



PRESENTATION
ON STATUS OF
OBRA THERMAL POWER
STATION
U.P.R.V.U.N.L.
24-01-2012

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Brief Description of Project

Obra Thermal Power Station is situated at Obra, Distt. Sonebhadra, UP which is 130 km from Varanasi/ Mirzapur and 12 km offshoot at Chopan from main highway Varanasi to Shaktinagar
Travel time presently 5:00 hours from Varanasi/Mirzapur due to dilapidated road condition
Obra TPS consist of 13 units, 8 units i.e. Unit 1-8 in ATPS & 5 Units i.e. Unit 9-13 in BTPS.
The first unit i.e. Unit#1 of 50 MW capacity was commissioned in 1968
Unit#11 is the first 200 MW Unit of India, which was commissioned in 1977.
Obra was the first to commission 400 KV switchyard
Present Units in operation - 2X50 & 4X 200 MW
Obra station is having turbine hall length is about 1.2Km which was longest in Asia during 1970.

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Station Capacity

No of Units Installed	13
Original Installed capacity	5x50+3x100+5x200 MW = 1550 MW
Present capacity after deration/deletion	1382 MW
Current units in operation	2x50 + 4x200
Units under R&M	1x200+1x100

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Details of unit of ATPS

Unit	Installed Capacity	Derated Capacity	Date of Synchronization	Running Hrs till March '2011	REMARKS
1	50	50	29.06.1967	123918	PLF up to 20.01.12 is 59.09
2	50	50	11.03.1968	137941	PLF up to 20.01.12 is 70.01
3	50	40	13.10.1968	159428	Deleted
4	50	40	07.07.1971	182792	
5	50	40	18.07.1973	158217	
6	100	94	14.12.1974	183492	Under Deletion
7	100	94	15.09.1975	133362	
8	100	94	26.01.1980	155441	Under Deletion

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Details of units of BTPS

Unit	Capacity	Date of Synchronization	Running Hrs till Dec'2011	REMARKS
9	200	26.01.1980	174734	Re-Synchronised after R&M on 26.06.11. PLF up to 20.01.12 is 44.24 FY 11-12
10	200	14.01.1979	193174	PLF up to 20.01.12 is 43.62
11	200	31.12.1977	186791	Under R&M
12	200	28.03.1981	176863	PLF up to 20.01.12 is 44.42
13	200	21.07.1982	190256	PLF up to 20.01.12 is 58.00

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STATUS OF UNIT 1&2

- Unit No. 1 synchronized after R&M on dated 30-04-2009.
- Unit 1 is running at 40-50MW after R&M work.

- Unit No. 2 synchronized after R&M on dated 05-02-2009.

- Unit 2 is running at 40-50MW after R&M work.

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STATUS OF 3x94MW UNITS

Unit 6,7 & 8 are out of bar

■ UNIT NO.6

- a) As per directions of Central Pollution Control Board, New Delhi, unit no.6 has been closed down permanently on dated 12.01.2011.
- b) Deletion Under Process.

■ UNIT NO.8

- a) As per directions of Central Pollution Control Board, New Delhi, unit no.8 has been closed down permanently on dated 24.06.2011
- b) Deletion Under Process.

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R&M OF UNIT NO.7

■ IMPORTANT DATES

- | | |
|--|-------------|
| ■ LOI placed on BHEL for R&M works | :27.05.2009 |
| ■ Effective date | :04.12.2009 |
| ■ Shut down date | :01.07.2010 |
| ■ Work completion date as per contract | :04.11.2011 |
| ■ Work completion date as per revised Schedule of BHEL | :20.08.2012 |

STATUS OF WORK

- a) Work of boiler structure is under progress, replacement of boiler tubes, erection of APH blocks under progress.
- b) Dismantling of ID/FD fans, ball mills under progress. Work of dust system auxiliaries under progress.

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**R&M AND UPRATING OF EACH
UNITS OF 5x200 MW FROM
200 MW TO 216 MW**

■ LOI placed on BHEL	: 13.05.2006
■ Effective date	: 20.06.2006
■ Completion as per contract	: Dec 2008
■ Contract value	: Rs.1175 Crs.

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Unit 9

Unit Shut down for R&M	: 02.11.2008
Unit Synchronised after R&M on	: 17.09.2010
Unit Re-Synchronised on	: 26.06.2011

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PRESENT STATUS OF UNIT-9 AFTER R&M

- ❖ Unit running at 180MW in place of 216MW.
- ❖ Following major work carried out during R&M
 - Complete replacement of ESP
 - Complete replacement of Pressure Parts, viz eco., RH,SH,LTSH& headers
 - Condensers Tube replacement - 100%
 - Complete Turbine HP,IP,LP modified with New design
 - Replacement and re-inforcement of ceiling girders of boiler
 - Complete R&M of Mills, Air heater, feeders, burners, wind box etc.

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PENDING ISSUES OF UNIT-9 AFTER R&M

- ❖ As per contract full uprated load of 216 MW could not be achieved in Unit 9 so far due to following problems -
 - Axial shift of turbine high (-0.55 to -0.60) at 180 MW and goes higher beyond this load. It moves towards positive (+0.40 mm) as soon as turbine trips.
 - Thrust pads getting damaged due to above axial shift
 - GC#2 getting pressurized
 - CVSM kept full open due to severe hunting
 - HP & LP Heaters kept out of service due to axial shift Problem.
 - V2# 38 (L&R) (substitute for LP bypass) is passing
 - Due to frequent failure of dual belt gravimetric feeder, there is loss in generation & increase in oil consumption.
 - Condenser tube leakage found during inspection of condenser 03 times within a period of 06 months from the date of synchronisation

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Critical Issues -Unit 9

- ❖ Contract between Power Machine Russia and BHEL for R&M of TG and auxiliaries broke down.
- ❖ PM did not supply BHEL with necessary drawing, designs, manuals and some of critical equipments like EHG etc.
- ❖ A lot of time lapsed for finalization of further course of action by BHEL.
- ❖ BHEL committed to complete R&M of turbine even without Power M/C.
- ❖ Repeated failures of unit 9 turbine forced BHEL to execute the R&M job with the help of M/S Siemens, Germany in different phases
- ❖ As per BHEL, Siemens is likely to provide solutions for turbine by Feb 2012
- ❖ Replacement of Thrust bearing with higher capacity is also envisaged by BHEL.

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Status of Unit 11

- ❖ UNIT UNDER SHUTDOWN FOR R&M :13.07.2011
- ❖ ESP DISMANTLING COMPLETED :20.10.2011
- ❖ TURBINE DISMANTLING COMPLETED :20.10.2011
- ❖ RLA OF TURBINE AND BOILER COMPLETED
BOILER DISMANTLING COMPLETED - About 80%
- ❖ CONDENSER TUBE REPLACEMENT IS IN PROGRESS.

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STATUS OF UNIT 10,12&13

- Unit 10 running at 90-100 MW. Unit shutdown for R&M is Proposed in next month. Subject to preparedness of BHEL.
- Unit 12 running at 150 MW .
- Unit 13 running at 150 MW.
- S/D of Unit 12 &13 for R&M will be taken after completion of R&M work of unit 10 & 11. R&M scope of work of Turbine not yet finalized for unit 10, 11, 12 & 13 on account of delay on the part of BHEL.

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Program for R&M of Remaining Units i.e. Unit no. 10, 11, 12 & 13

- ❖ In second phase R&M of Unit 10&11 is being taken up. Subsequently in third phase R&M of Unit 12&13 will be taken up.
- ❖ Total shut down requirement for R&M of Unit # 10 and 11 as per BHEL will be 20 months i.e. shut down of Unit 10 will be 12 months & that of Unit 11 will be 8 months after work completion of Unit 10.
- ❖ Unit 11 taken out of bar on 13.07.2011 for R&M as well as to facilitate and provide passage for R&M work of Unit 10 also.
- ❖ ESP dismantling of Unit 11 completed by Nigam but S/D of Unit 10 is getting over delayed due to non preparedness of BHEL.

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Thank You

SATPURA THERMAL POWER STATION, SARNI, DISTT. BETUL (MP)

M.P. Power Generating Co. Ltd.

Background

- ▣ Satpura Thermal Power Station is situated at Sarni in District Betul of M.P.
- ▣ The nearest Railway Station, Ghoradongri is 18 Kms., in route of Nagpur-Itarsi Section.
- ▣ The installed capacity of Power Station is 1142.5 MW as follows:
 - (I) 5x62.5MW (PH-I)
 - (II) 1x200MW + 1x210MW (PH-II)
 - (III) 2x210 MW (PH-III).

Details of units

<u>Unit No.</u>	<u>Date of Cmg.</u>	<u>Boiler Make</u>	<u>T.G. Make</u>	<u>Operating Hrs. (Upto 31.12.11)</u>
<u>P.H.-I</u>				
Unit No.1	06.10.1967	B&W, UK	GE, USA	300368
Unit No.2	21.03.1968	B&W, UK	GE, USA	301323
Unit No.3	14.05.1968	B&W, UK	GE, USA	291852
Unit No.4	10.07.1968	B&W, UK	GE, USA	297408
Unit No.5	21.03.1970	B&W, UK	GE, USA	284800

Details of units

<u>Unit No.</u>	<u>Date of Cmg.</u>	<u>Boiler Make</u>	<u>T.G. Make</u>	<u>Operating Hrs. (Upto 31.12.11)</u>
<u>P.H.-II</u>				
Unit No.6	27.06.1979	BHEL	BHEL LMW Design	201136
Unit No.7	20.09.1980	BHEL	BHEL LMW Design	206874
<u>P.H.-III</u>				
Unit No.8	25.01.1983	BHEL	BHEL LMW Design	205540
Unit No.9	27.02.1984	BHEL	BHEL LMW Design	194055

EXPANSION PROGRAMME

- ▣ Presently 2x250 MW units are being erected as expansion programme.
- ▣ The tentative schedule of COD of these units are:
 - Unit No. 10 August 2012
 - Unit No. 11 November 2012

The units of PH-I are to be phased-out within one year of commissioning of above expansion units as per condition imposed by MoEF while granting environmental clearance for extension units. Therefore no R&M is proposed for the 5x62.5 MW PH-I units.

Major R&M carried-out in past in PH-II & III

UNDER PHASE-I (1985-92)

- ▣ Installation of DIPC System in Unit 6 & Unit 7.
- ▣ Conversion of fuel oil system to handle LSHS.
- ▣ Modification in fire protection system.

Cntd..

UNDER PHASE-II (1992-97)

- ▣ Replacement of oil guns by Air cooled guns in Unit 8 & 9.
- ▣ Replacement of HP control valve No. 2 with modified one in Unit 6 to Unit 9.
- ▣ Augmentation of existing AHP of unit No. 6 & 7.
- ▣ Protection against water hammering in CRH/HRH lines Unit 6 & Unit 7.
- ▣ R&M of C&I equipments. Unit 6 & Unit 7.
- ▣ Provision of Debris filter & online condenser tube cleaning system in Unit 6 to 9.

APART FROM ABOVE

- ▣ Augmentation of ESPs for reduction in stack emission to the extent of 20%
- ▣ Installation of Online stack monitoring equipments.

PAST PERFORMANCE OF UNITS OF PH-II & III
PUF in %

UNIT No.	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12 UPTO Dec
6	81.54	71.10	79.51	80.17	68.62	61.53	48.51
7	76.33	73.43	69.43	70.54	64.76	54.96	49.32
8	76.34	75.10	80.68	69.28	64.02	60.62	36.34
9	73.94	81.48	73.39	71.66	59.40	59.26	57.33

PAST PERFORMANCE OF UNITS OF PH-II & III

HEAT RATE (KCal/KWH)

POWER STATION	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12 UPTO Nov 11
SATPURA PH-II	3099	3077	3066	3195	3279	3474	3501
SATPURA PH-III	2994	3023	3038	3204	3258	3459	3561

SPECIFIC OIL CONSUMPTION (ml/KWH)

POWER STATION	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12 UPTO Nov 11
SATPURA PH-II	2.14	1.7	2.4	2.4	3.4	6.03	5.2
SATPURA PH-III	1.64	1.3	1.5	1.4	2.8	6.20	7.3

PAST PERFORMANCE OF UNITS OF PH-II & III

SPECIFIC COAL CONSUMPTION (Kg/KWH)

POWER STATION	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12 UPTO Nov 11
PH-II	0.89	0.86	0.85	0.89	0.92	1.02	1.03
PH-III	0.86	0.85	0.84	0.90	0.91	1.01	1.06

AUXILIARY POWER CONSUMPTION (%)

POWER STATION	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12 UPTO Nov 11
PH-II	8.8	8.75	8.8	9.33	9.59	10.79	11
PH-III	9.06	9.15	9.11	9.82	10.35	11.13	12.25

PROPOSED R&M OF SATPURA TPS UNITS 6, 7, 8 & 9

- NTPC was appointed consultant for preparation of DPR for R&M & LE works based on CEA guidelines for R&M issued in Oct'2009.
- NTPC conducted detailed RLA, CA, Steam Path Audit, Energy Audit, Performance Evaluation Test and other tests/studies on unit no. 7.
- They also conducted walk-down survey on other 3 units and assessed the condition.
- NTPC has suggested the following options for R&M and LE works for these units in the DPR.

Base case option :-

1493.10 Crs. + 289.61 Crs (ESPs Augmentation work) = Rs 1782.71 Crs

Up-rating option :-

1651.24 Crs. + 289.61 Crs (ESPs Augmentation work) = Rs 1940.85 Crs

Post R&M Performance Parameters

☐ Life Extension of Plant	20 Years
☐ Capacity Addition	
▪ Base Case Option	NIL (830 MW)
▪ Up-rate Option	24 MW (854 MW)
☐ PLF	85%
☐ Station Heat Rate	2650* Kcal/KWH
☐ Sp. Oil Consumption	1.3* ml/KWH
☐ Aux. Power Consumption	8.5%*

*These are long term values

The work included in the DPR

- ▣ The cost as shown in the DPR of NTPC mainly include the work related to Boiler Pressure Parts, Turbine Modules replacement, electrical, C&I, BOP, BOP Electrical etc .
 - ▣ The works related to Boiler performance mainly include:-
 - Replacement of various Pressure parts.
 - Air heater modification works.
 - Replacement of Air and Flue gas path Expansion joints.
 - Replacement of wind Box assembly along-with SADC and Burner Tilt mechanism.
 - Replacement of Coal mill pipes.
 - *Replacement of volumetric type raw coal feeder to gravimetric type coal feeders (This scheme does not contribute any performance improvement however required for actual measurement of Coal as fired).*Other works are mainly for life extension of 20 years
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Contd.

- ▣ The work related to turbine performance mainly include:-
 - Replacement of new improved design HP, IP & LP inner module.Other works are mainly for life extension of 20 years
- ▣ Works in other areas i.e. Electrical, C&I, BOP, BOP Electrical are mainly for life extension as the equipments are not replaced since commissioning of the units.

Contd.

WORKS ALREADY EXECUTED / PLANNED IN NEXT AOH

- ▣ The boiler pressure parts replacement works viz. Economiser, Reheater coils, LTSH coils have been now executed during AOH of unit no. 6 & 8 and planned for replacement in unit no. 7 & 9 in the forthcoming AOH of the unit in 2012.
 - ▣ The works related to air heater modification and replacement of worn out turbine diaphragms are also planned for execution in these unit in the coming AOHs of units.
 - ▣ All above works have been carried out/ proposed to be carried out through OEM i.e. BHEL.
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IMPLEMENTATION OF R&M THROUGH LROT

- ▣ The BoD of MPPGCL has decided to explore the possibility of implementation of R&M/LE works through PPP on LROT (LEASE, REHABILITATE, OPERATE & TRANSFER) basis.
- ▣ The Guidelines of CEA Oct'2009 point out LROT is one of the option for funding the R&M schemes.
- ▣ As a first step, a Transaction Advisor is to be appointed. NIT has been published and is due for opening on 31.01.2012.

