

PI System & NTPC – A journey

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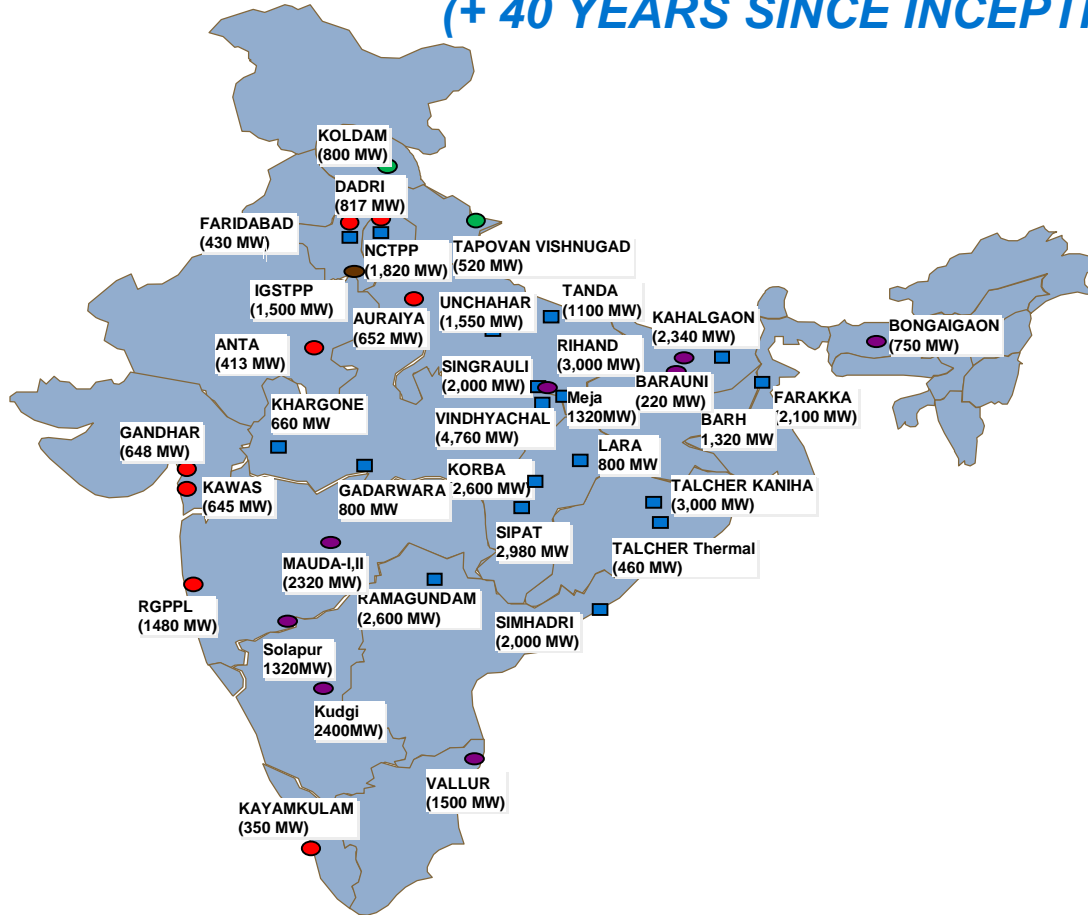
AGENDA

- **NTPC Overview**
- **ERP in NTPC**
- **Pre PI System scenario in NTPC**
- **PI System Implementation**
 - **Purpose and Benefits perceived**
 - **Phase wise approach**
 - **PI System – SAP - PI System Data Transfer**
 - **PI System Real Time Applications**
 - **Challenges**
- **Lessons Learnt**
- **Benefits**
- **Future Plan**

NTPC Overview

NTPC – A PAN INDIA PRESENCE

(+ 40 YEARS SINCE INCEPTION & ‘ENERGIZING INDIA’)



Capacity as on 15.10.2019		
Fuel/ Type	No. of Plants	Capacity (MW)
Coal	33	53361
Gas/Liquid Fuel	7	4017
Renewable	12	870
Wind	1	50
Hydro	2	808
Total	54	57106

• Ongoing Projects: 18001 MW

CORPORATE PLAN

Capacity by 2032 – 1,30,000 MW

Accomplishments and accolades

- ✦ **NTPC ranked 492nd in the '2019, Forbes Global 2000' ranking of the World's biggest companies..**
- ✦ NTPC has been felicitated at the Economic Times' 5th Annual Summit - "Power Focus" for its remarkable contribution to the power sector
- ✦ **NTPC has been awarded as the Best Performing Utility of the Country in Thermal Power Sector by Central Board of Irrigation and Power(CBIP)at a function held in New Delhi on 4th January, 2019**

NTPC has been felicitated at the Economic Times' 5th Annual Summit - "Power Focus" for its remarkable contribution to the power sector

Pre PI System Scenario in NTPC

Pre PI System Scenario

- All stations were having different types of real time systems provided by respective vendors
- Data was only available in the Unit Control Room
- Operation Performance Parameters Monitoring System application at respective stations only
- Compilation of data difficulties at RHQ, CC due to lack of integration between systems
- Data visibility across stations not there
- Only limited data available at RHQ, CC and that too , to a specific set of users

PI System Implementation

PI System implementation

- **Purpose**
 - Integrate process information with business transactions for effective decision making
- **Benefits perceived**
 - Real-time Unit efficiency & loss monitoring
 - Operation performance analysis
 - Generation information to Senior Execs
 - Catch abnormalities
 - MIS of stations performance
 - Ease of process data gathering

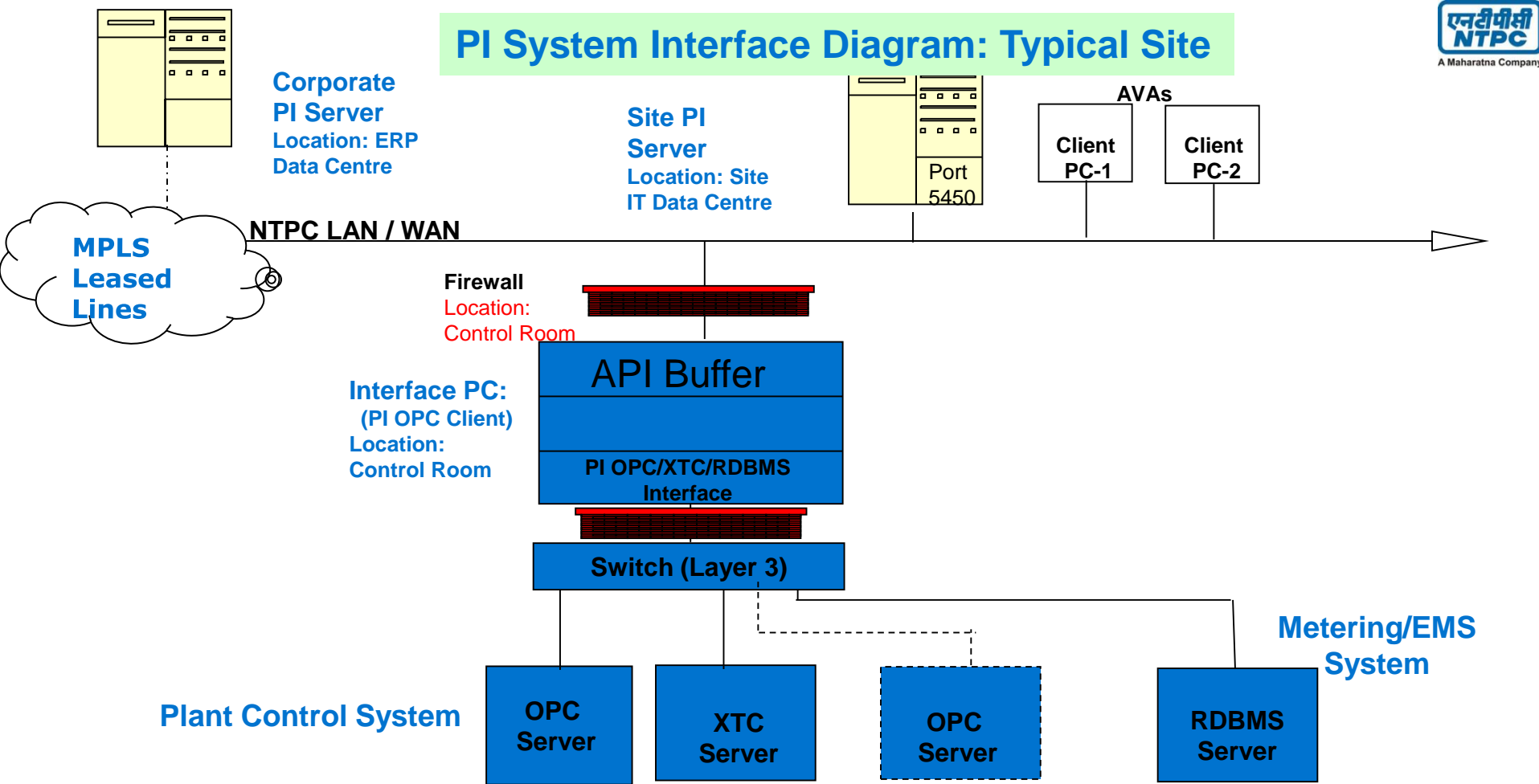
PI System implementation

- **Approach to implementation(pilot 5 stations)**
 - **Due diligence**
 - **Network Topology diagram**
 - **Site Readiness**
 - **Install, Connect & Configure**
 - **Training to users**

PI System implementation

- 23 stations were covered in total under ERP scope.
- Rate Contract for PI System hardware placed centrally for 23 stations.
- PI System procured through SAP from OSIsoft.
- 32-bit PI Server software and components.
- 1,44,000 tags purchased for 110 units.
- Distribution of tags :1500 tags for a 500 MW unit.
- For smaller units pro-rata allocation was done.

