POWER & UTILITIES

Iberdrola's WindCORE...Toledo, ES

POWER & UTILITIES

Endesa Dynamic Performance and Diagnostics Competence Center

POWER & UTILITIES

Saudi Aramco Command Center

OSIsoft.

Tracks 18,000 real-time data updated every 15 seconds, and 22,400 electric-power-generation and distribution data updated every 2 seconds

POWER & UTILITIES

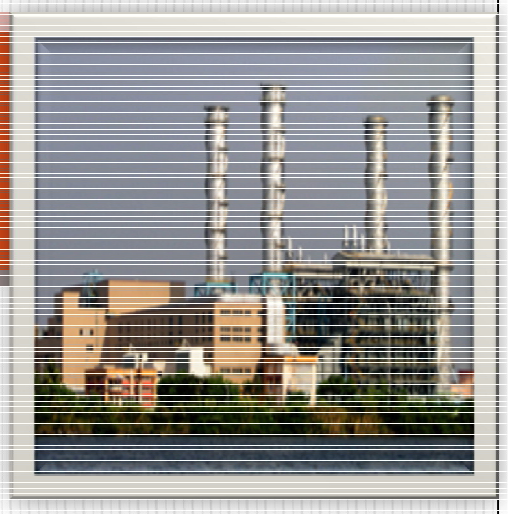
Thank you

skamath@osisoft.com

777 Davis St., Suite 250 San Leandro, CA 94577

ISA Delhi Section

Effective Planning of Resources and Monitor Overhauling Preparedness



Anand Prakash
V.P. Singh

National Thermal Power Corporation Limited

ISA(D) POWAT-INDIA 2012, New Delhi January 13th -14th, 2012

Presentation Overview

- About ERP
- Assets O&M-Solutions Coverage at NTPC
- Activity Based Budgeting (ABB):

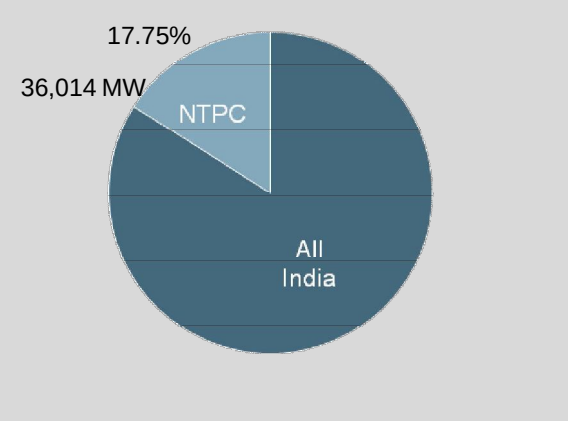
  Business Requirements, Salient Features, Process Flow/Steps, Benefits, Reports
- Overhaul Preparedness Index (OPI):

  Business Requirements, Salient Features/Benefits, Heads, Procurement activities, Score display
- Conclusion

NTPC Contributes More Than One-fourth of India's Total Power Generation with Less Than One-fifth Capacity

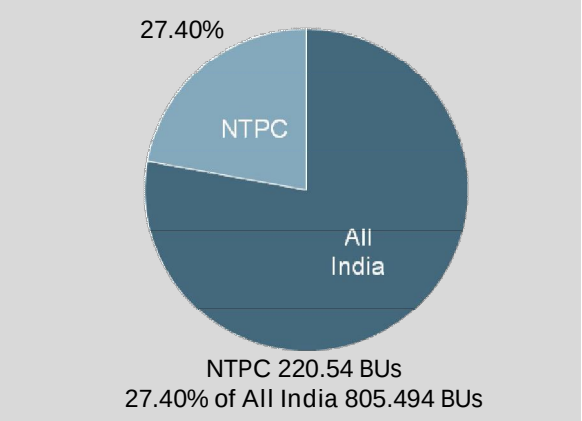
Total Capacity

Till date



Generation

2010-11



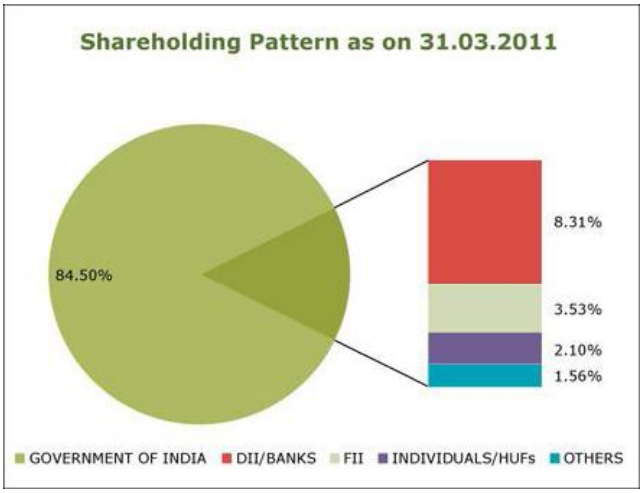
- Set up in 1975 with 100% ownership by government of India
- The largest power generation company in India, with comprehensive in-house capabilities in building and operating power projects
- Current operating capacity = 36,014 MW (including JVs).
- 20 coal based and 8 gas based power plants ; 3 hydro projects under construction
- Developing coal mines for captive use
- Exploring oil/gas blocks in consortium with partners

NTPC - Operational Performance

- Generation from NTPC units increased by around 1% to 220.54 BUs in 2010-11 from 218.84 BUs in 2009-10.
- 7 NTPC stations figure among the top 10 stations in the country in terms of PLF in 2010-11.
- Average PLF of NTPC coal stations was 88.29% in 2010-11.
- Average PLF of NTPC gas stations was 71.77% in 2010-11.
- Coal stations of NTPC achieved an Availability of 91.6% in 2010-11 against 91.4% achieved in 2009-10.

NTPC – Today

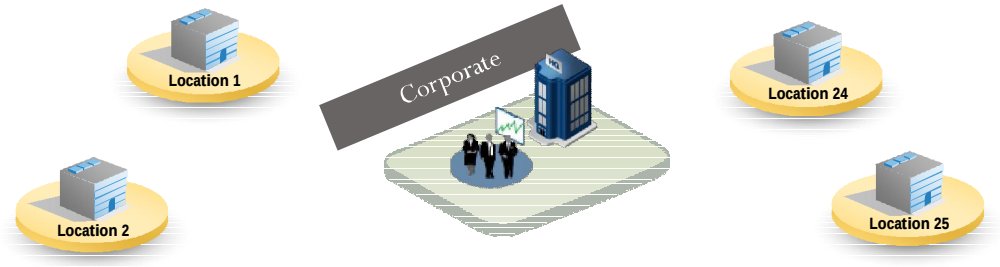
Ownership



Stature

- Awarded "Maharatna" status in May 2010
- No.1 Independent Power Producer globally in the Platts Top 250 Global Energy Company Rankings
- Ranked 348th in Global ranking among 'Global 2000' list of companies compiled by Forbes in 2011
- "Excellent" rating under Government of India MOU for the FY'11
- Most respected company in Power Sector for the year 2011 (by Businessworld).

Pre-ERP Disparate Application Landscape Did Not Support NTPC's Business Goals



Finance	HR	Procurement	Billing	Asset Mgmt.
OLIMFAS (Decentralized At 25 Locations)	Peoplesoft	OLIMFAS	ICMS	Anurakshan
		Wipro E-tendering		

Quality Mgmt	Engineering	Operation & Maintenance	Project Mgmt	Environment Safety
Windsor	Dreams	OPPMS	Primavera	PMS
		GDAMS		

COTS | Custom Application | Spreadsheet / Low system usage

Key Issues

- Integration
- Enterprise wide visibility
- Single version of "truth"
- Senior management reporting
- Financial closure & reconciliations
- Material codification and inventory management
- Employee empowerment through self service & knowledge management

ERP – The Genesis of Project 'Lakshya'

Project Start May 2006

Pilot Go Live June 2007

Roll Out at all sites Aug 2008

Define the Business Strategy

- Organisation restructuring and business process reengineering
- Long term business strategy
- HR Strategy
- IT strategy

Develop a Supporting IT Strategy

- Define the IT strategy/roadmap and select the right approach
- Home grown
- Best of breed
- Standard off-the shelf application

Select the right IT Partner

- Evaluate and award the contract to the best ERP solution provider
- Selected SAP as the IT platform for NTPC
- Awarded the contract to SAP Consulting & SISL to implement the project

Pilot Implementation

- Implemented the whole suite of SAP applications across 5 locations
- First pilot projects live in 10 months

