1.0 INTRODUCTION

A study was conducted by CPRI for MERC in the years 2008-09 and 2009-10 to assess the level of achievable technical performance parameters for all stations of MSPGCL except the newly installed 250 MW units. CPRI has recommended schemes into three broad categories (based on the time required to implement and the cost involved) to meet the targeted performance parameters:

- Immediate : below 12 months
- Medium term: 2-3 years
- Long Term : over 3 years

The objective of the present study is to assess the implementations of various measures for improvements in achievable performance parameters at Maharashtra State Power Generating Company Ltd (MSPGCL) thermal power stations.

This report pertains to the study of Koradi TPS (Units 5-7).

1.1 Design unit heat rates (UHR) & station heat rates (SHR)

Table 1 (see Annex 2) gives the design UHRs and SHRs of the station for the units under study. Table 2 (see Annex 2) gives the capacity and age of units.

1.2 Performance against targets

Table 3 gives the petitioned, approved and achieved key performance indices (KPI) including SHR for FY 2009-2010, FY 2010-2011 and FY 2011-2012 (till date) for the station under study.

2. STUDY & FIELD VISITS

The study of the MSPGCL is taken up for Koradi TPS during January 1st-2nd week 2012.

3. STUDY & FINDINGS

3.1 Assessment of the overall action plans for implementation of measures and benefits projected and accrued

The measures are classified as:

i. Immediate measures without financial implication (See Annex 3)
ii. Immediate measures with financial implication (See Annex 4)
iii. Medium term measures (See Annex 5)

iv. Long term measures (See Annex 6)

The schemes have been classified into 14 areas for better project management as given in Table 4 (Annex 2).

The summary of the implementation for KTPS is given as follows:

CPRI Recommendations	Total Nos.	Implemented	Deferred	Balance
Immediate term - having no financial implications (NFI)	56	53	1	2
Immediate term - having financial implications (FI)	59	15	16	28
Medium term measures	45	8	11	26
Long term measures	33	10	7	16
Not indicated	30	25	0	5
Total	223	111	35	77

The percentage implementation for the total number of measures is 50 %.

3.2 Assessment of the action plans for implementation of immediate measures (without financial implication) and benefits accrued

The summary of implementation of the immediate measures (without financial implications) is as follows:

CPRI Recommendations	Total Nos.	Implemented	Deferred	Balance
Immediate term - having no financial implications (NFI)	56	53	1	2

The percentage implementation for immediate measures (w/o FI) is 95 %.

Operational changes: Operation in sliding pressure operation in normal operation and use of ATRS during starts has been implemented.

Operational optimization: Operational optimization is being done through monitoring the parameters through GCR. A strong program must be launched for operational optimization (OO) for measure-control through operations-control through maintenance-measure based on the PDCA cycle with close intervals of monitoring and control to 4-6 hours. There should also be close monitoring of DM water make up which reflects on the steam lost through the system.

Leak reduction: Leak reduction is a critical area for the station in improving the performance. Importance must be given to quick response to leaks in steam, water, coal, ash, etc.. A strong leak reduction plan must be in place.

Cleanliness: A cleanliness improvement must be put into place to maintain the cleanliness level from coal dust, ash, etc.

3.3 Assessment of the action plans for implementation of immediate measures (with financial implication) and benefits accrued

The summary of implementation of the immediate measures (with financial implications) is as follows:

CPRI Recommendations	Total Nos.	Implemented	Deferred	Balance
Immediate term - having financial implications (FI)	59	15	16	28

The percentage implementation for immediate measures (with FI) is 25 %.

Hardware changes: many hardware changes like changing of heat exchangers, boiler coils, installation of VFDs, etc., have been successfully implemented.

IEDs: A decision is taken to procure only digital smart and intelligent transmitters and sensors in preference over analog systems. The same is being implemented.

Energy efficient option vs. maintenance comfort: Whenever there is some maintenance inconvenience on account of installation of energy efficiency measures or reduction of additional redundancy, the same may be viewed critically and a balanced view of the benefits vis-à-vis the inconvenience may be taken before a decision is taken on deferment of a measure.