PI System Interface Diagram: Typical Site



PI System implementation

- **User groups in NTPC – Power station**
 - **Efficiency**
 - **Operation**
 - **Maintenance**
 - **Maintenance Planning**
 - **Senior Management**

PI System implementation

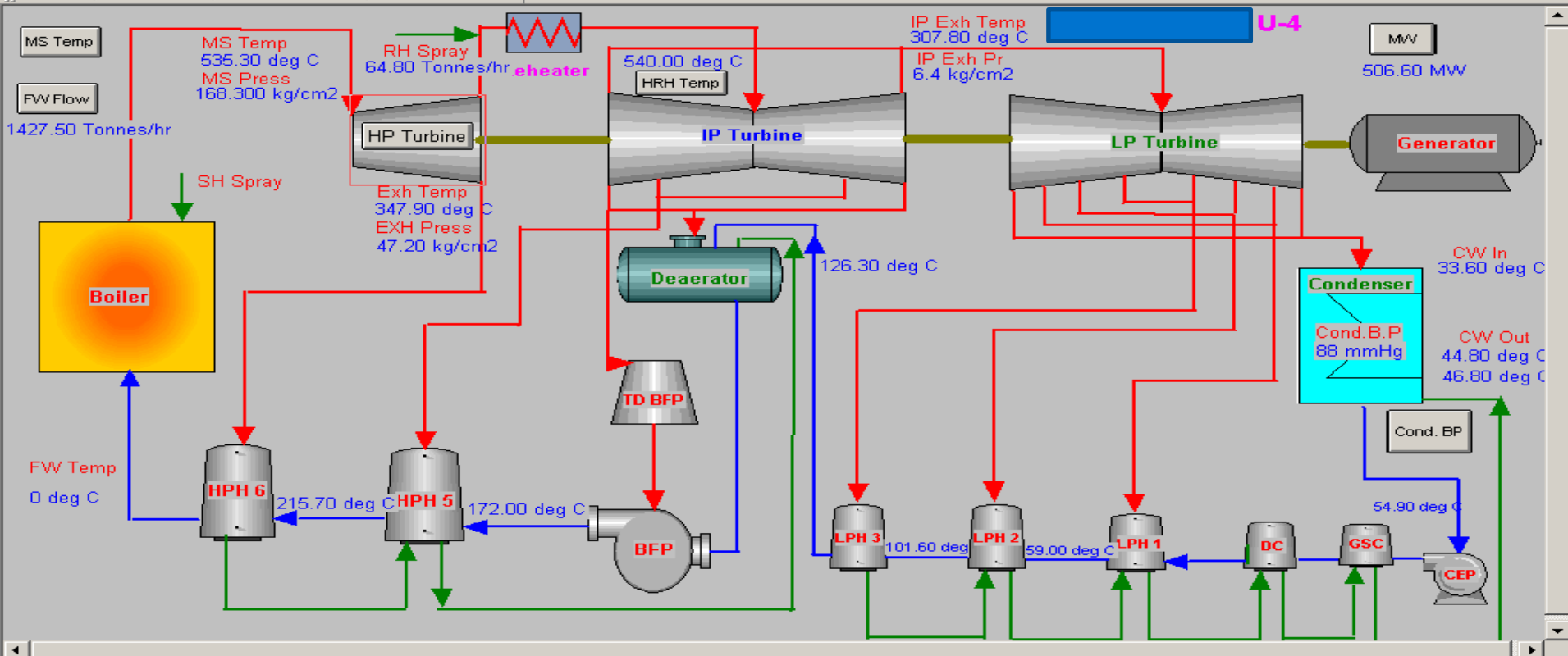
- **User groups in NTPC – Regional Office**
 - **Station Support**
 - **Senior Management**
- **User groups in NTPC – Corporate Office**
 - **Expert groups in Operation Services**
 - **Corporate Efficiency group**
 - **NTPC Energy Technology & Research Alliance**
 - **Senior Management at CC**

PI System implementation - now

- PI System implemented at all NTPC stations (31) and Corporate Centre
 - DCS, ABT Metering, EMS(Energy Management System) connected
 - Some data (about 10%) from all stations flowing to Corporate Centre PI server
 - Data directly being read from Internet and stored in PI Server
- Interfaces Connected
 - OPC (From vendor and homegrown)
 - XTC
 - RDBMS
 - UFL
- PI System Tools Used
 - Advanced Computing Engine (ACE) for developing efficiency programs using PI System data
 - PI DataLink used for capturing PI System data for analysis and PI ProcessBook used for making schematic displays & real-time monitoring
 - PI System Tools training held for users during PI Implementation, and later PI Vision for publishing general purpose process books on Internet

PI System implementation

- Phase 1 (ERP scope)
 - Implementation with the help of M/s RWE in 20 locations
 - Done in-house in 3 locations.
- Phase 2 (post ERP)
 - Done in-house in remaining 9 locations.
 - Conducted 16 trainings in-house for site PI Administrators
 - A large number of user trainings have been organized for training users on the use of PI ProcessBook and PI DataLink
 - All 32-bit PI Server software upgraded to 64-bit PI Server 2015 in the year 2016 in house and later upgraded to PI Server 2018 SP2 in the year 2019.
 - Asset Framework (AF) has been implemented at 12 stations and the plan to roll out AF in all stations.
 - Integration of PI System Data with SAP and vice versa has been done.
 - Many applications have been developed in-house viz TLA(Thermal Loss Analysis), OLA(Output Loss Analysis), PI Electronic Shift Log, PI Tag Health Monitor, Event Frames, ABT System, Aberration Monitor, Start-up Monitor etc



Coal Unit - Start Up

Microsoft Excel - Type a question for help

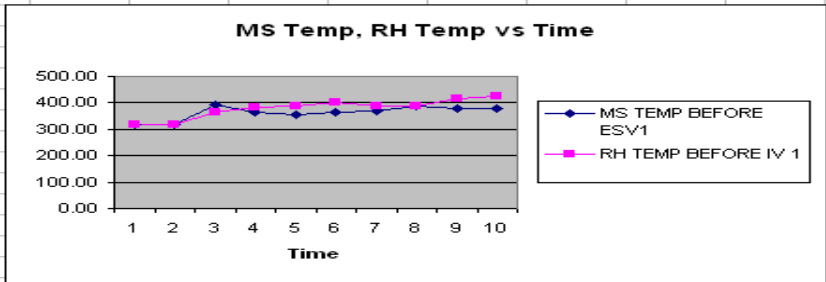
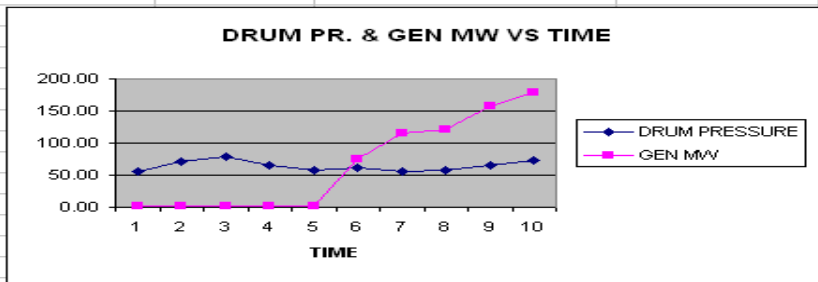
File Edit View Insert Format Tools Data Window PI Help

100%

Reply with Changes... End Review...

AutoFormat...

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1			From Time	04/01/2008 00:00										
2			To Time	04/01/2008 01:30										
3			Interval	10m										
4			Station / Unit	Unit#5										
5				00:00	00:10	00:20	00:30	00:40	00:50	01:00	01:10	01:20	01:30	
6	5TAG0081	kg/cm2	DRUM PRESSURE	54.91	72.10	78.68	65.77	58.44	61.94	55.60	56.86	66.34	73.41	
7	5TAG0133	MW	GEN MW	2.43	2.46	2.50	2.53	2.57	74.47	114.69	121.70	156.93	178.02	
8	5TAG0135	rpm	TURB SPEED	583.02	286.07	2461.36	2989.82	2973.27	2981.09	2983.94	2983.34	2982.73	2982.12	
9	5TAG0196	mm	AXIAL SHIFT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
10	5TAG0197	mm	REL EXP HP SHFT	-1.10	-1.10	-1.30	-1.30	-1.20	-1.00	-1.00	-0.90	-0.80	-0.80	
11	5TAG0198	mm	REL EXP IP SHFT	1.00	1.10	0.75	0.79	1.00	1.32	1.79	2.16	2.14	2.40	
12	5TAG0199	mm	REL EXP LP SHFT	8.92	9.10	7.07	6.54	7.07	6.92	7.54	7.93	8.58	8.82	
13	5TAG0200	mm	HP OVALL EXPN	16.53	16.49	16.44	16.40	16.36	16.31	16.27	16.22	16.18	16.14	
14	5TAG0201	mm	ABS EXPN IPCAS	6.20	6.20	6.20	6.00	6.00	6.00	6.00	6.00	6.00	6.00	
15	5TAG0174	deg C	MS TEMP BEFORE ESV1	316.35	316.83	393.48	363.32	354.80	365.14	368.06	387.21	379.49	377.36	
16	5TAG0179	deg C	RH TEMP BEFORE IV 1	317.62	318.04	366.08	381.62	386.95	400.24	389.22	387.01	414.52	423.08	



