Annex – 4
(Immediate measures with financial implication)

Measures Implemented

Functional Group	Sl. No.	CPRI Recommendation	Status of Implementation	REMARKS
P-1	1	Strengthening and Improving the maintenance practices at CHP	Implemented	
	2	Optimizing the time for wagon tipplers	Implemented	
	3	The risk of the transit loss can be made to be included in the scope of the Liaison agent and this can be included in the tender document for appointing of Liaison agent in future.	To be implemented	Included under general MSPGCL report
	4	Calibration of RC Feeder Speed for Coal Flow in Mills.	To be implemented	Practice of calibration of RC feeders will be implemented after installation of gravimetric feeders for Units- 3, 4 & 5.
	5	The responsibility and accountability of coal consumption is to be shared as follows: Source end to receiving end: Fuel Cell Receiving end to Bunker: Coal handling plant Consumption beyond bunker: Operations	To be implemented	This will be implemented after installation of belt weighers and bunker level measurement system.
	6	The principle of loading loss of coal into the heat rate of units results in errors in systems. Heat rate should strictly indicate heat consumption by the units and coal losses (if any) should be separately accounted as a weight loss. Coal losses before bunker cannot be attributed to the units and must not be included therein.	To be implemented	Included under general MSPGCL report
P-2	1	Measuring the ash to water ratio on daily basis	Implemented	
P-3	1	**Sample preparation improvement:** Sampling preparation through standard crushing and pulverizing equipment.	Implemented	
	2	**Analysis:** GCV determination only through a bomb calorimeter. Repair of equipment for primary crushing (12.5 mm size), secondary crushing (3 mm size) and fine crushing (70 % mass below 200 µm size). Quantity of water taken and tablet weight must be accurately taken.	Implemented	

	3	**Reporting, data entry and archiving:** Data entry to be authenticated by printout of the bomb calorimeter.	Implemented	
	4	Efforts must be made to ensure that the drop in monthly GCV between the receiving end and bunker is within 100 kcal/kg.	Implemented	Efforts are taken to bunker fresh coal or first come first serve basis. Difference in monthly GCV between the receiving end and bunker is reduced
	5	**Sampling improvement :** Sampling through automatic samplers under the supervision of chemists. Chemists must witness the taking of the samples.	Implemented	Sampling is being done by AUGAR at Tippler no. 5 only. As there is no provision of platform for AUGAR movement. Therefore at rest of the tippler the sampling is being done manually
	6	For further refinement in the coal heat value determination, it is recommended to measure **sample to sample variation** in a rake (for receiving end coal) for each rake and to measure **in-sample variation** to select the minimum sample size.	Implemented	
	7	Bomb calorimeter data to be interfaced with LAN.	To be Implemented	Print-out is available
P-5	1	Consumption and production/receipt of major resources like coal, fuel oil, DM water, soft water, etc., must be separately monitored.	Implemented	
	2	Recommendations of the performance optimization group for proactive parameter setting are required for optimization of the unit performance.	Implemented	The methods are already in practice. Parmeters refered by POG is confirmed ,maintained & controlled by operators. System shall be strengthened further.
	3	Resource consumption and conservation (coal, oil, DM water make up) is also to be given importance in the operational process and decision maker must be aware of key resource ratios.	Implemented	Consumption of coal oil, DM water is already being closely monitored daily via DPPR report & subsequently discussed in daily planning meeting. Decision for suitable Corrective action is taken accordingly.
	4	The data recorded in each shift by the Chemists must be used for Performance Optimization.	Implemented	