3.4 Assessment of the action plans for implementation of medium term measures and benefits accrued

The summary of implementation of the medium term measures is as follows:

CPRI Recommendations	Total Nos.	Implemented	Deferred	Balance
Medium term measures	45	8	11	26

The percentage implementation for medium term measures is 18 %.

Traditional replacements: Replacements must not be based on traditional replacements but energy efficiency options must be used because over a period of 20-25 years many new energy efficient hardware options have been evolved. Replacement of old and obsolete technology may not give the full benefits.

Coal weighment: The in motion weigh bridges are yet to be installed. Since they are low value items, the same may be given priority. The belt weighers are partially installed. Since they are low value items, the same may be given priority for total implementation for online unit coal measurement. The gravimetric feeders of rotary type or belt type are yet to be installed. Since they are high value items, some delay can be expected. However, the same needs to be expedited.

Steam path audits: Steam path audits have not been carried out during COH. The same may be rigorously followed to quantify the losses and restore the steam path to normalcy for getting the benefit of improved UHR.

3.5 Assessment of the action plans for implementation of long term measures and benefits accrued

The summary of implementation of the long term measures is as follows:

CPRI Recommendations	Total Nos.	Implemented	Deferred	Balance
Long term measures	33	10	7	16

The percentage implementation for long term measures is 30 %.

3.6 Reasons for delay, root cause of delay in implementation

1) Strategic decisions regarding implementations of different schemes like boiler reengineering, turbine retrofit, APH up gradation, replacement of Bag filters with latest ESP, modernization of C&I etc., through R&M to achieve best performance.
2) Finalization of few schemes needs support of performance trials at least at one TPS.
3) Implementation of few schemes needs sufficient outages to carry out the work with satisfactory performance.
4) Submission of capex proposals through DPRs
    a) Format finalization of the capex scheme proposal through DPR delayed by one year as the consultant appointed for DPR preparation a year after Energy audit by M/s CPRI.
    b) After submission of the proposals, few changes in proposal were required to fulfil the MERC norms like minimum value of Rs 10 Crore of DPR with similar type of schemes.
    c) Few schemes remain pending due to constraints of clubbing & deletion of some schemes as strategic decisions e.g. Installation of Dome for coal yard.

d) Problems regarding financial model to calculate Payback period, IDC etc. & Procedural changes & Methodology for submission also delayed the proposals.
e) Non-availability of trained manpower regarding the financial considerations in the capex / DPR proposals.
f) Delay in receipt of budgetary offers with sufficient data to estimate the cost of schemes.

3.7 Avoidable delays in implementation

Preparedness for implementation: The station was not initially geared up for implementation of schemes. The gearing up has taken time. Presently, it is considerably improved in the preparedness for implementation of schemes.

Mentoring of the younger engineers by senior engineers: A process of mentoring and guidance to the younger generation of engineers is required from the highly experience senior engineers in the implementation process.

Excessive reliance on OEM: While the views of the OEM are indisputably of primary importance to the operation, maintenance and safety of the plant, lack of commercial interest in many cases has led to the conclusion that the OEM is not favorable to a particular scheme. This has resulted in e avoidable time delay.

Monsoon preparedness: Better monsoon preparedness could have resulted in some time saving.

Manpower management at the station level: Placing persons with aptitude and skill for implementation program or higher rigor of training of the section level engineers in the implementation process in understanding the mechanism of successful implementation of a scheme.

What if? –apprehension: The fear of things going wrong and individuals not taking responsibility was present for some period. Now, MSPGCL has formed groups/ expert teams, etc. for different schemes rather than laying onus for implementation on individuals. Many more such groups/ expert teams cutting across the stations of MSPGCL need to be formed to collectively involve in implementation of the schemes in areas of boiler, turbine, C & I, etc., through technology assessment and technology evaluation.

Management model: The management model for implementation involved the traditional procedures which take time. Procedural delays could be minimized by operating in the ***fast track*** or ***mission mode*** for implementation, demonstrating and achieving the objectives of the schemes.