Microsoft Excel - Critical Parameters

File Edit View Insert Format Tools Data Report Writer Window PI PI-SMT Help

Type a question for help

100% 10 B

F19 fx

UNIT07 CRITICAL PARAMETERS					
			Start Time	8/16/2008 1:00	
			End Time	8/16/2008 2:00	
TAG NAME	TAG DESCRIPTION/TIME	UOM	Average for the Period	Point Healthiness %	
G7_MW	G7_Gross Meter_Total Active Power	MW	505.347	100	
7HAC10CT101_XQ03	FW TEMP AT ECO I/L	deg C	259.219	100	
7HHL10DF904	First Stage Pr	kg/cm2	1702.748	100	
7LAB10DF901_XJ01	TOTAL FW FLOW	tonnes/hr	1569.682	100	
7LAB10DF901_XJ03	TOTAL SH SPRAY	tonnes/hr	32.052	100	
7LAB15DF901_XJ01	SH Spray Flow-L	tonnes/hr	24.427	100	
7LAB16DF901_XJ01	SH Spray Flow-R	tonnes/hr	5.382	100	
7LAB25DF901_XJ01	RH Spray Flow -L	tonnes/hr	11.015	100	
7LAB26DF901_XJ01	RH Spray Flow -R	tonnes/hr	18.728	100	
7LAB31CT103_XQ03	HPH-6A FW OUTLET TEMP	deg C	259.033	100	
7LAB32CT103_XQ03	HPH-6B FW OUTLET TEMP	deg C	260.461	100	
7LAB40DT901	Common Feed Water Temperature at HPH outlet	deg C	256.824	100	
7LBA01CP002_XQ10	MS STM PR BEF HPPBP	kg/cm2	171.771	100	
7LBA01CP106_XQ01	MS PRESS AT SH O/L (L)	kg/cm2	0.216	100	
7LBA02CP101_XQ01	MS PRESS AT SH O/L-R	kg/cm2	173.738	100	
7LBA10CP001_XQ10	MS PR AT ESV (L)	kg/cm2(abs)	169.944	100	
7LBA10CT001A_XQ10	MS TEMP AT ESV (L)	deg C	541.882	100	
7LBA10DT901_XJ01.out	SH Outlet Temperature (L)	deg C	546.089	100	
7LBA20CT001A_XQ10	STM Temp at HPT I/L -R	deg C	541.206	100	
7LBA20DT901_XJ01.out	SH Outlet Temperature (R)	deg C	542.579	100	
7LBB01CT101_XQ03	HRH O/L STM TEMP-L	deg C	542.106	100	
7LBB01CT102_XQ03	HRH O/L STM TEMP-L	deg C	542.666	100	
7LBB02CT101_XQ03	HRH O/L STM TEMP-R	deg C	537.465	100	
7LBB02CT102_XQ03	HRH O/L STM TEMP-R	deg C	537.034	100	

UNIT07

Draw AutoShapes

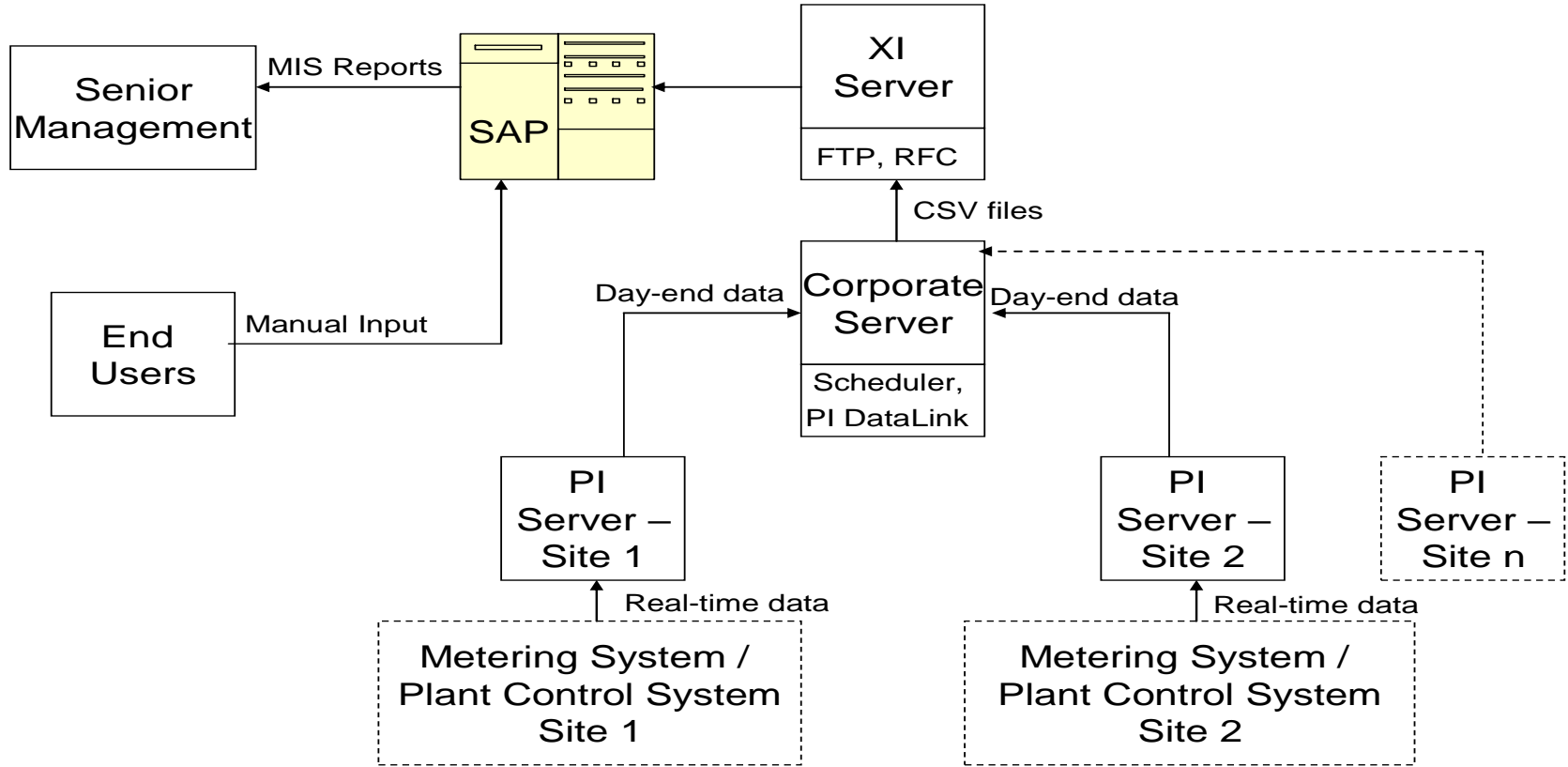
Ready NUM

Start SAP L... PIpres... C:\Doc... C:\Doc... Snap s... rdm o... 10:58 AM

PI System SAP PI System DATA TRANSFER

- **22 types of parameters**
 - **8 fully automatic**
 - **Gross Generation, Unit Aux Consumption, Peak Hour Generation, Gross Generation on Fuel for Gas station, Gross Generation on Operation Mode for Gas station, Unit On-bar Hours, Transmission Line Flow, Partial Loss due to Ambient conditions (gas stations only)**
 - **5 partially automatic**
 - **Outage hours Forced / Grid / Fuel / Planned, PL due to Grid**
 - **9 total manual entry**
 - **DC, SG, CSG, Fuel Consumption, Fuel CV, DM Water Consumption, PL due to Fuel / Planned Outage / Forced Outage**

PI System to SAP automatic data flow



PI System – Usage (Auto data transfer to SAP)

Windows interface showing the SAP XI RWE Report. The report displays a list of documents and their associated data points, including document numbers, server names, start periods, and descriptions.

Line No	RWE Tag	Value	Unit	Description	Flag	Text
748	PIRST	20090520001		55 20090520015 PIRFCUSER	S	Document is posted under number 0403058118
747	PISMT	20090520001		16 20090520016 PIRFCUSER	S	Document is posted under number 0403058117
746	PISST	20090520001		44 20090520016 PIRFCUSER	S	Document is posted under number 0403058116
745	PINCP	20090520001		12 20090520016 PIRFCUSER	S	Document is posted under number 0403058115
744	PIKY6	20090520001		10 20090520016 PIRFCUSER	E	Value 0, Hence not posted
743	PIDAG	20090520001		18 20090520016 PIRFCUSER	S	Document is posted under number 0403058114
742	PIFD6	20090520015		19 20090520015 PIRFCUSER	S	Document is posted under number 0403058113
10	GU01	.GGEN	2.866500	MU GROSS GENERATION GT1	S	Document is posted under number 0403058113
20	GU02	.GGEN	2.892942	MU GROSS GENERATION GT2	S	Document is posted under number 0403058113
30	GU03	.GGEN	3.410000	MU GROSS GENERATION ST	S	Document is posted under number 0403058113
40	GU01	.GNOC	0.000000	MU GROSS GENERATION (O/C) GT1	E	VALUE 0, HENCE NOT POSTED
50	GU02	.GNOC	0.000000	MU GROSS GENERATION (O/C) GT2	E	VALUE 0, HENCE NOT POSTED
60	GA01	.UATP	0.117430	MU UAT POWER CONSUMPTION 1	S	Data Posted Successfully in Table ZOPN21 a
70	GA02	.UATP	0.093500	MU UAT POWER CONSUMPTION 2	S	Data Posted Successfully in Table ZOPN21 a
80	GU01	.PHGM	0.500933	MU PEAK HOUR GENERATION: MORNING GT 1	S	Document is posted under number 0403058113
90	GU02	.PHGM	0.513156	MU PEAK HOUR GENERATION: MORNING GT 2	S	Document is posted under number 0403058113
100	GU03	.PHGM	0.579750	MU PEAK HOUR GENERATION: MORNING ST	S	Document is posted under number 0403058113
110	GU01	.PHGE	0.476350	MU PEAK HOUR GENERATION: EVENING GT 1	S	Document is posted under number 0403058113
120	GU02	.PHGE	0.469261	MU PEAK HOUR GENERATION: EVENING GT 2	S	Document is posted under number 0403058113
130	GU03	.PHGE	0.569750	MU PEAK HOUR GENERATION: EVENING ST	S	Document is posted under number 0403058113
140	GL01	.EXMU	2.750000	MU EXPORT - PALLA LINE 1	S	Data Posted Successfully in Table ZOPN0U3
150	GL02	.EXMU	2.800000	MU EXPORT - PALLA LINE 2	S	Data Posted Successfully in Table ZOPN0U3
160	GL03	.EXMU	3.410000	MU EXPORT - SAMAYPUR LINE 1	S	Data Posted Successfully in Table ZOPN0U3
170	GL01	.IMMU	0.000000	MU IMPORT - PALLA LINE 1	S	Data Posted Successfully in Table ZOPN0U3
180	GL02	.IMMU	0.000000	MU IMPORT - PALLA LINE 2	S	Data Posted Successfully in Table ZOPN0U3
190	GL03	.IMMU	0.000000	MU IMPORT - SAMAYPUR LINE 1	S	Data Posted Successfully in Table ZOPN0U3

Windows taskbar shows: Start, Microsoft Power..., SAP Logon 640, XI RWE Report, EN, 13:24

PI System implementation

- **Challenges faced**
 - Interface to Control System
 - Instrumentation inadequacy
 - Ensure Quality of data
 - End user Satisfaction
 - Data Refresh Rate
 - Ensuring PI System chain equipment uptime