Roll Out at all sites

- Rolled out the application to across the rest of the 25 locations

ERP – All Locations Are Live

S.No	Location	Actual Go live Date	S.No	Location	Actual Go live Date
1	Faridabad	Jun-07	16	Vindhyachal	Dec-07
2	Ramagundam	Jun-07	17	Korba	Feb-08
3	Koldam	Jul-07	18	Lucknow RO	Feb-08
4	NCR & Engg	Jul-07	19	Rihand	May-08
5	Corp HQ	Aug-07	20	Sipat	May-08
6	Hyderabad RO	Aug-07	21	Unchahar	May-08
7	Subs.	Aug-07	22	Badarpur	Jun-08
8	Anta	Sep-07	23	Barh	Jun-08
9	Gandhar	Sep-07	24	Dadri	Jun-08
10	Mumbai RO	Sep-07	25	Farakka	Jul-08
11	Kawas	Nov-07	26	Talcher 1	Jul-08
12	Kayamkulam	Nov-07	27	Talcher 2	Jul-08
13	Patna RO	Nov-07	28	Tanda	Jul-08
14	Auraiya	Dec-07	29	Kahalgoan	Aug-08
15	Simhadri	Dec-07	30	Singrauli	Aug-08

Project
L A K S H Y A

Asset Operations and Maintenance – Solution Coverage at NTPC

Process Description

- General Maintenance – Direct to maintenance where no planning required.
- Corrective Maintenance
- Preventive Maintenance – Automatically created by system as per schedule
- Condition Based Maintenance – On line/off line WOC creation.
- Calibration Process
- Refurbishment Process
- ABB-Activity Based Budgeting
- Overhauling Preparedness Index
- RCM-Data Porting for RCM Analysis.
- Workshop Management
- Spares Part Development
- DMS-O&M Documentation & Print Room Management
- Work Clearance Management
- Operation MIS in SAP – Operation MIS has been configured in SAP resulting in switchover from legacy OPPMS to SAP
- ORT through ERP – ERP reports & data being used in conductance of ORT

ABB – Business Requirements

- Repair & Maintenance/Capital Spares Budget be automatically derived from planned maintenance activities and resources.
- Availability of item wise requirement to facilitate monitoring of procurement and consumption.
- Simplification of procurement process.
- Monitoring of activity wise planned vs. actual consumption cost.

ABB - Nomenclature

- Activity: Activity means any maintenance job performed on a particular equipment/functional location.

- Budget: Budget means Repair & Maintenance/Capital Spares Budget during a particular financial year.

ABB – Salient Features

- Preparation of *planned* R&M (Consumption) Budget and Capital Spares (Procurement) Budget for next 3 fiscal years.
- Targets both type of resources i.e. material, services.
- Online Approval of budget.
- Purchase activity triggering for next 2 fiscal years in advance.

Caters to

- Preventive maintenance
- Corrective maintenance
- Overhauling maintenance
- Buildings
- Other assets
- Township

ABB – Process Flow

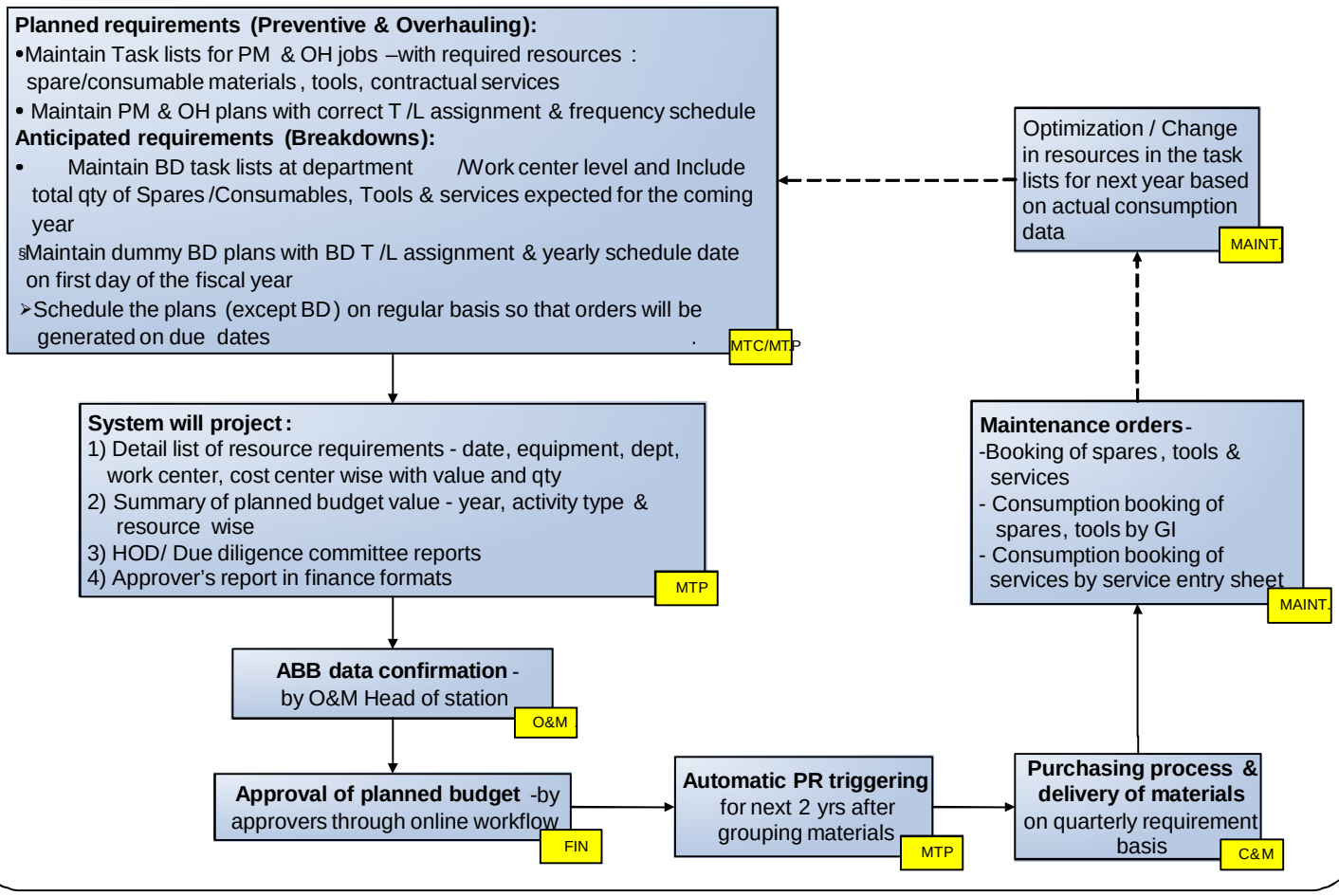


ABB – Process steps

- Creation of Task List – Activities & Resources (Mtc.)
- Creation and scheduling of Maintenance Plan (MTP)
- Data collection run (MTP)
- Display of collected data and checking (Mtc.)
- Review of data (HOD)
- Confirmation of data (Head of O&M)
- Triggering of approval workflow (Head of O&M)
- Online approval by Approvers (Site Fin, HOS, RHQ, CC-OS, CC-Fin)
- Triggering of material Purchase requisitions (MTP)
- Purchase process (C&M)
- Goods receipt as per quarterly delivery schedules

ABB – Benefits

- Budget is based on planned activities and required resources.
- Budget is approved once in a year - firm approval for the next year, provisional approval for 2nd and 3rd fiscal years.
- Indents are triggered in advance for next 2 years from approved budget - may lead to lower inventory.
- Better monitoring of consumption and procurement of the resources.

ABB - Reports

- Summary of Repair & Maintenance Budget
- Detailed display of Activities & Resources
- Resource Monitoring Report
- Approver/Finance Report
- On-line Approval Status Report
- Budget Utilization Report
- Capital Spares Budget Report

OPI – Business Requirements

- Requirement of a tool to monitor preparedness of unit overhaul over a certain period of time.
- Systematic monitoring of different procurement activities related to overhaul.
- Identification of exceptions in the process of overhaul preparation and submission to station management.
- Flagging of issues related to overhaul preparation to top management.

OPI - Nomenclature

- **Overhaul:** Maintenance activities carried out during periodic overhaul schedule of the generating unit.
- **Preparedness:** Preparedness of resources e.g. material, services required for the overhaul.
- **Index:** Score based on preparedness level of resources required for the overhaul.

OPI – Salient Features/Benefits

- OPI score is used as a tool to monitor status of overhaul preparedness from -24M onwards.
- One-time data entry with regards to resources required for unit overhaul.
- Automatic updation of procurement status with respect to resources required for overhaul.
- Calculation of OPI score based on the procurement status of the resources required for overhaul.
- Visibility of shortfall details with respect to different procurement activities.
- Display of OPI score of all overhauls of all NTPC stations on a single screen.

OPI - Heads

OPI score is calculated on the following heads:

- Spares
  - Critical
  - Non-critical
- Consumables
- T&P
- Services/Contracts

Overall OPI score is calculated based on the score of the individual heads.