Streamlining of purchase cum authorization processes: Streamlining at the station level by cutting across the hierarchy/proper channel route for movement of papers and approvals (within the MSPGCL framework of rules), could have resulted in reduced process time.

Vendor development program: A strong vendor development program involving a search for prospective vendors, study of the technological options available in the market, preparation of generalized specifications without giving undue advantage to any one vendor, detailed study of costs including POs issued to the vendor from other organizations, etc., needs to be in place for successful procurement and implementation. Haphazard vendor development has resulted in time delay in the actual procurement process in the form of non-responsiveness, non-conformance, re-tendering, etc.. This results in process delay.

Apprehensions of pass through: These have got to be clarified at an early date.

Measures with intangible or tacit benefits: These have suffered the most because of inability to convince the internal controllers. Life cycle approach could be a possible solution.

AOH & COH: These must be done as per schedule at the frequency of annually and once in five years respectively or as per any drawn out schedule. Skipping of overhauls results in degradation.

Uneven inter-station DPR initiating process: Co-ordination of common schemes required at different power stations got delayed because of different times taken by different stations. Some stations have taken almost 6 months more than others. Stations like Kordi have been slow in initiating DPRs.

High processing time: Inspite of considerable improvement in procurement processing, the processing time is still much on the higher side for which station level process of procurement and authorization need to be re-looked. Higher procurement processing time and limited number of items identified under capex has led to avoidable delays.

Ambiguity created by E-R & M: The decisions to go in for E-R & M has created an ambiguity whether to continue with the medium term and long term measures in the present or to club it with E-R & M. In cases where E-R & M is envisaged, it is clubbed with E-R & M.

Full time central monitoring and time frames: Though central monitoring was being done to some extent, strong HO monitoring is required for control of the implementation processes with time frameworks. The time frames have not been set or time targets have not been given for implementation of the simple, medium term and long term measures. As a result the progress is differential in different stations.

Success solution in one station is not translated to the others: The success solution in one of the stations has not been transferred or translated into best practice for the others.

Co-ordination in implementations between two sections: In the case of technologies which involves implementation between two or more sections and their

integration or inter-section co-ordination was not done by any one section, as a result of which the implementation was one sided.

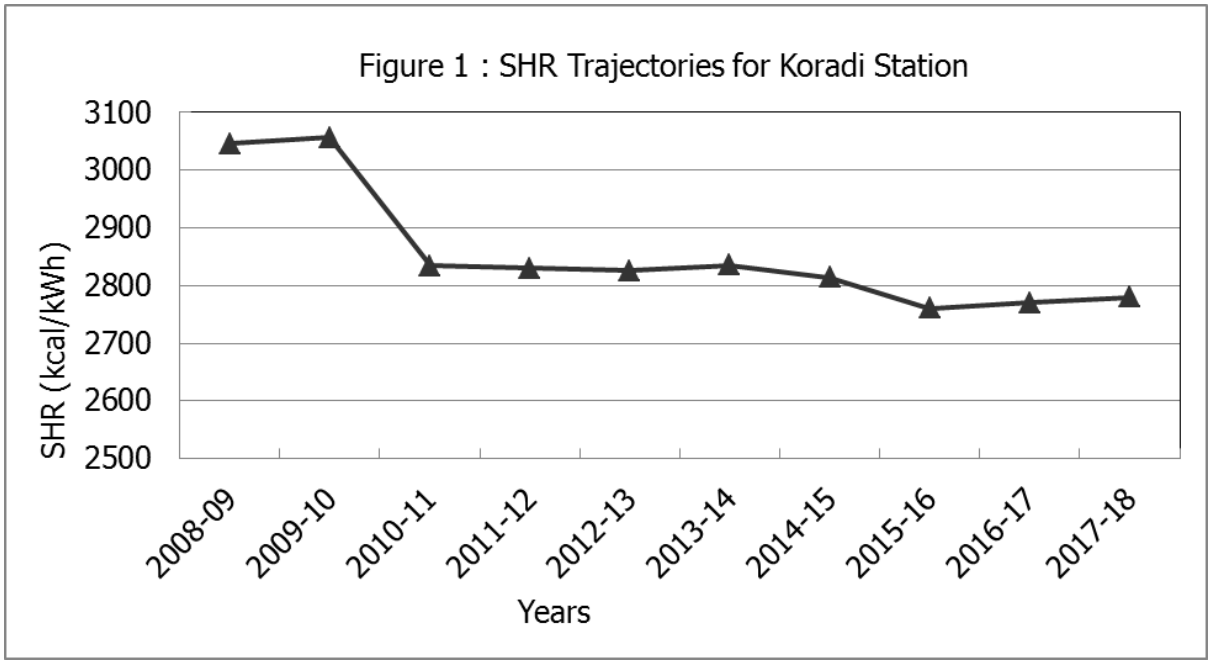
Higher involvement of top management or mentoring by seniors to juniors: Mentoring would have reduced some delay.