PI System implementation

- **Lessons learnt**
 - Remote installation of PI System related software
 - OPC compliance testing
 - Network security
 - System reliability
 - Monthly compliance format of PI System chain uptime
 - PI Audit of stations to improve PI System chain uptime
 - Using UFL to capture data in PI System from a file on Internet

PI Tag Conventions Standard

3-PI tag attributes - convention_modified printable [Compatibility Mode] - Excel

#	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	
7			52MAG01CP003XQ01	1	26-Oct-09 19:41:38	piadmin	0	1	28800	0	1	22-Oct-09 18:43:41	piadmin	o.r.w.g.r.w.r	piuser	OPC	COND PRESSURE -								
8	digital tags		57MAV22AP001XB01	1	23-Oct-09 16:05:56	piadmin	0	0	28800	0	1	23-Oct-09 16:05:56	piadmin	o.r.w.g.r.w.r	piuser	OPC	AOP-1 ON	OFF/ON	OFF/ON						
9			57MAV23AP001XB01	1	23-Oct-09 16:05:56	piadmin	0	0	28800	0	1	23-Oct-09 16:05:56	piadmin	o.r.w.g.r.w.r	piuser	OPC	AOP-2 ON	OFF/ON	OFF/ON						
10		Site	Tag name = same as DCS	1=yes - archiving will be done, 0=no - To be kept default as 1 & 0 for Server time tag.	system generated, leave blank	piadmin	system generated, leave blank	0=no compression, value depends on param UOM (follow attached convention)	in secs, max period between two values = 28800 (default value)	in secs, min period between two values, default value = 0	1=yes (default for tags), 0=no compression, for ABT params	for tags requiring conversion in formula, else keep = 1	system generated leave blank	piadmin	rights for writing into point = o.r.w.g.r.w.r	piuser	OPC or ABT or any other user created in PI, can change data value.	tag description, keep it meaningful (follow attached convention)	Only for Digital tags YES/NO, TRUE/FALSE, as per site DCS	Display width in PI tools, NOT Precision	UM as per site DCS, blank for digital (follow attached convention)	system generated, leave blank	0=no exception, 1/2 of comdev percent, governs accuracy required, depends upon UOM (follow attached convention)	in secs, max period between two exception values = 600	in min per bet two valu def
13	instrumenttag	location1	location2	location3	location4	location5	pointid	pointsour	pointtype	ptaccess	ptclassna	ptgroup	ptowner	recno	scan	shutdown	sourcetag	span	squareroot	srcriptd	step	totalcode	typicalval	userint1	use
14	51MAC11CP002XQ01	1	0	0	4	0	919	0	float32	o.r.w.g.r.w.r	classic	piadmin	piadmin	652	1	0		2	0	0	0	0	0	0	0
15	51MAC11CP003XQ01	1	0	0	4	0	920	0	float32	o.r.w.g.r.w.r	classic	piadmin	piadmin	653	1	0		2	0	0	0	0	0	0	0
16	51MAG01CP004XQ01	1	0	0	4	0	1045	0	float32	o.r.w.g.r.w.r	classic	piadmin	piadmin	772	1	0		2	0	0	0	0	0	0	0
17	52MAG01CP002XQ01	1	0	0	4	0	1046	0	float32	o.r.w.g.r.w.r	classic	piadmin	piadmin	773	1	0		2	0	0	0	0	0	0	0
18	52MAG01CP003XQ01	1	0	0	4	0	1047	0	float32	o.r.w.g.r.w.r	classic	piadmin	piadmin	774	1	0		2	0	0	0	0	0	0	0
19	57MAV22AP001XB01	1	0	1	1	0	3016	0	digital	o.r.w.g.r.w.r	classic	piadmin	piadmin	2201	1	0		1	0	0	1	0	0	0	0
20	57MAV23AP001XB01	1	0	1	1	0	3017	0	digital	o.r.w.g.r.w.r	classic	piadmin	piadmin	2202	1	0		1	0	0	1	0	0	0	0
21	MOST important, to match with Item-ID in OPC server	Interface ID in Interface PC	Spl condition, leave blank	1=Digital tag, 0=analog tag	Scan Class, 1=1 sec for digital tag, 3=5 secs (refer attached scan class convention sheet)	only for Output Tags, default = 0	sys gen, leave blank	O=OPC, L=Manual, A=ABT, J=PIPing, P=PI server, C=Performance Equation	float32 for analog, digital for digital tags	rights for pt attribs = o.r.w.g.r.w.r	base tags = classic	piadmin	piadmin = can change pt attribs	sys gen, leave blank	1=on, 0=off, default=1	leave blank	range		0	0	0 = analog tags, 1 = for digital tags	0	typical value of tag (design process value)	0	0

PI Tag Conventions Standard

3-PI tag attributes - convention_modified printable (Compatibility Mode) - Excel

File Home Insert Page Layout Formulas Data Review View LOAD TEST TEAM Tell me what you want to do... Sign in Share

Clipboard Font Alignment Number Styles

Normal Bad Good Neutral Calculation Check Cell Explanatory Input Linked Cell Note

Insert Delete Format AutoSum Fill Clear Sort & Filter Find & Select

Convention to be used for Unit of Measurement in PI Tags			
Name	EnggUnit	Name	EnggUnit
percent	%	cond heat transf coefficient	kW/m2K
percent per deg centigrade	%/degC	metre	m
percent bar	%bar	metre per second	m/s
percent volume	%vol	metre cube per hour	m3/h
conductivity - micro Seimens	microS	milli ampere	mA
micro Seimens per cm	microS/cm	milli bar	mbar
ampere	A	milligram per metrecube	mg/m3
bar	bar	milligram per Normal m3	mg/Nm3
bar abs	bar(abs)	conductivity	mho
degree Celsius	degC	micron	micron
degree Kelvin	degK	mega joule per kg	MJ/kg
equivalent operating hours	h	milli metre	mm
events per minute	event/min	milli metre per sec	mm/s
giga calorie per hour	Gcal/h	milli metre of mercury	mmHg
giga joules	GJ	millimetre of water column	mmwc
giga joule per deg c	GJ/degC	milli second	ms
giga joule per hour	GJ/h	million unit	MU
hours	h	mega volt ampere reverse	MVAR
hertz	Hz	mega voltampere hour reverse	MVARh
joule per gram per K	J/g/K	mega watt	MW
kilo ampere	kA	megawatt per minute	MW/min
kilo calorie	kcal	mega watt hour	MWh
kilo calorie per hour	kcal/h	number	No
kilo calorie per kg	kcal/kg	pascal	Pa
kilo calorie per kilo watt hour	kcal/kWh	vibration	pc/g
kilo calorie per liter	kcal/L	power factor	PF
kcal per standard metre cube	kcal/Sm3	alkalinity	pH
kilogram	kg	parts per billion	ppb
kilogram per centimetre square	kg/cm2	parts per million	ppm
kilogram per centimetre square(abs)	kg/cm2(abs)	pounds per square inch	psi
kilogram per kilogram	kg/kg	revolutions per minute	rpm
kg per kilowatt hour	kg/kWh	rpm per min	rpm/min
kilogram per metre cube	kg/m3	acceleration	rpmmin
kg per second	kg/s	rupees per day	Rs/day

PI Tag Conventions Standard

3-PI tag attributes - convention_modified printable [Compatibility Mode] - Excel

File Home Insert Page Layout Formulas Data Review View LOAD TEST TEAM Tell me what you want to do... Sign in Share

Clipboard Font Alignment Number Styles

Normal Bad Good Neutral Calculation Check Cell Explanatory Input Linked Cell Note

Insert Delete Format AutoSum Fill Sort & Filter Find & Select Clear

Print Area : Abbreviations to be used in PI tag description

Abbreviations to be used in PI tag description		
WORD / PHRASE	STANDARD FORM	Remarks
PERCENT	% / Percent	
LOAD	Unit-XX / Stage_XX / Station Load (Gross)	Use unit, stage or station as applicable.
LOAD ACTUAL	Unit-XX / Stage_XX / Station Load (Gross)	
ACTIVE POWER	Unit-XX / Stage_XX / Station Load (Gross)	
UNIT LOAD	Unit-XX / Stage_XX / Station Load (Gross)	
ACTIVE POWER NET	Unit-XX / Stage_XX / Station Load (Net)	
AFT	After	
AIR	Air	
AMBIENT	Ambient	
AIR HEATER	APH	
AIR PREHEATER	APH	
ASH	Ash	
ASH SLURRY PUMP HOUSE	Ash Slurry PH	
ASH WATER	Ash Water	
AVERAGE	Average	
BEFORE	Before	
BEF	Before	
BOILER FEED WATER PUMP	BFP	
FEED PUMP	BFP	
BREAKER	BKR	
BOILER	BLR	
STEAM GENERATOR	BLR	
BSTR	Booster	
BOTTOM ASH	Bottom Ash	
BEARING	BRG	
BNKR	Bunker	
CATION	Cation	
CONDENSATE EXTRACTION PUMP	CEP	
CONDENSATE PUMP	CEP	
CIRCUIT	CKT	
CO	CO	
CARBON DI OXIDE	CO2	
CONDENSER	Cond / Condenser	
CONDENSATE	Condensate	
CLR	Cooler	
CUMMULATIVE	CUM / Cumulative	
CURRENT	Current	
CIRCULATING WATER	CW	
COOLING WATER	CW	
DEAERATOR	DEA / Daeerator	
D/A	DEA / Daeerator	
DEAERATED	DEA	

Tag attrib tag UOM Convention tag description Convention tag attribute convention scan class_OPC

PI Tag Conventions Standard

3-PI tag attributes - convention_modified printable [Compatibility Mode] - Excel

File Home Insert Page Layout Formulas Data Review View LOAD TEST TEAM Tell me what you want to do... Sign in Share

Clipboard Font Alignment Number Styles Cells Editing

K7

1 * The purpose of the following tag attributes convention is to assist the PI Administrator in
 2 new tags creation & fine tuning existing tags attributes. The following is the general
 3 guidelines for deciding the tag attributes which may vary depending upon the actual site
 4 processes & requirements. The site attributes for a tag are to be finalized in consultation
 5 with site Operation, EEMG, C&I/EM (or Tag management committee at site).
 6
 7
 8

9 **Digital tags**

Digital tags	compdev ercent	excdevper cent	Zero	Span	Max Range	exception dev in deg C	location 4
ABT	0	0	as per tag defined below			0	1
ABT Tags	0	0	as per tag defined below			0	2