THANKS



Maharashtra State Power Generation Co. Ltd

**Presentation for JICA study on R&M/
complete Replacement of old TPSs
Current status of Mahagenco's TPSs**

24th JANUARY 2012

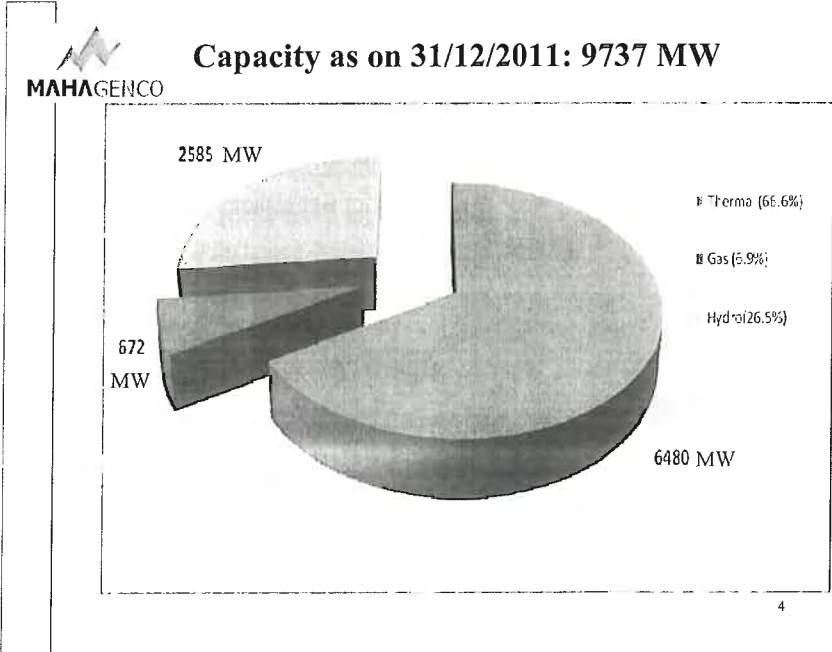
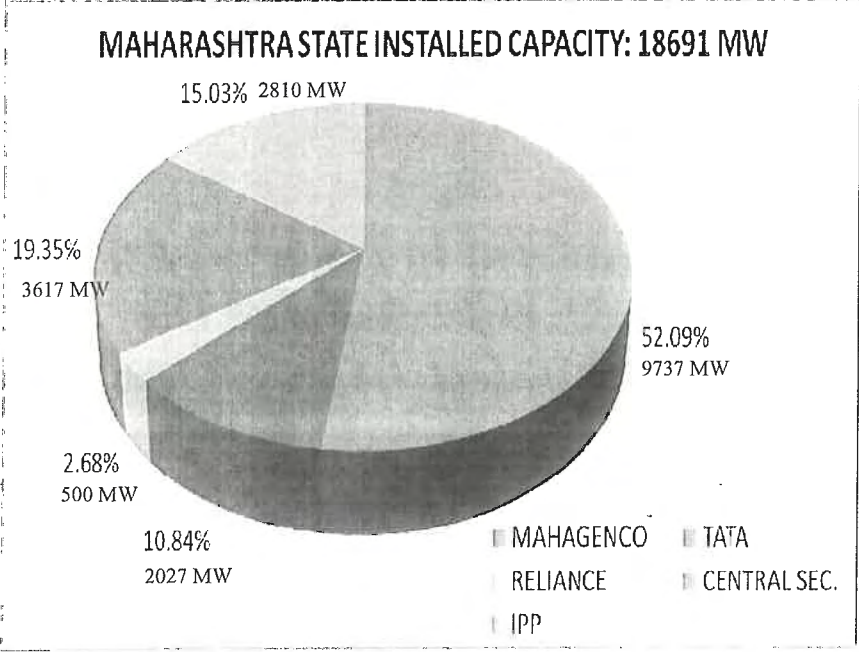


Generating for Generations

Maharashtra State Power Generation Co. Ltd.

Vision of Mahagenco

*"Generating adequate power for Maharashtra on a
sustainable basis at competitive rates in a socially
responsible manner"*





**MAHAGENCO INSTALLED CAPACITY
AS ON 31.12.2011**


Sr. No.	Power Station	Units & Size (MW)	Installed Cap. (MW)
A	THERMAL P.S.		
1	KORADI 5 TO 7	1*200 + 2*210	620
2	NASIK 3 TO 5	3*210	630
3	BHUSAWAL 2 TO 3	2*210	420
4	PARAS	2*250	500
5	PARLI 3 TO 7	3*210 + 2*250	1130
6	K'KHEDA 1 to 4	4*210	840
7	CHANDRAPUR 1 TO 7	4*210 + 3*500	2340
	MAHAGENCO THERMAL		6480
B	GAS TURBINE P.S.		
8	URAN G.T.	4*108	432
	W.H.R. 1&2	2*120	240
	MAHAGENCO GAS		672
	MAHAGENCO TOTAL (Th. + Gas)		7152
C	HYDRO CAPACITY		2585
	MAHAGENCO TOTAL(A+B+C)		9737



Sr No	Power Plant	Unit	Inst. Cap. (MW)	Comm Date	Age in Years as on
					31-12-11
1	2	3	4	6	7
1	Koradi	5	200	15-07-78	33
*2	Nasik	3	210	26-04-79	32
*3	Bhusawal	2	210	30-08-79	32
4	Nasik	4	210	07-10-1980	31
*5	Parli	3	210	10-10-1980	31
6	Nasik	5	210	30-01-81	31
*7	Koradi	6	210	30-03-82	30
8	Bhusawal	3	210	05-04-1982	29
9	Koradi	7	210	13-01-83	29
*10	Chandrapur	1	210	15-08-83	28
*11	Chandrapur	2	210	07-11-1984	27
12	Parli	4	210	26-03-85	27
13	Chandrapur	3	210	05-03-1985	26
14	Chandrapur	4	210	03-08-1986	26

* In R & M : 1st phase programme


Age (years):
30 & Above - 7 units
25-30 - 7 units


MAHAGENCO

Designed GCV / Actual GCV

S.NO.	STATION	Capacity(MW)	Design GCV(Kcal/kg)	Bunkered Coal GCV(Kcal/kg) (Apr.'09 to Mar.'10)	Bunkered Coal GCV(Kcal/kg) (Apr.'10 to Mar.'11)	Bunkered Coal GCV(Kcal/kg) (Apr.'11 to Dec.'11)
1	BHUSAWAL	210	5100	3359	3054	2940
		210	5100	3359	3054	2940
2	CHANDRAPUR	210	4313	3426	3147	2927
		210	4313	3426	3147	2927
		210	4445	3426	3147	2927
		210	4445	3426	3147	2927
		500	3750	3296	3096	2973
		500	3750	3296	3096	2973
		500	3500	3296	3096	2973
3	KHAPARKHEDA	210	4400	3489	3041	3126
		210	4400	3489	3041	3126
		210	3500	3489	3041	3126
		210	3500	3489	3041	3126
4	KORADI	200	5000	3889	3345	3243
		210	5000	3889	3345	3243
		210	5000	3889	3345	3243

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MAHAGENCO

Designed GCV / Actual GCV

S.NO.	STATION	Capacity(MW)	Design GCV(Kcal/kg)	Bunkered Coal GCV(Kcal/kg) (Apr.'09 to Mar.'10)	Bunkered Coal GCV(Kcal/kg) (Apr.'10 to Mar.'11)	Bunkered Coal GCV(Kcal/kg) (Apr.'11 to Dec.'11)
5	NASIK	210	4690	3716	3467	3332
		210	5000	3716	3467	3332
		210	5000	3716	3467	3332
6	PARAS	250	3400	3709	3309	3036
		250	3400	3709	3308	3045
7	PARLI	210	5000	3738	3729	3286
		210	4890	3738	3729	3286
		210	4445	3738	3729	3286
		250	3400	3619	3342	3162
		250	3400	3619	3223	3136
MAHAGENCO TOTAL		6480				
MAHAGENCO AVERAGE			4400	3537	3245	3090

S.No	STATION	Unit No.	Cap. (MW)	Design GCV (Kcal/kg)	Bunkered Coal GCV(Kcal/kg) (Apr.'09)	Bunkered Coal GCV(Kcal/kg) (Apr.'10 to	Bunkered Coal GCV(Kcal/kg) (Apr.'11)
1	BHUSAWAL	2	210	5100	3359	3054	2940
2	BHUSAWAL	3	210	5100	3359	3054	2940
3	CHANDRAPUF	1	210	4313	3426	3147	2927
4	CHANDRAPUF	2	210	4313	3426	3147	2927
5	KORADI	5	200	5000	3889	3345	3243
6	KORADI	6	210	5000	3889	3345	3243
7	NASIK	3	210	4690	3716	3467	3332
8	NASIK	4	210	5000	3716	3467	3332
9	PARLI	3	210	5000	3738	3729	3286
Average GCV				4835	3613	3306	3130

Parameters	(07-08)	(08-09)	(09-10)	(10-11)	(10-11) (Apr-Dec)	(11-12) (Apr-Dec)
Generation(MU)	43958	42061	41522	37446	26060	26583
Availability Factor (%)	87.58	86.69	88.40	81.64	59.53	63.36
Plant Load Factor (%)	76.99	70.61	69.71	61.73	59.63	63.33
Heat Rate (Kcal/Kg)	2709	2898	2989	2817	2866	2730
Sp.Oil Cons.(ml/Kwh)	1.78	4.12	3.56	5.75	7.27	5.44
Aux. Cons (%)	8.78	9.49	9.93	10.63	11.17	10.86



PERFORMANCE FOR LAST THREE YEARS OF UNITS
IDENTIFIED FOR R&M PROJECT

Particulars	Bhusawal U#2			Chandrapur U#1			Chandrapur U#2		
	09-10	10-11	11-12_ Upto Dec	09-10	10-11	11-12_ Upto Dec	09-10	10-11	11-12_ Upto Dec
Gen.(Mus)	1209.07	1167.66	696.48	1320.55	906.03	895.942	1178.39	877.13	721.977
PLF %	65.72	63.47	50.25	71.78	49.25	64.64	64.06	47.68	52.09
AVF %	82.41	86.55	68.95	98.05	75.12	95.01	89.55	73.02	83.38
Sp. Oil Cons.	3.95	9.54	6.30	1.01	3.76	2.18	1.44	3.91	3.50
Aux. Cons.	10.83	11.29	11.24	8.08	10.77	10.25	10.07	11.25	11.72

- phase 1 - R&M projects



PERFORMANCE FOR LAST THREE YEARS OF UNITS
IDENTIFIED FOR R&M PROJECT

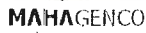
Particulars	Nashik U#3			Koradi U#6			Parli U#3		
	09-10	10-11	11-12_ Upto Dec	09-10	10-11	11-12_ Upto Dec	09-10	10-11	11-12_ Upto Dec
Gen.(Mus)	1443.64	1368.07	939.915	1187.46	946.72	930.665	1085.81	1127.33	522.658
PLF %	78.48	74.37	67.81	64.55	51.46	67.15	59.02	61.28	37.71
AVF %	86.47	92.33	85.64	93.42	79.73	94.51	82.08	84.44	59.13
Sp. Oil Cons.	2.11	8.68	7.35	10.14	9.14	5.73	5.10	8.08	13.90
Aux. Cons.	9.69	10.40	10.49	11.36	13.07	11.99	16.12	14.58	12.45

- phase 1 r&M projects



PERFORMANCE FOR LAST THREE YEARS OF UNITS
IDENTIFIED FOR R&M PROJECT

Particulars	Nashik U#4			Koradi U#5			Bhusawal U#3		
	09-10	10-11	11-12_ Upto Dec	09-10	10-11	11-12_ Upto Dec	09-10	10-11	11-12_ Upto Dec
Gen.(Mus)	1548.36	1158.92	893.799	1145.20	975.33	783.365	1507.59	1201.43	921.2
PLF %	84.17	63.00	64.49	65.37	55.67	59.35	81.95	65.31	66.46
AVF %	95.35	76.60	84.26	91.24	79.94	82.34	97.52	83.47	88.28
Sp. Oil Cons.	1.97	6.40	7.60	8.79	8.95	6.57	2.37	8.16	4.65
Aux. Cons.	9.83	10.61	10.90	12.26	13.05	12.47	10.31	11.18	11.54



PERFORMANCE FOR LAST THREE YEARS OF UNITS
PROPOSED FOR R&M

Particulars	Chandrapur U#3			Chandrapur U#4			Koradi U#7		
	09-10	10-11	11-12_ Upto Dec	09-10	10-11	11-12_ Upto Dec	09-10	10-11	11-12_ Upto Dec
Gen.(Mus)	1461.26	972.52	1000.392	1339.98	1209.37	858.317	1146.00	1176.59	863.415
PLF %	79.43	52.87	72.18	72.84	65.74	61.93	62.30	63.96	62.30
AVF %	98.57	68.13	92.55	87.77	84.43	75.09	84.97	90.67	84.83
Sp. Oil Cons.	1.75	4.16	2.30	1.42	3.92	1.92	7.29	7.07	7.76
Aux. Cons.	9.40	10.10	10.45	9.03	10.50	9.57	11.94	12.25	11.84

Particulars	Nashik U#5			Parli U#4			Parli U#5		
	09-10	10-11	11-12_ Upto Dec	09-10	10-11	11-12_ Upto Dec	09-10	10-11	11-12_ Upto Dec
Gen.(Mus)	1370.45	1398.05	918.299	1280.97	1095.68	686.613	1340.17	1066.27	738.99
PLF %	74.50	76.00	66.26	69.63	59.56	49.53918	72.85	57.96	53.32
AVF %	87.44	95.13	90.22	86.48	79.80	74.10	91.98	83.83	87.50
Sp. Oil Cons.	2.43	6.72	6.97	3.08	5.48	11.73296	2.60	11.32	15.88
Aux. Cons.	10.05	10.56	11.43	8.90	9.85	12.95	9.42	10.58	13.34

R&M/LE Program -Objectives

- To restore and enhance original generation capacity
- Life extension upto 20 years
- To enable the unit to operate with the available coal Quality
- To improve heat rate
- To improve availability
- To reduce auxiliary consumption
- To reduce specific oil consumption etc.
- To reduce emission levels

Mahagenco's R&M Program

Name of TPS & Unit No.	Aprrox Cost (Rs. Crore)	DPR	Remarks
I. Units identified by CEA for 12th R&M plan.			
1. Koradi TPS U-6	486.00	DPR prepared & approved.	World Bank funded. Bids for BTG, BOP & Electrical packages opened & contracts will be by May 2012 after WB approvals.
2. Nasik TPS U-3	481.46	DPR prepared & approved.	Funded by KFW Germany. Feasibility study is completed. BTG, BOP & Electrical & CHP . ICB in May 2012.
3. Chandrapur STPS U-1 4. Chandrapur STPS U-2	1000.00	April 2012 (U-2) Jan 2013 (U-1)	GEF grant is made available by World Bank for various TA. Studies are in final stages.
5. Bhusawal TPSU-2	500.00	April 2012	
6. Parli TPS U-3	500.00	May 2012	

Contd.....

Mahagenco's R&M Program

Name of TPS & Unit No.	Approx Cost (Rs. Crore)	DPR	Remarks
I. Units identified by CEA for 12th R&M plan.			
7. Koradi TPS U-5	500.00	May 2013	Feasibility Studies initiated by Mahag
8. Nasik TPS U-4	500.00	May 2013	
9. Bhusawal TPS U-3	500.00	May 2013	

Mahagenco's R&M Program

Name of TPS & Unit No.	Approx Cost (Rs. Crore)	Target date of DPR	Remark
II. Units proposed to be included in 12 th plan by Mahagenco			
1. Koradi TPS U-7	500.00		
2. Nasik TPS U-5	500.00	Jan 2013	Selection of Consultant for Feasibility study is initiated.
3. Chandrapur TPS U-3 4. Chandrapur TPS U-4	1000.00		
5. Parli TPS U-4 6. Parli TPS U-5	1000.00		
3. Units proposed to be included in 13 th R&M plan.			
Chandrapur STPS U-5&6 Khaperkheda TPS U-1,2,			



R&M Program – Financial Arrangements

- 1. Koradi U-6 (World Bank Funding)
 - Estimated cost of the project is- Rs. 486 Crores
 - Funding arrangement
 - IBRD Loan & GEF grant - 74% ,
 - GoM equity- 20%
 - Balance from MSPGCL's internal resources.
 - World Bank has provided GEF grant for Tech Assistance (ISC& QAC) @Rs 5.7 Cr.

- 2. Chandrapur- 1&2 , Bhusawal-2 & Parli-3

World Bank has provided GEF grant for Tech Assistance for design of EER&M scheme above units @ Rs 8.8 Cr.