4. REVISION OF PERFORMANCE TRAJECTORIES

4.1 Test SHRs and degradation rates measured and revised performance trajectories

Annual overall station heat rate			
Unit No.	**Capacity**	**Annual UHR**	**UHR x C**
	MW	**kcal/kWh**	
1	105	3499.1	367404
2	105	3576.2	375505
3	105	3226.9	338820
4	105	3289.9	345438
5	200	2752.1	550418
6	210	2845.8	597626
7	210	2808.9	589872
Stage I		kcal/kWh	**3398**
Stage II		kcal/kWh	**2803.1**
Station	SHR	kcal/kWh	**3043.4**

Station	Overall Station
Degradation rate as per CPRI test TG HR	
	%/year
Koradi	0.34

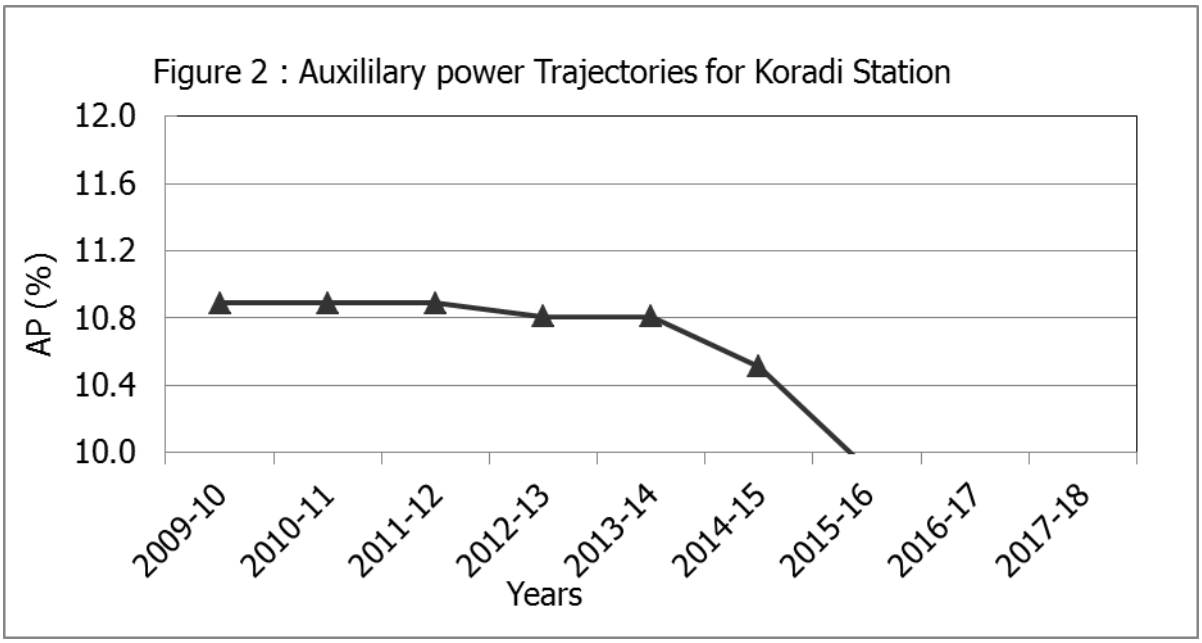


Koradi TPS								
Year	Previous year heat rate, kcal/kWh	Degradation @ 0.34 % / year	Immediate measures	Medium term measures	Long term measures	EER&M benefit on SHR, kcal/kWh	Annual overall SHR, kcal/kWh	Comments
2008-09	3043	2.6					3046	[1]
2009-10	3046	10.3					3056	[2]
2010-11	2824	10.4					2834	[3]
2011-12	2834	9.6	-13.8				2830	[4]
2012-13	2830	9.6	-13.8				2826	[5]
2013-14	2826	9.6					2835	[6]
2014-15	2835	9.6				-31.2	2814	[7]
2015-16	2814	9.6				-62.4	2761	[8]
2016-17	2761	9.6				0.0	2770	[9]
2017-18	2770	9.4					2780	[10]

Comments	Comments
[1]	Date of test on 07 - 01 - 2009
[2]	
[3]	Vintage unit withdrawn however the calculations from 2008-09 are for stage-II 210 MW units only.
[4]	starting value minuses the uncontrollables
[5]	
[6]	
[7]	U-6 will in service only for 3 months during 2014-15 after EE-R & M
[8]	U-6 After EE-R&M. No degradation is considered for U-6
[9]	U-6 After EE-R&M.
[10]	

		R & M Plan		
Unit No.	2014-2015			
5	2825	12		
6	2544	3		2014-15 unit 6 will be taken for EER&M for 9 months and balance 3 months the HR is 2544
7	2825	12		
		2793.78	-31.22	
Unit No.	2015-2016			
5	2825	12		
6	2544	12		Unit-6 No degradation is considered after the EER&M
7	2825	12		
		2731.33	-62.44	
Unit No.	2016-2017			
5	2825	12		
6	2544	12		
7	2825	12		
		2731.33	0.00	

4.2 Test auxiliary power measured and revised performance trajectories