16 **Temperature**

Design Temperature	compdev ercent	excdevper cent	Zero	Span	Max Range	exception dev in deg C	location 4
upto 60 C	0.5	0.25	-10	70	60	0.175	6.7
upto 200 C	1	0.5	0	200	200	1	6.7
upto 400 C	0.5	0.25	0	400	400	1	6.7
upto 700 C	0.25	0.125	0	700	700	0.875	6.7

24 **Pressure**

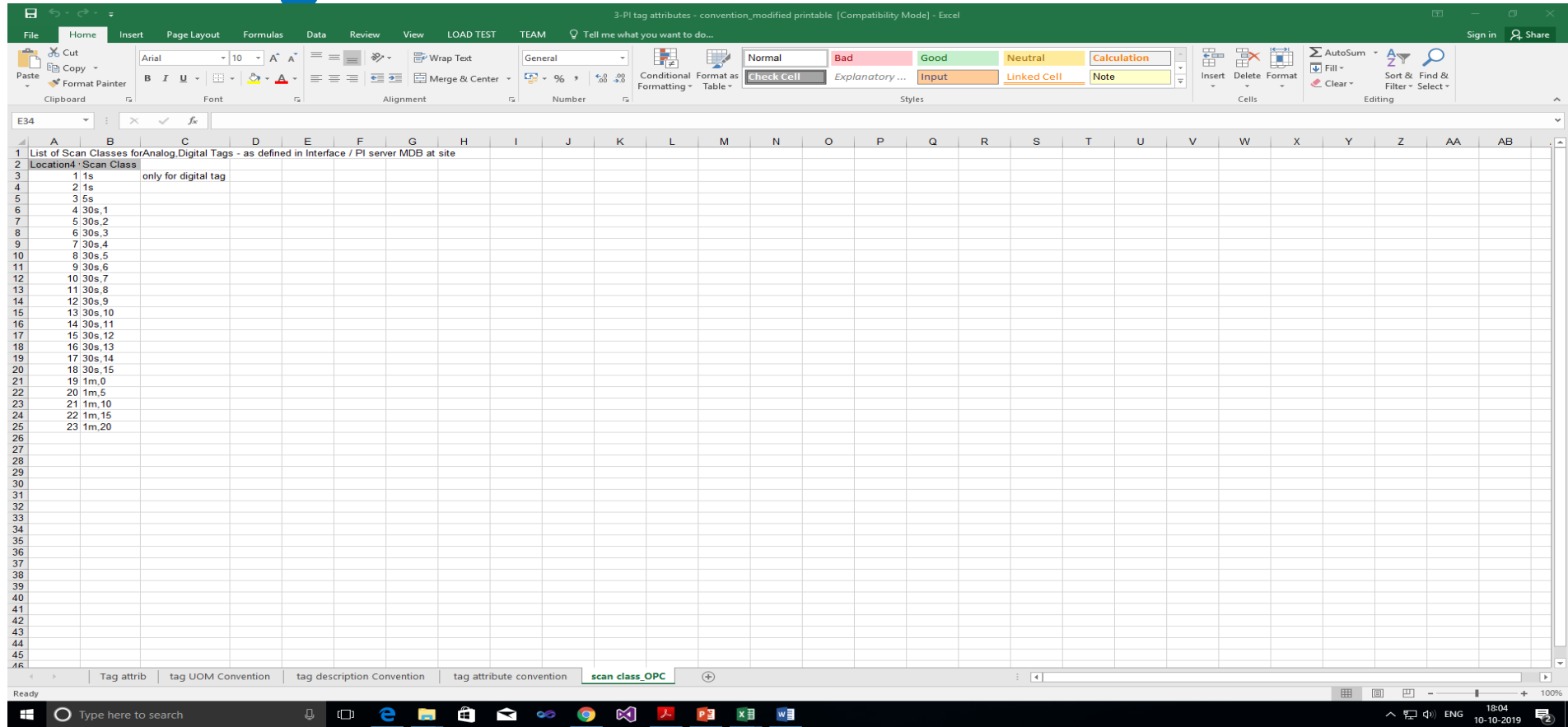
Design Pressure	compdev ercent	excdevper cent	Zero	Span	Max Range	exception dev in ksc	location4
upto 10 ksc	0.2	0.1	0	10	10	0.01	3
from 10 to 50 ksc	1	0.5	0	50	50	0.25	3
from 50 to 120 ksc	0.2	0.1	0	120	120	0.12	3
from 120 to 250 ksc	0.2	0.1	0	250	250	0.25	3

32 **Power**

Design Power	compdev ercent	excdevper cent	Zero	Span (125 % of the design power)	Max Range	exception dev in MW	location4
upto 0.1 MW	1	0.5	0	0.125	0.125	0.00125	4

34 tag attrib tag UOM Convention tag description Convention tag attribute convention scan class OPC

PI Tag Conventions Standard



The screenshot shows an Excel spreadsheet with the following content:

Location	Scan Class
	only for digital tag
1	1 1s
2	2 1s
3	3 5s
4	4 30s,1
5	5 30s,2
6	6 30s,3
7	7 30s,4
8	8 30s,5
9	9 30s,6
10	10 30s,7
11	11 30s,8
12	12 30s,9
13	13 30s,10
14	14 30s,11
15	15 30s,12
16	16 30s,13
17	17 30s,14
18	18 30s,15
19	19 1m,0
20	20 1m,5
21	21 1m,10
22	22 1m,15
23	23 1m,20

PI System : Real-time applications

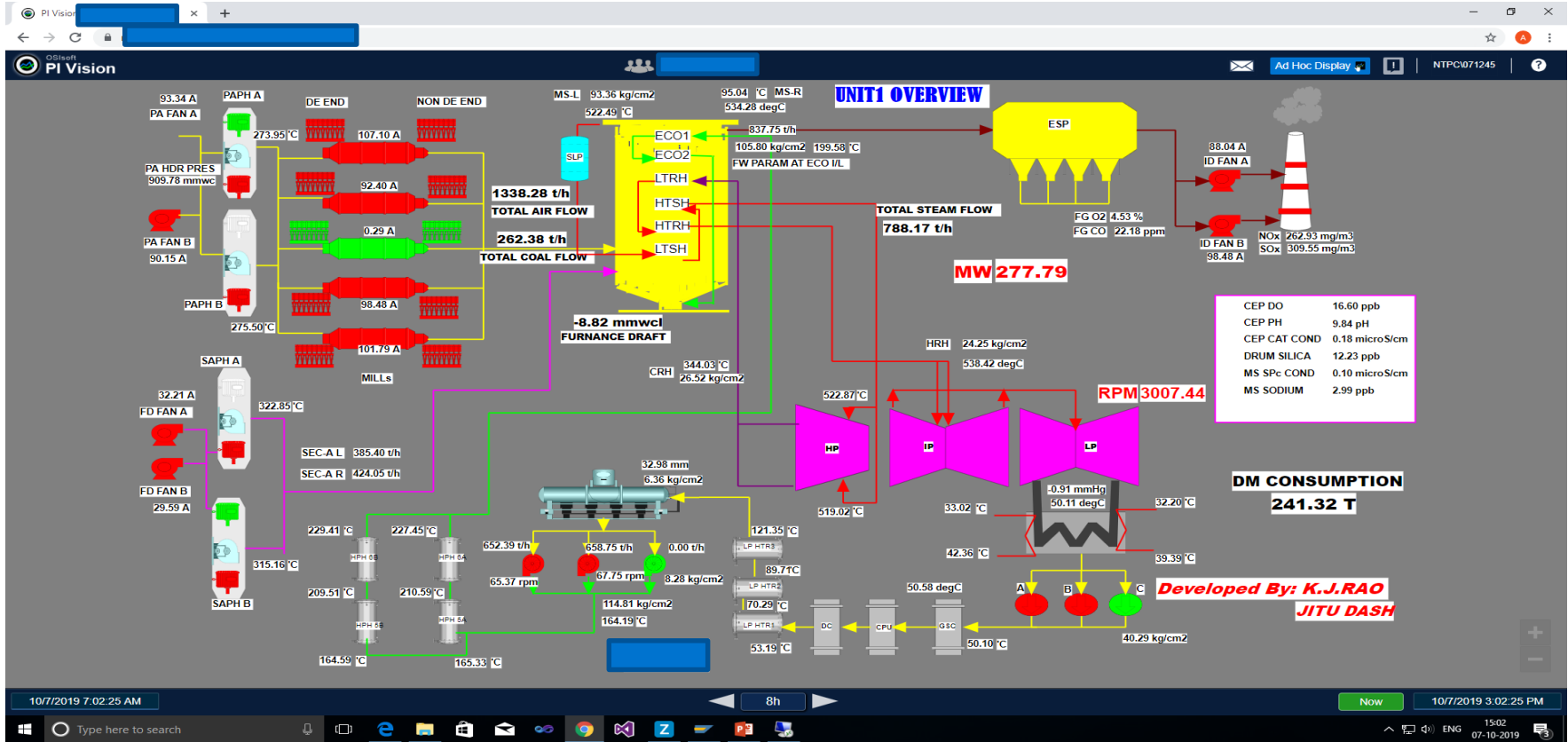
- eShiftlog
- Thermal Loss Analysis(TLA)
- Output Loss Analysis(OLA)
- Event Frames
- PI Tag Health monitor
- ABT Application
- PI System Aberrations
- Start-up Monitoring