OPI - Procurement activities

Calculation of OPI score considers following 5 procurement activities:

- Identification of items
- Purchase Requisitions raised (of no. of items)
- Purchase enquiry issued (of no. of items)
- Purchase order placed (of no. of items)
- Items received (of no. of items)

OPI – Score display of all overhauls

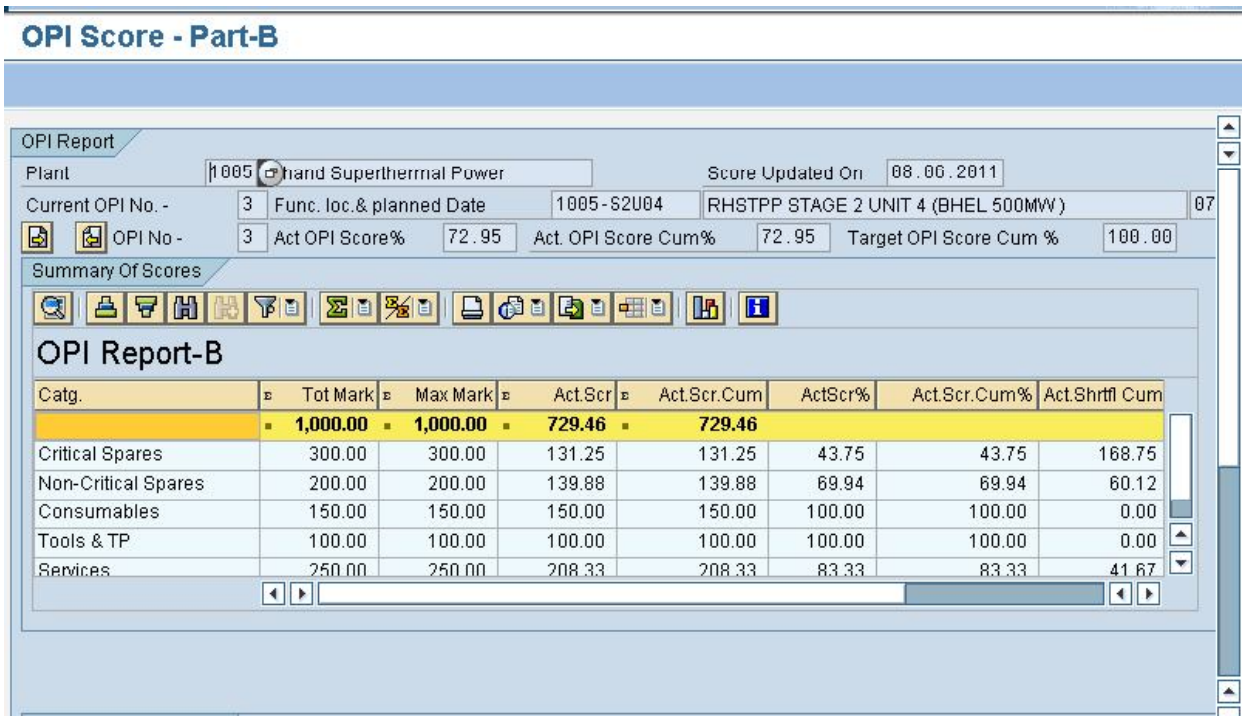
OPI PART-B Summary Report

COMPANY LEVEL REPORT

Financial Year 2011 - 2012

Plant Name	Func. Location Desc.	OH Date	OPI No.(-)	Act. OPI Score Cum %	Act. OPI Score
Singrauli Super Thermal Power	STAGE 1 UNIT#1	08.09.2011	3	66.64	66.57
	STAGE 1 UNIT#2	25.09.2011	3	86.39	84.81
	STAGE 1 UNIT#3				
	STAGE 1 UNIT#4				
	STAGE 1 UNIT#5	01.12.2011	6	67.44	84.59
	"Stage-2,U 06,500MW"	31.12.2011	6	62.22	91.35
	"Stage 2, Unit 07 , 500 MW,BHEL"	15.10.2011	4	62.51	69.17
Rihand Superthermal Power	RHSTPP STAGE 1 UNIT 1	01.04.2011	1	70.81	70.81
	RHSTPP STAGE 1 UNIT 2				
	RHSTPP STAGE 2 UNIT 3 (BHEL 500 MV				
	RHSTPP STAGE 2 UNIT 4 (BHEL 500MW	07.09.2011	3	72.57	72.57
Feroz Gandhi Unchahar Thermal	U#1 STAGE-1 UNIT-1				
	UNCHAHAR STAGE-1 UNIT-2 (U#2)	01.04.2011	1	76.98	76.98

OPI – Score display of an overhaul



Catg.	Tot Mark	Max Mark	Act.Scr	Act.Scr.Cum	ActScr%	Act.Scr.Cum%	Act.Shrtfl Cum
	1,000.00	**1,000.00**	**729.46**	**729.46**			
Critical Spares	300.00	300.00	131.25	131.25	43.75	43.75	168.75
Non-Critical Spares	200.00	200.00	139.88	139.88	69.94	69.94	60.12
Consumables	150.00	150.00	150.00	150.00	100.00	100.00	0.00
Tools & TP	100.00	100.00	100.00	100.00	100.00	100.00	0.00
Services	250.00	250.00	208.33	208.33	83.33	83.33	41.67

Conclusion

- ABB is a systematic and logical way of preparing Repair & Maintenance/Capital Spares Budget.
- Effectiveness of ABB depends on the quality of resource planning.
- R&M and Capital Spares Budget are being prepared across all the operating stations of NTPC through ABB.
- OPI system developed in ERP is an automated way to monitor preparedness of overhaul over 2 year period.
- OPI has been implemented across all the operating stations of NTPC.

Thank You

Task list – Activities and Resources

unc. Loc. 1010-S2U04-BLR-BBF-EEF-EF3 U#4 BOILER CORNER EF3 ELEVATI
roup 80437 OH OF IGNITOR EF3 Grp.Countr OI

General Operation Overview

OpAc	SOp	Work ctr	PInt	Ctrl	Operation Description
0010		I100BLR	1010	WCM	TAKE PERMIT
0020		I100BLR	1010	PM03	ANNUAL OVERHAUL
0030		I100BLR	1010	ZPMD	CHECK JAMESBURY VALVE OPERATION AND RECT
0040		I100BLR	1010	ZPMD	CLEAN LINE FILTERS AND OIL FILTER
0050		I100BLR	1010	ZPMD	CLEAN SPARK PLUG SET RIGHT THE CABLE
0060		I100BLR	1010	ZPMD	TIGHT CONNECTIONS IN J.B.
0070		I100BLR	1010	ZPMD	1. PURGE THE LINES.
0080		I100BLR	1010	ZPMD	1.CLEAN THE JUNCTION BOX.
0090		I100BLR	1010	PM01	

Component Assignments

Material	Quantity	Un	B	M	Component Description
M0365400026	0.050	KG	☐		PVC SHEET RIGID TYPE-1 IS:6307, 0.12
M0747164009	0.100	KG	☐		VAR. INSUL. AIR DRY ELMOTHERMF LIC
M0752230047	0.100	L	☐		RUST TREATMENT COMPOUND-RUST(
M1010100009	0.500	L	☐		CTC FOR CLEANING OF ELECTRICAL (
M1030604998	0.100	NO	☐		RUBBER ADHESIVE/QUICK FIX
M1039103915	0.200	KG	☐		GENERAL PURPOSE M-SEAL COMPOU
M2381751559	1.000	NO	☐		EMERY PAPER GRIT100-230X280MM SI
M2001010303	0.100	NO	☐		MARKIN CLOTH WHITE COTTON 120 CI

Li...	Del. Ind.	Service No.	Short Text	Quantity	Un
10	☐	CI0603017024	Servicing Igniters	1	NO
20	☐				
30	☐				
40	☐				
50	☐				