Year	Previous year AP, %	Immediate measures	Medium term measures	Long term measures	EER&M benefit on AP, %	Annual overall AP, %	Comments
2009-10	10.89					10.89	[1]
2010-11	10.89					10.89	[2]
2011-12	10.89					10.89	[3]
2012-13	10.89		-0.08			10.81	[4]
2013-14	10.81					10.81	[5]
2014-15	10.81				-0.3	10.51	[6]
2015-16	10.51				-0.6	9.91	[7]
2016-17	9.91					9.91	[8]
2017-18	9.91					9.91	[9]

Comments	Comments
[1]	
[2]	Vintage units withdrawn.
[3]	
[4]	ID fan overhaul for increased availability; Impact of immediate measures is getting absorbed in the low PLF operation
[5]	
[6]	U6 R&M (effect for three months)
[7]	U6 R&M
[8]	When other units R & M are taken up the long term trajectory can be achieved.
[9]	When other units R & M are taken up the long trerm trajectory can be achieved.

5. CONCLUDING REMARKS

i. The Koradi is slower than the other Stations in the implementation of the energy saving measures.

ii. Measures of a non-financial nature such as operational optimization, leak reduction, minimizing DM water make up, cleanliness in the power house, etc., need to be taken more seriously and with vigour to achieve and sustain the heat rates. Otherwise the trajectories are not maintainable.

iii. The installation of in-motion weigh bridges needs to be expedited.

iv. The detailed progress and the trajectories are given in the text.

v. The reasons for delay are due to initial time lost in gearing up for the program and uncertainties regarding the program. Strong monitoring would help in reduction of implementing time. The station would also require mentoring from the HO or top management in helping to implement the measures.

vi. The performance is not as per the original trajectories because the implementation program has been taken up on a pilot basis for one unit or unit station in many cases and afterwards proposed to be taken up in other units. Also, many medium and long term measures have been clubbed with R & M schemes which are going to be taken up in next few years. Hence the trajectories will be linked with these schemes.