- 3. Nasik-3 (KfW funding)
Estimated cost - Rs. 481.46 Cr. (Approx.)
Loan / equity ratio - 80:20



Outage Schedule of R&M units

2013-14	2014-15	2015-16	2016-17
Nashik-3	Chandrapur-1	Chandrapur-3	Chandrapur-4
Koradi-6	Chandrapur-2	Nashik-4	Bhusawal-3
	Bhusawal-2	Nashik-5	Parli-4
	Parli-3	Koradi-5	Parli-5
			Koradi-7

MAHAGENCO YEAR WISE CAPACITY ADDITION PROGRAMME
PROJECT COMPLETED (500 MW), ONGOING PROJECTS (4730 MW) & GAS BASED PROJECT UNDER PLANNING (1220 MW)

Name of the Project	Unit No.	Zero Date	Synchronisation	COD	Capacity of the unit (MW)	Net Capacity Addition	Net capacity Addition During year	Year
A) Coal Based Thermal Projects Under Execution (4730 MW)								
Khaperkheda TPS	Unit 5	23-Jan-07	31-Mar-11	31-Jan-12	500	500	1500 MW	2011-12
Bhusawal TPS	Unit 4	23-Jan-07	11-May-11	20-Mar-12	500	500		
Bhusawal TPS	Unit 5	23-Jan-07	15-Nov-11	31-Mar-12	500	500		
Parli TPS	Unit 8	20-Jan-09	15-Jan-13	15-May-13	250	210	1450 MW	2013-14
Chandrapur TPS	Unit 8	9-Feb-09	9-Sep-12	30-Jun-13	500	500		
Chandrapur TPS	Unit 9	9-Feb-09	30-Jan-13	30-Dec-13	500	500		
Koradi TPS	Unit 8	23-Sep-09	23-Sep-13	21-Dec-13	660	240	1320 MW	2014-15
Koradi TPS	Unit 9	23-Sep-09	23-Mar-14	21-Jun-14	660	660		
Koradi TPS	Unit 10	23-Sep-09	23-Sep-14	21-Dec-14	660	660		
Total					4730	4270	4270 MW	
B) Gas Based Project under planning (1220 MW)								
Uran GTPS	Block I	Feb. 2012	May, 2014	Jul.2014	406	406	406 MW	2014-15
Uran GTPS	Block II	Feb. 2012	Aug. 2014	Nov.2014	814	814	814 MW	
Total of Gas Based Projects B					1220	1220	1220 MW	
<i>- Net capacity for replacement project is considered as (New Capacity - Old Capacity)</i>								

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THANK YOU

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**MAHAGENCO YEAR WISE CAPACITY ADDITION PROGRAMME
PROJECTS UNDER PLANNING & FUTURE PROJECTS (12720 MW)**

C) Project Under Planning & Engineering and Future Projects(12720MW)								
Latur Project (JV)	Gas Based	Apr.2012	Feb.2015	Apr.2015	1500	1500	1500	2015-16
Bhusawal TPS	Unit 6	May. 2012	May. 2016	Oct. 2016	660	550	3190	2016-17
Dhopave TPS	Unit 1	Jul.2012	July.2016	Oct.2016	660	660		
Dondaicha TPS	Unit 1	Aug.2012	Aug.2016	Nov. 2016	660	660		
Kanpa (Nagbid)	Unit 1	Aug. 2012	Aug.2016	Nov.2016	660	660		
Mendaki TPS	Unit 1	Oct. 2012	Oct.2016	Jan.2017	660	660	5690	2017-18
Dhopave TPS	Unit 2	Jul.2012	Jan.2017	Apr.2017	660	660		
Manora(Gondia) TPS	Unit 1	Jan.2013	Jan.2017	Apr.2017	660	660		
Nashik TPS	Unit 6	Dec.2012	Dec.2016	May.2017	660	410		
Dondaicha TPS	Unit 2	Aug.2012	Feb.2017	May.2017	660	660		
Kanpa (Nagbid)	Unit 2	Aug.2012	Feb.2017	May.2017	660	660		
Mendaki TPS	Unit 2	Oct. 2012	Apr.2017	Jul.2017	660	660		
Dhopave TPS	Unit 3	Jul.2012	July.2017	Oct.2017	660	660		
Manora(Gondia) TPS	Unit 2	Jan.2013	Jul.2017	Oct.2017	660	660		
Dondaicha TPS	Unit 3	Aug.2012	Aug.2017	Nov. 2017	660	660		
Dondaicha TPS	Unit 4	Aug.2012	Feb.2018	May.2018	660	660	1320	2018-19
Dondaicha TPS	Unit 5	Aug.2012	Aug.2018	Nov. 2018	660	660		
Paras TPS	Unit 5	Under planning			660	660	660	
Total of C					12720	12360	12360	
- Net capacity for replacement of old unit project is considered as (New unit Capacity - Old unit Capacity)								
Total capacity addition from 2010 to 2019(Coal+Gas)- A+B+C					18670	17850	17850	

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Profitability since inception

(Rs Crores)

SR NO.	ITEM	2005-06 (from 31-05-2005)	2006-07	2007-08	2008-09	2009-10	2010-11
INCOME							
1	Revenue from sale of power	5362	7345	8082	9346	11083	12115
2	Other income	107	96	167	133	103	105
	TOTAL	5469	7441	8248	9479	11187	12220
EXPENDITURE							
1	Cost of fuel	4241	5650	5998	7156	8313	8282
	Generation Admin. & Repair-Maint						
2	Expenses	295	545	926	864	1152	1212
3	Employee Costs	332	341	475	630	557	871
4	Depreciation	328	347	207	308	301	398
5	Interest & Finance Charges	103	203	120	448	470	657
	TOTAL	5298	7086	7726	9406	10793	11420
	Net Profit Before Tax	170	355	522	73	394	800
	Tax Provision	57	121	222	(11)	191	491
	Profit After Tax	113	234	300	84	203	309

Balance Sheet of Genco

31st March 2011

RS CRORES

NET WORTH		FIXED ASSETS	
Equity	4797	Net Fixed Assets	8809
Reserves	972	Assets under Const.	11930
	5769		20739
LONG TERM LIABILITY		CURRENT ASSETS	
Secured Loans	11728	Cash & Bank	43
Unsecured Loans	4644	Stock	1273
Deferred Tax	819	Other receivables	9002
	17192		10318
CURRENT LIABILITY			
Accounts Payable	8096		
	8096		
	31057		31057

Outage Schedule of R&M units

Sr No.	Station Name	Unit No.	Capacity	Outages		Outage Days
				From	To	
1	Bhusawal	2	210			
		3	210			
2	Chandrapur	1	210	01-06-2015	29-09-2015	120
		2	210	01-06-2016	29-09-2016	120
		3	210			
		4	210			
3	Nashik	3	210	18-12-2013	20-06-2014	184
		4	210	01-09-2015	29-02-2016	181
		5	210	01-07-2016	01-01-2017	184
5	Koradi	5	200			
		6	210	01-08-2013	31-03-2014	242
		7	210			
7	Parli	3	210			
		4	210			
		5	210			

KHAPERKHEDA THERMAL POWER STATION

Unit	Capacity MW	Commissioning Date	Boiler Make	Turbine Make
1	210	26.03.1989	BHEL	BHEL/KWU
2	210	08.01.1990	BHEL	BHEL/KWU
3	210	31.05.2000	BHEL	BHEL/KWU
4	210	07.01.2001	BHEL	BHEL/KWU

KHAPERKHEDA UNIT 1 (210 MW)

Operating Parameters	2008-2009	2009-2010	2010-2011
PLF in %	86.406	74.272	89.403
AVF in %	93.713	83.873	98.601
Aux. Consumption in %	9.555	9.127	8.986
Heat Rate in kcl/kwh	2886	2929	2723

KHAPERKHEDA UNIT 2 (210 MW)

Operating Parameters	2008-2009	2009-2010	2010-2011
PLF in %	89.243	82.395	69.390
AVF in %	97.764	95.371	82.263
Aux. Consumption in %	9.061	9.669	9.922
Heat Rate in kcl/kwh	2875	2905	2734

KHAPARKHEDA UNIT- 3 (210MW)

Operating Parameters	2008-2009	2009-2010	2010-2011
PLF in %	92.676	80.446	85.460
AVF in %	98.487	88.233	96.987
Aux. Consumption in %	9.189	10.198	10.278
Heat Rate in kcl/kwh	2743	2702	2585

KHAPARKHEDA UNIT-4 (210MW)

Operating Parameters	2008-2009	2009-2010	2010-2011
PLF in %	80.476	89.386	66.458
AVF in %	87.119	96.948	79.675
Aux. Consumption in %	8.894	9.035	9.986
Heat Rate in kcl/kwh	2717	2722	2600

Japan International Cooperation Agency

**Study
on
Renovation & Modernization /
Complete Replacement
of
Old Coal based Thermal Power Stations
In India**

Inception Report (Draft)

January 2012

Electric Power Development Co., Ltd.

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Abbreviation	Official Term
C/P	Counterpart
CEA	Central Electricity Authority
JICA	Japan International Cooperation Agency
LE	Life Extension
M/M	Minutes of Meeting
MOP	Ministry of Power
MPSEB	Madhya Pradesh State Electricity Board
MSPGCL	Maharashtra State Power Generation Company Limited
O&M	Operation & Maintenance
R&M	Renovation & Modernization
UPPCL	Uttar Pradesh Power Corporation Limited

1. The Objective and Period of the Study

1.1 The Objective of the Study

The study aims to collect information and investigate the current status of old coal-fired power stations in India in terms of two categories, namely: (1) power stations/units to be replaced (scrap-and-build) with highly efficient stations/units and (2) power stations/units to be renovated and modernized to enhance thermal efficiency. The findings will serve as the basic information for considering yen-loan assistance followed by due needs assessment with respect to complete replacement or renovation and modernization, together with cost-benefit analysis.

1.2 The Period of the Study

The study is to be implementing from middle of January 2012 to end of May 2012.

2. Basic Policies of the Study

2.1 Scope of the Study

In accordance with the work instructions, the study includes the following activities. (See Section 3.2 "Methodology and Items of Study" for details of each item studied.)

- 1) Examination of existing documents and information on the government and power sector in India together with interview surveys at relevant organizations
- 2) Selection of target power stations and units
- 3) Survey of the sites space and infrastructure of target power stations
- 4) Survey of the target units (e.g., current operational status, performance)
- 5) Survey of the maintenance of target units
- 6) Examination of the actual plans for replacement, renovation and modernization made by the Indian executing agencies
- 7) Review of the method for replacement (scrap-and-build), renovation and modernization
- 8) Preliminary estimation of the costs for replacement (scrap-and-build), renovation and modernization

Detailed investigation or planning for replacement, and renovation and modernization is excluded from the study, since its main objective is to gain basic information for consideration of yen-loan assistance. While the provision of information from counterparts is essential, either information exchange with the counterparts or provision of technical information from the Japanese side is not included.

2.2 Considerations to be made for the Study

In conducting the study, the following considerations should be made.

(1) Consultation with Relevant Local Organizations

Sufficient consultation and coordination shall be conducted with MOP and CEA, acting as partner organizations for the study. Sufficient consultation shall be conducted with the organizations who own the target coal-fired power stations (e.g., State Electricity Corporations), under prior agreement with MOP and CEA. Sufficient discussion and coordination shall be conducted with JICA India during field works in India. Follow up items to be conducted by JICA India for future shall be identified in the final report.

(2) Collection and Confirmation of Basic Information

Whilst collecting and confirming basic information, JICA's past assistance to the Indian power sector and corresponding progress, together with the existing development policy and plans of the Indian government, should be taken into account.

(3) Ongoing or Planned Studies by Other Organizations

In consideration of the studies conducted by other organizations in India, sufficient information collection from these organizations should be conducted, whilst also avoiding overlap of the items studied. Examples of such organizations include aid donors such as the World Bank, German KfW, and USAID, as well as Japanese agencies such as the Japan Coal Energy Center and the New Energy and Industrial Technology Development Organization.

(4) Information Collection for Formation of a New Project

The study is designed to propose a policy on replacement, and renovation and modernization of coal-fired power stations/units through due investigation of current status. Because a yen-loan project is envisaged for the replacement, and renovation and modernization of coal-fired power stations/units based on the study, information collection shall be conducted with the designing of a yen-loan project in mind. In cases that a project is focused on facility construction and equipment provision, the maintenance system is crucial. Therefore, information must be collected not only on the status of facilities but also on the status of maintenance, operation and management system.

(5) Screening of the Target Power Stations/Units for the Study

Screening and selection of the power stations/units for replacement, and renovation and modernization are now in process by JICA India through prior consultation with the Indian government. General agreement has been reached as to which power stations shall be candidates for the study. Accordingly, the number of power stations representing candidates for the on-site survey shall be reduced to approximately four in consultation with JICA on the preparatory stage in Japan, and the target power stations shall be determined in the first Field Work based on consultation with MOP and CEA.

(6) Study Report

The following reports and information will be submitted to JICA as the final product of the study.

1) Study report

(1) Inception report (IC/R)

Contents: basic guidelines, methodology, work schedule, and staffing plan for the study

Expected delivery: Draft: January 2012, Final: February 2012

Number of copies: Japanese: 5 copies, English: 5 copies

(2) Draft final report (Df/R)

Contents: Result of entire study

Delivery: April 2012

Number of copies: Japanese: 5 copies, English: 20 copies

(3) Final report (F/R)

Contents: Final report by correction of Df/R in accordance with comments

Delivery: May 2012

Number of copies: Japanese: 10 hard copies, English: 20 hard copies, Electronic data (PDF format: English 10 copies, Japanese 5 copies)

2) Study progress report

Contents: Study progress and corresponding summary

Delivery: Monthly (before the 15th of the following month)

Number of copies: Japanese: 1 copy

3) Collected information

Contents: Collected documents and data together with corresponding list

Delivery: Upon completion of the study

Number of copies: Japanese: 1 copy

4) Minutes and photographs

Contents: Outcome of various consultations between the study team and Indian counterparts

Delivery: After each Field Work

Number of copies: Japanese: 2 copies (for JICA Headquarters and Indian office)

Photos: Photographs attached to the final report through extraction from the first, second, and third field works (approximately 30 photographs in total, including those taken during the on-site survey)

5) Confidentiality

Final Report will be basically disclosed to the public. Information or data, which shall be confidential, will not be disclosed through confirmation among JICA, the Counterparts and the Study Team.

2.3 Basic Policies on Technical Issues

(1) Basic Policies

1) Information is to be collected on the status of R&M work implemented at candidate sites, including the coal-fired power stations of Obra, Satpra, and Khaperkheda, on the basis of available reference materials.

2) Selection of target power stations

In consultation with JICA, the number of target power stations is to be narrowed down to roughly 4, selected from the 4 stations indicated in the work instructions and the 1 station proposed by the JICA Study Team. The target stations will be determined in consultation with MOP and CEA, after the JICA Study Team has explained the reasons for the selection. The selection criteria to be applied are described clause 3.2 (1) 4).

On-site investigation will be conducted at the stations that have been selected according to the above criteria. It is intended to select 2 units from 4 power stations that require R&M and 2 power stations that require replacement. Detailed arrangements will be determined in consultation with JICA.

- 3) The subjects of study for possible R&M at the target power stations (units) are the boiler, turbine, condenser, generator, and main equipment (feed-water heater, boiler feed-water pump, circulating water pump, main transformer, and main control system).
- 4) Information must be collected regarding the site of the target power station (both the power station and adjacent area), fuel, fuel receiving capacity, the ash pond capacity, cooling water, water supply, wastewater, power lines (incl. trunk lines and substations), and access routes for carrying large components.
- 5) When assessing the performance of the power-generating facilities, the performance test procedure and past performance test result reports are to be obtained.
- 6) For each target power station, the financial situation of the corresponding state government and state electricity corporation is to be investigated.
- 7) The target power stations are to be studied from environmental aspect.
- 8) Proposals are to be made regarding the modernization and efficient operation of the facilities at the target power stations (units) based on analysis and evaluation of the collected information. In addition, proposals are to be made regarding possible replacement by high efficiency power stations (units).
- 9) The approximate costs of the proposed replacement and R&M are to be estimated and the overall project cost calculated.
- 10) Possible technical assistance, including training, is to be proposed based on the evaluation of target power stations and observations during field works.
- 11) The feasibility of the involvement of Japanese manufacturers for replacement, and renovation and modernization is to be checked.

2.4 Basic Policies for Administrative Issues

Judging from the items studied and basic guidelines on technical issues proposed, team members are to be appointed for the study from amongst staff who are experienced in coal-fired power generation in Japan or overseas.

(1) Study Team

In consideration of the scope of works, the team shall be composed of the following 6 members:

- Team leader/Coal-fired power stations (overall plan) 1 person
- Deputy team leader/Coal-fired power station design (replacement, R&M) 1 person
- Facility survey and planning 1 (mechanical/replacement, R&M) 1 person
- Facility survey and planning 2 (mechanical/O&M) 1 person
- Facility survey and planning 3 (electrical/O&M) 1 person
- Financial analysis/environmental and social considerations 1 person

Two mechanical experts are deployed for the tasks related to replacement, and renovation and modernization, and O&M as well since survey and facility planning are to be focused on mechanical matters.

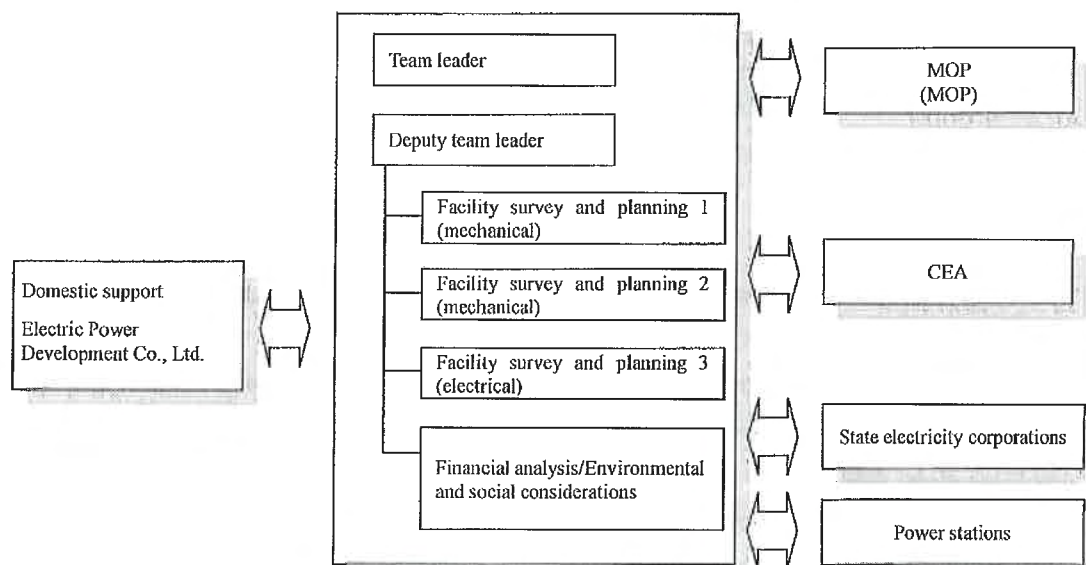


Fig. 2.4-1 Structure of Study Team

(2) Establishment of Counterpart Team

This study involves numerous organizations because the direct counterparts for the study are the state electricity board and state electricity corporation which are owner agencies of the coal-fired power stations, together with MOP and CEA acting as partners supporting the study activities. A framework organized in the partner country is crucial for ensuring a smoothly conducted study. A counterpart team needs to be formed in order to clearly define the persons to contact and the persons in charge whilst the study is being conducted.