Maintenance Plan – Scheduling

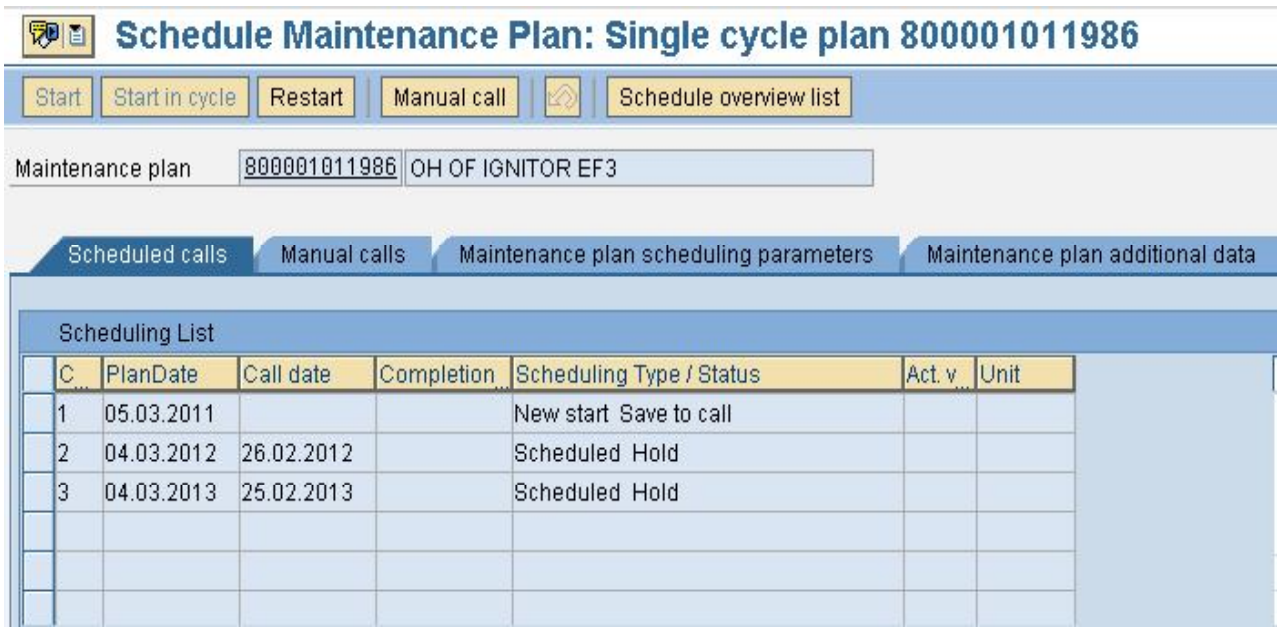


ABB - Summary of R&M Budget

Cost Ratios(Planned)

HOD/DDC Reports

Approver/Fin Reports

Total Repairs and Maintenance Budget (Rs. Lacs)

Plant	Run Year	Req. Year	Material Cost	Tool Cost	Service Cost	Total Cost
1017	2011	2012	6,623.37	13.74	4,915.58	11,552.69
1017	2011	2013	7,057.95	10.34	7,100.53	14,168.82
1017	2011	2014	4,589.81	1.20	4,206.48	8,797.49

Total Repairs and Maint.(Plant and M/c) Budget (Rs. Lacs)

Plant	Run Year	Req. Year	Material Cost	Tool Cost	Service Cost	Total Cost
1017	2011	2012	6,290.74	13.74	2,956.42	9,260.90
1017	2011	2013	6,725.32	10.34	5,141.37	11,877.03
1017	2011	2014	4,332.12	1.20	2,690.44	7,023.76

Overhauling Maintenance Budget (Rs. Lacs)

Plant	Run Year	Req. Year	Material Cost	Tool Cost	Service Cost	Total Cost
1017	2011	2012	3,904.52	1.43	1,526.37	5,432.32
1017	2011	2013	4,336.56	1.00	3,710.16	8,047.72
1017	2011	2014	2,161.29	0.76	1,305.28	3,467.33

Preventive Maintenance Budget (Rs. Lacs)

Plant	Run Year	Req. Year	Material Cost	Tool Cost	Service Cost	Total Cost
1017	2011	2012	573.40	11.87	1,045.54	1,630.81
1017	2011	2013	567.79	8.90	1,046.65	1,623.34
1017	2011	2014	541.61	0.00	1,006.89	1,548.50

ABB – Detailed display

Planned D...	Functional Loc Desc	Task Description	Material Text	Service Short Text	Qty	Net Value
26.03.2013	KSTPP-U6 COAL MILL A	C&I-OH OF COAL MILL A C&I	HAG SOL ASCO C		1.000	52,591.53
26.03.2013	KSTPP-U6 COAL MILL A	C&I-OH OF COAL MILL A C&I		Misc Works (<>) Fabrication	5.000	0.00
26.03.2013	KSTPP-U6 COAL MILL C	C&I-OH OF COAL MILL C C&I		Pneumatic Actuators (<>) OH	3.000	1,395.00
26.03.2013	KSTPP-U6 COAL MILL C	C&I-OH OF COAL MILL C C&I	E/P CONVERTER		0.010	66.07
26.03.2013	KSTPP-U6 COAL MILL C	C&I-OH OF COAL MILL C C&I		Cables (Dia<= 25MM) Laying	100.00(	1,400.00
26.03.2013	KSTPP-U6 COAL MILL C	C&I-OH OF COAL MILL C C&I		Local Pr. Switches (<>) Serv	4.000	688.00
26.03.2013	KSTPP-U6 COAL MILL C	C&I-OH OF COAL MILL C C&I		Temp.Gauge (<>) Checking	3.000	630.00
26.03.2013	KSTPP-U6 COAL MILL C	C&I-OH OF COAL MILL C C&I	MERCURY IN STE		0.010	4.39
26.03.2013	KSTPP-U6 COAL MILL C	C&I-OH OF COAL MILL C C&I		Pneumatic Actuators (<>) OH	1.000	465.00
26.03.2013	KSTPP-U6 COAL MILL C	C&I-OH OF COAL MILL C C&I		Pneumatic Actuators (<>) OH	1.000	465.00
26.03.2013	KSTPP-U6 COAL MILL D	C&I-OH OF COAL MILL D C&I		Pneumatic Actuators (<>) OH	1.000	465.00
26.03.2013	KSTPP-U6 COAL MILL D	C&I-OH OF COAL MILL D C&I		Pneumatic Actuators (<>) OH	4.000	1,860.00
26.03.2013	KSTPP-U6 COAL MILL D	C&I-OH OF COAL MILL D C&I		Local Pr. Switches (<>) Serv	5.000	860.00
26.03.2013	KSTPP-U6 COAL MILL D	C&I-OH OF COAL MILL D C&I		Local Pr. Switches (<>) Serv	4.000	688.00
26.03.2013	KSTPP-U6 COAL MILL A	C&I-OH OF COAL MILL A C&I	PR SWCH INDICA		1.000	4,012.02

ABB – Resource Monitoring Report

ABB Material/Spares monitoring Report for HOD/Due Dilligence Committee

Material	Description	UM	MType	Stock	Av Past...	Av Pa...	Proj FY1 Qty	Proj FY1 ...	Proj FY...	Proj FY2 V...	Proj FY...	Proj FY3 Val...
M016510	MS ROD DIA 35MM	NO	ZOTS				2.000	110.00				
M103905	OKS-601 MULTIFUI	NO	ZCGE				1.000	188.49	1.000	188.49	1.000	188.49
M106025	HYDROGEN ZERO	NO	ZCGE		0.667	3,560.6	4.000	21,364.00	4.500	24,034.50	4.000	21,364.00
M106088	O2 FOR CALI CON(	NO	ZCGE		0.667	3,560.6	3.000	16,023.00	3.500	18,693.50	3.000	16,023.00
M107020	Cal.GAS,CO2 GAS I	NO	ZCGE		4.000	1,662.1	26.000	54,678.00	26.000	54,678.00	27.000	56,781.00
M107040	21%OXYGEN+BAL/	NO	ZCGE	2.000			7.000	455.00	8.000	520.00	7.000	455.00
M107050	Cal.Gas, H2 GAS 9!	NO	ZCGE		1.000	1,167.4	26.000		26.000		26.000	
M107055	95% H2 ,BALANCE	NO	ZCGE				26.000	1,690.00	26.000	1,690.00	26.000	1,690.00
M107070	95% HYDROGEN +	M3	ZCGE				26.000	1,820.00	26.000	1,820.00	26.000	1,820.00
M111200	SERVO CONVAL 4(	L	ZO&L		350.000	36,269.	520.000		525.000		520.000	
M111201	OIL HYD. CIR. SYS:	L	ZO&L		10,923.0	1,125,5	344.800	20,108.58	344.800	20,108.58	349.000	20,353.52
M111500	HYDROMOTOR OIL	BT	ZO&L	13.000	16.667	5,807.3	35.000	12,226.90	35.000	12,226.90	10.000	3,493.40
M161334	MS ERW PIPES HE	M	ZOTH	439.02	2,961.52	1,097,8	15.000	6,591.30	15.000	6,591.30	15.000	6,591.30
M161690	S S BRD HOS CON	NO	ZOTH	80.000	64.000	18,414.	154.000	37,283.40	4.000	968.40	4.000	968.40

