated 28-09-2017 for an extension of contract by 31st March, 2018 to complete the remaining activities.

d) Review of Experience from Pilot R&M Capacity Interventions in TPS in India:

WAPCOS was appointed as a consultant w.e.f. 23-07-2012. WAPCOS has submitted the final reports on all four activities, namely, Review of Procurement Experience, Implementation Experience, Strengthening O&M Practices & Post R&M Experience in O&M on 15th, 17th and 22nd March 2017 respectively. The

reports were accepted by CEA on 29th March 2017. The same have been shared with stakeholders in Power Sector and have also been hosted on the CEA website.

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

The 3rd Memorandum of Understanding (MoU) on Indo – Japan Cooperation for Project on Efficiency & Environment Improvement for Sustainable, Stable and Low Carbon Supply of Electricity between CEA and JCOAL was signed on 22nd January, 2016. The objective of the MoU is to address issues and barriers in promoting sustainable, stable and low-carbon thermal power development in India. Under this MoU, JCOAL has carried out feasibility study for replacement of Badarpur TPS by new units based on SC/USC technologies. RLA study of unit-3 (210 MW), Dadari TPS has been carried out by JCOAL. The feasibility study for Singrauli STPS Stg. I & II units (5x200 MW+2x200 MW) of NTPC has been carried out during December 2016 to March 2017. Talcher TPS of NTPC has been selected for replacement study under CEA- JCOAL Co-operation. NTPC has also offered Vindhyachal TPS for the study on flexible operation by JCOAL. An Environmental Study through Combustion Test of Indian Coal has also been carried out by JCOAL. 25 tonnes, G12 grade coal was sent to Japan from Talcher coal mine for Combustion test. The combustion test was done at Akitsu Works, MHPS, Japan and report was submitted in January 2017. A study on best O&M practices of thermal power unit is being carried out by JCOAL at unit-1, DTPS, DVC in 2017-18.

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

1.0 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 30.09.2017 was 329298.27 MW of which thermal power plants contributed 219449.51 MW (66.64 %). The contribution of Coal, Gas and Diesel based thermal power plants of total installed capacity is 58.74 %, 7.65 % and 0.25 % 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 11th 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 30.09.2017

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	01(200)	--	--	--	01 (200)	--	01 (200)
Total No. of units (MW)	01(200)	--	--	--	01 (200)	--	01 (200)
	01(200)		----		01(200)		

5.1 Details Achievements of LE and R&M Programme during 2017-22 upto 30.09.2017.

	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
R&M	--	--		--	--	--	--
Sub Total		01 (unit)		200			
Total LE	01 (200)	State	01(unit)	200			
		Centre	--	--			
Total R&M	00 (00)	State	--	--			
		Centre	--	--			
Grand Total		01(unit)	200				

Details of thermal power units where the R&M/ LE Works have been completed during 2017-22 up to 30.09.2017 are given at **Annexure 2& 3**.

5.2 Details of thermal units under shut down for R&M and LE works

The following 4 units are under shut down for R&M and Life Extension works.

Sl.No.	Name of Project	Utility	State	Unit No.	Capacity (MW)
1.	Obra TPS	UPRVUNL	U.P.	7	100
2.	Barauni TPS	BSPGCL	Bihar	6	110
3.	Koradi TPS	MSPGCL	Maharashtra	6	210
4.	Obra TPS	UPRVUNL	U.P.	12	200
Total					620

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 30.06.2017:

i)	BHEL	:	Rs. 725.07 crores
ii)	KBUNL	:	Rs. 180.00 crores
iii)	NTPC	:	Rs. 20.11 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.

Commencement of work and Completion Schedule:

Name of TPS	Unit No.	Zero Date	Contractual Completion Date	Anticipated Completion Date	Present physical status as on 31.12.2015
Barauni TPS	7	15.11.2009	15.11.20011	Completed	Unit was synchronized on 03.08.2016.
	6	15.11. 2009	15.06.2012	10-01-2018	Boiler: Erection of 1615 MT done out of 2900 MT. ESP: 60% work completed. 320 Items awaited from BHEL Ranipet. Fan Erection: FD, ID and PA Fan are to be commissioned. GT: 40% work completed. One no. stator conductor bar sent for repair works. Duct: erection is under progress. 41 items awaited from Trichi and 3 items awaited from Jagdishpur. Mills: erection of 3 mills out of 5 are under progress Anticipated completion of Unit- 6 is 10-01-2018.
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) notified “Environment (Protection) Amendment Rules, 2015” for thermal power stations on 07.12.2015. All existing stations are required to comply with the new Standards within 2 years (i.e. by Dec. 2017) and the new stations including all station presently under construction are required to meet the new norms by 01-01-2017.

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 implemented before 2022.

The implementation plan including units commissioned up- to 31.08.2017 is enclosed at Annexure 5. The year-wise FGD Phasing Plan and ESP Upgradation Plan are given below.

i) Year wise FGD Phasing Plan

Year	Capacity (MW)	No. of units
2018	500	1
2019	4940	8
2020	27230	55
2021	64027.5	172
2022	64704.5	178
Plan not Available	150	1
Total	161552	415

ii) Year wise ESP Upgradation Plan

Year	Capacity	Units
2018	500	1
2019	1300	2
2020	10705	28
2021	23495	97
2022	28525	94
Plan not Available	1400	9
Total	65925	231

7.0 External Co-operation for R&M of TPS

To demonstrate the Energy Efficiency R&M programme in thermal power stations in India, a few pilot R&M projects have been financed by some external funding agencies such as KfW Development Bank-Germany, World Bank, European Union (EU) etc. The soft loans are provided by these external agencies for energy efficiency R&M programmes. Also, KfW & World Bank have provided some grant for technical assistance for preparation of Feasibility Reports/DPRs at selected thermal units and carrying out some R&M related studies. METI (Ministry of Economy, Trade and Industry), Japan and MOP, Govt. of India have agreed to extend their cooperation in sharing technical expertise as well as in actual implementation of mutually agreed techno-economical R&M solutions. In addition to this, KfW has also financed the project “Development of Tender Procedure and Model Contract for the R&M of Fossil Fuel Based Thermal Power Plants in India”. The details of the above programme are as follows:-

7.1 Development of the Tender Procedures and Model Contract for the R&M of Fossil Fuel Based Power Plants in India.” Funded by KfW Development Bank– Germany.