PI System implementation

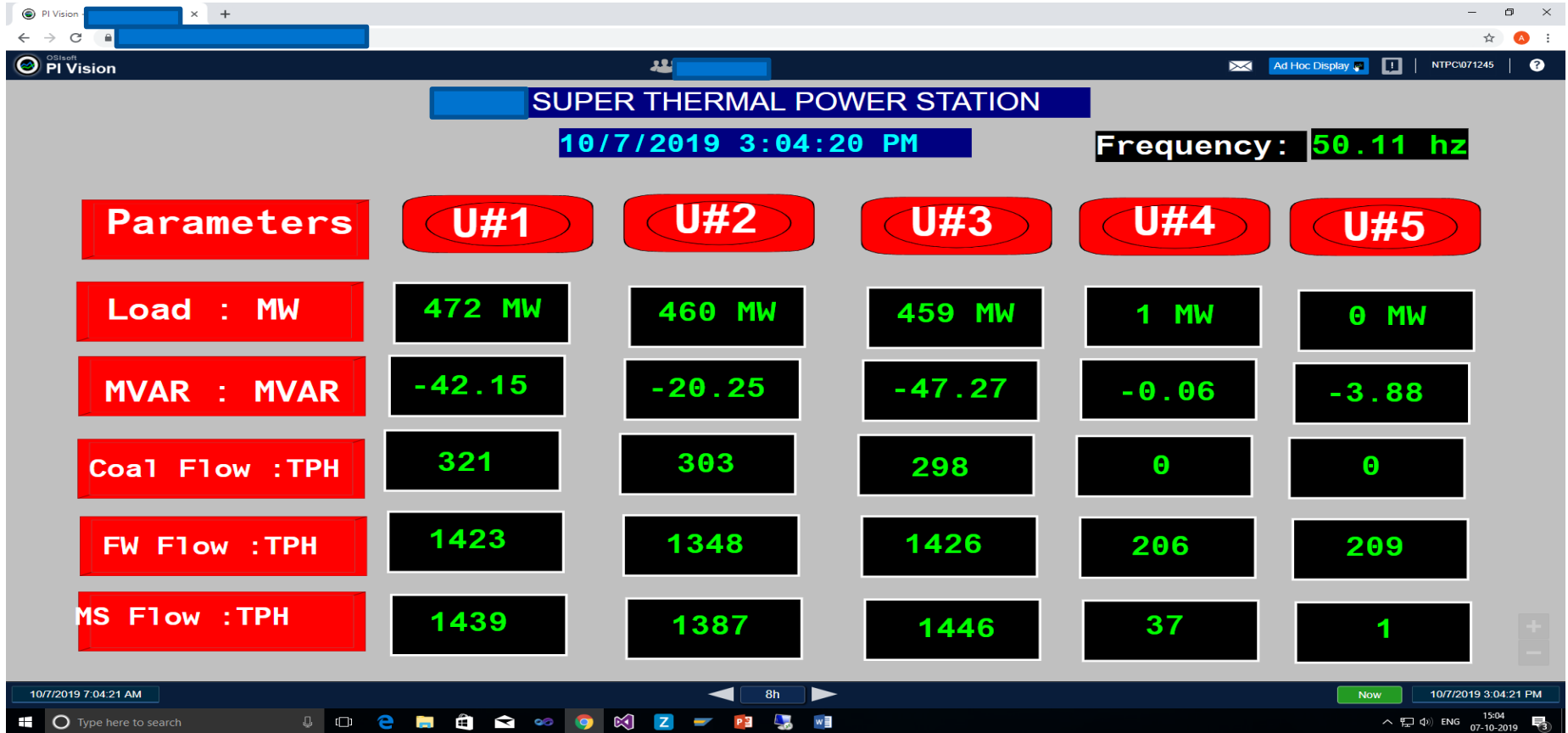
- **New Initiatives**

- **PI Vision 2017 SP2 has been implemented with over 100 displays published centrally**
- **Publishing PI System Data on Internet for CPCB monitoring**
- **PI System Data availability on mobile**
- **PI Tag Management Committee formation at sites**
- **PI Tag Health Monitoring software to manage the stale, bad tags**
- **PI Audit Viewer of sites periodically**
- **PI System Consultancy projects**

PI Vision



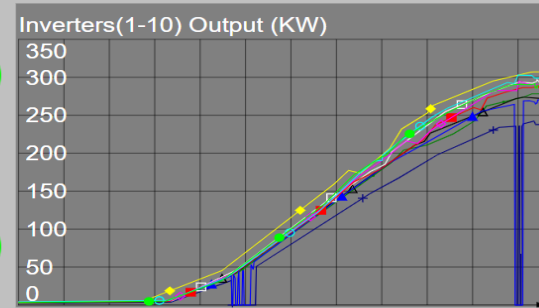
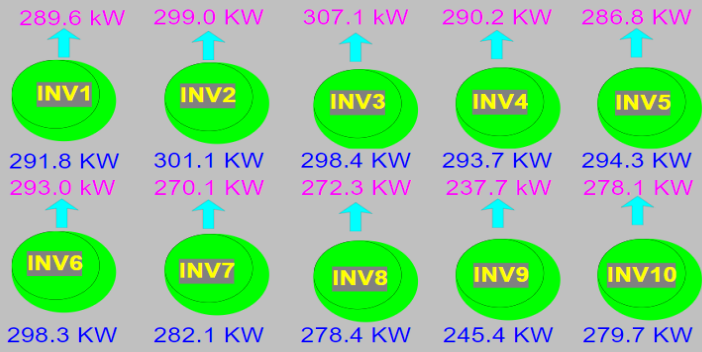
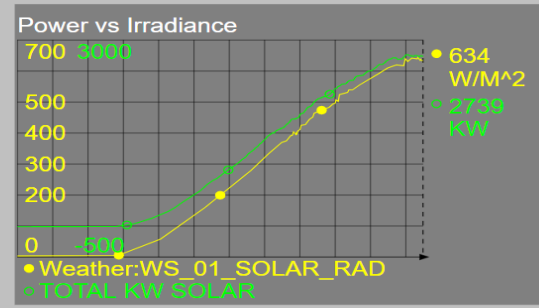
PI Vision



SOLAR POWER

10/11/2019 10:44:30 AM
50.02 Hz

Solar Radiation 634.0 W/M^2	Power Output@33KV 2739 KW
Max Solar Insolation 642.0 W/M^2	CUF: 54.78 %
Amb Temperature 31.5 DEG C	Day Generation 5821.2 KWH
Wind Speed 65510.0 MPH	



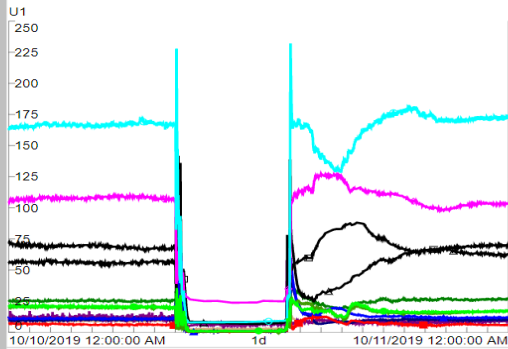
PI Vision

(16) WhatsApp x PI Vision [redacted]

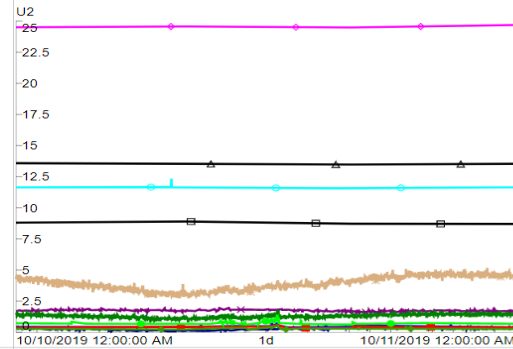
OSIsoft PI Vision [redacted]

Ad Hoc Display [redacted]

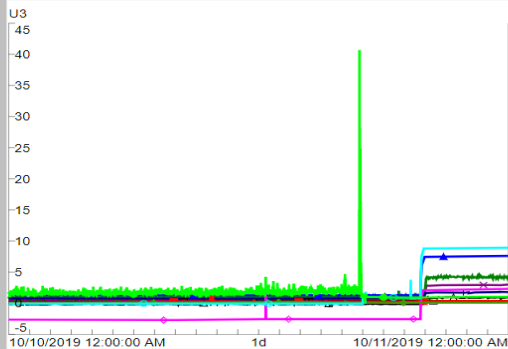
NTPC071245



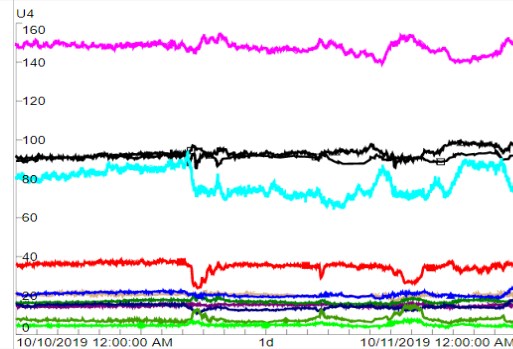
- 1MAD11CY051 XQ03/VXA
- 1MAD11CY901 XQ03/VXA
- ◆ 1MAD12CY051 XQ03/VXA
- ◇ 1MAD12CY901 XQ03/VXA
- 1MAD13CY051 XQ03/VXA
- 1MAD13CY901 XQ03/VXA
- ▲ 1MAD14CY051 XQ03/VXA
- △ 1MAD14CY901 XQ03/VXA
- + 1MKD11CY021 XQ03/VXA
- 1MKD11CY022 XQ03/VXA
- × 1MKD12CY021 XQ03/VXA
- ✖ 1MKD12CY022 XQ03/VXA



- 2MAD11CY051 XQ03/VXA
- 2MAD11CY901 XQ03/VXA
- ◆ 2MAD12CY051 XQ03/VXA
- ◇ 2MAD12CY901 XQ03/VXA
- 2MAD13CY051 XQ03/VXA
- 2MAD13CY901 XQ03/VXA
- ▲ 2MAD14CY051 XQ03/VXA
- △ 2MAD14CY901 XQ03/VXA
- + 2MKD11CY021 XQ03/VXA
- 2MKD11CY022 XQ03/VXA
- × 2MKD12CY021 XQ03/VXA
- ✖ 2MKD12CY022 XQ03/VXA



- 3MAD11CY051 XQ03/VXA
- 3MAD11CY901 XQ03/VXA
- ◆ 3MAD12CY051 XQ03/VXA
- ◇ 3MAD12CY901 XQ03/VXA
- 3MAD13CY051 XQ03/VXA
- 3MAD14CY051 XQ03/VXA
- ▲ 3MAD14CY901 XQ03/VXA
- △ 3MKD11CY021 XQ03/VXA
- + 3MKD11CY022 XQ03/VXA
- 3MKD12CY021 XQ03/VXA
- × 3MKD12CY022 XQ03/VXA