	5	The process of performance trending can be taken up for operational optimization, the aid of TGA of fired coal, stress evaluation, etc., can also be used as guidelines.	To be Implemented	DPR submitted to HO
	6	MSPGCL to be a part of the National Perspective Plan of Ministry of Power, Govt. of India (operated by CPRI) for achieving sustainable improvement in heat rate and seeking solutions to associated technical problems.	To be Implemented	Included under general MSPGCL report
	7	The monthly data submitted to HO and to Regulatory Commission must also give the unit test heat rate and station test heat rate obtained by testing the unit on average coal and obtained through online heat rate monitoring software.	TO be Implemented	Included under general MSPGCL report
P-7	1	The capacity of the Contractors must be critically examined in the areas of maintenance works so that the work may be given to multiple agencies for completion of similar jobs faster.	Implemented	This is followed for important works of boiler , turbine and CHP.
	2	For special components which are posing difficulty in obtaining spares, competent agencies for reverse engineering should be identified.	Implemented	i) Availability/ Delivery of spares within minimum period compared to OEM ii) Cost effective. iii) Inventory reduced due to minimum delivery period iv) Services after sales are better than OEM.
	3	While procuring replacement spares, material up gradation and new technology options must be kept in mind instead of old time tested spares.	Implemented	Life increased, material being corrosive resistance hence main. Problems reduced.
	4	Dynamic proactive vendor development	Implemented	
	5	The percentage of tenders turning into orders must be increased to over 90 %.	Implemented	
	6	The time constant for vendor registration which is around 2-3 months presently must be reduced by a re-look at the process.	Implemented	In e-tendering system, Vender registration is online and depends upon submission of necessary documents by the vender.
	7	Vendor development must also involve grading the tooling and instrument capability of the vendor and giving preference to vendors with superior tooling and instrumentation.	Implemented	Included in Qualifying Requirements of tender/proposal.

	8	Capex budget scheme may be utilized better form renovation and modernization of old equipment, components, sub-systems and systems.	Implemented	
	9	Utility-academic-vendor initiative or innovative solutions to the TPS problems	Implemented	
	10	Vendor development either through Vendor-TPS meet for identification of competent vendors in the areas of : HVOF coating; Reverse engineering for problematic or obsolete components with difficult to get or spares; Erosion and corrosion resistant materials; Software resources.	Implemented	
	11	Process audits for Accounts and Administrative Processes as these have a bearing on the main business domain of MSPGCL.	Implemented	ISO audit is carried out every six months by external auditor.
	12	It is recommended that the minimum, maximum and average re-order points of the chemicals for condenser scale control as well as biological control in cooling towers may be worked out for both minimizing the inventory carrying cost as well as timely re-order.	Implemented	
	13	In the Procurement of items related to control, instrumentation and information technology: Obsolesce in the scheme/technology; site specific conditions such as protocol compatibility, parameter compatibility, etc., must be ensured before ordering.	Implemented	
	14	Development of process for preservation of materials at stores	Implemented	Material which needs preservation are indented by user section after receipt oat major store
	15	Long term contracting can be entered into to minimize inventory levels for many items.	Implemented	for long term contract / supply unit rate contracts are introduced in some areas.
	16	Direct emergency procurement or back to back borrowal arrangements with Raichur TPS & Vindhachal TPS for emergency supplies and spares.	To be Implemented	Included under general MSPGCL report
	17	Station must be empowered for procurement through proprietary certification.	To be Implemented	Included under general MSPGCL report
	18	Station must be empowered for procurement involving advance payments.	To be Implemented	Included under general MSPGCL report
	19	Direct procurements through organizations approved by State Govt. and Central Govt.	To be Implemented	Included under general MSPGCL report

	20	Pooling the resources through a Central Common Consumable Resource Planning Store having ***common bank of spares*** instead of each Section carrying its own stock of spares reduces the locked up capital.	To be Implemented	Included under general MSPGCL report
	21	The e-tendering process needs strengthening.	To be Implemented	Included under general MSPGCL report
	22	Inventory analysis on the basis of cost criticality availability (MUSIC 3D approach)	To be Implemented	Included under general MSPGCL report
	23	Capital budget should be linked to business strategy.	To be Implemented	Included under general MSPGCL report
	24	Previous/historic efficiency of funding vis-à-vis performance may be compared for present year's allotment rather than on purely historic trends.	To be Implemented	Included under general MSPGCL report
	25	***Dynamic optimization of stock levels*** provides opportunities for cost reduction by maintaining optimal safe stock which is lower than the present levels.	To be Implemented	Included under general MSPGCL report
	26	Planning, authorization, approval, financial pre-audits should be de- coupled from the tendering process. Number of steps in the process needs to be considerably reduced to render the process of procurement tenable and effective.	To be Implemented	Included under general MSPGCL report
	27	Purchases must be made considering the TPS as the structural and functional unit of the MSPGCL. Processes involving HO approvals must be critically reviewed and delegated to the Station head.	To be Implemented	Included under general MSPGCL report
	28	Concept of accumulation of item requirements for all stations for centralized purchase through HO must be critically reviewed as the volume benefits seem to be over-run by time delay.	To be Implemented	Included under general MSPGCL report
	29	The procurements may be divided into 4 or 5 categories based on cost criterion and alternative processes may be developed for each.	To be Implemented	Included under general MSPGCL report
	30	Station must be empowered for procurement involving foreign exchange.	To be Implemented	Included under general MSPGCL report
	31	Equipment /system centric costing system may be given consideration in preference to the traditional Section basis.	To be Implemented	Included under general MSPGCL report
	32	In MOD, cost data may be further refined/fine-tuned by more accurate data	To be Implemented	Included under general MSPGCL report
	33	The number of groups which certify the payments must be restricted to one.	To be Implemented	Included under general MSPGCL report
	34	Process simplification in fuel procurement, employee claims like OT, TA, etc.; and in delegation of powers.	To be Implemented	Included under general MSPGCL report