The Sub-Group-I on “Efficiency Enhancement in Fossil Based Power Plants” constituted under the Indo-German Energy Forum, in its first meeting held on 12.03.2008 identified the Development of Standard Documents for R&M Projects among the three other issues. The development of Standard Documents was envisaged to be done in two phases as under.

Phase-I Activity

The objective of Phase-I Activity is an assessment of tendering procedures currently being followed by public utilities in India and a review of documents used for standard R&M projects as well as the documents which have already been developed for projects financed particularly by World Bank. The Phase-I Activity was carried out by the consultant-M/s. Evonik Energy Services India appointed and funded by GIZ. M/s. Evonik Energy Services India submitted the report on Phase-I activity in September 2009.

Phase-II Activity

The main objective of Phase-II Activity is the preparation of the model documents/templates for R&M Projects in consultation with Task Force, Power Utilities & financing agencies. It is intended to apply the documents for the Energy Efficiency Programme financed by KfW.

The MoP nominated CEA as Project Implementing Agency in December 2009 to carry out the Phase-II Activity. Lahmeyer International (India) Pvt. Ltd has been appointed as consultant

w.e.f 16-03-2012 for “Development of the Tender Procedures and Model Contract for the R&M of Fossil Fuel based Power Plants in India” under Phase-II Activity.

The following R&M model documents and Phase-II Activity Report have been prepared by CEA and uploaded on CEA website.

Sl No.	Description of the Report
1	Model Feasibility Report
2	Model Detail Project Report (DPR)
3	Model RLA/CA Report of R&M projects Model
4	Model Energy Audit Report of R&M projects
5	Model Tender Documents for selection of R&M Contractor
6	Model Tender Documents for selection of R&M Consultant
7	Model Tender Documents for selection of ISC
8	Phase –II Activity Report

7.2 “Coal-Fired Generation Rehabilitation Project-India” funded by World Bank.

The World Bank has financed the “Coal-Fired Generation Rehabilitation Project-India” for demonstrating Energy Efficiency Rehabilitation & Modernization (EE R&M) at coal fired generating units through rehabilitation of 640 MW of capacity across three States-West Bengal, Haryana and Maharashtra. The above project has two components: -

Component-1. Energy Efficiency R&M at Pilot Projects

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

Component-2. Technical Assistance to CEA and Utilities

The Technical Assistance component of the project is aimed at providing support in implementation of EE R&M pilots, developing a pipeline of EE R&M interventions, addressing barriers to EE R&M projects and strengthening institutional capacities of implementing agencies for improved operation and maintenance practices. The World Bank has earmarked US \$ 7.5 million GEF grant for the Component-2.

7.2.1 World Bank Funded Energy Efficiency Pilot R&M Projects

(A) Bandel TPS (Unit-5, 210 MW)

The total estimated cost of R&M project is around US \$ 107.38 Million comprising of loan of around US \$ 59, GEF Grant of around US \$ 12.45 million. In addition to above, Technical

Assistance of US \$ 1.3 million under GEF Grant has been provided for consultancy. Further, additional US\$ 22.21 million comprising of IBRD loan of US\$ 18.01 million and GEF grant of US\$ 4.2 million due to restructuring of funds as a result of cancellation of R&M works in Panipat TPS have also been provided for Bandel TPS.

Status of Physical Progress

The unit- 5 was taken under S/D for R&M/LE works in November.2013 and the unit synchronized on coal on 21st September, 2015. The unit attained a load of 215 MW on 24th November, 2015.

(B) Koradi TPS (Unit-6, 210 MW)

Background

The total estimated cost of the project is around US\$ 110.5 Million and the fund allocation for the Koradi TPS is loan of around US \$ 59 million (Loan)), grant of around US \$ 12.45 million. In addition to above Technical Assistance of US \$ 3.3 million under GEF Grant has been provided for 10 consultancy studies.

The Commercial Operation Date of the unit is 30.03.1982 & the unit is about 34 years old. The estimated cost of the R&M project based on award of contract is Rs. 486 Crore. The zero date for R&M project is 3rd March, 2014. The unit is under shutdown since 20th July, 2015 and targeted synchronization date is 30.12.2017.

Status of Physical Progress

- i) **BTG Package:** i) Mahagenco issued that the Letter of Award to BHEL on May 31, 2013. The contract was signed on December 18, 2013. Approximately 96% of the material (on Amount basis) is supplied by BHEL at site & further supply is in progress. 57% work of new ESP Control Room building at new location is completed. Erection of HP & IP Turbine is 100% completed. LP Turbine modification work is 100% completed. Erection of LP Turbine is 80% completed Mill overhauling work is 50 % completed. FD fan overhauling work is 50% completed. Erection of BFP is 100% completed. Generator package electrical is 80% completed and GTR erection is 99% completed.
- ii) **Electrical Package:** Mahagenco issued the Letter of Award to M/s ABB Ltd on March 19, 2012 and the final contract was signed on May 25, 2012. Later on the package price escalation issue was resolved & M/s ABB restarted the work at site from 07.10.2015. Approximately 61% of the material (on Amount basis) is supplied by M/s ABB at site & further supply is in progress. Breaker ON/OFF time test completed. Retrofitting of HT breakers completed. HT/LT Motors overhaul 70% and 75% completed respectively. Unit Aux. Transformer (UAT) placed in position. FBT panel erection work is 40% completed. HT switchgear work 100% completed.
- iii) **BOP Package:** Letter of Award (LOA) for Cooling Tower Plant Package, Ash Handling Plant package and Fire Detection, Protection & Inert Gas System Package are issued and contract is signed on 23.09.2016, 26.10.2016 & 05.11.2016 respectively. DM Plant & Pre-Treatment System Package has been cancelled. The need based work of DM Plant &

Pre-Treatment System shall be carried out separately by O&M section. Under Cooling Tower Plant Package 95% of overall material has been supplied at site & 60% of the dismantling work has been completed. 46% installation & civil works completed. Design Engg. work is in progress of Ash Handling Plant. Design Engg works of AHP Package is in progress.