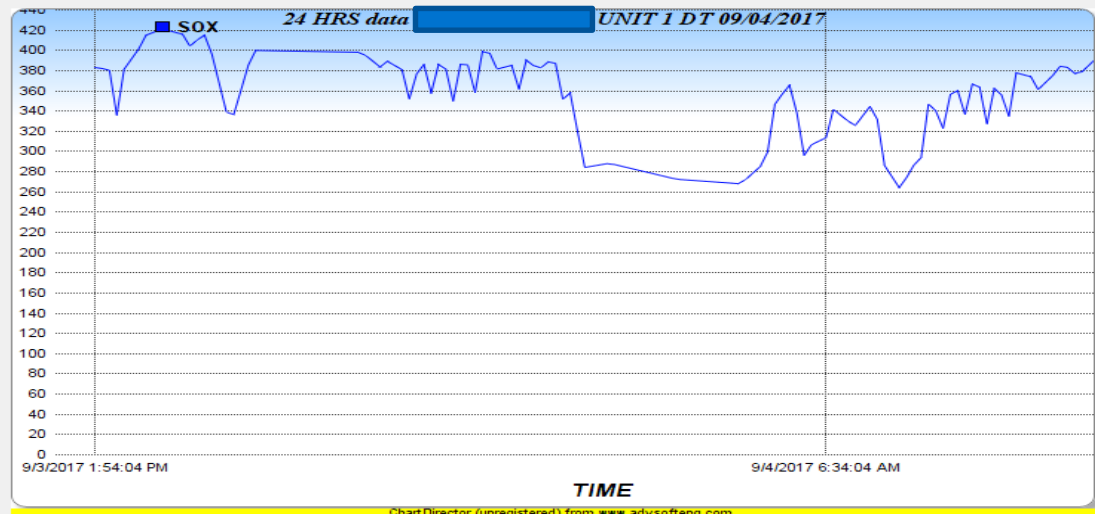
- 4MAD11CY051 XQ03/VXA
- 4MAD11CY901 XQ03/VXA
- ◆ 4MAD12CY051 XQ03/VXA
- ◇ 4MAD12CY901 XQ03/VXA
- 4MAD13CY051 XQ03/VXA
- 4MAD14CY051 XQ03/VXA
- ▲ 4MAD14CY901 XQ03/VXA
- △ 4MKD11CY021 XQ03/VXA
- + 4MKD11CY022 XQ03/VXA
- × 4MKD12CY021 XQ03/VXA
- ✖ 4MKD12CY022 XQ03/VXA

10/10/2019 12:00:00 AM [redacted] 1d [redacted] Now 10/11/2019 12:00:00 AM

Type here to search [redacted]

10:47 11-10-2019

-24HRS +24HRS 09/04/2017 [dropdown] OK



HOURLY AVERAGE OF TAG 1CEMS_SOX FOR 09/04/2017

00-01	01-02	02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24
368.4	286.6	279.3	271.6	271.3	331.3	318.3	325.2	293.7	353.6	357.8	371.5	384.2											

Menu

Log Date (yyyy/mm/dd)	Station Name	Area	Select Log Book	Shift	Group	User Logged In
2015/08/14	NTPC	Unit Control Room	Combined Cycle Log Book	Morning	A	rpsingh
PI Server : 191.254.172.31		Log Id : 20150814A60		Shift Time : 07:00:00 – 14:00:00		User Id : 005838
<input type="button" value="Start Log"/>		<input type="button" value="Prev Log"/>		<input type="button" value="Next Log"/>		<input type="button" value="Save Log"/>
				<input type="button" value="Delete Log"/>		<input type="button" value="Close"/>
<input checked="" type="checkbox"/> Shift begin parameters from PI noted : 07:46				<input checked="" type="checkbox"/> Shift end parameters from PI noted:		Log Status : Open
<input checked="" type="checkbox"/> Auto Save : 13 mins		Your machine IP Address : 10.0.249.199		Last PI data updated on : 14/8/2015 at 11:45:53		Comments Attached : No

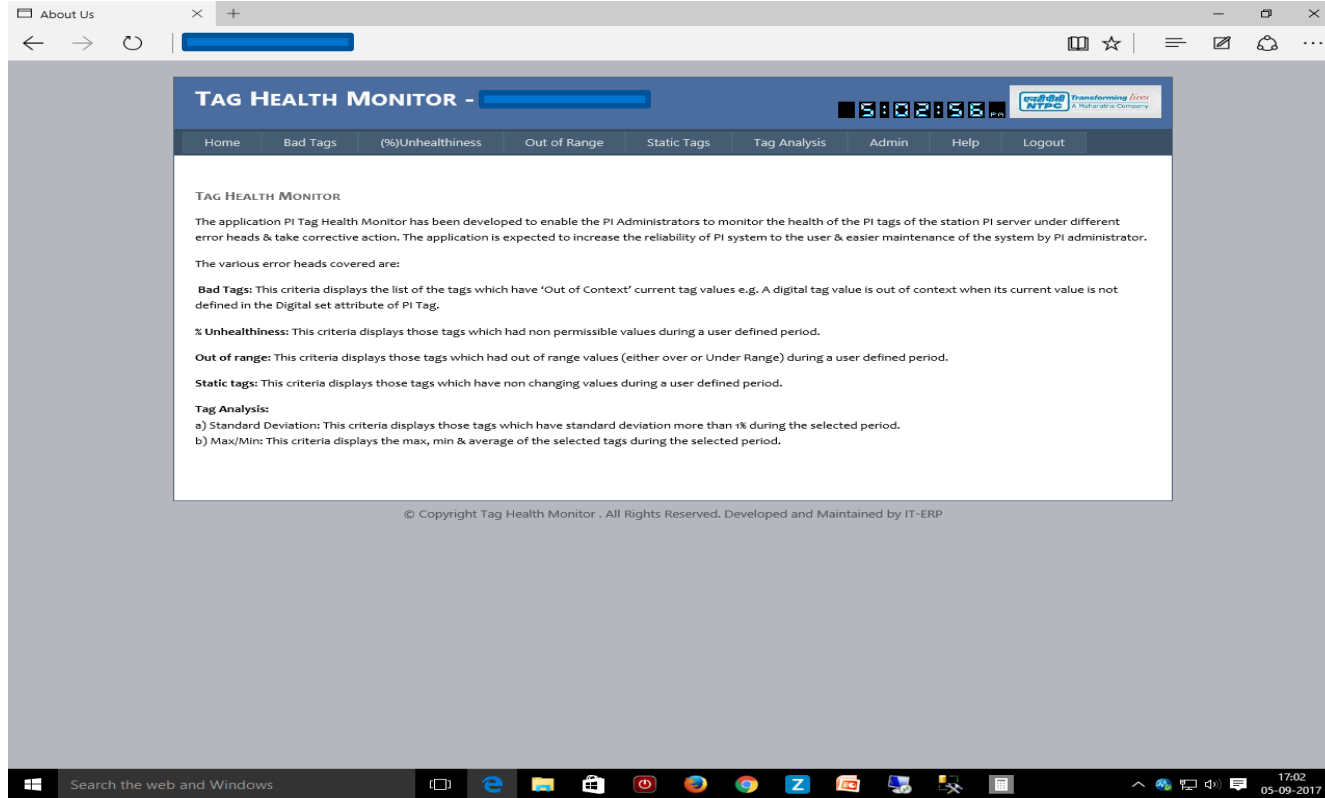
Log Book


 Paragraph St...

Font Name | Size | Apply CSS Cl...

क्रम	ऑफ़डे	पाली प्रारम्भ	पाली समाप्त
1	एस टी जी लोड ST Load (MW)	123.63	122.49
2	एस टी जी STG MVAR	-5	
3	एस टी स्पीड ST Speed (RPM)	2991.61	3000.18
4	जेनरेटर कोल्ड एअर टेम्प्रेचर Gen Cold Air Temp (OC)	41.48	
5	जेनरेटर हॉट एअर टेम्प्रेचर Gen Hot Air Temp (OC)	64.90	
6	स्टेटर वाइंडिंग टेम्प्रेचर अधिकतम / न्युनतम Stator Windg Temp (Max/Min (OC)	83.20/78.32	

PI Tag Health Monitor



The screenshot shows a web browser window displaying the 'About Us' page of the PI Tag Health Monitor application. The browser's address bar is empty, and the page title is 'About Us'. The application interface features a dark blue header with the title 'TAG HEALTH MONITOR' and a digital clock showing 5:02:58 PM. Below the header is a navigation menu with the following items: Home, Bad Tags, (%Unhealthiness), Out of Range, Static Tags, Tag Analysis, Admin, Help, and Logout. The main content area contains the following text:

TAG HEALTH MONITOR

The application PI Tag Health Monitor has been developed to enable the PI Administrators to monitor the health of the PI tags of the station PI server under different error heads & take corrective action. The application is expected to increase the reliability of PI system to the user & easier maintenance of the system by PI administrator.