The state electricity board and a state electricity corporation will be requested to form the counterpart team (CP team), since the study of existing coal-fired units of the state electricity corporation requires close coordination with that corporation, including the collection of facility specifications/drawings and operational data, and interview surveys regarding operation and maintenance. The CP team should comprise of a leader who is in charge of the overall project and a person in charge assigned from each target power stations/units. Liaisons from both MOP and CEA will also be appointed.

(3) Counterparts

The following are list of counterparts in this study.

- Ministry of Power (MOP)
- Central Electricity Authority (CEA)
- Uttar Pradesh Power Corporation Limited (UPPCL)
- Madhya Pradesh State Electricity Board (MPSEB)
- Maharashtra State Power Generation Company Limited (MSPGCL)

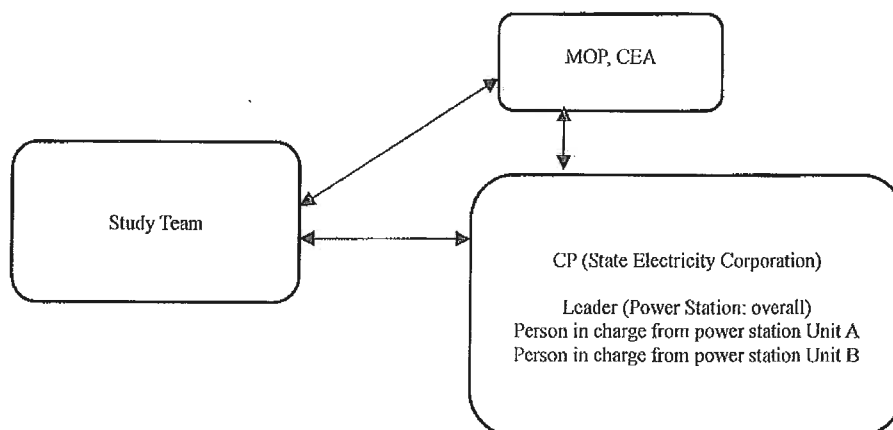


Fig. 2.4-2 Counterpart Team

(4) Assistance Provided by Partner Country

The following assistance shall be provided by the partner country:

- 1) Establishment of liaisons at MOP and CEA
- 2) Formation of the CP team by the state electricity board and state electricity corporation
- 3) Income tax exemption for the Team member experts
- 4) Coordination with relevant organizations in India (when necessary)
- 5) Acquisition of required budgets on the Indian side
- 6) Access to power stations (units) and collection of necessary data (including authorization for taking photographs)
- 7) Provision of office work space (e.g., meeting room) for the study team (including Internet access)

8) Travel arrangements in India for the study team (e.g., transportation, accommodation). The study team will pay transportation and accommodation cost.

(5) Liaison and Communication with Related Parties

1) Between team members and Indian counterparts

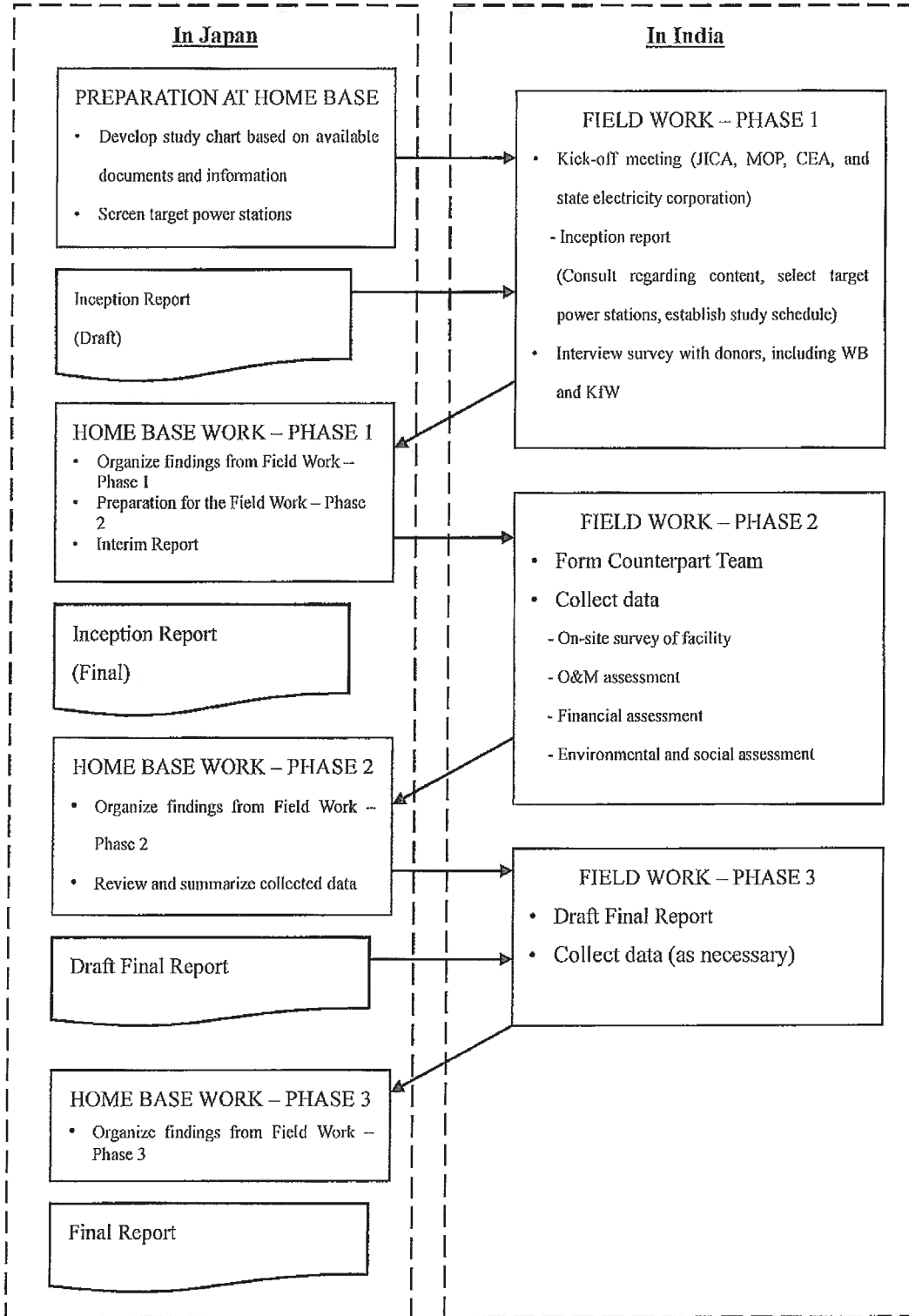
As specified in the work instructions, the scope of this study is mainly investigate existing coal fired thermal power stations, so it is essential to obtain the cooperation of counterparts. By means of the abovementioned CP team, the relevant tasks must be performed effectively and efficiently by maintaining a close partnership with the state electricity board and state electricity corporation, information being shared not only amongst team members but also with other related parties, and due consideration being given to promoting communication. In addition, the J-Power Liaison Office in New Delhi should be utilized as necessary to facilitate activities.

(6) JICA and other parties

Before and after the field investigation, and at various stages of the investigation, the Study Team will contact JICA's Headquarters and India Office, and the Japanese Embassy in India and keep close communication with each other, and proceed with the Study through confirmation and correction of the way to go. If necessary, the content of the study should be revised and adjusted, through consultation with related parties that include the person in charge from JICA.

3. Methodology of the Study

3.1 Overall Study flow



3.2 Methodology and Items of Study

The study will be conducted taking into consideration the study's background and objectives, together with the "Considerations to be made of for the Study" stipulated in the work instructions.

(1) Preparation in Japan

1) Preparation of the inception report (draft)

The inception report (draft) will contain the following:

- (1) Basic guidelines for the field work
- (2) Items to be studied
- (3) Selection criteria and selection of target power stations
- (4) Overall schedule

2) To establish practical methodology and guidelines for the study, existing materials and data will be examined, and interview surveys will be conducted in Japan covering the following items:

- (1) The Indian government's energy policy, power policy, climate change countermeasures, and other relevant measures (including R&M plans for coal-fired power stations; Perform, Achieve and Trade (PAT) scheme; and implementation of CDM)
- (2) Overview of the power sector in India and target states (e.g., economic standing/financial situation, power demand forecasts, electrical power development plans, power system development, power supply plans, electrification of rural areas, power loss, electricity tariffs, supply costs, and demand characteristics)
- (3) The situation of existing coal-fired power stations in India
- (4) Supply and demand forecasts for primary energy (especially coal) and related political measures
- (5) Technology and systems that may be suitable for replacement (scrap-and-build) and R&M of coal-fired power stations (units)
- (6) Case studies of replacement of coal-fired power stations in Japan

3) Consultation will be conducted with JICA regarding selection criteria and screening of target power stations, and other issues. The outcome will be incorporated into the draft inception report drafted in Japanese and English and submitted to JICA. The draft inception report in English will cover mainly the methodology and guidelines for the study and be kept concise (up to 10 pages) in view of its later use for briefing to Indian counterpart organizations including MOP, CEA, the state electricity board, and state electricity corporation. The draft inception report will be mailed to Indian counterparts so that it may be reviewed, enabling further elaboration and discussion of the contents at the kick-off meeting during the phase 1 Field Work. The finalized inception report will reflect the results of the kick-off meeting.

4) The selection criteria to be applied are as follows: units which started operation in the 1970s–80s; stations (units) listed in the National Perspective 11th and 12th Plan developed by CEA; units that suffer from a low plant load factors; stations that include small and old units of output capacity

around 100 MW; and unit types that are widely applied in India—enabling widespread reproduction of the results obtained.

- 5) A questionnaire will be prepared in order to collect information from the state electricity board and state electricity corporation in the state where the study will take place.

In order to efficiently determine the target power stations, a survey and data list will be prepared for the state electricity board and state electricity corporation of the target state. The information to be collected regarding the existing coal-fired power stations (units) will include the following: specifications (number of power-generating units; total/unit power output; name of manufacturer, model types, and design specifications of each facility including boiler, turbine, and main equipment; and types of coal used); heat balance diagram (during 100% rated output and partial load), P&I diagram for power station (unit) systems (water/steam flow diagram of boiler/turbine, fuel supply diagram, air/flue gas flow diagram, etc.; main control system diagram, layout drawing of the power station); operation manual (to be selected 2-3 manuals); past/latest performance test reports; performance test procedure, RLA reports (summary), unit trip reports, annual operation pattern, past R&M record, R&M plan report, environmental regulation of flue gas/waste water, coal receiving capacity, industry water receiving capacity, capacity of transmission line, ash pond capacity and etc..

- 6) Request for setting up of counterpart team (CP team)

A list will be prepared for the purpose of requesting formation of a CP team composed of a leader for the project—representing the state electricity board and state electricity corporation—and persons in charge of the target units. In addition, a list of liaisons at MOP and CEA is also to be prepared.

(2) Field Work – Phase 1

- 1) Brief JICA India on the inception report (written in Japanese and English)
- 2) Submit inception reports (English) to MOP, CEA, state electricity board and state electricity corporation prior to the field work in order to brief them on the guidelines and the items to be studied. Confirm output (MW), commercial operation year, plant load factors, thermal efficiency, and assistance record by other donors on the basis of MOP's list of old coal-fired power stations and CEA's list of power stations selected for R&M.
- 3) Perform screening in order to decide on around 4 target coal-fired power stations (units), reaching agreement with MOP and CEA after due consultation, and giving consideration to the information collected and analyzed in Japan and the content of the inception report.
- 4) Carry out interview surveys with other donor agencies, including the World Bank and German KfW which engage in similar studies.
- 5) Establish liaisons with MOP and CEA and arrange coordination with respect to the work ahead.
- 6) Hand over the survey and data lists to the state electricity board or state electricity corporation, requesting that these be submitted in advance, or by the phase 2 field work. In addition to requesting formation of the CP team, determine the person who will act as a contact with regard to coordinating the work ahead.
- 7) Develop the overall schedule in consultation with counterparts.

- 8) Finalize the draft inception report based on the results of the kick-off meeting.

(3) Home Work in Japan – Phase 1

- 1) Back in Japan, organize a debriefing session for the JICA South Asia Department and Industrial Development and Public Policy Department.
- 2) Organize and analyze the collected data and findings from the phase 1 field work in order to enable consideration of the replacement and R&M project, and list any missing information.
- 3) Prepare for the phase 2 field work. List the information to be collected which is necessary for evaluation, including the financial situation of the power stations.
- 4) Taking note of the findings from phase 1 field work, develop a proposal for the study plan for the phase 2 field work and make an interim report to the JICA South Asia Department and Industrial Development and Public Policy Department. Concise briefing materials are to be provided for this interim reporting.
- 5) Submit the final version of the inception report.

(4) Field Work – Phase 2

- 1) Brief JICA India on the study plan for the phase 2 field work.
- 2) At the start of the field work, report to MOP and CEA on progress made with respect to the studied items.
- 3) Based on the information collected and analyzed in the phase 1 field work, carry out the phase 2 field work, including interview surveys with related parties regarding items 4 to 7 below, placing emphasis on supplementing the missing information through information collection and analysis.
- 4) Carry out on-site surveys at the target coal-fired power stations (units) in order to examine the location, access, land area of site, and related infrastructure, such as power line and cooling water intake/discharge.
- 5) Focusing on the target power stations (units) for possible replacement and R&M, determine the commercial operation year, maximum output, annual electricity production, plant load factors, thermal efficiency at generation end and fuel reduction effect (ton) expected from the reduced heat consumption ratio.
- 6) Carry out interviews with personnel at the target power stations (units) regarding the status of maintenance, past failures, instances of problems, etc.
- 7) Examine the content of specific plans that the implementing agencies (e.g., state electricity board or state electricity corporation) has for replacement and R&M, if any.
- 8) Confirm CP team.
- 9) Collect the informational material and data requested earlier.

(5) Home Work in Japan – Phase 2

- 1) Back in Japan, organize a debriefing session for the JICA South Asia Department and Industrial Development and Public Policy Department.

- 2) Investigate replacement and R&M of the power stations based on the findings from the phase 2 field work, and estimate costs.
- 3) Individually examine the possibility of replacement or R&M of the power-generation facilities studied. Design and make proposals for the envisaged schedule, budgetary scale, organizational structure for implementation, and environmental and social impact involved, keeping the possibility of yen-loan assistance in mind. In addition, consider and propose possible technical assistance, including training, that would be effective with respect to replacement or R&M of the power stations (units).
- 4) Summarize the findings from the phase 2 field work (analysis and organization of collected data).
- 5) Prepare the draft final report.
- 6) Prepare for the phase 3 field work.

The draft final report will be sent to counterparts in advance

(6) Field Work – Phase 3

- 1) Prior to the field work, the draft final report—which gathers together the findings of the study—is to be submitted to MOP and CEA, after consultation with and authorization by JICA.
- 2) At their Headquarters, brief state electricity board personnel (including those in charge at the state electricity corporation) regarding the contents of the draft final report.
- 3) Based on the information already collected and analyzed during the phase 2 field work, supplement any missing information and acquire additional information for collection and analysis by conducting interviews with related organizations and performing on-site surveys.

(7) Home Work in Japan – Phase 3

- 1) Prepare the draft final report (English and Japanese)—gathering together the results and findings of the study—and submit it to JICA.
- 2) Prepare the final report (English and Japanese), making necessary corrections to the draft final report (English and Japanese) in accordance with the comments provided by JICA. Submit the final report to JICA.