Installation & Civil works is about to start for Fire Detection, Protection & Inert Gas System Package.

Various Revised Milestones for R&M work at Unit-6, Koradi TPS are as under:

S.No.	Milestone	Target Date	Revised Target Date	Actual Date
1.	Zero date R&M Project	03-03-2014	--	03-03-2014
2.	Date of Shut Down for R&M	25-08-2015	--	20-07-2015
3.	Synchronization	20-04-2016	30-12-2017	--
4.	Trial Run or Reliability Run	20-05-2016	--	--
5.	P.G. Test	18-08-2016	--	--

C) Panipat TPS (Unit-3&4, 2x110 MW)

The unit 3 & 4 of Panipat TPS was initially identified for R&M under World Bank Programme. A loan of 448.36 Crores was assigned under R&M of Unit 3&4, PTPS, Panipat. As per the final TAR of consultant R&M cost was 561.27 Crores which was not found financial viable due to high sensitivity of returns to Station Heat Rate and exceeding of estimated cost against available funds. Therefore, HPGCL requested World Bank for foreclosure of the Loan Agreement.

6.2.2 Technical Assistance to CEA

World Bank has financed the project “India: Coal Fired Generation Rehabilitation Project.” aimed at demonstrating Energy Efficiency Rehabilitation & Modernization (EE R&M) of coal fired generation units through rehabilitation of 640 MW of capacity across three states- West Bengal, Haryana and Maharashtra. The project is funded through IBRD loan of USD 180 million and GEF grants of USD 45.4 million out of which USD 7.5 million have been earmarked for Technical Assistance/Studies. Under sub- component (iii) of component -2 of the coal Fired Generation Rehabilitation Project.

Under Component-2 of the Coal Fired Generation Rehabilitation Project, CEA is implementing the project on “Technical Assistance to CEA for Addressing the Barriers to Energy Efficient R&M of Coal Fired Generating Units in India”. The consultants appointed for the above project are namely, ABPS Infrastructure, KPMG, Mercados Energy Market India and WAPCOS Ltd. Brief Status of various consultancies under Technical Assistance is as given below: -

S.No	Name of Study	Physical Progress As on 30.09.2017
1.	Implementation Support Consultancy (ISC)	ABPS assisted in the review of the Capacity Strengthening Plan for CEA and participated in the review meetings held from time to time.
2.	Review of Institutional Capacity and Implementation of Capacity Strengthening Interventions at CEA	KPMG submitted the revised Capacity Strengthening Plan after changes on 30th September 2016. The same was discussed in the Special Authority Meeting chaired by Chairman, CEA held on 27 th October 2016. The revised Capacity Strengthening plan was submitted by KPMG on 02.02.2017. A meeting chaired by Chairperson (CEA) was held on 22 March 2017 for discussion on the Capacity Strengthening Plan for CEA prepared by KPMG. Based on the discussion KPMG has been asked to revise the plan. The revised Capacity Strengthening Plan is still awaited from KPMG. The letters/reminders have been sent to KPMG. In this regard a meeting between KPMG, ABPS and CEA was held on 01-08-2017. . KPMG has requested vide letter dated 28-09-2017 for an extension of contract by 31 st March, 2018 to complete the remaining activities.
3.	Reduction of barriers to R&M interventions in thermal power plants in India	The Study Report has been accepted by CEA in January, 2014 and sent to various stakeholders in the power sector. The consultancy was completed in November 2013.
4.	Developing Markets for Implementation of R&M scheme in thermal power stations in India	The Study Report has been accepted by CEA in January, 2014 and sent to various stakeholders in the power sector. The consultancy was completed in November 2013.
5.	Review of experience from Pilot R&M interventions in thermal power stations in India	WAPCOS organised a Workshop on 3 rd Feb 2017 at India Habitat Centre, New Delhi to share the learnings/ findings from the study. The consultant submitted the final reports on the following four aspects covered in the study during March 2017. (i) Procurement Experience at Pilot R&M projects (ii) Implementation Experience at Pilot R&M projects (iii) Post- R&M Experience in O&M of the TPS (iv) Experience in Strengthening O&M practices The reports were accepted by CEA on 29 th March 2017. The copies of the reports have been sent to various stakeholders in Power Sector and have also been hosted on the CEA website.

6.3 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. Accordingly, generating units are selected from Ukai and Wanakbori TPS (GSECL), Ramagundem STPS (NTPC) and Vijaywada TPS (APGENCO) for pre – primary studies. After Pre-Primary Studies, JCOAL finalized 3 units viz., Vijaywada TPS Unit-1 (210MW) of APGENCO, Wanakbori TPS Unit-1 (200 MW) of

GSECL and Kahelgaon STPS Unit-2 (210 MW) of NTPC for full-fledged diagnosis. The final report had been submitted in December 2012.

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. Durgapur TPS unit no.4 (210 MW LMZ Unit) of DVC and one unit each from Badarpur TPS and Unchahar TPS of NTPC were selected for studies during the 2nd phase. JCOAL team visited these stations 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.

Under Clean Coal Technology (CCT) Programme two study tours to Japan have been organized from 26th January, 2016 to 3rd February, 2016 and 2nd February, 2016 to 10th February, 2016 in which 10 participants from different power utilities have participated. also, two study tours to Japan, from 19th October to 27th October, 2016 and from 11th January to 19th January 2017 were conducted during the year 2016-17 in which 17 officers/ engineers from MoP, CEA, NTPC and other utilities participated. The total 79 officers from MoP, CEA and different power utilities were participated in the study tour under CCT Training Programme. During the current year 2017-18 a CCT Training is planned from 29-11-2017 to 07-12-2017.

Under CEA- JCOAL Co-operation a study on replacement of old units of Badarpur TPS by highly efficient super critical units of higher size has been carried out. JCOAL team has carried out three site surveys and investigations in the month of Nov, 2015, Jan, 2016 and in March, 2016. The report on the study has been submitted in June, 2016 by JCOAL.

JCOAL has also carried out feasibility study on replacement of Singrauli STPS Stg. I & II units (5x200 MW+2x200 MW) of NTPC between December, 2016 to March, 2017.