P-8	1	Each and every maintenance action must be reviewed and unnecessary planned scheduled maintenance frequency may be modulated based on reliability and risk indices.	Implemented	
	2	Capture and dissemination of maintenance knowledge	Implemented	
	3	The time constant for online repair of steam leaks must be restricted to a few hours and not wait for the next shut down clearance.	Implemented	
	4	Overhaul should be oriented towards performance. Testing before and after an AOH using the *same type of coal* and the results should be archived.	Implemented	
	5	Benchmarking of unit performance before and after an overhaul with the same type of coal	Implemented	
	6	Forced Outage data needs to be captured and converted into knowledge by trying to understand the origin of the outage and various scenarios of avoiding the outage.	Implemented	Event analysis and root cause analysis of F/O carried out and circulated to other Power Station. Knowledge based improvement
	7	Analysis of Forced Outage and equipment failures, development of a knowledge base of these and conversion of the knowledge base into a learning experience with horizontal and vertical penetration	Implemented	Covered in ERP
	8	Renovation & modernization is a continuous process and small steps in the direction of refurbishment, retrofitting, modernization, uprating and up gradation of small sub-systems and components must be a part of continual improvement.	Implemented	
	9	Development and implementation of major maintenance works standards must be made mandatory for all.	Implemented	Quality procedures are prepared through ISO 9001 and major maint. works stds are followed as per OEM manuals.
	10	Strategic planning for integrated management (all MSPGCL) of cold stand high capacity and high power by equipment like ID fans, motors, generator rotors, etc.	Implemented	

	11	R & M schemes must be aligned to performance improvement	Implemented	
	12	Cleaning of HT and LT panels at regular intervals	Implemented	
	13	MSPGCL must critically review its **maintenance processes and its maintenance organization structure** and make necessary provisions for two groups viz. Technical & planning and Execution. Work and time studies of maintenance processes is a worthy exercise.	To be Implemented	Included under general MSPGCL report
	14	Maintenance performance must be mapped through effectiveness, outage and rework indices.	To be Implemented	Included under general MSPGCL report
	15	5 year rolling plan for maintenance should be got approved in one go rather in yearly instalments.	To be Implemented	Included under general MSPGCL report
	16	Annual overhauls need to be carried out every year and should not be deferred by over 2 months under any circumstance.	To be Implemented	Included under general MSPGCL report
	17	Capital overhauls may be taken up in 5 years intervals without fail and should not be delayed by over 3 months under any circumstance.	To be Implemented	Included under general MSPGCL report
	18	After stabilizing and levelling of previous years backlogs of skipping of COH & AOH, maintenance budget and man power allocation should be linked to performance of the units in terms of availability.	To be implemented	Included under general MSPGCL report
	19	For essential OEM maintenance spares of a critical nature, 5 years rolling plan may be made and put up for approval in one go. The process may be simplified.	To be Implemented	Included under general MSPGCL report
	20	Technical experts group must be formed by identifying experts from among various MSPGCL power stations.	To be Implemented	Included under general MSPGCL report
	21	The planning function must be incorporated with long term planning for refurbishment and renovation unit wise and equipment wise.	To be Implemented	Included under general MSPGCL report