3.3 Methodology for each Stage Study

Methodology for Each Study Stage

TOR	TIME	PLACE	ITEM	METHOD	REMARKS
1 Investigation of Indian government energy policy, power policy, climate change countermeasures, and other relevant measures	Preparatory Work in Japan	Japan	①Energy policy ②Electric Power Policy ③Policy on R&M/Complete Replacement ④PAT; Perform, Address and Trade (PAT) scheme ⑤Implementation of GDM	Hearing Investigation	Table-1
2 Overview of the power sector in India and target states	Ditto	Ditto	①Financial Status ②Power demand forecasts ③Electrical power development plan ④Transmission line development plan ⑤Power supply plan ⑥Utilization of run-of-river ⑦Power loss ⑧Tariff ⑨Cost of power supply ⑩ Power demand characteristics	Ditto	Table-1
3 The status of existing coal-fired power stations in India until 2011	Ditto	Ditto	① Name, capacity (MW), COD, generation (MWh), PLF	Ditto	Table-1
4 Supply and demand forecasts for energy source (especially coal) and related policy	Ditto	Ditto	①Supply demand forecasts, energy source (especially coal), related policy	Ditto	Table-1
5 Survey of suitable technology for replacement (scrap-and-build) and renovation/modernization of coal-fired power stations	Ditto	Ditto	①Case of replacement 1)Construction plan 2)Construction method ②Case of enhancing efficiency 1)Achievement of introduction of a new technology 2)Achievement of operation improvement	Ditto	⑩To incorporate contents in APP guide book
6 Selection power stations/units for study	Ditto	Ditto	①The units started operation in the 1970s-80s and its capacity is around 100 MW. The units have a low plant load factor. The units are not carried out R&M and LE within 10 to 15 years. ②The units started operation in the 80s and its capacity is more than 200MW	Explanation Discussion	Table-2 Candidate power plants (units) ①Uttar Pradesh Power Corporation Limited : Clara Thermal Power plant ②Maharaja Pradesh State Electricity Board : Salora Thermal Power plant ③Maharashtra State Power Generation Company Limited : Neyveli Thermal Power plant ④Tamil Nadu Electricity Board - Karaikal Thermal Power plant
7 Questionnaire	Ditto	Ditto	①Preparation of questionnaire about information collection ②Preparation of data list	Request for cooperation of preparation of questionnaire and data list	Table-3 The information to be collected regarding the existing coal-fired power stations will include the following: ①Facility specifications (number of power-generating units, total power output, manufacturer, model types, and designed specification of each facility including boiler, turbine, generator and types of coal used) ②Heat balance diagram ③Power station system diagram (water/steam system diagram of boiler/turbine, fuel diagram, electro-combustion gas diagram, electrical single line drawing, etc.) ④Layout chart of the power station ⑤Operation & maintenance manual ⑥Past performance test reports (Boiler, Turbine), Performance test procedure (Boiler, Turbine), Remaining life assessment report ⑦Unit trip report, normal operation pattern (duration of operation) ⑧Technical assessment report or DPR for R&M, I.E, Replacement ⑨Emission regulation, Waste water regulation ⑩Cool receiving capacity (t/day) ⑪Raw water receiving flow (t/s) ⑫Transmission line capacity (MW) ⑬Ash pond volume (m ³)
8 Discussion and selection of candidate power plants (units)	Ditto	Ditto	①Selection of candidate power plants (units)	Explanation Discussion	
9 Explanation and submission of the Inception Report (Draft)	Ditto	Ditto		Ditto	
10 Selection of candidate power plants (units)	#1 Field Investigation	MOP,CEA and State Utility	①Selection of candidate power plants (units)	Ditto	
11 Explanation of the Inception Report (draft)	Ditto	JICA India		Ditto	
12 Explanation of the Inception Report (draft)	Ditto	MOP,CEA and target states	①Explanation of the Inception Report (draft) ②Request for cooperation of preparation of questionnaire and data list ③Request for cooperation of organization of the counterpart (management of contact person)	Ditto	
13 Work schedule	Ditto	Ditto	Preparation of the overall/site working schedules	Ditto	
14 Survey of similar project by the other donating agencies	Ditto	WB, ICM, USAID	Carry out interview surveys with other donating agencies, including the World Bank, USAID and German KfW.	Interview Investigation	
15 Explanation of the #1 Field Investigation	#1 Home work	JICA Tokyo	①Report on the result of discussion of the inception report (draft) ②Selection of candidate power plants (units) ③Investigation of similar project by the other donating agencies ④Overall schedule	Explanation Discussion	
16 Review of the #1 Field Investigation	Ditto	Japan	①Definition and Analysis of the collected data ②Study on replacement and of R&M ③Preparation of additional questionnaire	Analysis Study	
17 Preparation of #2 Field Investigation questionnaire	Ditto	Ditto	①Preparation of financial sheet ②Preparation of additional questionnaire sheet	Hearing Investigation	Table-4
18 Explanation of #2 Field Investigation plan	Ditto	JICA Tokyo	①Preparation of #2 Field Investigation plan ②Preparation of progress report	Explanation Discussion	
19 Submission of the Inception Report (Final)	Ditto	Ditto	①Preparation of Inception Report (Final)	Ditto	
20 Explanation of #2 Field Investigation plan	#2 Field Investigation	JICA India	①Explanation of #2 Field Investigation plan	Ditto	
21 Explanation of progress and establishment of Counterpart	Ditto	MOP,CEA and Target states	①Confirmation of counterpart team member	Ditto	Counterpart team: Responsibility for the study
22 Information collection and analysis	Ditto	Ditto	①Collection of inquiry sheets ②Collection of additional information ③Collection of heat efficiency information ④Location, power, location situation of site and related infrastructure, such as transmission line, cooling water intake/discharge line, waste water system and etc. ⑤COD, maximum output, MWh per annual PLF, HR, Boiler efficiency ⑥Carry out interviews with personnel at the target power stations regarding the status of O&M as per follows, present problems, etc. ⑦Replacement and R&M plan	Hearing Investigation	
23 Site survey	Ditto	Target states coal-fired power stations		Ditto	
24	Ditto	Ditto	①Survey the financial situation of power station ②Survey the environmental/social impact accordance with the guideline	Ditto	①For each target power station, based on the analysis of the financial performance of the corresponding state power utilities, site-survey for the purpose of the analysis conclusion. Also request to submit the monthly report for each power plant, if any, recording monthly revenues and expenses for each power plant. ②Site-survey report on environmental checks for thermal power station established by JICA
25 Explanation of the #2 Field Investigation	#2 Home work	JICA Tokyo		Explanation Discussion	
26 Review of the #2 Field Investigation	Ditto	Japan	①Study on replacement and R&M of the power stations based on the findings from the #2 field investigation, and cost estimation. ②Individually examine the possibility of replacement or R&M of the power stations. ③ Design and make proposals for the envisaged schedule, budgetary scale, organizational structure for implementation, and environmental and social impact involved in achieving the changes, including the possibility of job-then assistance. ④Consider and propose possible technical solutions, including retrofit, that would be effective with respect to replacement or R&M of the power stations.	Analysis Study Evaluation Presentation	
27 Explanation and submission of the Final Report (Draft)	Ditto	JICA Tokyo	①Preparation of Final Report (Draft)	Explanation Discussion	
28 Explanation of the Final Report (Draft)	#3 Field Investigation	JICA India		Ditto	
29 Explanation of the Final Report (Draft)	Ditto	MOP,CEA and Target		Ditto	
30 Information collection (if necessary)	Ditto	Ditto	①Collection of additional information	Hearing Investigation	
31 Submission of the Final Report (Draft)	#3 Home work	JICA Tokyo		Explanation Discussion	
32 Submission of the Final Report	Ditto	JICA Tokyo	①Preparation of Final Report	Final report of all field investigation	

Table 1 Check list of Questionnaires (1/1)

Item	Item to be confirmed during visit to India (Reference Documents or Web Sites)	Question to	Note	Web Site	Answers Available	Preparation by MOP	Preparation by CEA	Preparation by State Elect. Utility	Preparation by P/S
TOR-1-4	1. Government Policy	-							
	1) Energy Policy	Gov.	???	???					
	2) Electric Power Policy	Gov.	National Electricity Policy	http://powermin.nic.in/whats_new/national_electricity_policy.htm					
	3) Policy on R&M/Complete Replacement	Gov.	National Electricity Plan R&M: National Perspective Plan Replacement: ???	http://cea.nic.in/reports/renov_modern/national_plan.pdf Replacement: ???					
	2. Government Policy on Climate Change	-							
	1) Climate change countermeasures, and other relevant measures (including R&M plans for coal-fired power stations; Perform, Achieve and Trade (PAT) scheme; and implementation of CDM)	Gov.	National Action Plan on Climate Change	http://www.india.gov.in/allimpfrms/afidocs/15651.doc					
	3. Overview of the power sector in India (e.g., economic standing, power demand forecasts, electrical power development plans, power system development, power supply plans, electrification of rural areas, power loss, electricity prices, supply costs, and demand characteristics)	Gov.	Monthly: Monthly Review of Power Sector Yearly: ???	http://cea.nic.in/executive_summary.html only executive summary Where is whole report? Yearly???					
4. The status of existing coal-fired power stations in India at 2011 (Name, Capacity (MW), COD, Generation (MWh), PLF)	Gov.	All India Electricity Statistics Electrical Energy Generation Review Thermal Performance review unit-wise???, COD???	http://cea.nic.in/reports/yearly/general_review_rep/0405/index.pdf only index http://cea.nic.in/reports/yearly/energy_generation_10_11.pdf http://cea.nic.in/reports/yearly/thermal_performance_review_rep/0910/highlights.pdf highlights only						
5. Supply and demand forecasts on energy source (especially coal) and related	Gov.	???	???						
6. Implementation Status and Plan for R&M/Complete Replacement Project	Gov.	R&M: Quarterly Review Report	http://cea.nic.in/archives/thermal/qrr/jul_sep11.pdf						

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Table 2 Criteria of power STATION (Unit) selection

Power Station	OBRA TPS, U.P.								
	Criteria of Selection Item	Out Put (MW)	Age (70s, 80s, 85s) Commercial Operation Year	Listed in National Prospective Plan (11th and 12th)	Plant Load Factor (%)	Status of rehabilitation and/or replacement	Potential candidates for the complete replacement study by JICA Study Team	Potential candidates for the R&M study by JICA Study Team	B/T Manufacture
Unit									
1		50	1967	Yes	38.26 *1	LE already carried out (May 2009)	NA	NA	TPE/TPE
2		50	1968	Yes	38.26 *1	LE already carried out (Mar 2010)	NA	NA	TPE/TPE
3		50	1968 already retired	-----	-----	-----	Yes	NA	-----
4		50	1969 already retired	-----	-----	-----	Yes	NA	-----
5		50	1971 already retired	-----	-----	-----	Yes	NA	-----
6		100	1973	Yes	38.26 *1	LE already carried out (Mar 2008)	NA	NA	BHEL/BHEL
7		100	1974	Yes	38.26 *1	Small R&M already carried out	Yes *2	NA	BHEL/BHEL
8		100	1975	Yes	38.26 *1	Small R&M already carried out	Yes *2	NA	BHEL/BHEL
9		200	1980	Yes	38.26 *1	BHEL has already taken over the study	NA	Yes	BHEL/BHEL (LMZ)
10		200	1979	Yes	38.26 *1	BHEL has already taken over the study	NA	Yes	BHEL/BHEL (LMZ)
11		200	1977	Yes	38.26 *1	BHEL has already taken over the study	NA	Yes	BHEL/BHEL (LMZ)
12		200	1981	Yes	38.26 *1	BHEL has already taken over the study	NA	Yes	BHEL/BHEL (LMZ)
13		200	1982	Yes	38.26 *1	BHEL has already taken over the study	NA	Yes	BHEL/BHEL (LMZ)

*1: Obra total PLF year 2010 to 2011. Each unit PLF is to be clarified *2: Clarification is required.

NA: Not Applicable

The selection criteria

a) Replacement

* The units started operation in the 1970s-80s and its capacity is around 100 MW

* The units have a low plant load factor

* The units are not carried out R&M and LE within 10 to 15 years.

b) R&M

* The units started operation in the 85s and its capacity is more than 200MW

* The units are listed in the National Prospective Plan 11th and 12th developed by CEA;

Table 2 Criteria of power STATION (Unit) selection

Power Station	Satpura TPS, MLP.							
Criteria of Selection Item	Out Put (MW)	Age (70s, 80s, 85s) Commercial Operation Year	Listed in National Prospective Plan (11th and 12th)	Annual Plant Load Factor (%)	Status of rehabilitation and/or replacement	Potential candidates for the complete replacement study by JICA Study Team	Potential candidates for the R&M study by JICA Study Team	B/T Manufacture
Unit								
1	62.5	1967	No	64.0 *1	Unknown	Yes *2	NA	B&W/GE
2	62.5	1968	No	64.0 *1	Unknown	Yes *2	NA	B&W/GE
3	62.5	1968	No	64.0 *1	Unknown	Yes *2	NA	B&W/GE
4	62.5	1968	No	64.0 *1	Unknown	Yes *2	NA	B&W/GE
5	62.5	1970	No	64.0 *1	Unknown	Yes *2	NA	B&W/GE
6	200	1979	Yes (LE 12th Plan)	64.0 *1	NTPC did some study in the past and the DPR has also been	NA	Yes	BHEL/BHEL(LMZ)
7	210	1980	Yes (LE 12th Plan)	64.0 *1	NTPC did some study in the past and the DPR has also been	NA	Yes	BHEL/BHEL(LMZ)
8	210	1983	No	64.0 *1	NTPC did some study in the past and the DPR has also been	NA	NA	BHEL/BHEL
9	210	1984	No	64.0 *1	NTPC did some study in the past and the DPR has also been	NA	NA	BHEL/BHEL

*1: Satpura total PLF till Dec. 2010. Each unit PLF is to be clarified *2: Clarification is required.

NA: Not Applicable

The selection criteria

a) Replacement

* The units started operation in the 1970s-80s and its capacity is around 100 MW

* The units have a low plant load factor

* The units are not carried out R&M and LE within 10 to 15 years.

b) R&M

* The units started operation in the 85s and its capacity is more than 200MW

* The units are listed in the National Perspective Plan 11th and 12th developed by CEA;

Table 2 Criteria of power STATION (Unit) selection

Power Station	Khaperkheda TPS, Maharashtra							
Criteria of Selection Item	Out Put (MW)	Age (70s, 80s, 85s) Commercial Operation Year	Listed in National Prospective Plan (11th and 12th)	Annual Plant Load Factor (%)	Status of rehabilitation and/or replacement	Potential candidates for the complete replacement study by JICA Study Team	Potential candidates for the R&M study by JICA Study Team	B/T Manufacture
Unit								
1	210	1989	No	76.89 *1				
2	210	1990	No	76.89 *1	Unkown	NA	NA	BHEL/BHEL(KWU)
3	210	2000	No	76.89 *1	Unkown	NA	NA	BHEL/BHEL(KWU)
4	210	2001	No	76.89 *1	Unkown	NA	NA	BHEL/BHEL(KWU)

*1: The Station PLF for the year 2010 is 76.89 %

NA: Not Applicable

The selection criteria

a) Replacement

* The units started operation in the 1970s-80s and its capacity is around 100 MW

* The units have a low plant load factor

* The units are not carried out R&M and LE within 10 to 15 years.

b) R&M

* The units started operation in the 85s and its capacity is more than 200MW

* The units are listed in the National Perspective Plan 11th and 12th developed by CEA;

INVESTIGATION SHEET

Table 3-1

POWER STATION NAME :
SHUT DOWN BY TROUBLE FROM 2006 TO 2010

No.	DATE	SHUT DOWN PERIOD (HR)		EQUIPMENT	REASON/COUNTER MEASURE
	D/M/Y	UNIT SHUT DOWN	PARTIAL SHUT DOWN		

INVESTIGATION SHEET

Table 3-2

POWER STATION NAME :

PAST R&M and LE

NO.	UNIT	R&M/LE	DATE D/M/Y	SHUT DOWN PERIOD (HR) FOR R&M, LE	SYSTEM/EQUIPMENT CONTENT OF MODIFICATION	REASON	RESULT	COST (RP)

INVESTIGATION SHEET

Table 3-3

POWER STATION NAME :
PLAN R&M and LE

NO.	UNIT	R&M/LE	DATE D/M/Y	R&M, LE REASON	SYSTEM/EQUIPME NT CONTENT OF MODIFICATION	REQUIRED SHUT DOWN PERIOD (HR) FOR R&M, LE	BUDGET (RP)	IS ORDER PLACED WITH MANUFACTU RE

INVESTIGATION SHEET

Table 3-4

POWER STATION NAME :

EQUIPMENT LIST WITH TOP 5 OF MAINTENANCE COST FROM 2006 TO 2010

No.	YEAR	EQUIPMENT	MAINTENANCE COST (RP)	REASON
1	2006-2007			
2				
3				
4				
5				
1	2007-2008			
2				
3				
4				
5				
1	2008-2009			
2				
3				
4				
5				
1	2009-2010			
2				
3				
4				
5				

INVESTIGATION SHEET

Table 3-5

POWER STATION NAME :

MAJOR PROBLEM AT PRESENT

NO.	UNIT	BOILER	TURBINE	OTHERS

INVESTIGATION SHEET

Table 3-6

POWER STATION NAME :

Coal Analysis Data

			Design	Present-1	Present-2	Present-3	Present-4
1	Inherent moisture (AD)	%					
2	Volatile (AD)	%					
3	Fixed carbon (AD)	%					
4	Ash (AD)	%					
5	Total	%					
6	HHV	kJ/kg					
7	Fuel ratio						
8	Surface water	%					
9	C	%					
10	H	%					
11	S	%					
12	N	%					
13	O	%					
14	H ₂ O	%					
15	Ash	%					
16	Total	%					
	AD: Air dry						
	Ash fusion, reducing						
17	IT	°C					
18	ST	°C					
19	HT	°C					
20	FT	°C					
	Ash fusion, oxidizing						
21	IT	°C					
22	ST	°C					
23	HT	°C					
24	FT	°C					
	Ash mineral analysis						
25	SiO ₂	%					
26	Al ₂ O ₃	%					
27	Fe ₂ O ₃	%					
28	CaO	%					
29	MgO	%					
30	Na ₂ O	%					
31	K ₂ O	%					
32	TiO ₂	%					
33	MnO	%					
34	SO ₃	%					
35	P ₂ O ₅	%					

INVESTIGATION SHEET

POWER STATION NAME :
GENERAL

Table 3-7

ITEM	UNIT1	UNIT2	UNIT3	UNIT4	UNIT5	UNIT6	UNIT7	UNIT8	UNIT9	UNIT10	UNIT11	UNIT12	UNIT13
100%Load Output (MW)													
Commercial Operation Date (COD)													
Boiler Manufacture													
Turbine Manufacture													
Cumulative Operation Hours (hrs) COD to end of 2011													
Generated Ash Volume per year (ton)													
Consumption of industrial water per year (ton)													
Emission actual/regulation													
Dust (mg/nm3)													
SOx (ppm)													
NOx (ppm)													

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INVESTIGATION SHEET

Table 3-8

POWER STATION NAME :