Unit-3 of Dadri TPS of NTPC was identified for implementation of full-fledged diagnosis study i.e. Residual Life Assessment (RLA) study. JCOAL team has conducted RLA/Diagnostic Study at Unit-3 Dadri TPS of NTPC from 30th November, 2015 to 10th of December, 2015. The report on RLA/CA study of Unit-3 of Dadri TPS has been submitted by JCOAL. The objective of the RLA Study is to identify the remaining life and the current condition of Unit -3, to constitute the base for formulation of the plan of R&M implementation. that is tentatively scheduled in 2018.

CEA- JCOAL meeting was held on 13-06-2017 in CEA and on 14-06-2017 in MoP and following studies are to be carried out by JCOAL during the year 2017-18

- A Study of O&M enhancement of existing units of DSTPS, DVC is being carried out in order to share O&M and safety related best practices.
- JCOAL will carry out a Flexibilisation Study at NTPC's Vidhyanchal STPS in phased manner -1st on system analysis, 2nd action to be taken at Power Plant end.

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

STATE SECTOR LE Works**(as on 30.09.2017)**

S.No.	State	Name of Station	Unit No.	Year of Comm.	Cap. (MW)	Status
1.	U.P.	Obra	12	1981	200	Unit is under s/d since 01-10-2016 for R&M works. LE Works started on 01.10.2016. Boiler: Work started from 15.02.2014. Nearly 70% work completed. Turbine. Work started on 03.07.2017. Nearly 20% work completed. Generator: 20% work completed. ESP foundation completed, Pass-A-100%, Pass-B-100%. Ash Handling: Nearly 20% works completed. Switch Yard 400 kv CB- 20% work completed. Water treatment plant- 98% work completed. Coal Handling plant- nearly 50% work over. Date of commissioning given by M/s. BHEL is 31-12-2018.
2.	U.P.	Obra	13	1982	200	Date of commissioning given by M/s. BHEL is 31-12-2018. Approval from Head Quarter to get s/d for unit-13 is under consideration.
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	Turbine and Boiler R&M Works Phase-II: Order for consultancy work considering heat rate (efficiency) improvement with ramping up/ down of the load and PG test of ESP is placed on STEAG, Noida on 30.03. 2016.After observing the satisfactory performance of Phase-I(Ukai-4) retrofitted unit, the R&M of Phase-II R&M of LMZ turbine will be implemented. GSECL asked consultant to incorporate dual firing system. Tender preparation for turbine Retrofitting & Boiler R&M is under process. GSECL proposed to issue final order for turbine after observing first unit. Boiler Back Pass Modification: Work at unit-3 started after observing performance of unit-4. Ash Slurry Pump House: DPR submitted by consultant. The scope includes the work of Ash Slurry pump house. Draft tender received. Draft tender approved on 27.06.2017

7.	Gujarat	Ukai	4	1979	200	Ukai TPS Unit -4 was taken under S/D on 07-12-2016 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. Final reports are awaited.
8.	Gujarat	Ukai	5	1985	200	The consultancy services for turbine retrofitting and modification in Boiler Back Pass with achievement of revised emission norms for Ukai unit 3 & 5 is already awarded. Based on the feasibility report for implementation of FGD &PG test results of Ukai Unit No. 4, the implementation of R&M of proposed Units shall be decided. For implementation of DeNOx system, GSECL is awaiting the results of pilot projects of NTPC. Meanwhile, Ash Slurry Pump House: DPR submitted by consultant. The scope includes the work of Ash Slurry pump house. Draft tender received. Draft tender approved on 27.06.2017
9.	Gujarat	Wanakbori	1	1982	210	The consultancy services for turbine retrofitting and modification in Boiler Back Pass with achievement of revised emission norms for Wanakbori unit 1&2 is already awarded. Based on the feasibility report for implementation of FGD &PG test results of Ukai Unit No. 4, the implementation of R&M of proposed Units shall be decided. For implementation of DeNOx system, GSECL is awaiting the results of pilot projects of NTPC. ESP: : The order for retrofitting is issued to BHEL on 18.03.2016. Approx. 93% material supplied. Meanwhile, GSECL has initiated feasibility study for replacement of WTPS 2x 210 MW Units by 1x800 MW Super Critical Units. Pending work of 1 No. of Unit-2, Bus coupler will be carried out in available in available shutdown.
10.	Gujarat	Wanakbori	2	1983	210	

11.	Gujarat	Wanakbori	3		210	Turbine Retrofitting Work Shutdown of WTPS Unit No. 3 is commenced from 25.07.2017. Box- up activities of HP & IP turbine completed along with installation stop & control valves. LP turbine modification work completed. LP turbine box- up activity under progress. Final shaft- line alignment under progress. Lube oil & seal oil system flushing completed. Control oil system flushing under progress. 98% piping & auxiliary work completed (B) Boiler Back Pass Modification & APH Replacement work Replacement of existing Economizer by new double bank Economizer with header & terminal tube and LTSH coil and inlet & outlet header with terminal tube completed. Replacement of roof & rear wall panels with bottom ring header and roof sealing of Penthouse. Replaced of existing Air pre heater with 72 Degree PA opening Air pre heater having 04 layers of heating element and double sealing system. Replacement of Hot & Cold Primary and Secondary air duct and eco hopper with Duct between Economizer & APH completed. Work of attachments and fin welding is under progress. (C) ESP Retrofitting work Shutdown of WTPS Unit No. 3 is commenced form 25.07.2017. Adding 01 field in series with increased height of existing ESP from 9 mtr to 15 mtr. In CD pass ESP internals, transformer rectifier with its controller, service, transformer, rapping system, heaters and ash level indicators replaced. In AB pass installation of Collecting electrode & Inner roof erection completed. In AB pass Insulation over inner roof and outer roof installation under progress. In B pass gauging work completed and emitting electrode installation work under progress. ESP inlet & outlet ducts with funnels, gate and expansion joints replaced. LT switchgear panels replaced. Minor welding, insulation, cabling and commission work under progress.
11.	Maharashtra	Koradi	6	1982	210	The unit is being taken up by WB funded project. The total cost of the project including IDC is 636.93 crores. The unit is under shutdown since 25th August, 2015 and expected to be synchronized on 31-12-2017. BTG Package: Approximately 96% of the