ABB – Approver/Finance Report

ABB Budget Summary Report as per Finance Format A/S/08

Repair & Mtc.	Head	2009-10	2010-11	2011-12	BE (2012-13)	RE (2012-13)	BE (2013-14)	BE (2014-15)
(i) Plant & Machin.								
Overhaul	Material	1,362.20	2,812.29	2,336.20	3,927.06	3,904.52	4,336.56	2,161.29
	Contractor Cost		652.79	927.12	1,644.10	1,526.37	3,710.16	1,305.28
	Others (Tools)	4.09	2.39	5.79	1.07	1.43	1.00	0.76
Preventive	Material	539.34	749.44	634.97	603.23	573.40	567.79	541.61
	Contractor Cost		83.57	346.21	936.80	1,045.54	1,046.65	1,006.89
	Others (Tools)	3.22	9.14	0.15	3.03	11.87	8.90	
Corrective	Material	2,116.71	1,794.11	1,104.29	747.41	1,215.27	1,223.42	1,223.42
	Contractor Cost		415.20	335.24	342.87	359.85	359.89	359.89
	Others (Tools)	21.96	7.43	5.99	0.37	0.44	0.44	0.44
Reliability	Material				564.66	324.08	324.08	133.92
	Contractor Cost				1.05	13.80	13.81	7.52
	Others (Tools)							
Exception	Material				587.55	273.47	273.47	271.88

ABB – On-line approval status Reoprt

Approval Status of ABB Data

Run Year : 2011-12

Plant	Head of O&M	Head of Finance	Head of Project	RED	ED(OS)	ED(Finance)
Singrauli Super Thermal Po	Initiated(17/12/2011)	Appr.(19/12/2011)	Appr.(19/12/2011)	Appr.(21/12/2011)		
Rihand Superthermal Powe	Initiated(17/12/2011)	Appr.(17/12/2011)	Appr.(17/12/2011)	Appr.(21/12/2011)		
Feroz Gandhi Unchahar Th	Initiated(28/11/2011)	Appr.(28/11/2011)	Appr.(28/11/2011)	Appr.(21/12/2011)		
Tanda Thermal Power Proje	Initiated(03/12/2011)	Appr.(06/12/2011)	Appr.(14/12/2011)	Appr.(21/12/2011)		
Badarpur Thermal Power St	Initiated(06/01/2012)	Appr.(06/01/2012)	Appr.(06/01/2012)	Appr.(06/01/2012)		
Dadri Thermal Power Projec	Initiated(02/12/2011)	Appr.(03/12/2011)	Appr.(03/12/2011)	Appr.(06/01/2012)		
Auraiya Gas Power Project	Initiated(05/01/2012)	Appr.(06/01/2012)	Appr.(06/01/2012)	Appr.(06/01/2012)		
Anta Gas Power Project	Initiated(06/01/2012)	Appr.(06/01/2012)	Appr.(06/01/2012)	Appr.(06/01/2012)		
Dadri Gas Power Project	Initiated(17/12/2011)	Appr.(17/12/2011)	Appr.(17/12/2011)	Appr.(06/01/2012)		
Faridabad Gas Power Static	Initiated(06/01/2012)	Appr.(06/01/2012)	Appr.(06/01/2012)	Appr.(06/01/2012)		
Korba Super Thermal Powe	Initiated(28/11/2011)	Appr.(29/11/2011)	Appr.(02/12/2011)	Appr.(05/12/2011)	Appr.(09/12/2011)	
Vindhyachal Super Thermal	Initiated(09/12/2011)	Appr.(09/12/2011)	Appr.(09/12/2011)	Appr.(13/12/2011)		
Sipat Super Thermal Power	Initiated(08/12/2011)	Appr.(09/12/2011)	Appr.(09/12/2011)	Appr.(13/12/2011)		
Kawas Gas Power Project	Initiated(10/12/2011)	Appr.(10/12/2011)	Appr.(10/12/2011)	Appr.(12/12/2011)		
JHANOR-GANDHAR GAS P	Initiated(10/12/2011)	Appr.(12/12/2011)	Appr.(12/12/2011)	Appr.(12/12/2011)		
Farakka Super Thermal Pov	Initiated(05/12/2011)	Appr.(05/12/2011)	Appr.(06/12/2011)	Appr.(08/12/2011)		
Kahalgaon Super Thermal F	Initiated(01/12/2011)	Appr.(01/12/2011)	Appr.(01/12/2011)	Appr.(05/12/2011)	Appr.(09/12/2011)	

ABB – Budget Utilization Report

Repair & Mtc.		Apr Mon(B)	Apr Mon(A)	Apr YTM(B)	Apr YTM(A)	May Mon(B)	May Mon(A)
(i) Plant & Machin.							
Overhaul	Material Cost	44,376,575.07	44,226,853.22	44,376,575.07	44,226,853.22	58,960,816.11	37,950,637.63
	Contractor Cost	28,062,872.75	8,617,544.90	28,062,872.75	8,617,544.90	39,908,081.95	8,251,650.40
	Sub Total	72,439,447.82	52,844,398.12	72,439,447.82	52,844,398.12	98,868,898.06	46,202,288.03
Preventive	Material Cost	4,121,264.21	8,427,688.39	4,121,264.21	8,427,688.39	6,429,076.60	4,719,238.78
	Contractor Cost	6,763,747.75	16,371.50	6,763,747.75	16,371.50	8,623,628.66	219,758.08
	Sub Total	10,885,011.96	8,444,059.89	10,885,011.96	8,444,059.89	15,052,705.26	4,938,996.86
Corrective	Material Cost	85,461,146.62	7,785,514.29	85,461,146.62	7,785,514.29		8,400,655.46
	Contractor Cost	37,441,660.56	115,500.00	37,441,660.56	115,500.00		1,765,205.50
	Sub Total	122,902,807.18	7,901,014.29	122,902,807.18	7,901,014.29		10,165,860.96
Reliability	Material Cost	3,777,600.48		3,777,600.48		15,876,410.08	
	Contractor Cost	4,230.00		4,230.00		19,151.02	
	Sub Total	3,781,830.48		3,781,830.48		15,895,561.10	
Exception	Material Cost	4,883,088.00		4,883,088.00		5,041,243.20	
	Contractor Cost	209,796.50		209,796.50		209,746.50	
	Sub Total	5,092,884.50		5,092,884.50		5,250,989.70	

Key Cost Ratios	Apr Mon(B)	Apr Mon(A)	Apr YTM(B)	Apr YTM(A)	May Mon(B)	May Mon(A)	May YTM(B)	May YTM(A)	Jun
Rout. Mat. Cost/Total Rout. Cost (%)	66.96	99.19	66.96	99.19	42.71	86.86	64.51	93.27	
OH Mat. Cost/Total OH Cost (%)	61.26	83.69	61.26	83.69	59.64	82.14	60.32	82.97	
OH Cost/(Routine+OH) Cost (%)	35.13	76.38	35.13	76.38	86.79	75.36	53.51	75.90	

ABB – Capital Spares Budget Report

Material Cd	Description	Population	Present Stock	Pipeline ...	Mod. Rate	2012-13 Proc Qty	2012-13 Proc Value
M18401606	SLUICE/GATE VALVEC.I. 0-	30	2.000		24,790.22	3.000	0.74
M18512616	NON RETURN VALVE 300 N	12			48,107.00	1.000	0.48
M20525810	GEARBOX E315-12V,PIV MA	6			4,300,000.00		
M32468100	IMPLR PN151 ST-1 HP ASH	3	8.000		132,757.08	2.000	2.66
M32468761	BHR35/30:IMPELLER	5	4.000		248,131.98	2.000	4.96
M32801700	IMPELLER, PNO7, MEGHRA	2				1.000	
M33428400	IMPELLAR PART NO.26 SAM	2					
M33940700	WARMAN MAKE ASH SLURI	6		1.000	439,963.13		
M34088360	SCREW ELEMENT FOR TA(	6	2.000		2,817,665.34		
M34480560	ASSLY PISTON 9-1/2X7NLP	8			150,000.00	1.000	1.50
M34480560	ASSLY. PISTON P.N.704039	8			150,000.00	4.000	6.00
M34533800	EXT.PISTON,HP-S,PN45320	2					
M34533800	CRANK SHAFT,PN4517224	2					
M34533800	PISTON LP STAGE,IAC,2HY	2					
M56024100	SEC.STAGE WORM WHEEL	6	3.000				
M56051000	Deleted DRIVEN SPROCKE				25,079.23		
M56150400	VACUM P/P INTS.(ROTOR V		4.000				

Advance Vibration Analysis & Diagnosis System for Power Plant Rotary Machines

It Saves Cost & Increases Up Time !!

Mukesh Vyas
Division Head India
Forbes Marshall

ISA(D) POWAT-INDIA 2012, New Delhi January 13th -14th, 2012

Overview

- Introduction
- Power Plant Vibration Monitoring – Why Required ?
- Power Plant Turbine Vibration Monitoring Overview.
- Pump , Fan , Motors – On Line VMS Monitoring Solution.
- Plant Wide Vibration Analysis & Diagnosis Solution.
- Conclusion

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Introduction

- ***Forbes Marshall India.***

A Leading Indian Instrumentation Company with 87 year legacy with leading Joint Venture :

27 Branches….1170 Members…

25000 Customers…

Rs 800 Cr Turnover….