	22	MSPGCL must have back to back Moue understanding with neighbouring utilities for sharing of hardware, technical expertise and knowledge. Periodic interactions are essential for confidence building.	To be Implemented	Included under general MSPGCL report
	23	Maintenance execution model needs to be involved for future with a scenario of lower level of artisans and engineers on the TPS side due to retirements.	Implemented	
	24	Quarterly assessment of obsolete, surplus & scrap material to be carried out and action will be initiated by major stores.	To be implemented.	Included under general MSPGCL report
	25	Cannibalization of the spares & accessories of the dismantled / replaced parts & machinery.	Implemented	
	26	Auctioning of the scrap materials to be at quarterly frequency.	To be implemented.	Included under general MSPGCL report
	27	Removal of all spares lying in the various locations in the boiler, turbine and premises leading to cooling towers	To be Implemented	Included under general MSPGCL report
	28	In the heat exchanger replacement process, the station must explore possibilities of material upgradation, material profile improvement, design changes to improve velocity profiles and improved erosion control devices in preference over old design and old material.	To be Implemented	
	29	Mini overhauls of 10 days intervals can be considered instead of an AOH if there is no single activity exceeding 10 days. However, these should note delayed by over a month from the schedule.	To be Implemented	Included under general MSPGCL report
	30	Multiple tier decisions resulting in frequent changing of the R & M plans must be avoided.	To be Implemented	Included under general MSPGCL report
	31	**Decision making:** Station centric decision making is called for in the following areas: Ø Overhauls (COH & AOH) with only co-ordination from HO for queuing or lining up of the present station along with others. Ø Procurement decisions. Ø Station load management through optimal loading on good units and backing down of poor sets. Also decisions on withdrawal of poorly operating sets in lieu of reduction of overall station load. Ø Training decisions Ø Air travel decisions	To be Implemented	Included under general MSPGCL report

P9	1	Trend analysis of coal may be performance by the Coal Handling Plant which can be used as an input for more meaningful load predication for ABT.	Implemented	
	2	Video conference facilities of MSPGCL to be put to effective usage for HO-station and Station to station meetings/discussions.	Implemented	
	3	Decision maker in operations must be trained and regularly updated with policy issues of tariff, ABT, OLC & its financial consequences on operation decisions	Implemented	
	4	GCR working needs to be strengthened in respect of heat rate and its financial impact on realistic basis.	To be Implemented	Included under general MSPGCL report
	5	IT expertise is required in: networking, Data base management and administration; hardware, IT support systems, systems engineering	To be Implemented	Included under general MSPGCL report
	6	As is followed in stations In USA and Europe, the previous year's data on the same day may be used as in input for load prediction ABT	To be Implemented	Included under general MSPGCL report
P-10	1	Parameter defect card system must be introduced for operational optimization	Implemented	
	2	Currents of individual equipment for different plant load may be made available in the control room	Implemented	
	3	The station may seek exciting challenges such as operating one unit continuously for 100 days at a stretch.	Implemented	
	4	Profiling of start-ups and shut downs to optimize resources.	Implemented	
	5	The TPS must ensure, from energy efficiency considerations, that the minimum load does not go below 90 % MCR (16 MW) for 20 MW units and 80 % MCR for 210 MW units (168 MW).	Implemented	
	6	Booking of generation loss in appropriate category by Operation Head for effective analysis of root cause.	Implemented	

	7	Maintaining the coal – air temperature near to design value	Implemented	
	8	Optimizing the mill coal fineness by adjusting and monitoring the classifiers at regular intervals.	Implemented	
	9	Increase the PA fan discharge pressure near to the design value	Implemented	
	10	Operational optimization should be essentially implemented. Focused monitoring and control for achieving reduction in coal consumption.	Implemented	
	11	Colour coding may be as per ANSI A13.1 Standard for pipe identification as follows: Yellow for gas, lube oil, steam, petroleum oil (LDO & FO), hazardous materials like corrosive fluids, etc.; Green for water pipe lines, feed water lines at low pressure say below 5 kg_f/cm^2; blue for feed water, compressed air carrying at above 5 kg_f/cm^2; red for electric power lines, conduits carrying cables, etc.	Implemented	
	12	Process simplification through review and revamp of clauses such as justification clauses, etc.	Implemented	
	13	Implementing a detailed rainy season station management plan.	Implemented	
	14	Increasing the FD Fan Discharge Pressure	To be Implemented	ID fan getting overload.
	15	Operating single CWP pumps during winter season.	To be Implemented	Not possible for full load (as condenser vacuum drops)
P-11	1	There must be place for decision making in the annual performance assessment.	Implemented	
	2	Focused in-house training based on actual need for training in required areas.	Implemented	
	3	360° feedback is essential for all training programs.	Implemented	
	4	Young talent with around 3 years of service in operation/maintenance side should be regularly brought into POG for training and enrichment.	Implemented	