						material (on Amount basis) is supplied by BHEL at site & further supply is in progress. 57% work of new ESP Control Room building at new location is completed. Erection of HP & IP Turbine is 100% completed. LP Turbine modification work is 100% completed. Erection of LP Turbine 80% completed. Mill overhauling work is 50 % completed. FD fan overhauling work is 40% completed. Erection of BFP is 100% completed. Generator package electrical is 80% completed and GTR erection is 99% completed. Electrical Package: Approximately 61.05% of the material (on Amount basis) is supplied by M/s ABB at site & further supply is in progress. Breaker ON/OFF time test completed. Retrofitting of HT breakers completed. HT/LT Motors overhaul 70% and 75% completed respectively. Unit Aux. Transformer (UAT) placed in position. FBT panel erection work is 40% completed. HT switchgear work 70%. BOP Package: Letter of Award for Cooling Tower Plant Package, Ash Handling Plant Package and Fire Detection, Protection System Package are issued and contract is signed on 23.09.2016, 26.10.2016 & 05.11.2016 respectively. The need based work of DM Plant & Pre-Treatment System shall be carried out separately by O&M section. Under Cooling Tower Plant Package 95% of overall material has been supplied at site & 60% of the dismantling work has been completed. 46% of installation & civil works has been completed. AHP Package: Design Engg. Works is progress. Fire Detection, Protection & Inert Gas System Package: Installation & Civil works about to start.
12.	Maharashtra	Koradi	7	1983	210	R&M/LE study not carried out
13.	Maharashtra	Bhusawal	2	1979	210	All studies Completed, Final DPR received from M/s Energo Engg Ltd has been approved by MSPGCL Board in May, 2016. Further, MSPGCL Board directed that no other R&M work shall be taken up without monitoring results of Koradi U-6.
14.	Maharashtra	Bhusawal	3	1982	210	RLA/ Feasibility study for EER&M has not been carried out.
15.	Maharashtra	Nashik	3	1979	210	DPR finalised, Govt. of Maharashtra has approved 20% equity. The unit-3 was to be taken up under KfW funded project. All studies completed, and DPR has been prepared. Also Tender documents have been prepared. But Nasik Unit-3 R&M project withheld and Nasik Unit -4 R&M shall be taken up on priority. Further, MSPGCL Board directed that no other R&M work shall be taken up without monitoring results of Koradi U-6.
16.	Maharashtra	Nashik	4	1980	210	All studies Completed, Final DPR is submitted by M/s Steag. Approval of DPR is in progress. Nasik Unit -4 R&M shall be taken up on priority. Further, MSPGCL Board directed that no other R&M work shall be taken up without monitoring results of Koradi U-6.
17.	Maharashtra	Nashik	5	1981	210	R&M/LE feasibility study completed. MSPGCL Board directed that no other R&M

						work shall be taken up without monitoring results of Koradi U-6.
18.	Maharashtra	Parli	4	1985	210	R&M/LE study not carried out. Board directed that no other R&M work shall be taken up without monitoring results of Koradi U-6.
19.	Maharashtra	Parli	5	1987	210	R&M/LE study not carried out. Board directed that no other R&M work shall be taken up without monitoring results of Koradi U-6.
20.	Maharashtra	Chandrapur	3	1983	210	R&M/LE study not carried out. Board directed that no other R&M work shall be taken up without monitoring results of Koradi U-6.
21.	Maharashtra	Chandrapur	4	1984	210	R&M/LE study not carried out. Board directed that no other R&M work shall be taken up without monitoring results of Koradi U-6.
22.	Maharashtra	Chandrapur	5	1983	500	R&M/LE study not carried out. Board directed that no other R&M work shall be taken up without monitoring results of Koradi U-6.
23.	Maharashtra	Chandrapur	6	1984	500	R&M/LE study not carried out
24.	Maharashtra	Khaperkheda	1	1989	210	R&M/LE study not carried out
25.	Maharashtra	Khaperkheda	2	1990	210	R&M/LE study not carried out
26.	Bihar	Barauni	6	1983	110	Boiler: 85% work completed, Erection of 1615 MT done out of 2900 MT. 41 items awaited from BHEL Trichy. ESP: Erection of 675 MT done out of 1400 MT. 60% work completed. 320 items awaited from BHEL Ranipet. Fan Erection: FD, ID and PA fans are to be commissioned. 3 items are awaited from BHEL Jagdishpur. Mills: Erection of 236 MT done out of 400 MT. Erection of 3 mills out of 5 are under progress Anticipated completion date of Unit- 6 is 06-01-2018.
27.	W.Bengal	Kolaghat	1	1990	210	DPR has been prepared and accepted. After successful completion of the unit-3 work the R&M works of the Unit -1&2 will be taken up.
28.	W.Bengal	Kolaghat	2	1985	210	DPR has been prepared and accepted. After successful completion of the unit No. 3 work the R&M works of the Unit No 1&2 will be taken up.
29.	W.Bengal	Kolaghat	3	1984	210	BTG-BOP:- DPR ready; NIT is expected to be uploaded in the month of August, 2017 ESP: LOA placed on M/s Cottrell India Pvt Ltd. Date of start of work is 22.03.2017. Schedule is 35 months from LOA. Dismantling of Unit-3 is completed. After successful completion of the unit No.3 ESP and AHP R&M work the R&M works of the Unit No 1&2 will be taken up. Electrical: 1(GRP) & 2 (breaker Relay): DPR ready.NIT is expected to be uploaded in the month of August, 2017.