JV/Partner – Spirex , Krohne , Codel , Shinkawa, Arca , Vyncke , Trisen , Recordum….

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Introduction

- ***Shinkawa Electric Co Ltd Japan***

A Leading Asian VMS Manufacturer with US$ 350 Million Turnover.

Innovative VMS Supplier with High Quality, in house manufacturing of Non Contact Sensors , Monitoring System and Analysis/Diagnostic Software.

Leading OEM Partners – Mitsubishi , Toshiba , Hitachi , BHEL , Triveni , Shinippon , Fujii , Shanghai Electric…..

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Forbes Marshall & Indian Power Industry

- **Shinkawa Vibration Monitoring system – More than 1300 Customers and Used in 300 Large Power Plants above 250 / 500 / 600 MW…800 MW & 500 Captive Power Plants…**
- **Codel – Insitu Gas Analyzers – Changed the wave ….24 X 7 Working Analyzers for Sox , Nox & CO + Opacity Monitoring.**
- **SWAS – It is installed in almost all power plants of India.**
- **Ambient Air Monitoring System (AAQMS) – Plug & Play – Air pointer…No Need of Shelters !! A Revolution .**
- **Valves , Flow Meters , Level Measurement , Water Quality Analyzers….**

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Why on line Vibration Monitoring required for Power Plant Rotating Machine ?

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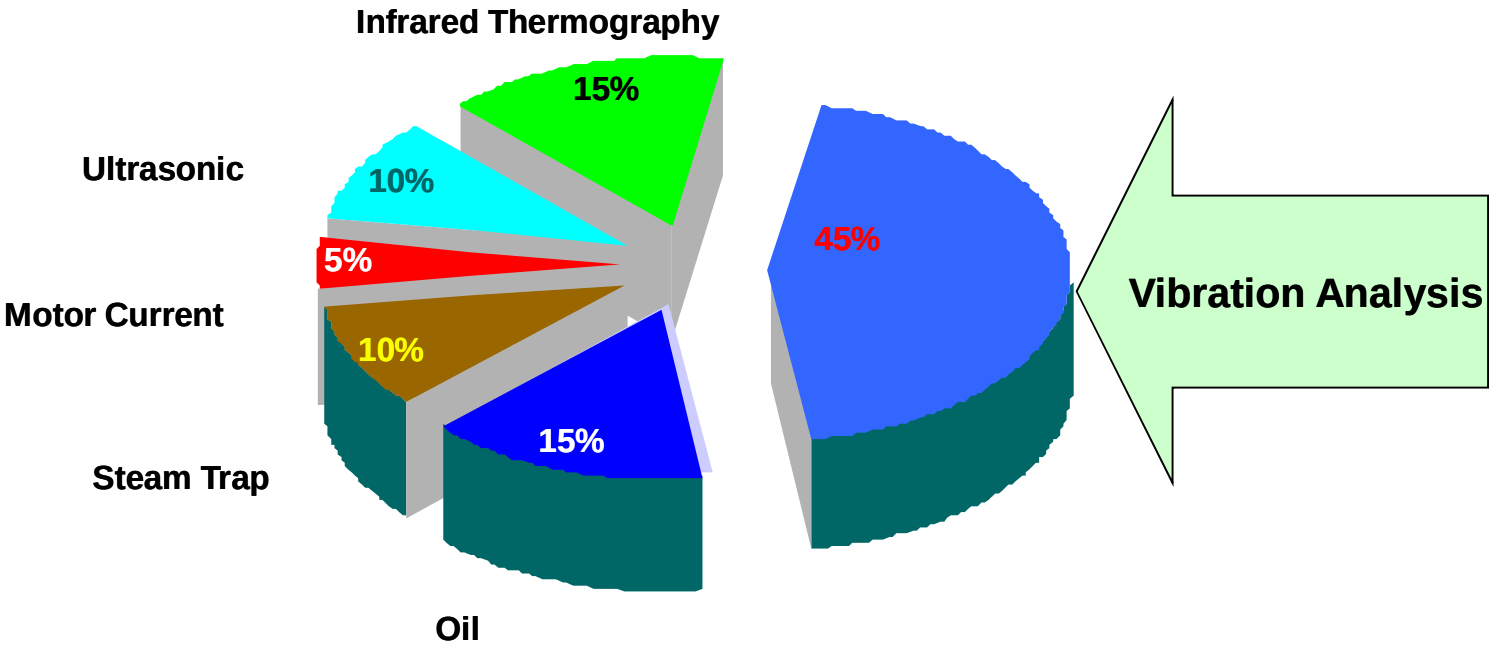

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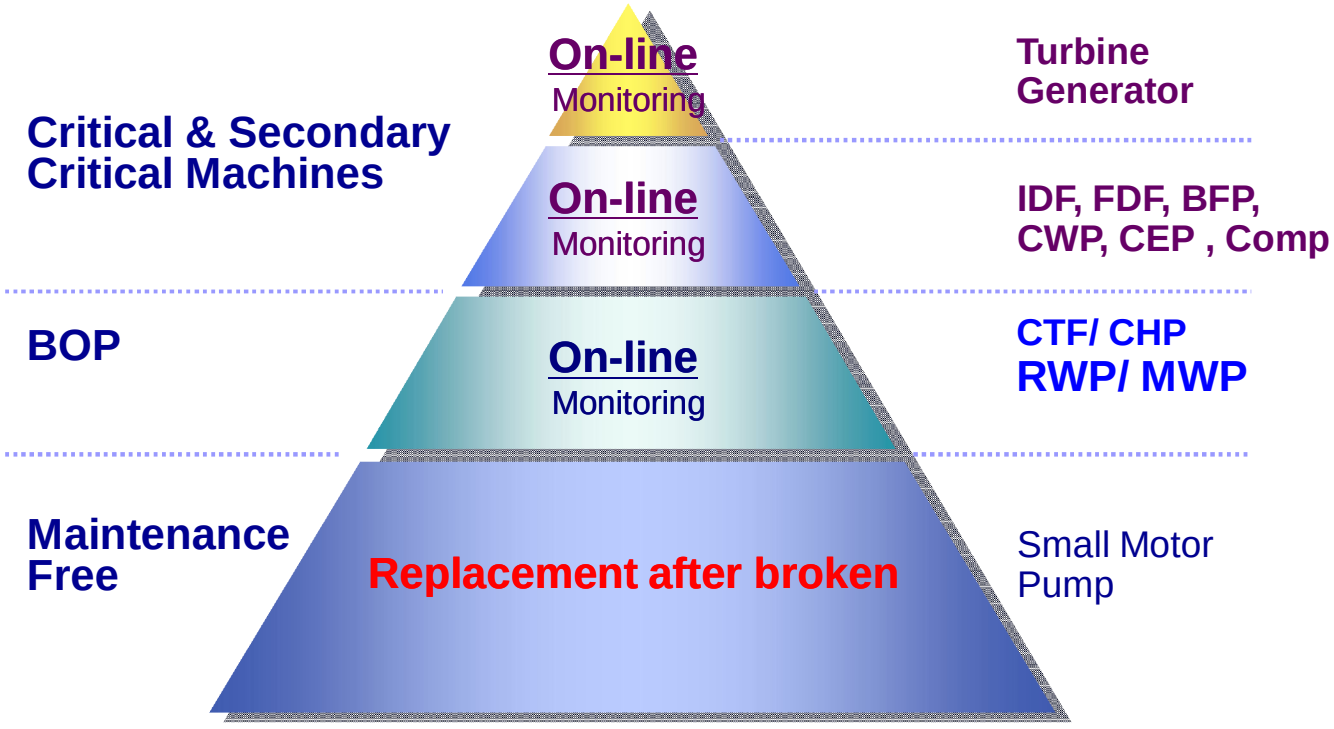
Category of VMS by Machine



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Power Plant Rotary Machine Overview for on line Vibration Monitoring