AVAILABILITY OF DRAWINGS, DOCUMENTS AND INFORMATION

NO.	TITLE	AVAILABILITY YES/NO	REMARKS
1	SPECIFICATION & DRAWING OF BOILER		OUTLINE DWG SECTIONAL DWG
2	SPECIFICATION & DRAWING OF TURBINE		OUTLINE DWG SECTIONAL DWG
3	SPECIFICATION & DRAWING OF GENERATOR		OUTLINE DWG SECTIONAL DWG
4	LAYOUT DRAWING (PLOT PLAN, GENERAL ARRANGEMENT)		including available site area
5	FLOW DIAGRAM (MAIN FLOW (STEAM/WATER, FUEL, AIR AND FLUE GAS))		
6	ELECTRICAL SINGLE LINE DRAWING		
7	PERFORMANCE TEST REPORT (BOILER, TURBINE)		AT TAKING OVER AFTER TAKING OVER INCLUDING UNBURNED CARBON IN FLY ASH
8	PERFORMANCE TEST PROCEDURE (BOILER, TURBINE)		
9	HEAT BALANCE DIAGRAM		100% LOAD
10	REMAINING LIFE ASSESSMENT REPORT (SUMMARY) FOR BOILER, TURBINE		
11	TECHNICAL ASSESSMENT REPORT OR DPR FOR R&M, LE, REPLACEMENT		
12	EMISSION REGULATION		NOx, SOx, DUST
13	WASTE WATER REGULATION		flow, quality
14	COAL RECEIVING CAPACITY (t/day)		
15	RAW WATER RECEIVING FLOW (t/h)		
16	TRANSMISSION LINE CAPACITY (MW)		
17	ASH POND VOLUME (m ³)		Remaining Volume
18	OPERATION AND MAINTENANCE MANUAL		including spare part management

INVESTIGATION SHEET

POWER STATION NAME :

OPERATION HOURS AND PLF

Table 3-9

YEARLY OPERATION HOURS (JAN.1 TO DEC.31)

YEAR	UNIT1	UNIT2	UNIT3	UNIT4	UNIT5	UNIT6	UNIT7	UNIT8	UNIT9	UNIT10	UNIT11	UNIT12	UNIT13
2006													
2007													
2008													
2009													
2010													

PLF(%)

YEAR	UNIT1	UNIT2	UNIT3	UNIT4	UNIT5	UNIT6	UNIT7	UNIT8	UNIT9	UNIT10	UNIT11	UNIT12	UNIT13
2006													
2007													
2008													
2009													
2010													

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$$PLF(\%) = \frac{\text{Power Generation per year (MWh)}}{\text{Rated Output (MW)} \times 24(\text{h}) \times 365(\text{d})} \times 100$$

INVESTIGATION SHEET

POWER STATION NAME :
EFFICIENCY

Table 3-10

Boiler efficiency (% - HHV basis)

YEAR	UNIT1	UNIT2	UNIT3	UNIT4	UNIT5	UNIT6	UNIT7	UNIT8	UNIT9	UNIT10	UNIT11	UNIT12	UNIT13
Design													
PG test													
2006													
2007													
2008													
2009													
2010													

Turbine heat rate (kJ/kWh)

YEAR	UNIT1	UNIT2	UNIT3	UNIT4	UNIT5	UNIT6	UNIT7	UNIT8	UNIT9	UNIT10	UNIT11	UNIT12	UNIT13
Design													
PG test													
2006													
2007													
2008													
2009													
2010													

4. Work Schedule

4.1 Work Schedule

Work Schedule: Study on Renovation & Modernization/Complete Replacement of Old Coal based Thermal Power Stations in India

Work Items	2012							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
	1	2	3	4	5	6	7	8
Work Phases	Field Work-Phase 1		Field Work-Phase 2		Field Work-Phase 3			
	Preparation at Home Base	Home Base Work -Phase 1		Home Base Work -Phase 2	Home Base Work -Phase 3			
Reports	△ ICR	△ Interim Report			△ DfR			
Meetings with MOP, CEA, and state electricity board (state Electricity corporation)	▲		▽ ICR (Final)	▲		▽ Final Report		
1 Survey of Indian power policy, climate change countermeasures, related measures, overall status of state power sector, etc.	▬	▬						
2 Survey of overall status of power sector in India and the target state	▬	▬						
5 Preparation of inception report (draft)	▬	▬						
6 Consultation regarding selection of target power stations (JICA)	▬	▬						
7 Briefing on inception report and formation of counterpart team	▬	▬						
8 Preparation of survey and data list, and request made for their submission	▬	▬						
9 Interim report, examination of collected materials and data, and submission of inception report		▬						
10 Information collected at target power stations			▬					
11 Consideration of items for replacement or renovation/upgrade				▬	▬			
12 Cost estimation and schedule design for items requiring replacement or renovation/modernization				▬	▬			
13 Draft final report preparation and briefing				▬	▬			
14 Final report preparation and submission					▬			

Fig. 4.1-1 Work Schedule

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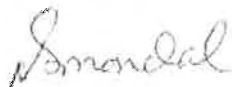
Attachment-8 Minutes of Meeting: Field Work Phase-2

The Study
on
Renovation and Modernization / Complete Replacement of Old
Coal based Thermal Power Stations in India

Minutes of Meeting
of
Field Work Phase 2

JICA, JICA Study Team and
CEA

DATE : 4th April 2012 from 11:30 to 13:00
VENUE : CEA Office Meeting Room in Delhi



Mr. N. S. Mondal
Director
CEA
India



Mr. Nonyuki Shimizu
Leader
JICA Study Team
Japan

The meeting proceeded with explanation by JICA-ST of the Summary of Investigation for Complete Replacement and Renovation & Modernization by referring the attached sheets.

1. Discussion

JICA-ST informed to CEA the result of Field Work Phase 2 including the actual work schedule. The contents of discussion are as follows;

1) General

According to Field Work Phase 2 for Parli unit #3 - #5, Bhusawal unit #2 and #3, Satpura unit#1 - #5 and Obra unit#1 - #8, JICA-ST confirmed that two State Utilities namely UPPGCL and MPPGCL had already made DPR for a new project at Obra TPS and Satpura TPS respectively and one State Utility i.e. MSPGCL is now preparing DPR for a new project at Bhusawal TPS. In order to actualize JICA Yen Loan projects faster, JICA-ST proposed that Parli TPS (MSPGCL) shall be moved out of the scope of complete replacement study due to non preparation of DPR and be changed only to the scope of R&M study.

CEA agreed to and accepted the above proposal of JICA-ST.

2) Bhusawal Power Station (#2 and #3)

MSPGCL formerly had a plan for replacement of already-retired unit #1 with a new 660MW unit. However, they changed their plan and are reconsidering to construct a new 660MW unit near the existing power station because existing area of unit #1 is not enough for a 660MW unit.

Instead of the above MSPGCL's plan, JICA-ST proposed an alternative plan to MSPGCL where replacement could be considered in the place of existing unit #1 - #3 area after demolition of #1 to #3 units subsequent to retirement of units #2 and #3.

CEA pointed out that due scarcity of land it is difficult to acquire new lands in India, therefore CEA requested JICA-ST to conduct a cost-comparative evaluation between land acquisition case (new land) and existing plant demolition case (utilization of existing land).

JICA-ST replied that the cost comparison would be considered in the Study.

3) Satpura Power Station (#1 - #5)

It was informed that MPPGCL has already taken a decision that units #1 - #5 would be retired and demolished after completion of units #11 and #12 which are now under construction. JICA-ST reported to CEA that they would study for construction of new plant after demolishing the existing plant since it was a typical case for replacement.

CEA mentioned that it seemed the most appropriate case for complete replacement in the Study, therefore CEA requested JICA-ST to proceed with further step.

4) Obra Power Station (#1 - #8)

R&M for units #1 and #2 were already completed 3 years ago and another 12 year operation is expected. In addition, R&M for unit #7 is going on and another 4-5 year operation is expected after completion of its R&M work.

Considering above situation, UPPGCL expressed their intention that existing units of Obra A (#1 to #8) would be retired one after another depending on their remaining lives in order to avoid reduced output during replacement and to maximize the remaining values after completion of Obra C (660MWx2) project which was on going at new area near existing Obra A and B.

CEA responded initially that the said project though was a kind of green field project, considering existing land utilisation and utilization of other resources of existing power station such as coal supply, ash pond and water supply etc, Obra C project might not be a fully green field project but be applicable to this Study.

CEA finally agreed to consider Obra C project as the project for this Study.

5) Parli Power Station (#3 - #5)

JICA-ST explained that the RLA study for Parli unit #3 (Generator, Turbine and BOP) was conducted by an Indian consultant and the report would be submitted by May 2012.

In accordance with this report, Parli Power Station will select implementation items of R&M and apply those to units #4 and #5 after demonstration at unit #3.

CEA requested JICA-ST to make their own study for R&M of these units and make some suggestion.

JICA-ST explained that their present study should be finished by the end of May 2012 based on the contract with JICA therefore it was difficult to review the RLA report in this scope of work. Instead, JICA-ST suggested that the Study report could mention the results observed by Field Work Phase 2 and the next steps to be taken for future.

CEA agreed to their proposal, also requested to JICA to consider inclusion of study for R&M works for Parli Power Station either by another contract or amendment of the current contract with JICA.

The meeting ended with vote of thanks.

Attachment-1 Complete Replacement Summary of Investigation
Attachment-2 R&M Summary of Investigation

ATTENDED BY

CEA	Mr. T P Singh, Chief Engineer (TRM Divn.), Mr. N S Mondal, Director
JICA India Office	Ms. K. Ohnuma, Representative Ms. S. Khanna, Senior Development Specialist
JICA Study Team	Mr. N. Shimizu Mr. M. Miyagi Mr. N. Koizumi Mr. M. Tanimoto Mr. K. Gima Mr. K. Meguro

Attachment-1 Complete Replacement Summary of Investigation

Complete Replacement Summary of Investigation

	MSPGCL				MPPGCL				UPRVUNL			
	Parli #3, #4, #5		Bhusawal #2, #3		Satpura #1 to #5				Obra #1 to #8			
FINDINGS												
1. Start of operation (COD)	#3: 1980		#2: 1979		#1: 1967				#1: 1967			
	#4: 1985		#3: 1982		#2: 1968				#2: 1968			
	#5: 1987				#3: 1968				#3: (1968) [already retired]			
					#4: 1968				#4: (1969) [already retired]			
					#5: 1970				#5: (1971) [already retired]			
									#6: (1973) [already retired]			
									#7: 1974 [under renovation]			
									#8: (1975) [already retired]			
2. Rated output	#3: 210MW		#2: 210MW		#1: 62.5MW				#1: 50MW			
	#4: 210MW		#3: 210MW		#2: 62.5MW				#2: 50MW			
	#5: 210MW		Total: 420MW		#3: 62.5MW				#3: (50MW) [already retired]			
	Total: 530MW				#4: 62.5MW				#4: (50MW) [already retired]			
					#5: 62.5MW				#5: (50MW) [already retired]			
					Total: 312.5MW				#6: (100MW) [already retired]			
									#7: 100MW [under renovation]			
									#8: (100MW) [already retired]			
								Total: 200MW (350MW)				
3. Annual generation (MU) 2009 & 2010	2009		2010		2009		2010		2009		2010	
	#3: 210MW		#2: 210MW		#1: 62.5MW				#1: 50MW			
	#4: 210MW		#3: 210MW		#2: 62.5MW				#2: 50MW			
	#5: 210MW				1798.4		1761.1		#6: 100MW		1361.3 1243.7	
					#4: 62.5MW				#7: 100MW			
4. PLF 2009 & 2010	2009		2010		2009		2010		2009		2010	
	#3: 210MW		62.81 54.06		#2: 210MW		73.53 65.73		#1: 62.5MW		63.70 66.57	
	#4: 210MW		64.71 60.68		#3: 210MW		72.88 81.95		#2: 62.5MW		65.08 60.39	
	#5: 210MW		69.63 54.06						#3: 62.5MW		67.46 64.92	
									#4: 62.5MW		65.45 65.45	
5. Plant efficiency (Gross %)	2009		2010		2009		2010		2009		2010	
	#3: 210MW		31.25 31.88		#2: 210MW		28.69 30.41		#1: 62.5MW		25.55 24.50	
	#4: 210MW		31.27 32.01		#3: 210MW		28.88 30.52		#2: 62.5MW		24.18 24.45	
	#5: 210MW		30.73 30.36						#3: 62.5MW		23.38 23.87	
									#4: 62.5MW		23.01 24.66	
6. Site area	2009		2010		2009		2010		2009		2010	
	#3: 210MW		31.25 31.88		#2: 210MW		28.69 30.41		#1: 62.5MW		25.55 24.50	
	#4: 210MW		31.27 32.01		#3: 210MW		28.88 30.52		#2: 62.5MW		24.18 24.45	
	#5: 210MW		30.73 30.36						#3: 62.5MW		23.38 23.87	
									#4: 62.5MW		23.01 24.66	
7. Coal transportation	2009		2010		2009		2010		2009		2010	
	#3: 210MW		31.25 31.88		#2: 210MW		28.69 30.41		#1: 62.5MW		25.55 24.50	
	#4: 210MW		31.27 32.01		#3: 210MW		28.88 30.52		#2: 62.5MW		24.18 24.45	
	#5: 210MW		30.73 30.36						#3: 62.5MW		23.38 23.87	
									#4: 62.5MW		23.01 24.66	
8. Ash disposal pond	2009		2010		2009		2010		2009		2010	
	#3: 210MW		31.25 31.88		#2: 210MW		28.69 30.41		#1: 62.5MW		25.55 24.50	
	#4: 210MW		31.27 32.01		#3: 210MW		28.88 30.52		#2: 62.5MW		24.18 24.45	
	#5: 210MW		30.73 30.36						#3: 62.5MW		23.38 23.87	
									#4: 62.5MW		23.01 24.66	
6. Site area	Plant site consists of #3 to #5 and retired #1 and #2, and there is a common turbine building for #3 to #5. #1 and #2 will be demolished soon. Coal storage area is located backward of the stacks of #3, #4 and #5. Switch yard area belongs to transmission company MSETCL. There is not enough vacant area for a new unit inside Parli TPS unless the existing site is utilized.											
	Plant site consists of #2, #3 and retired #1, and there is a common turbine building for #2 and #3. #1 will be demolished soon. Coal storage area is located backward of the stacks of #2 and #3. Switch yard area belongs to transmission company MSETCL. There is not enough vacant area for a new unit inside Bhusawal TPS unless the existing site is utilized.											
	Plant site consists of PH1(#1 to #5), PH2(#6, #7) and PH3 (#8, #9). Coal storage area is located approx. 1 km western from power station. There is not enough vacant area for a new unit inside Satpura TPS unless the existing site is utilized.											
	Plant site consists of Obra A (#1 to #8) and Obra B (#9 to #13), and there is a common turbine building for Obra A and B. Obra A coal storage area is located south east of Obra A stacks, and mutual back-up between Obra A and B is possible. Coal transporting rail way runs along south east boundary of coal storage area. There is not enough vacant space for new unit(s) inside Obra A and B station unless existing sites for Obra A and B are utilized.											
	Coal is transported by rail way, and coal receiving capacity is 10,800 t/d. Coal consumption in 2010 was 4.7 mil t/y.											
7. Coal transportation	Coal is transported by rail way, and coal receiving capacity is 10,000 t/d. Coal consumption in 2010 was 2.3 mil t/y.											
	For PH1, coal is transported from coal mine directly by conveyer and by truck. Coal consumption in 2010 was approx. 177,000 t. Max. coal receiving capacity for PH1 is 12,000t/d.											
	Coal is transported by rail way, and coal receiving capacity is approx. 5,000,000 t/y. (Obra A & Obra B)											
	Ash disposal area is 445 ha to receive ash from #3 to #8. Monitoring of the decanted water quality, water recycle system and protection sheet to prevent penetration to underground are yet to be confirmed.											
	Ash disposal area is 200 ha to receive ash form #2 and #3. It is estimated that the ash pond will be reclaimed by 2014 by disposed ash from #4, #5 and #6. Therefore, 5 year extension of life is planned by raising the height of ash pond bank. Analysis of PH and turbidity of decanted water is carried out every day and reported by monthly average. A part of effluent for the ash pond is utilized for agricultural use. There is no protection sheet to prevent penetration to underground.											
8. Ash disposal pond	The existing ash disposal area for PH1, 2 and 3 is 372 ha. Analysis of PH and turbidity of decanted water is carried out every day and reported by monthly average. A part of decanted water is recycled for ash treatment water. There is no protection sheet to prevent penetration to underground. Two new ash disposal areas are under construction, one is 111ha for PH1, 2, 3 and new 660MWx1, the other is 130ha for PH4 (250MWx2). It is designed that HDPE (high density polyethylene) is laid down at the bottom to protect water penetration to underground. AWRS (ash water recycle system) is also planned to recycle the decanted water for ash treatment system.											
	Ash disposal area, approx. 75 ha, is located natural hollows area, and its natural geography minimizes artificial bank. From Obra A and B, bottom ash water slurry is discharged to this area. In future, when remaining disposal capacity closes to the end, it is planed to increase height of bank, and then the area will have 25 to 30 years capacity. (Obra A and B). Currently, AWRS (Ash water recycle System) is under construction, in order to recycle decanted water for ash treatment system, and is scheduled to be completed in coming 6 months. Decanted water is now discharged to adjacent river without treatment, but analysis of oil, PH, turbidity is carried out once a month. There is no protection sheet to prevent penetration to underground.											