						Total estimated cost of R&M/LE works is Rs. 1090 Crs for unit-1,2 & 3.
30.	W.Bengal	Kolaghat	5	1991	210	
31.	Karnataka	Raichur	1	1985	210	Boiler C&I works completed.
32.	Karnataka	Raichur	2	1986	210	DPR is being revised, duly incorporating additional works in the R&M/LE scope of work is put up for Head Office approval. Once the DPR is approved, same will be submitted to KERC for approval. Project cost is Rs. 1240.18 crores. However, all the efforts are being made to reduce the R&M expenditure to minimum considering essential works required for enhancing performance/ Heat Rate. KPCL has engaged a consultant to explore the technologies/ possibilities to meet the new environmental norms. Consultant has submitted feasibility reports/DPR. The same has been put up to HO. Further proposal for implementation of environmental solutions is being prepared after visiting some of the power plants who have already installed FGD system. After finalization of DPR KPCL will take decision on comprehensive R&M works of unit 1 & 2, according to the recommendations for DPR. FGD tender document preparation under progress.
33.	Karnataka	Raichur	3	1991	210	M/s Energo Engineers Projects limited., Gurgaon is appointed as consultant for conducting Feasibility studies, Preparation of DPR, Technical Specifications & Bid Document and assisting KPCL in selection of EPC contractor for R&M of 210 MW Coal fired TPS Unit-3, at RTPS. As a part of Comprehensive R&M of unit-3 consultant conducted Energy Audit during the month of Feb-17 & Condition assessment during the month of March-17, and carried out RLA studies of Boiler in month of June-2017.Awaiting for EA & RLA reports form the consultant.
Sub Total State Sector (LE)			34		7570	

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

S.N.	State	Name of Station	Unit No.	Year of Comm.	Cap. (MW)	Status
1.	U.P.	Obra	7	1974	100	- Work is being executed by BHEL. - Zero date of the scheme is 04.12.2009. Unit was scheduled on 23 months from zero date i.e Nov 2011. The revised cost of R&M scheme for unit 7 is 144.11 crores. All mechanical works completed. Lightup of unit was withheld due to fire in 6.6 kV breaker in Nov., 2016. BHEL and Scheider experts are called to assess the extent of damage and submit list of required spares for revival of switchgear of the unit. Erection work has been completed. Boiler: 100% work completed (steam blowing done). Turbine: 100% work completed (Only rolling pending). Generator: 99% work completed (Only H₂ filling pending) BoP: 100% work completed (only mill-7A trial pending. Reserve supply required) Restoration of electrical supply in S/G room is under progress. Expected to be synchronized in December 2017.
2.	U.P.	Anpara'B	4	1993	500	R&M works is being executed by BHEL & M/s MITSUI & Toshiba OEM, Japan. — Total cost of scheme is Rs. 691.97 cr. Total expenditure upto 31.12.2016 is 387.16 crs. Boiler: Nearly 65% work completed. TG: Nearly 70% work completed. Electrical & Instrumentation: Nearly 58% work completed. BOP: Nearly 70% work completed. - The R&M work would be carried out in AOH and are likely to be completed by September, 2018. 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	Utility decided to do need based R&M at estimated expenditure of Rs. 55 Cr. NTPC prepared the DPR based on the previously conducted RLA/CA Study. Retrofitting of 125 Nos. and 34 nos. ACB's has been completed in unit-1 & 2. Replacement of six Nos. Boiler Feed Booster Pump with more efficient. Replacement of old & obsolete HP Heaters & APH completed in unit-1 & 2. Replacement of existing APH with modified design 24 Sector APH in unit-2 and replacement of complete Reheater assemblies of unit 1&2 have been completed. SF-6 breakers have been fitted & commissioned in 220kV switchyard. Steam & Water Analysis System (SWAS) of unit-1 & 2 has been retrofitted and commissioned. Erection and commissioning will be done during overhauling of unit-1 in February, 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. New Replacement of steam & water analysis system have been installed & commissioned on unit 1,2,4,5 while retrofitting work has been carried on on Unit 3 & 6, commissioning would be done when Units would be on load. All the requisitioned valves has been retrofitted & commissioned, while on unit-2, 90% of valves has been retrofitted. The electro Mechanical Vibratory Feeders at ERH in CHP has been installed & commissioned. Upgradation of wagon Trippler No.3 in coal habdeling plant of GGSSTP, magnetic seperators on conveyors in CHP has been installed & commissioned PAH would be replaced during overhauling of Unit-1 in Feb, 2018. Phase-II Migration of WDPF System to Ovation system on Unit-5 completed
7.	Punjab	Ropar	6	2001	210	
8.	Punjab	GH TPS (Leh. Moh.)	1	1997	210	R&M works yet to be decided by the utility.
9.	Punjab	GH TPS (Leh. Moh.)	1	1997	210	
10.	Rajasthan	Kota	3	1988	210	Total 14 activities sanctioned for R&M. Estimated cost of R&M is Rs. 35.613 crores. - 10 nos of works fully completed. - R&M work of CHP system is under progress. - Order placed to M/s. Enrtgo Engineering Projects Ltd. - Work of Vacuum pump is under progress, placed to M/s. Millenium Impex Pvt. Ltd. - 01 no. work of Air Compressor replacement has been dropped due to technical reasons. - E- Tender for VFD cancelled due to technical reasons. The tentative proposals of R&m/LE plan for the period of
11.	Rajasthan	Kota	4	1989	210	
12.	Rajasthan	Kota	5	1994	125	
13.	Rajasthan	Suratgarh TPS	1	1998	250	
14.	Rajasthan	Suratgarh TPS	2	2000	250	R&M works yet to be decided by the utility.
15.	Rajasthan	Suratgarh TPS	3	2001	250	
16.	Rajasthan	Suratgarh TPS	4	2002	250	
17.	Chhattisgarh	Korba (West)	1	1983	210	
18.	Chhattisgarh	Korba (West)	2	1984	210	CSPGCL has taken-up need based R&M for life extension on the basis of R&LA studies and also plan for compliance of new environmental norms. RLA studies done by M/s Evonik. Scope of work of Boiler, Turbine, Electrical Instrumentation, Civil and BOP is being finalised. The CSERC in its order dated 61-03-2016 has approved such scheme under capital investment plan. Order placed on BHEL Noida for Augmentation, R&M and up-gradation of ESPs to maintain emission level limit below 50mg/Nm³. Tender floated for Augmentation of DCS/ C&I System. Fire protection system of Transformer & Cables Vault Galleries are under process. Other schemes approved by CSERC for financial year 2016-17 to 2020-21 are under tendering process.
19.	Chhattisgarh	Korba (West)	3	1985	210	
20.	Chhattisgarh	Korba (West)	4	1986	210	
21.	M.P.	Sanjay Gandhi	1	1993	210	Unit-1 –The consultant has completed