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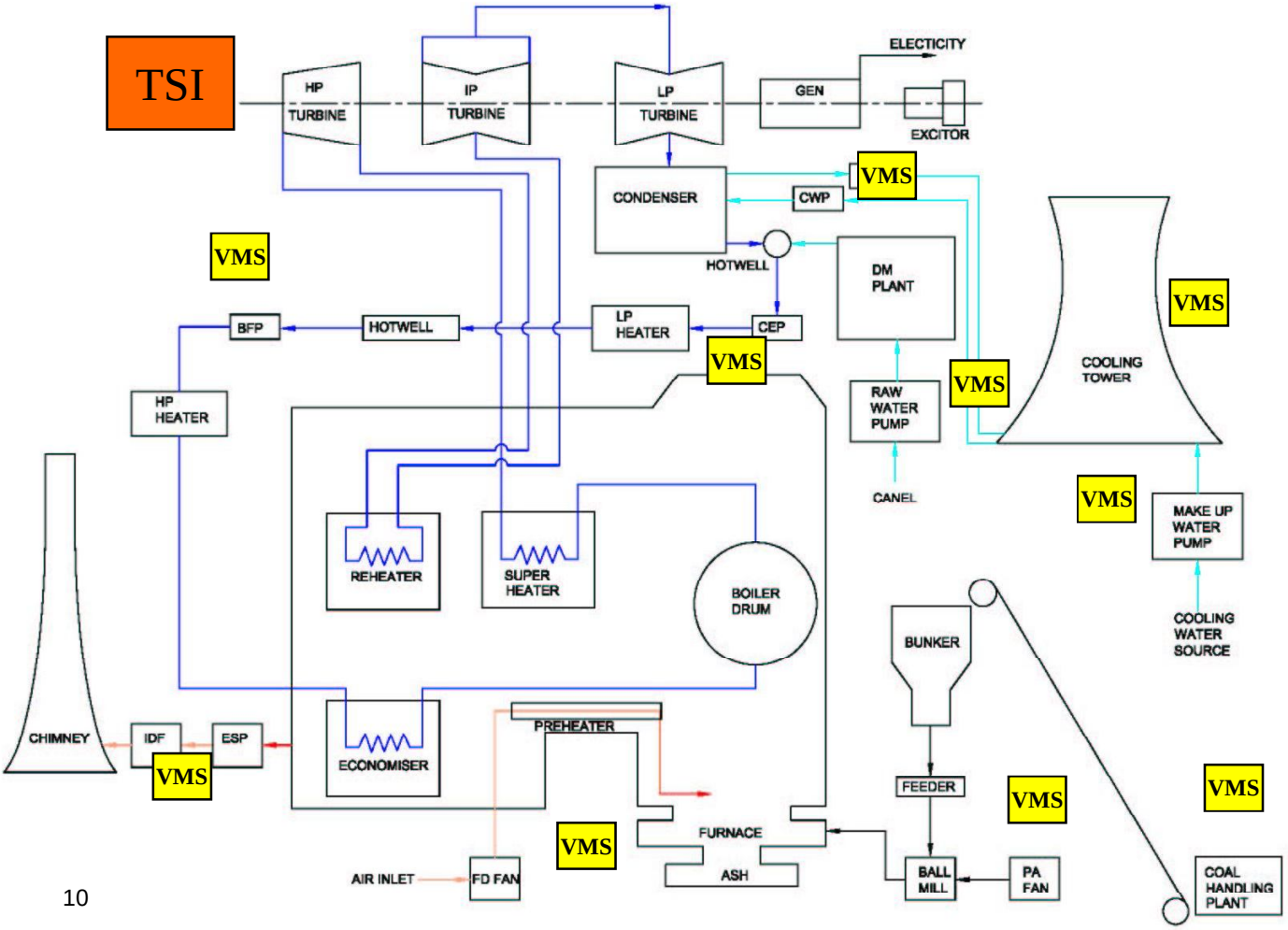
TYPICAL COAL FIRED POWER PLANT -SCHEMATIC



Typical Power Plant Rotating Machines

- **Critical Machine**
  - **Turbine & Generator**

- **Secondary Critical Machines**
  - **Boiler Feed Pumps & Motors**
  - **CE Pumps & Motors**
  - **CW / ACW Pumps & Motors**
  - **ID / FD / PA Fans & Motors**
  - **Mill Motors**

- **Balance of Plant Machines**
  - **Coal Handling Plants**
  - **Cooling Tower Fan & Motors**
  - **Make up Water & Raw Water Pumps**
  - **Compressors for Utility**

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How Power Plant Rotary Machine Vibration Monitoring is done and the issues.

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Main Turbine Vibration Monitoring

- Typically for New Turbine it is supplied by Main TG Suppliers.
  - TG Vendor will select Proven System as per API 670 with PTR.

- For R&M and Old Turbine – It is done by TG OEM / DCS OEM or VMS Supplier
  - It is Plant Team Specifications plays role. Specification needs to be correct to avoid issues later. It needs plant survey report too for right selection of system.

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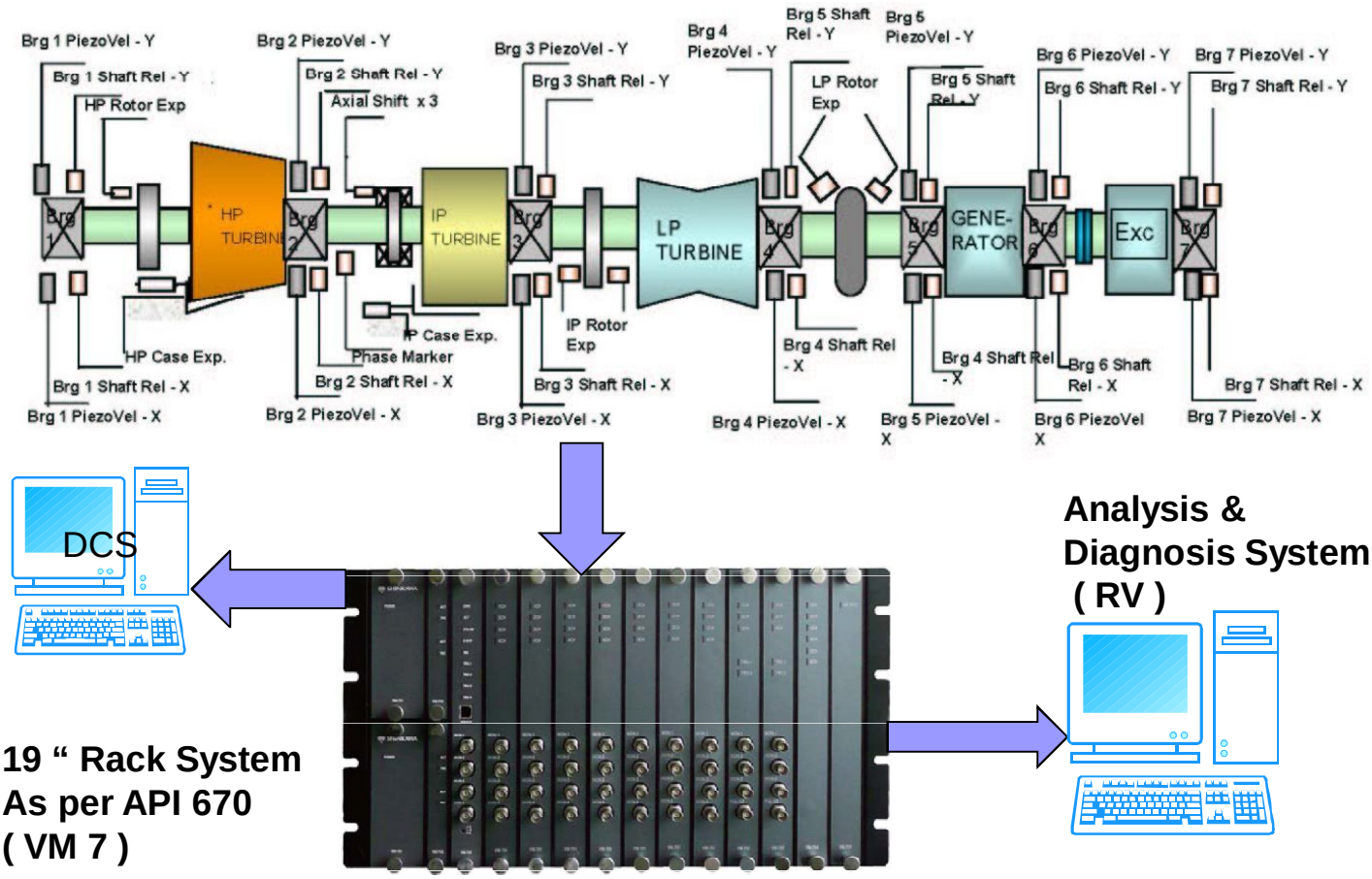
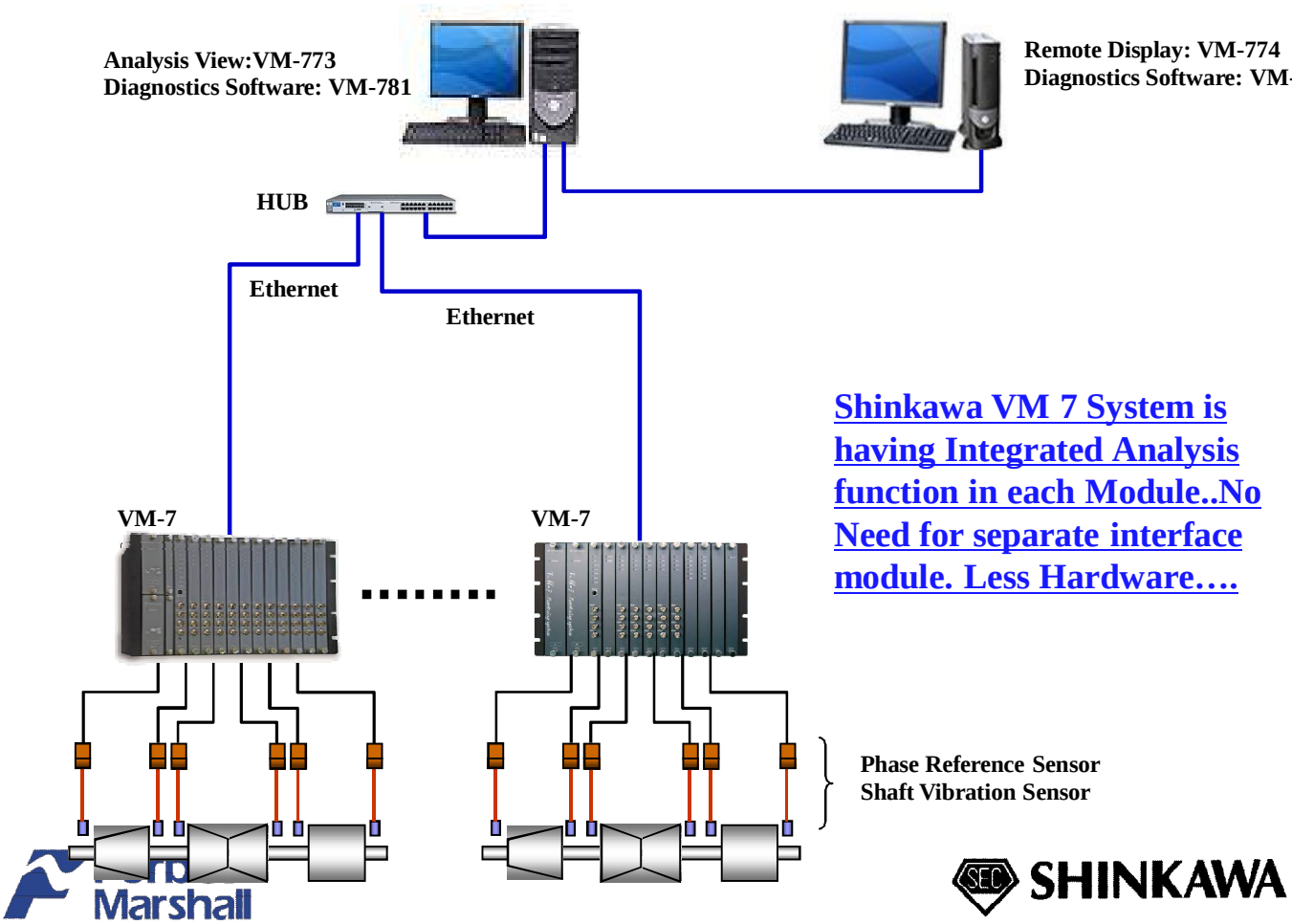
Typical 500 MW – TSI Monitoring & Analysis Details