	5	Station Head to facilitate exposure of latest technologies and best practices to its maintenance engineers and propagate learning at station level through talk / presentation by the deputed engineers.	Implemented	
	6	**On-Job rotation** policy should ensure job rotation into three areas in the entry level, three other areas in second level and balance areas at the third level as a pre-qualification to the next higher level.	To be Implemented	Included under general MSPGCL report
	7	**Decision making:** A critical review of decision making hierarchies and resetting the processes at appropriate levels.	To be Implemented	Included under general MSPGCL report
	8	Aligning of timing of General Services Depts. with O & M General shift timing.	To be implemented	Included under general MSPGCL report
	9	A transparent, uniform, system dependent and person independent placement and transfer policy for officers, technicians and non-technical personnel.	To be Implemented	Included under general MSPGCL report
	10	Suggestion scheme & positive mechanism to absorb suggestions.	Implemented	
	11	Revamp of the promotional procedures and policies.	To be Implemented	Included under general MSPGCL report
	12	Performance based job delivery system are in place at all levels at the section level. These must be focused at the individual engine level. Job functions must be linked to performance.	To be Implemented	Included under general MSPGCL report
	13	**Employee Lien program**: For every 5 years of continuous service 1 year of lien could be provided while retaining person's seniority and salary scale protection.	To be Implemented	Included under general MSPGCL report
	14	**Mid-career management education interventions** for MBA.	To be Implemented	Included under general MSPGCL report
	15	Quality circles must be initiated at Parli TPS	To be implemented	
	16	Formation of **Management quality circle** at the TPS	To be implemented	
	17	Quality circle movement at MSPGCL has majority participation from artisans while the role of engineers is to remain as facilitator/coordinator. **Formation of Engineers quality circles** is required.	To be implemented	
	18	Future managers at the CGM and GM levels must be of a younger age group for which revisiting the promotional policy to career based schemes as the prime criterion.	To be Implemented	Included under general MSPGCL report

	19	**Designation:** Re-designation of engineering cadre by extending managerial designation below GM level and bring in managerial role & responsibility for transformation.	To be Implemented	Included under general MSPGCL report
P-12	1	The section level ISO objectives must be more focused on performance and oriented towards achieving better levels of performance. Instead of objectives oriented towards resource conservation, shift towards heat rate improvement.	Implemented	
	2	**KAIZEN** is recommended for improvements in maintenance and operations procedures.	To be Implemented	Included under general MSPGCL report
P-13	1	Arresting leakages in Mills.	Implemented	
	2	Reducing air leakages in compressed air line	Implemented	
	3	Optimizing the use of HP water pumps, clear water pumps and ash water pumps at stage II	Implemented	
	4	Optimizing the voltage at motor terminals by changing the transformer taps	Implemented	
	5	Reducing overloading of motors	Implemented	
	6	Overhauling of inter-stage cooler heat exchanger	Implemented	
	7	Cleaning of lube oil coolers of all HT equipment	Implemented	
	8	Avoiding overloading of RWP at Naikota PH	Implemented	
	9	Plotting of auxiliary power variation with plant load and made available at control room for the operator to monitor the auxiliary power	Implemented	
	10	Arresting air leakages and flue gas leakages in ducts	Implemented	
	11	Reducing the pressure of service air compressors to 4.0 kg_f/cm^2	To be Implemented	IAC & SAC are interconnected
	12	GT secondary energy meter (from GCR) reading may also be incorporated in auxiliary power computation.	To be Implemented	The matter will be taken up with MSETCL for sparing 1 spare channel of having 4 – 20 mA format, if not available. New Energy Meter to be installed at GT Secondary of 0.2 Accuracy Class.
P-14	1	Water/air washing of boiler gallery once a month	Implemented	

	2	The cleanliness levels in the boiler and turbine galleries need to be improved at all elevations by removal of debris of the repair works. **Monthly air/water cleaning** of boiler, galleries and surrounding areas can be considered.	Implemented	
	3	When leakage of valves in boiler gallery or turbine elevations occur and cannot be eliminated or mitigated a tray with a drain leading clearly off the equipment below the valve may be kept to avoid secondary damage. Unit- **3,4 & 5.**	Implemented	Trays with drain lines are provided to avoid secondary damages .