The various error heads covered are:

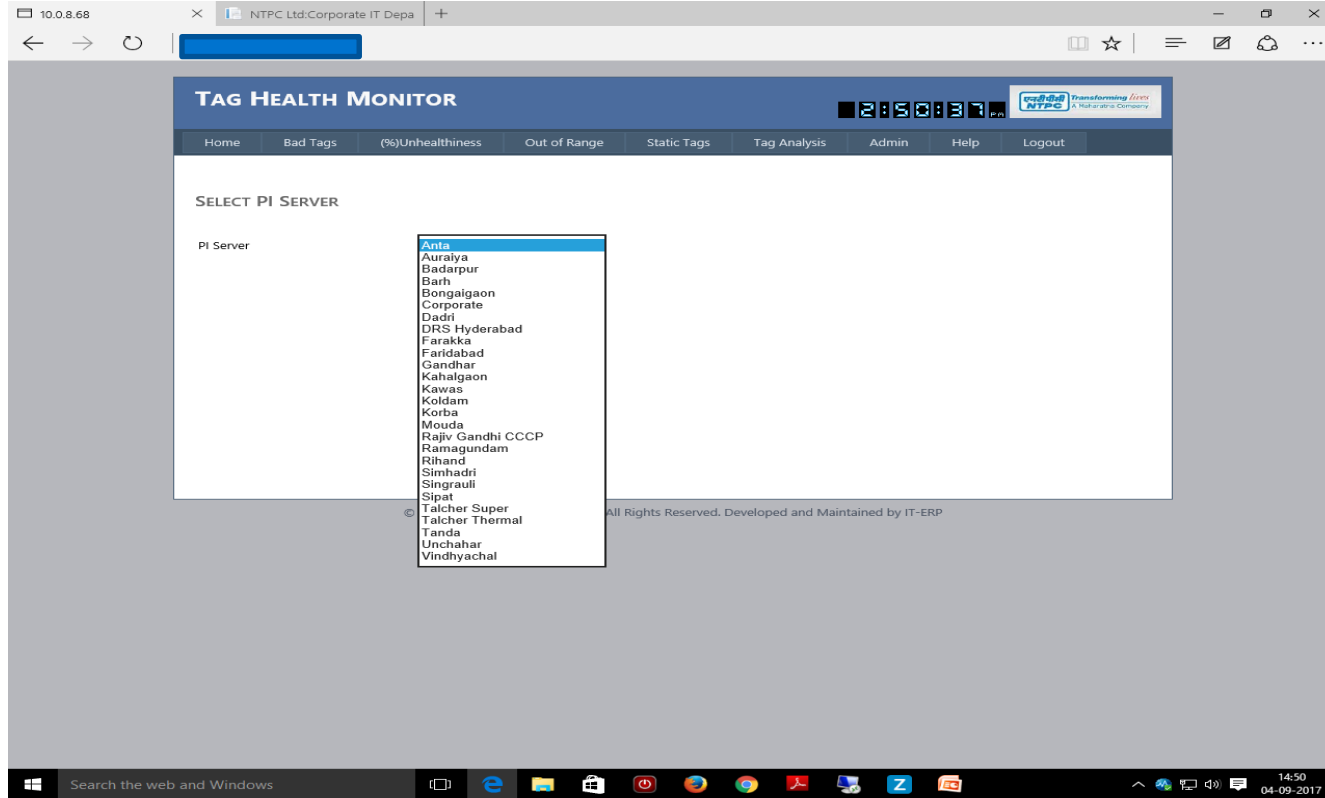
- Bad Tags:** This criteria displays the list of the tags which have 'Out of Context' current tag values e.g. A digital tag value is out of context when its current value is not defined in the Digital set attribute of PI Tag.
- % Unhealthiness:** This criteria displays those tags which had non permissible values during a user defined period.
- Out of range:** This criteria displays those tags which had out of range values (either over or Under Range) during a user defined period.
- Static tags:** This criteria displays those tags which have non changing values during a user defined period.

Tag Analysis:

- Standard Deviation: This criteria displays those tags which have standard deviation more than 1% during the selected period.
- Max/Min: This criteria displays the max, min & average of the selected tags during the selected period.

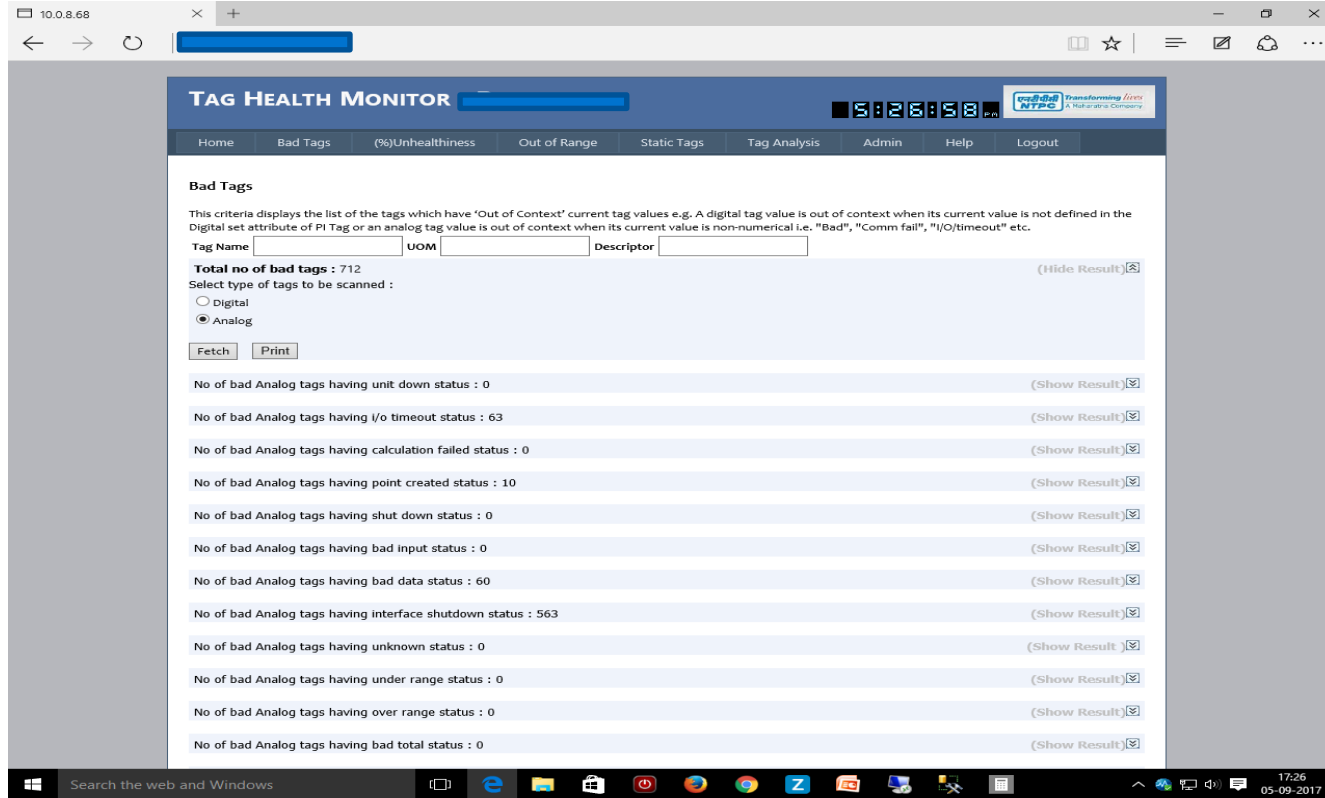
© Copyright Tag Health Monitor . All Rights Reserved. Developed and Maintained by IT-ERP

PI Tag Health Monitor



The screenshot shows a web browser window displaying the 'TAG HEALTH MONITOR' application. The browser's address bar shows '10.0.8.68' and the page title is 'NTPC Ltd:Corporate IT Depa'. The application header includes a navigation menu with items: Home, Bad Tags, (%Unhealthiness), Out of Range, Static Tags, Tag Analysis, Admin, Help, and Logout. A digital clock displays '2:50:37 PM'. The main content area is titled 'SELECT PI SERVER' and features a search box labeled 'PI Server'. A dropdown menu is open, listing various server locations: Anta, Auraiya, Badarpur, Barh, Bongaigaon, Corporate, Dadri, DRS Hyderabad, Farakka, Faridabad, Gandhar, Kahalgaon, Kawas, Koldam, Korba, Mouda, Rajiv Gandhi CCCP, Ramagundam, Rihand, Simhadri, Singrauli, Sipat, Talcher Super, Talcher Thermal, Tanda, Unchahar, and Vindhyachal. The footer of the application states 'All Rights Reserved. Developed and Maintained by IT-ERP'. The Windows taskbar at the bottom shows the search bar, task view, and several application icons, with the system tray displaying the time '14:50' and date '04-09-2017'.

PI Tag Health Monitor



The screenshot shows a web browser window displaying the 'TAG HEALTH MONITOR' application. The browser address bar shows '10.0.8.68'. The application header includes a navigation menu with items: Home, Bad Tags, (%Unhealthiness), Out of Range, Static Tags, Tag Analysis, Admin, Help, and Logout. A digital clock shows 5:25:58 PM. The NTPC logo and tagline 'Transforming Lives' are visible in the top right.

The main content area is titled 'Bad Tags'. It contains a description: 'This criteria displays the list of the tags which have 'Out of Context' current tag values e.g. A digital tag value is out of context when its current value is not defined in the Digital set attribute of PI Tag or an analog tag value is out of context when its current value is non-numerical i.e. "Bad", "Comm fail", "I/O/timeout" etc.'

Below the description are input fields for 'Tag Name', 'UOM', and 'Descriptor'. A summary line states 'Total no of bad tags : 712' with a '(Hide Result)' link. There are radio buttons for 'Digital' and 'Analog' (selected), and 'Fetch' and 'Print' buttons.

A list of statistics follows, each with a '(Show Result)' link:

- No of bad Analog tags having unit down status : 0
- No of bad Analog tags having I/O timeout status : 63
- No of bad Analog tags having calculation failed status : 0
- No of bad Analog tags having point created status : 10
- No of bad Analog tags having shut down status : 0
- No of bad Analog tags having bad input status : 0
- No of bad Analog tags having bad data status : 60
- No of bad Analog tags having interface shutdown status : 563
- No of bad Analog tags having unknown status : 0
- No of bad Analog tags having under range status : 0
- No of bad Analog tags having over range status : 0
- No of bad Analog tags having bad total status : 0

The Windows taskbar at the bottom shows the search bar, task view, and various application icons. The system tray displays the time 17:26 and date 05-09-2017.

Benefits

- **Data visibility improvement across NTPC**
- **Data available anytime anywhere**
- **Increased Accuracy and Consistency of data**
- **Timely Reporting**
- **Increased end-user acceptance of Automation Systems**
- **Uniformity of calculation logic across stations**

PI System implementation

- **Future Plans**
- **Wind stations integration**
- **PI System Implementation through Cloud at solar stations**
- **Support formation of RE Remote Monitoring Centre**
- **Developing mobile apps/ applications as per need**
- **Implement High Availability for Interface Nodes**
- **Integrate new stations/units as and when they get commissioned**
- **Regular PI Audit Viewer to improve PI System chain uptime**
- **Establish Centre of Excellence for PI System**
- **Consultancy jobs at other power utilities.**

PI SYSTEM AUDIT VIEWER – FINDINGS

- Standby PI Server/Interface PC not available/ loaded with the same software programs versions and not having same names, as loaded on main machine in order to facilitate easy changeover.
- Backup of PI Server not being moved to external storage, checked for its completeness periodically as per guidelines.
- Standby OPC Servers not available.
- UPS supply not maintained in all the equipment in the PI System chain.

PI System

- Questions?

Thank You