Shinkawa VM 7 System is having Integrated Analysis function in each Module..No Need for separate interface module. Less Hardware….

Secondary Critical Rotary Machine Vibration Monitoring.

- BFP/CWP/ACWP/CEP/ID/FD/PA & Mill Motors.
  - New Projects – NTPC / Reliance / Lanco follows 19” Rack Based system with API 670. Many companies use sensor and transmitter system.
  - Old Power Plants – There is no consistency in the specs. It changes based on case to case and input data available.

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Secondary Rotary Machine VMS Monitoring Solutions – Pump/Fan/ Motors.

- Solution 1 - API 670 – 19” Rack Based System
  - Advantage : Uniformity with TSI System in the Plant , Easily Possible to Exchange with other API 670 System , High Reliability and Quality.
  - Disadvantage : Higher cost than Transmitter System.
- Solution 2 – Non API 670 System – 19” Rack Based .
  - Advantages – It is cost effective solution with modbus output and Analysis function with API 670 Sensors.
  - Disadvantages – It is proprietary system.

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Secondary Rotary Machine VMS Monitoring Solutions – Pump/Fan/ Motors.

- Solution 3 – NON API 670 – Field Transmitters & Analysis Interface.
  - Advantage : It meets partially API 670 System functions . It gives all outputs required. Cost Effective solutions.
  - Disadvantage : Supplier Specific Solutions.

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BOP Machine VMS Solution – CTF/CHP & Other machines.

- Rolling Element Bearing Machines.
- We suggest to use API 670 Sensors with Field Transmitters with all outputs to interface with DCS / PLC.
- Optionally – It should be possible to interface with Third Party Analysis System with Raw Signals.

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Power Plant Vibration Monitoring Solutions

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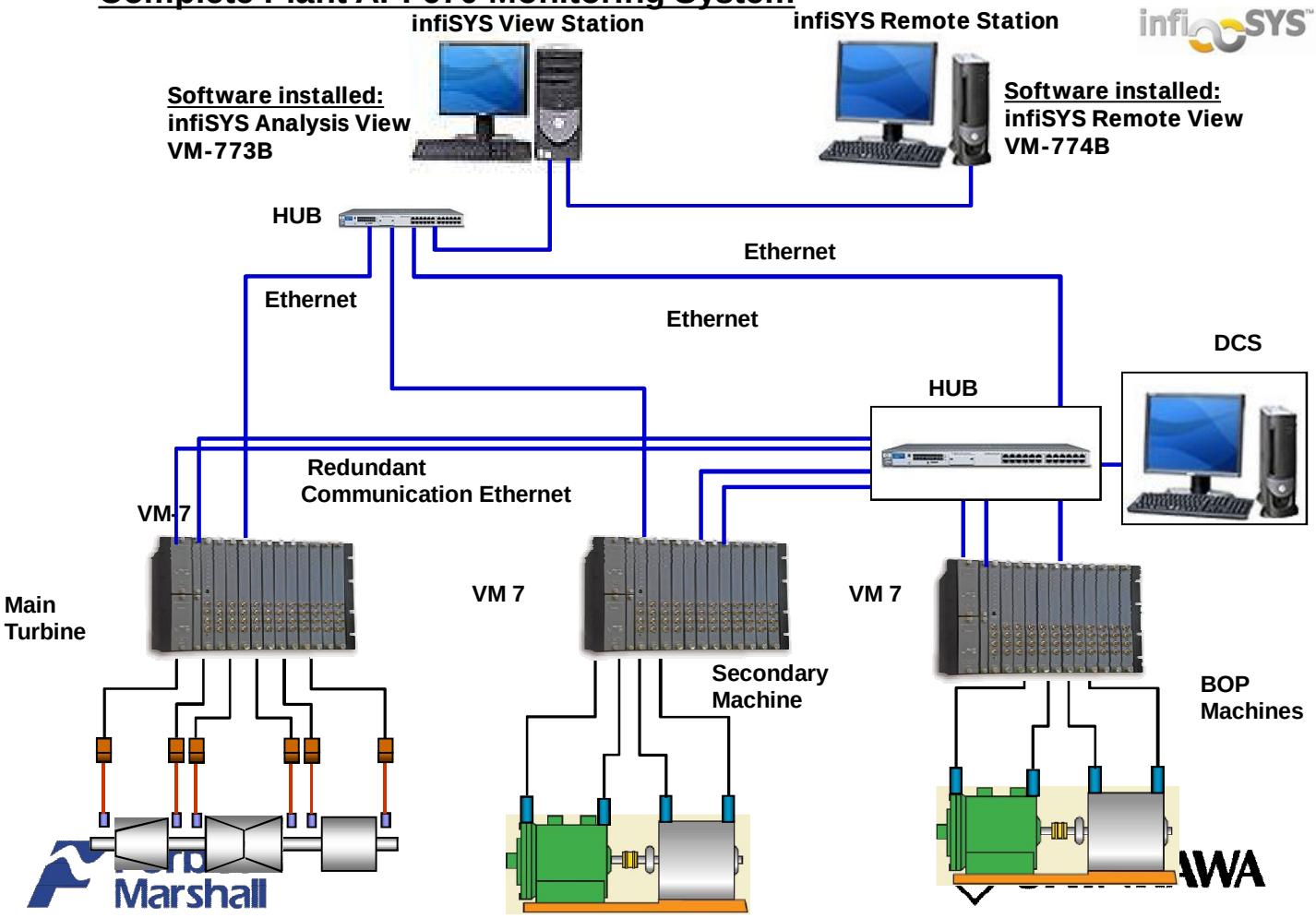
Complete Plant API 670 Monitoring System



Complete Plant API 670 TSI Monitoring System & Non API 670 for other Machines