	MSPGCL		MPPGCL	UPRVUNL
	Parli #3, #4, #5	Bhusawal #2, #3	Satpura #1 to #5	Obra #1 to #8
9. Cooling water	Make up water for cooling tower is taken from 2 sources, one is Paithan dam which locates 9km away from the station, and the other is Majgaon dam neighboring the station.	Make up water for cooling tower is taken from neighboring Tapi reservoir.	Cooling water for condenser is taken from neighboring Satpura reservoir and discharged to the reservoir. (one through). Same system is applied for PH2 and PH3. Natural draft cooling tower is applied for PH4.	Condenser cooling water is taken from neighboring Obra reservoir, and discharged again to the reservoir. (one through) Same system as Obra B.
10. Waste water	Waste water from the station is discharged to Effluent Treatment Plant and is transferred for Ash Handling Slurry Pit for recycle to slurry water.	Waste water from the station is discharged to Effluent Treatment Plant and is transferred for Ash Handling Slurry Pit for recycle to slurry water.	Waste water from the station is discharged to neutralization plant to keep PH between 6.5 and 8.2, transferred to slurry pit and utilized as ash slurry water.	Waste water from the station is discharged to adjacent river without treatment. Now effluent treatment plant is under construction, and is scheduled to be completed in coming 6 months.
11. Transmission line	The switch yard including transmission line belongs to MSETCL. Transmission voltage for #3 to #5 is 220kV.	The switch yard including transmission line belongs to MSETCL. Transmission voltage for #2 and #3 is 132kV.	The switch yard belongs to MPPGCL. Transmission voltage for #1 to #5 is 220kV.	The switch yard belongs to UPRVUNL. Transmission voltage for Obra A is 220kV and Obra B 400kV.
12. Access to site (Transpiration of heavy cargo)	They have experience to transport heavy equipment for 250MW class power plant which is now under construction.	They have experience to transport heavy equipment for 500MW class power plant which is now under construction.	They have experience to transport heavy equipment for 210MW class power plant. Now heavy equipment for PH4 (250MWx2), which is under construction adjacent to PH3, is carried into the site.	They have experience to transport heavy equipment for 200MW class power plant to Obra. By Varanasi - Shaktinagar road, there are experiences of transportation of heavy equipment for 500MW-800MW class power plant.
13. Extension plan by State Utilities	A 250MW unit is under construction 2km far from the station.	A new 660MW unit is planned next to the area for #5 which is now under construction. DPR is now under preparation.	PH4 (250MWx2) is under construction in the area adjacent to PH3. A new 660MW unit is planned by replacement of PH1. Draft DPR was prepared.	There is acquired land for 660MWx2 Obra C near Obra A & B, DPR was already prepared, EIA report is scheduled to be approved in coming 6 months. The leveling of land is partially being carried out.
14. Emission regulation	Stack outlet Dust : Existing (#3 to #5): 100 mg/Nm3 Existing (#6, #7): 70 mg/Nm3 new 250MWx1: 70mg/Nm3 SO2 : 80 t/d (MS State regulation) NOx : 50mg/Nm3 (MS State regulation)	Stack outlet Dust : Existing: 150 mg/Nm3 new 500MWx2: 50 mg/Nm3 SO2 : 80 t/d (MS State regulation) NOx : 50mg/Nm3 (MS State regulation)	Stack outlet Dust : Existing: 150 mg/Nm3 new 250MWx2: 50 mg/Nm3 new 660MWx1: 50 mg/Nm3 SO2 : no regulation NOx : no regulation	Stack outlet Dust : Existing : 150 mg/Nm3 SO2 : no regulation NOx : no regulation
15. Operation and Maintenance				
O&M organization chart	Received from power station	Received from power station	Received from power station	Received from power station
Operation shift	5 groups / 3 shifts	5 groups / 3 shifts	4 groups / 3 shifts	4 groups / 3 shifts
Operation manual	Confirmed operation manuals. Operation manual for Boiler tube leakage was requested to submit for reference.	yet to be confirmed	As for operation manual, they prepared manuals only for unit start-up (cold and hot) for themselves. As for the other operation and maintenance manuals, OEM manuals prepared by OEM are utilized.	Confirmed operation manual. Maintenance manual is yet to be confirmed.
Spare parts management	managed by ERP system	managed by ERP system	Manually recorded.	Management procedure is yet to be confirmed.
16. ISO certificate				
ISO9001	Acquired	Acquired	Not acquired.	Not acquired.
ISO14000	Acquired	Acquired	Not acquired.	Not acquired.
Occupational Safety/Health	yet to be confirmed.	yet to be confirmed.	yet to be confirmed.	yet to be confirmed.
17. Remarks		Dust dispersion from PH1 and PH2 affects health of surrounding residents.		
Preliminary Evaluation				

	MSPGCL		MPPGCL	UPRVUNL
	Parli #3, #4, #5	Bhusawal #2, #3	Satpura #1 to #5	Obra #1 to #8
1. Replacement scenario to be studied	<ul style="list-style-type: none"> After retirement of #3 to #5, demolish #1 to #5 and construct a new 660MW in the same area. (same as MSPGCL's plan) 	<ul style="list-style-type: none"> After retirement of #2 and #3, demolish #1 to #3 and construct a new 660MW in the same area. (same as MSPGCL's plan) 	<ul style="list-style-type: none"> After start of commercial operation of PH4 (250MWx2), #1to #5 will be retired and all facilities are planned to be dismantled. After dismantling, a new 660MW will be constructed in the same area. (same plan as MPPGCL's DPR) 	<ul style="list-style-type: none"> AS for #1 & #2, major R&M was carried out in 2009, and life was extended by approx. 15 years. #7 is renovated now and expected to continue operation for 5 years. Taking power demand and residual value of renovated units into consideration, Obra power station considers that it is not acceptable to shut down and replace Obra A. The space of retired #3 to #6, even after dismantling, is not enough for a new 660 MW unit, since required length can not get. Accordingly, new units should be constructed at Obra C site area, and after that Obra A will be retired accordingly. <p>Finally JICA-ST decided to study the scenario to construct new unit(s) with 660MW each at the new site C, 2km far from Obra A and B.</p>
2. Barrier for replacement				
(1) Land	Areas for #1 to #5 will be utilized after demolish.	Areas for #1 to #3 will be utilized after dismantling together with demolish of switch yard.	Areas for PH1 and 220kV switch yard will be utilized after dismantling. It is necessary to modify cooling water piping/culvert for PH2 and PH3. There is no space for the second 660MW unit in the same site.	<ul style="list-style-type: none"> Required land for Obra C : 660MWx2 was already acquired. The land leveling is partially carried out.
(2) Coal Commitment	Coal linkage for the existing #3 to #5 will be utilized for the new 660MW. The additional coal requirement to cope with increased generation output shall be secured.	<ul style="list-style-type: none"> Capacity up of existing facility is required to cope with increased generation output. Confirmation of rail way transportation capacity is necessary. 	<ul style="list-style-type: none"> Since coal receiving system is newly installed, if receiving amount is increased, there will be no problem. But, confirmation of rail way transportation capacity is necessary. Draft DPR states necessity of coal allocation by Coal India for a new 660MW unit. 	<ul style="list-style-type: none"> Since coal receiving system is newly installed, if receiving amount is increased, there will be no problem. But, confirmation of rail way transportation capacity is necessary. According to DPR of Obra C, coal supply contract with a coal mine in Orissa is agreed for some amount of coal, but it is necessary to arrange balance of coal supply.
(3) Water Commitment	It is necessary to increase the water from Paithan dam and Majgaon dam to cope with increased generation output.	It is necessary to increase the water from Tapi reservoir to cope with increased generation output.	According to draft DPR, it is necessary to get allocation of approx. 1,800 t/h water from Satpura reservoir.	According to DPR of Obra C, expected water consumption of 20,000 t/h is taken from cooling water discharge line from Obra A & B. Therefore, there is no additional water is taken from Obra reservoir.
(4) Capacity of transmission line	Study of extension of 400kV switch yard and transmission line is necessary.	Study of extension of 400kV switch yard and transmission line is necessary.	Study of extension of 400kV switch yard and transmission line is necessary.	Generation power from Obra C is planned to be transmitted by new 400kV line(s).
(5) Ash disposal	Since ash disposal area will be common use for existing units, it is necessary to study remaining volume.	Since ash disposal area will be common use for existing units, it is necessary to study remaining volume. (There is no underground penetration protection sheet.)	New ash disposal area (common for PH1, PH2 and PH3 with area of 111ha) will be used. (It is planned to be laid down underground penetration protection sheet)	Since ash disposal area will be common use for existing Obra A & B, it is necessary to study remaining volume. (There is no underground penetration protection sheet.)
(6) Approval by authorities				
NOC from Airport authority of India (AAI)	yet to be confirmed	yet to be confirmed	Preparation for application of approval.	<ul style="list-style-type: none"> Approval acquired for Obra C
Consent Letter from State Government	yet to be confirmed	yet to be confirmed	Preparation for application of approval.	<ul style="list-style-type: none"> Approval acquired for Obra C
Environmental Clearance	yet to be confirmed	yet to be confirmed	Preparation for application of approval.	<ul style="list-style-type: none"> Approval for EIA is planned to acquire in coming 6 months.
2 . Fuel reduction due to improved generation efficiency (ton of oil equivalent)	To be prepared later	To be prepared later	To be prepared later	To be prepared later
3 . Increased electricity supply due to reduction of forced shut down (MWh)	To be prepared later	To be prepared later	To be prepared later	To be prepared later
4 . Financial/Economic Evaluation	To be prepared later	To be prepared later	To be prepared later	To be prepared later

	MSPGCL		MPPGCL	UPRVUNL
	Parli #3, #4, #5	Bhusawal #2, #3	Satpura #1 to #5	Obra #1 to #8
5 . Eagerness of State Utilities for actualization of JICA Yen Loan replacement project	Chief Engineer, HQs did not give specific comments to JICA project, but Chief Engineer, Bhusawal TPS was positive.	Chief Engineer, HQs did not give specific comments to JICA project, but Chief Engineer, Bhusawal TPS was positive through discussion on low interest rate and preferential condition of Japanese ODA loan.	Draft DPR for replacement of PH1 was already prepared and preparation for approval procedure is proceeding. Managing Director did not give specific comment to JICA project, but station general manager was positive.	DPR of Obra C was already prepared by NTPC, various approval of authorities were acquired, and necessary actions to implement the project are proceeding. Financial director is highly appreciating high reliability of Anpara B, which was supplied by Japanese manufacturers, and also appreciating low interest rate and preferential condition of Japanese ODA loan, and expecting implementation of the project by Japanese ODA loan.

Attachment-2 R&M Summary of Investigation

Renovation & Modernization Summary of Investigation

		MSPGCL
		Parli #3, #4, #5
FINDINGS		
1. Start of operation (COD)	#3: 1980	210MW
Rated output	#4: 1985	210MW
	#5: 1987	210MW
3. Status of O&M, past incident/trouble		
Past major incidents/troubles	1) Boiler tube leakage (W/W) 2) Reheater tube leakage 3) Eco tube leakage 4) LTSH tube leakage 5) H2 leakage (Generator) 6) Turbine bearing 6 vibration high 7) PA fan 3A motor bearing replaced 8) Coal nozzle assembly C3,D3 & D4 replaced 9) HRH tube leakage 10) Drum safety valve repair work 11) MOP bearing replacement & float adjustment work carried out 12) Generator casing H2 gasket leakage 13) Furnace pressure very high (by wet coal) 14) Flash over occurred at 6.6 KV breaker of ID Fan	
4 Past major R&M items	1) Renovation of Fly Ash Handling System (#3) 2) Air heater seal modification (#3) 3) Replacement of SH&RH spray control valve (#3,#4,#5) 4) Replacement of 6.6 kV MOCBs by VCBs (#3,#4) 5) Installation of pneumatically type of CMRHS (#3,#4) 6) Retrofitting of MOCBs by VCBs (#3,#4,#5) 7) Replacement of cold air gates & dampers and hot air dampers (#3,#4,#5) 8) Upgradation of C&I system (#3) 9) Installation of microprocessor based controller system (#4,#5)	
5. R&M plan	Investigation of #3 for Boiler RLA, Turbine Generator RLA and BOP RLA was carried out by the external consultants in February 2012. The report, which is to be submitted to the power station May 2012 (expected), will be reviewed by station engineers about R&M items for #3 in order to and plan the implementation schedule. In the Phase 2 field work, JICA ST was not able to obtain this report from the station, however the following major R&M items were identified through interviews. 1) BFP replacement 2) CWP (# 3) system modification 3) Air compressor replacement 4) Mill replacement 5) IDF/PAF replacement 6) ESP (# 3) replacement	
Preliminary Evaluation		
1. Necessity of R&M		
(1) Aging of equipment	Cumulative Operation hours from COD to end of 2011 of #3,#4 and #5 are as follows. #3: approx. 190,000 #4: approx. 176,000 #5: approx. 164,000 The plant efficiency/reliability is decreasing due to the aging of equipment.	
(2) Domestic coal quality degradation	Design coal calorific value is 5,000-4,445kcal/kg, however actual value of supplied coal is 3400-3500kcal/kg due to domestic coal quality degradation. It results in increase of number of mill operation from 5 to 6 (maximum) in order to generate electricity at the rated output. In addition, mill body casing thickness is decreasing by wear and tear which causes pulverized coal leakage from mill casing. As for ash contents, design value is 26.7%, however actual ash contents of supplied coal is approx. 40%. It causes boiler tube leakage, insufficient capability of ESP and ash handling system.	
2. Assumed R&M items	Assumed R&M items are as follows. • Turbine replacement • Mill replacement • ESP replacement	

Attachment-9 Minutes of Meeting: Field Work Phase-3


Attachment-9 Minutes of Meeting: Field Work Phase-3

The Study
on
Renovation and Modernization / Complete Replacement of Old
Coal based Thermal Power Stations in India

Minutes of Meeting
of
Field Work Phase 3

JICA, JICA Study Team and
CEA

DATE : 10th May 2012 from 15:30 to 16:30
VENUE : JICA India Office Meeting Room in Delhi



Mr. T.P. Singh
Chief Engineer
CEA
India



Mr. Noriyuki Shimizu
Leader
JICA Study Team
Japan

1. Purpose

Explanation by JICA-ST of the comments obtained from the relevant state electric utilities regarding Draft Final Report (DPR) and discussion of the policies to reflect those comments to DPR.

2. Discussion

JICA explained that JICA-ST had prepared DPR, explained it to the relevant state electric utilities and collected their comments. Those comments and DPR itself will be discussed in this meeting. Since MoP can not attend the meeting, the result of the discussion will be reported to them by JICA.

JICA-ST explained that they had identified and classified importance of the comments by coloring their boxes in the Attachment. JICA-ST skipped the non colored comments which mean simple correction and only explained the colored comments for discussion as follows;

R&M for Parli: (JICA-ST) The RLA report will be submitted at the end of May 2012 by MSPGCL's consultant (ENERGO). MSPGCL agreed to hand the report to JICA-ST as soon as they receive it. However, because the termination of the contract between JICA and JICA-ST is end of May 2012, JICA HQs and JICA-ST are going to discuss the possibility of implementation of the review work of RLA report including extension of the contract.

Item 12: (CEA) Regarding the heat rate enhancement by R&M, it is presumed that an improvement of "5%" evaluated by JICA-ST is in a reasonable range and a heat rate of "2,395 kcal/kWh" commented by MSPGCL is such that it is applicable for a new power station. CEA agrees and follows JICA-ST's comment.

Item18: (JICA-ST) A state utility commented that the word "effluent" had an image of non treated water. Because the exceeded water from ash pond is usually discharged as clear fluid after sedimentation, we will replace the word "effluent" wherever used in DPR with "ash water".

Item20: (JICA-ST) As a countermeasure for exceeding SPM emission beyond the regulation, the state utility commented that the specific measure had been and would be implemented respectively for ESPs of Units 3 and 2 to improve

efficiency of dust collection. We will mention it in DPR.

Item23: (JICA-ST) We received a good comment from Bhusawal Power station that in case of complete replacement, the auxiliary power consumption could be also reduced compared to the previous value. Therefore we will mention the effect wherever applicable in DPR.

Item35: (JICA-ST) We understand that preventing penetration of ash water by using clay layer on the bottom of ash pond is technically feasible.

Item38: (CEA, JICA) Although coal linkage is crucial matter, there will be no problem if UPRVUNL secures their own coal mines to supply coal to the new Obra C project.

Item41: (JICA-ST) Regarding R&M for Parli power station, RLA study for Unit 3 was already conducted with assistance of World Bank (WB). Therefore we presume that to review the above study report is a shorter and more efficient way. Judging from the previous experience of JICA study project which was conducted for NTPC thermal power stations, it will take more time if it is conducted by JICA-ST itself.

(CEA, JICA) Although it all depends on substance of RLA report, it should be considered that JICA –ST is to review the report.

Item42: (CEA) Regarding the change mind of Bhusawal proposal, the complete replacement study for Bhusawal was already decided during the kickoff meeting and it is difficult to change it to R&M study at this stage. Therefore, the description of DPR should be remained as it is and we leave judgment of this matter to MSPGCL.

Item44: (CEA) We understood JICA-ST's verbal explanation on the resources of Obra C, however, English text in DPR is not clear. Description should be revised clearly.

Item46: (CEA, JICA) The request of ODA loan from MPPGCL to Indian central government via MP state government shall be a first priority. It is important that MPPGCL try to convince the relevant divisions in the state government and to receive their agreements.

The direct financing from JICA to

MPPGCL is difficult.

Item47: (CEA, JICA) The request of ODA loan from UPRVUNL to Indian central government via UP state government shall be a first priority. If any procurement is conducted for the project before agreement of ODA loan, it will be impossible to apply ODA Loan. It is necessary to complete the necessary application procedure beforehand.