22.	M.P.	Sanjay Gandhi	2	1994	210	RLA/CA Studies in Dec 2014 and submitted the DPR in March 2015. Unit-2- The consultant have completed RLA/CA Studies in Aug 2016 and submitted the DPR in Jan 2017. Boiler: - A consultancy order has been placed on M/s Steag Energy Services(I) Pvt. Ltd., Noida for providing consultancy services to prepare bid documents, assistance in selection of executing agency & monitoring of implementation of R&M Works. The consultant made site visit & discussions to freeze the detailed scope of work. TG:- The M/s Steag team made site visit & discussions to freeze the detailed scope of work. BOP :- The M/s Steag team made site visit & discussions to freeze the detailed scope of work. Electrical & C&I:- The M/s Steag team made site visit & discussions to freeze the detailed scope of work.
23.	Maharashtra	Chandrapur	7	1997	500	R&M works yet to be decided by the utility.
24.	Maharashtra	Khaperkheda	3	2000	210	R&M works yet to be decided by the utility.
25.	Maharashtra	Khaperkheda	4	2001	210	R&M works yet to be decided by the utility.
26.	Tamil Nadu	Tuticorin TPS	1	1978	210	1st and 2nd RLA already completed. Bolier: Strengthening of weak insulation of Boiler-To be carried out during 2017-18. T.G.: -Minor repair works such as attending cracks in the Strengthening of weak insulation of Boiler-To be carried out during 2017-18. 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 and modification of APH sealing system by double sealing completed during 2009-10. Replacement of existing steam ejectors by Vacuum pumps programmed during 2017-18. Re-tender floated for Installation of Ammonia Injection system. Tender opened for complete replacement of Economizer coil assembly, LTSH supply tubes and straight tubes panels for super heater Rear wall economizer. Administrative approval accorded on 07-04-2017 for retrofitting of 210 MW, LMW surface condenser in any one of the unit-I, II & III at TPS. ESP: Administrative approval is under scrutiny for augmentation of ESP. Tender for Installation of 10 MLD Desalination Plant consultancy services floated and opened on 11-10-2017 (common to station)
27.	Tamil Nadu	Tuticorin TPS	2	1980	210	Need based R&M works have been carried out in Boiler TG, C&I and BoP. Following works have been completed in unit-2. Boiler: - Replacement of reheater Rear pendant Assembly-work completed in 2007-08. Complete replacement of economizer coils

						assembly, LTSH supply tubes and straight tubes panels for super heater rear wall near economizer- work completed in 27.3.2017 Strengthening of weak insulation of Boiler-To be carried out during 2016-18. T.G:- All diaphragms in HPT,LPT,IPT had been renewed. All 3 rotors have been replaced with reconditioned spare rotors-during 2008. Electrical & C&I: Modernisation of DCS-work completed during 2008-09. Administrative approval accorded on 07-04-2017 for retrofitting of 210 MW, LMW surface condenser in any one of the unit-I, II & III at TPS. BOP:-Refurbishment of complete bottom ash system-work completed in 2008-09. Modification of APH sealing system by Double sealing-work completed on 27.3.2017. Replacement of existing steam ejectors by Vacuum pumps-commissioned on 14.07.16. Tender for Installation of 10 MLD Desalination Plant consultancy services floated and opened on 11-10-2017 (common to station)
28.	Tamil Nadu	Tuticorin TPS	3	1982	210	1st and 2nd RLA already completed. Boiler:- Repalcement of Eco. Header-work completed in 2007-08. Replacement of water wall tubes in high heat zone (20M to 40M)-Work completed during 2013-14 Strengthening of weak insulation of Boiler-one part completed & others to be carried out during 2017-18. T.G.:- IP Rotor, diaphragms, IP Nozzle segment, TG Bearing 5,6&7, HPT Control Valve 3&4 renewed during COH IN 2011-12. Electrical & C&I:- Replacement of existing static AVR by DVR work completed during 2013. BOP:- Modification of APH by double sealing 13-14. Administrative approval accorded on 07-04-2017 for retrofitting of 210 MW, LMW surface condenser in any one of the unit-I, II & III at TPS. Replacement of existing steam ejectors by Vacuum pumps-programmed during 2017-18 Tender for Installation of 10 MLD Desalination Plant consultancy services floated and opened on 11-10-2017 (common to station)
29.	Tamil Nadu	Tuticorin TPS	4	1992	210	Boiler: Replacement of Eco. Coil assembly works completed during COH 2014-15 T.G.- Minor repair works-completed during COH 2014-15 Electrical & C&I:- Generator Stator replaced with new, static AVR replaced by DVR, Upgrading of Hitachi DCS, R&M of man machine interface system during 2014-15. Replaced existing analog type static generation protection system by numerical type Gen. protection system during 2015-16.

						BOP:- Modification of APH sealing system by Double Sealing, Replacement of complete ESP internals for first two rows and controllers, renewal of flue gas duct from APH outlet to ESP inlet completed during COH 2014-15. Administrative approval accorded on 29-05-2017 for Hot Re-heater Assembly in Unit IV Boiler. Tender for Installation of 10 MLD Desalination Plant consultancy services floated and opened on 11-10-2017 (common to station)
30.	Tamil Nadu	Tuticorin TPS	5	1991	210	Ist RLA completed. Boiler:- Replacement of ECO. Coil assembly works completed during 2016-17 T.G.:- During the Capital overhaul 2015-16 CRH strainer alone renewed. Electrical & C&I:- static AVR replaced by DVR, Provision of integrated energy management system during 2015-16. Upgradation of turbine control system completed during 2016-17. Administrative approval accorded on 19-05-2017 for replacement of existing outdated Pro-control systems in FSSS, SBC, APRDS, STC, SADC and scanner system by latest DCS in Unit-V. BOP:- Modification of APH sealing system by double sealing in 2015-16.replacement of ESP field internals, high voltage transformer rectifiers, electronic control panel with latest technology in 2015-16 Renewal of flue gas duct from APH outlet to ESP inlet during 2015-16. Tender for Installation of 10 MLD Desalination Plant consultancy services floated and opened on 11-10-2017 (common to station)
Sub Total State Sector (R&M)				30	7135	
	Total State Sector (LE+R&M)			64	14705	

CENTRAL SECTOR R&M (Gas Based)

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) The new vibration monitoring system procured against unit-1 had to be installed in unit-4 due to available s/d and requirement of the unit. The process for tender for procurement of another new vibration monitoring system is under progress and expected to be completed during 2017-18. (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 2019-20 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 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. The materials already received and commissioned on 31.07.2017. (b) The process of tender procurement of new vibration monitoring system is under progress and expected to be completed on or before 31.03.2018. (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 unit is planned in 2018-19.
3		Kathalguri CCGT	GT-3	1995	33.50	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 the rotor after CRR/CRI in Japan already reached the Plant site. The above works for GT 3 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 planned in July 2017.
4		Kathalguri CCGT	GT-6	1996	33.5Z	Order for supply and commissioning already placed with M/s BGGTs, the OEM and likely to be commissioned on or before 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: LOI for upgradation of AVR already placed with M/s.ABB and expected to be commissioned in 2017-18. c) Upgradation of 3300-series, BENTLEY-NEVADA- make vibration system: Offer to be obtained from the OEM. d) Upgradation of 3300-series, BENTLEY-NEVADA-make temperature monitoring system: Offer to be obtained from the OEM.
6		Kathalguri CCGT	ST-2	1998	30.00	Offer to be obtained from the OEM.
7		Kathalguri CCGT	ST-3	1998	30.00	a) Upgradation of 3300-series, BENTLEY-NEVADA- make vibration system: Offer to be obtained from the OEM in due course of time. b) LOI for upgradation of AVR already placed with M/s.ABB and expected to be commissioned in 2017-18.
Total Central Sector- Gas (R&M)			7		224	
Total R&M/LE (State+ Centre)			71		14929	

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	

Total (State) - 01 Units 200.00 MW

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
-	--	--	--	--	--	--

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						
1.	Bathinda	3	110	PSPCL	State Sector	05.08.2012
2.	Kawas	GT-1A	106	NTPC	Central Sector	21.01.2013
3.	Parichha	2	110	UPRVUNL	State Sector	05.05.2013
4.	Muzafarpur	1	110	KBUNL	Joint venture of BSPGCL & NTPC	05.07.2013
5.	Kawas	GT-1B	106	NTPC	Central Sector	28.08. 2013
6.	Gandhar	GT – 3	131	NTPC	Central Sector	29.09. 2013
7.	Kawas	GT-2B	106	NTPC	Central Sector	05.03.2014
8.	Bathinda	4	110	PSPCL	State Sector	10.07. 2014
9.	Muzafarpur	2	110	KBUNL	Joint venture of BSPGCL & NTPC	30.09.2014
10.	Auraiya	GT-1	111.19	NTPC	Central Sector	22.06. 2014
11.	Gandhar	GT-1	131	NTPC	Central Sector	06.07.2014
12.	Kawas	GT-2A	106	NTPC	Central Sector	22.08.2014
13.	Auraiya	GT-2	111.19	NTPC	Central Sector	28.10.2014
14.	Auraiya	GT-3	111.19	NTPC	Central Sector	25.12.2014
15.	Auraiya	GT-4	111.19	NTPC	Central Sector	02.03.2014
16.	Harduaganj	7	110	UPRVUNL	State Sector	01.05. 2015
17.	Bandel	5	210	WBPDC	State Sector	21.09.2015
18.	Gandhar	GT-2	131	NTPC	Central Sector	15.04.2015
19.	Obra	10	200	UPRVUNL	State Sector	08.04.2016
20.	Barauni	7	110	BSPGCL	State Sector	03.08.2016
21.	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						
1.	DPL	6	110	WBPDC	State Sector	07.05.2012
2.	Patratu	10	110	JSEB	State Sector	24.05.2012
3.	Anpara’A	1	210	UPRVUNL	State Sector	21.03.2013
4.	Anpara’A	2	210	UPRVUNL	State Sector	21.03.2013
5.	Anpara’A	3	210	UPRVUNL	State Sector	21.03.2013
6.	Tanda	2	110	NTPC	Central Sector	15.09.2012
7.	Kathalguri	GT-3	33.5	NTPC	Central Sector	31.03.2014
8.	Kathalguri	GT-4	33.5	NTPC	Central Sector	31.03.2014
9.	Kathalguri	GT-5	33.5	NTPC	Central Sector	31.03.2014
10.	Simhadri	1	500	NTPC	Central	31.03.2016
11.	Simhadri	2	500	NTPC	Central	31.03.2016
12.	Ramagundam	4	500	NTPC	Central	March, 2017
13.	Ramagundam	5	500	NTPC	Central	March, 2017

14.	Ramagundam	6	500	NTPC	Central	March, 2017
15.	Rihand STPS	1	500	NTPC	Central	March, 2017
16.	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			

Summary of implementation for phasing plan for FGD installation/ESP Upgradation

Sl. No.	Description	Capacity (MW)	Units
1.	Total Capacity Considered	196667	650
2.	Capacity retired/identified for retirement	8967	82
3.	Capacity after Retirement (1-2)	187700	568
4.	Capacity already having FGD capable of meeting new Sox norms	6130	15
5.	Capacity with CFBC Boilers	5524	48
6.	Capacity taken for analysis (3-4-5)	176046	505
7.	FGD Implementation Plan		
a)	Capacity which claims to be Sox complaint	5115	23
b)	Balance Capacity (6-7 (a))	170931	482
c)	Capacity where FGD has been planned (Annexure-III)	161552	415
d)	Capacity where FGD implementation plan available	161402	414
e)	Capacity where FGD implementation plan not submitted by developer	150	1
f)	TOTAL CAPAICTY WHICH WOULD BE FGD NON COMPLANT f (i) + f(ii)	9379	67
(i)	Capacity where FGD installation is being explored	690	7
(ii)	Capacity where FGD cannot be installed	8689	60
8.	ESP IMPLEMENTATION PLAN		
(i)	Capacity which is SPM non- complaint	72659	273
(ii)	Capacity which would be Sox non- complaint	6344	38
(iii)	Capacity FGD installation being Explored	390	4
(iv)	Balance Capacity (i-ii-iii) where ESP upgradation considered	65925	231
(v)	Capacity where ESP Implementation plan available	64525	222
(vi)	Capacity where ESP Implementation plan not submitted by developer	1400	9