CEA: For project implementation, it is important that the debt amount owed by and capacity for repayment of the loan is confirmed by the state electric utilities.

We are satisfied with DFR prepared by JICA-ST.

For next procedure, JICA-ST should submit "Final" Draft Final Report, which includes applicable comments from the state utilities based on today's discussion, to JICA, CEA and the state utilities by 17th May, 2012 via E-mail in order to receive their final comments , if any, by 23rd May.

JICA-ST will submit "Final Draft Report" by 31st May 2012 after reflecting final comments above.

The meeting ended with vote of thanks.

Attachment: Comments to Draft Final Report

ATTENDED BY

CEA	Mr. T. P. Singh, Chief Engineer (TRM Divn.),
JICA Tokyo	Ms. A. Tachikawa
JICA India Office	Mr. K. Ohnuma, Representative Ms. S. Khanna, Senior Development Specialist
JICA Study Team	Mr. N. Shimizu Mr. M. Miyagi Mr. M. Tanimoto Mr. K. Meguro Mr. K. Gima

Attachment

Comments to Draft Final Report

Comments to Draft Final Report

box color legend -->

needs to pay attention

important comments/notes

No	Page	Section	JICA	MSPGCL		MPPGCL	UPRVUNL	Action by JICA-ST confirmed with SEUs	Reflection to similar parts
				Parli #3, #4, #5	Bhusawal #2, #3	Satpura #1 to #5	Obra #1 to #8		
1	iv	Abbreviation	MOP shall be MoP.					To be Corrected.	
2	2	1.4 (1) 1st Para 4th line	based on the study, information collection shall be conducted with the designing of an ODA loan project based on the information collected during the study.					To be Corrected as commented.	
2	3	1.4 (1) 2nd Para 1st line	In case,s that a project is focused on facility construction and equipment provision, the maintenance system shall beis crucial.					To be Corrected as commented.	
9	4	> MSPGCL				Mr.Arvind Shrivastava, Officer On Special Duty (PRG) instead of Mr.V.K.Naidu CE(PRG), Mrs. Usha Diwan (Sr. Accounts Officer) instead of Mr. (the name has been typed twice), Mr.P.K.Khare (Sr.Chemist) instead of S C, Mech Maint-I, Elect Maint-I instead of Mech Maint and Elect Maint		To be Corrected as commented.	
18	5	Table 2.2-6 Madhya Pradesh				Expected date of commercial operation SSTPP-I U# 1 March 2013, STPS Unit No.10- Dec-2012 Unit No.11-April 2013.		To be Corrected as commented.	
26	6	4) 1st Para 2nd line	present ash pond will be filled up by 2034. The PH, the turbidity and of the ash water effluent from the ash pond are measured once a month every day and the measured values are summarized as monthly average in the report. The ash water effluent is partially re-used as agriculture water.					To be corrected as below; present ash pond will be filled up by 2034. The PH, the turbidity and the oil and grease content of the ash water effluent from the ash pond are measured once a month every day and the measured values are summarized as monthly average in the report. The ash water effluent is fully partially re-used as agriculture water. Exceeded ash water which occurs in monsoon season is discharged to the small stream.	
27	7	(b)						Ash pond effluent is to be corrected with "Ash pond water"	
28	8	(f) 1st line						The turbidity of ash water effluent from the ash pond exceeds the limit.	
33	9	5th line R&M items						To be corrected with addition of the following item at the first. - R&M of Turbine (replacement of blade and up rating 210MW to 220MW)	
33	10	4) (b)	Besides R&M for the turbine, R&M for all the facilities such as BTG, BOP, AHP, CHP, etc. shall be reviewed. In this case, R&M cost is estimated to be 2 crore/MW instead of 2 billion yen mentioned.					For efficiency improvement, R&M of the turbine is dominant compared to R&M of the other facilities. The study team could not review the other facilities in this short period for this study. Based on our experience in the similar JICA study for NTPC two years ago, it took two years to conduct RLA of boiler and turbine. The study period could be minimized if the RLA reports now under preparation for Parli are submitted for our review. (refer to No. 41)	
33	11	4) (b) last bullet	Estimated costs are approximately 2 billion yen for R&M of one unit of turbine including assembly of the turbine at the actual site.					To be corrected as proposed.	
33	12	5) (a)	The heat rate after R&M works is estimated to be 2,395 kcal/kWh compared to the heat rate of 2,852 kcal/kWh mentioned in the report.					The said heat rate includes improvements by whole R&M. We only reviewed improvement by turbine R&M. Therefore, we correct the text as follows; The estimated efficiency improvement by turbine R&M is 5% and the heat rate after the renovation is estimated to be 2,852 kcal/kWh.	

No	Page	Section	JICA	MSPGCL		MPPGCL	UPRVUNL	Action by JICA-ST confirmed with SEUs	Reflection to similar parts
				Parli #3, #4, #5	Bhusawal #2, #3	Satpura #1 to #5	Obra #1 to #8		
13	36	Table 4.1-4 Item 3		This content is contradictory to the description in the former part of this section since only turbine R&M was reviewed by the study team.				These items mentioned were identified through interviews. For consistency, we include R&M of turbine and correct as follows; - R&M of turbine (replacement of new type of blade and up rating 210MW to 220MW)	
14	37	Table 4.2-1			Gross Electricity Generation 2009-10 (Units 2 and 3) 2010-11 (Units 2 and 3) Plant Load Factor 2009-10: 73.5362.72 (Unit 2) 2010-11: 30.4163.47 (Unit 2) 2009-10: 72.8881.95 (Unit 3) 2010-11: 81.9565.31 (Unit 3)			To be Corrected as commented.	
15	37	4.2 (2) 1) 5th line			Coal storage yard is located in the rear (North) side of the stacks for Units 1, 2 and 3.			To be corrected as below; Coal storage yard is located in the rear (North) side of the stacks for Units 1 to 2 and 3.	
16	37	4.2 (2) 1) 6th line			The facilities for switchyard on the south of unit-1, 2 and 3 possession of MSETCL, power transmission company and the land is owned by MSPGCL, BTPS.			To be corrected as below; The facilities of the switchyard and its land, on the south of Units 1 to 2 and 3, is owned by MSETCL, the power transmission company and the land is owned by MSPGCL..	
17	38	4) 1st Para 2nd line			that the present ash pond will be filled up to 2018 and there is a plan to raise the dike of pond. Secondly as utilization may be enhanced from 70% to 100%.			To be corrected as below; that the present ash pond will be filled up by 2018 since increased ash from Units 4 to 6 will be transported to the pond, and therefore there is a plan to raise the dike of the pond to extend its life for approximately five years. In addition, fly ash utilization will be enhanced from current 70% to 100% by 2014.	
18	38	4) 2nd Para			The Vellhala ash pond (Phase III) effluent will be reused as recycling water to expansion unit.			To be corrected as below; The PH and the turbidity of the ash water effluent from the ash pond are measured once a month everyday and the measured values are summarized as monthly average in the report. The ash water effluent is partially re-used as agriculture water and will be fully re-used as ash recycling water. The remaining not re-used is discharged to the nearby small stream. The word "effluent" will be replaced by "ash water" wherever mentioned in DFR. ✓	
19	38	4) 3rd Para			What are other components?			One example is silt seam to prevent penetration. Or please look at page 46 where HDPE liner is referred to.	
20	40	(f)			Efforts to reduce SPM emission was conducted by applying ammonia injection system to improve SPM collection efficiency at ESP for Unit 3 in 2005 resulting in better results. The same is planned to be applied to Unit 2 in Dec 2012.			To be corrected as follows; SPM of flue gas at stack outlets does not comply with the regulations (150400 mg/Nm3) for Unit 2. Efforts to reduce SPM emission was made by applying ammonia injection system at Unit 3 in 2005 resulted in compliance with the regulation. The said system will be introduced to Unit 2 by December 2012. Although monthly reports containing such data have been submitted to GEA, the power station has not been subject to any penalties so far.	
21	40	11) 2nd Para 2nd line			In addition to maintenance manuals, some example of operation manuals were provided to the study team.			To be corrected as follows; operation manuals and maintenance manuals were properly prepared while operation manuals had not been confirmed yet.	
22	40	(3) 1)			During the monsoon season the water is accumulated at the minus level of unit-2 & 3. This may create lot of problem of discharging the accumulated water. Location may be reviewed in the DPR.			No need to refer in DFR.	

No	Page	Section	JICA	MSPGCL		MPPGCL	UPRVUNL	Action by JICA-ST confirmed with SEUs	Reflection to similar parts
				Parli #3, #4, #5	Bhusawal #2, #3	Satpura #1 to #5	Obra #1 to #8		
23	42	5) (a)			The reduction in auxiliary consumption shall be considered in respect of proposed replacement as a saving. (Existing auxiliaries consumption is 11.2% which need to be reduced to below 9%.)			This is a good suggestion. The said improvement is to be included where it is referred to.	✓
24	43	9) d)						To be corrected as follows; the legal limit (150400 mg/Nm3)	
25	45	(1) 2nd Para				Commercial operation of Unit 10 in December 2012 and that of Unit 11 in April 2013		To be Corrected as commented.	
26	46	2) 2nd Para						To be corrected as follows; currently receiving accepting domestic coal (raw coal) at a rate of 6,500 tons of coal per day.	
27	46	4) 3rd and 4th Para's			Please write in last Para "the ash pond of PH-4 (2x2.50MW unit)" in place of "The ash pond". In Para No. - 3 the new ash pond (11 ha) is only for PH-I, I & III, it is not for proposed 660 MW unit.			To be corrected as follows; There are two The new ash ponds, now under construction. One is divided into two sections: the 111 ha ash pond section is planned to be used for PH-1, 2 and 3 and 660 MW x 4, and the other 130 ha section for PH-4 (250 MW x 2). Bottom ash from the 660MW unit will be dumped to the 111 ha ash pond, while fly ash is disposed to either the 111 ha or 130 ha ash ponds. The 130 ha ash pond is designed to prevent water penetration to the underground with HDPE (high density polyethylene) liner placed on the bottom. National Environment Research Institute, Nagpur is now studying the necessity to install a liner to the 111 ha ash pond. The liner will be installed when it is recommended by the Institute. AWRS (ash water recycle system) is also planned to be installed at two ash ponds so that the ash water effluent can be recycled for ash handling.	
28	46	5) 2nd line				Here "Forced Cooling Tower" is mentioned, so "tower" should be deleted from it.		The water taken from the Reservoir is used mainly for condenser cooling forced cooling towers, and then returned back to the Reservoir (the once-through system).	
29	48	11) 1st Para 1st line				Open. & Main. Egg. directly report to Addl. CUE. (O&M)-I & Chief Engineer(Gen.) of power station.		To be corrected as follows; The Operation and Maintenance system is organized and Operation and Maintenance Engineering Groups responsible by operation manager and maintenance manager who directly report to Additional Chief Engineer (O&M)-I and Chief Engineer of the power station.	
30	48	11) 1st Para 3rd line				There are four groups in operation in place of 5 groups, so please make correction "Four groups" is please of 5 groups.		To be corrected as follows; station operators are divided in four five groups (15 operators in one group) and work in three shifts	
31	50	4) (a)				Does the study consider construction lay down area and preassembling area for the 660 MW unit?		Construction lay down area and preassembling area were not reviewed in the study. Details shall be studied at the next step.	

No	Page	Section	JICA	MSPGCL		MPPGCL	UPRVUNL	Action by JICA-ST confirmed with SEUs	Reflection to similar parts
				Parli #3, #4, #5	Bhusawal #2, #3	Satpura #1 to #5	Obra #1 to #8		
32	51	5) (a) 3rd line				"Fundamental data for April-2011 Feb.-20", written here please correct it.		To be Corrected as follows; Satpura PH1 (Units 1 to 5) Fundamental Data for April 2011-February 2012	
33	51	6) Budgetary Scale				Please indicate the basis if Cost Estimation. Table 4.3-3 Sr.No.6 (page 53)		Budgetary Scale was estimated as follows; - removing cost: power plant demolition experience in Japan - construction cost: other project information in India	
34	54	(1) Table 4.4-1 Overview of Current Facilities and Operation						Table 4.4-1 (Source: Obra Power Station of UPRVUNL/MPPGCL)	✓
35	55	4) 3rd Para Ash pond					Existing ash pond has clay layer at the bottom of ash pond to prevent penetration of ash water.	The 3rd Para is replaced by the following sentence; The existing ash pond has clay layer at the bottom to prevent penetration of ash water.	
36	55	5) Raw water supply system (cooling water, etc)						The water from the Dam is mainly used for condenser cooling forced-cooling towers, and then returned back to the Obra Dam (once-through system). Obra B applies the same system.	
37	57	(f) Problems concerning the social circumstances					ESP of Unit 9 is under R&M and ESPs of Unit 10, 11, 12 and 13 are planned to be implemented with R&M for reduction of dust in accordance with instruction of the State Pollution Control Board. EIA report of Obra C describes total amount of dust emission of Obra A, B and C.	To be corrected as commented.	
38	58	4) (b) Coal supply					Obra C has two dedicated coal mines and they will supply 10 mil tones of coal per year.	To be corrected as commented.	
39	59	4) (c) Raw water supply system					The necessary amount of raw water for Obra C is able to be taken from Obra dam separately from Obra A and B, and this has been agreed on by the state government.	To be corrected as commented.	
40	61	Table 4.4-1, Item 7						Executing agency is UPRVUNL/UPRVNL	✓
41	63	5.1 (1) 1) MSPGCL Parli power station		In case of Parli U-3 to 5 complete study of boiler and boiler side auxiliary, turbine and turbine side auxiliary should be completed. It's report should be received then only R&M activities will be decided. Via e-mail from CE (Works), MSPGCL, dated May 8, 2012				The study team explained in the meeting at MSPGCL head office on May 4, 2012 by introducing our experience of similar JICA study for NTPC which took two years for completion that it would take longer time if we conduct R&M study for all the major components including BOP by ourselves from the beginning. Therefore, we also proposed that the shorter way was to review by ourselves the Report of RLA study for Parli Unit 3 being conducted by MSPGCL with support of World Bank. However, the report has not yet been issued.	
42	63	5.1 (1) 2) MSPGCL Bhusawal power station			Bhusawal U-2 and 3 instead of complete replacement R&M of these units should be proposed so that the life of the units will be enhanced by 15 years. Via e-mail from CE (Works), MSPGCL, dated May 8, 2012			This is not in line with the methodology and premise of the study agreed on each other in the joint kick off meeting on January 24, 2012 at JICA India Office with attendance of MoP, CEA and the three State Electric Utilities.	
43	63	5.1 (1) 4) 1st Para 3rd line UPRVUNL Obra A power station						by utilizing current resources recourses of -----such as raw water, coal linkage and ash pond.	

No	Page	Section	JICA	MSPGCL		MPPGCL	UPRVUNL	Action by JICA-ST confirmed with SEUs	Reflection to similar parts
				Parli #3, #4, #5	Bhusawal #2, #3	Satpura #1 to #5	Obra #1 to #8		
44	63	4) (1) 4) UPRVUNL Obra A power station					The raw water, coal linkage and ash pond for Obra C were secured for two 660MW units, therefore UPRVUNL requested to include the following sentence of "construction of another super critical 660 MW unit is also feasible" to DFR.	To be corrected as follows; At least one super critical 660 MW unit shall be constructed in the Obra C site, at new location, by utilizing current resources such as raw water for resources of already-retired units of Obra A (Units 3 to 6 and 8) and ash pond for Obra A and B, such as raw water coal linkage and ash pond. Besides, other resources of coal linkage and raw water separately from that for Obra A have already been secured for two units of Obra C. Although allocation of existing resources and new resources has not yet been decided, the construction of another super critical 660 MW unit is also feasible considering further improvement of may be considered to improve total economies of the project. Units 1, 2 and 7 are to be retired when their extended lives due to R&M expired one after another. The resources for these units can be utilized for further development of generating capacity in the future.	
45	64	(c) 2nd Para 4th line Environmental aspect						The following sentence is to be added; If the ash pond for the proposed 660 MW unit has no protection measures for penetration, quality of underground water shall be monitored at wells already exist and/or newly constructed in order to confirm no penetration occurs.	
46	64	(f)				Replacement schedule planned by MPPGCL is as follows; - finalization of DFP: end of May 2012 - preparation period of EIA report: 4 to 6 months from Jun 2012 - commitment of coal linkage: after getting the EIA report approval - Start of PH-1 demolition work: April 2013 Therefore, schedule of Japanese ODA loan shall meet this planned schedule. Furthermore, direct financing to the state electric utility shall be established in order to shorten the necessary period for loan application on condition that proper documentation process is maintained in parallel for the state and the central governments.		To be discussed in the joint meeting with MoP, CEA and JICA. Official request for application of the Loan by Indian Government to Japanese Government shall be made as fast as possible for further action.	
47	64	(f) Process for Japanese ODA loan					UPRVUNL is planned to conclude EPC contract for Obra C within 24 months from the present, therefore UPRVUNL requested the study team to find out the way to minimize the duration mentioned in Attachment 5 for ODA application.	To be discussed with JICA and revert back to UPRVUNL. Official request for application of the Loan by Indian Government to Japanese Government shall be made as fast as possible for further action. No procurement shall be made by executing agencies before agreement of Japanese ODA Loan.	
48	65	2) (d) 1st Para 1st line Economic evaluation of new construction and replacement						In Obra case, UPRVUNL MPPGCL planned...	✓
49	66	(b) 2nd sub-Para last line The Energy Conservation Rules, 2012						production of the third second cycle.	