TATA POWER





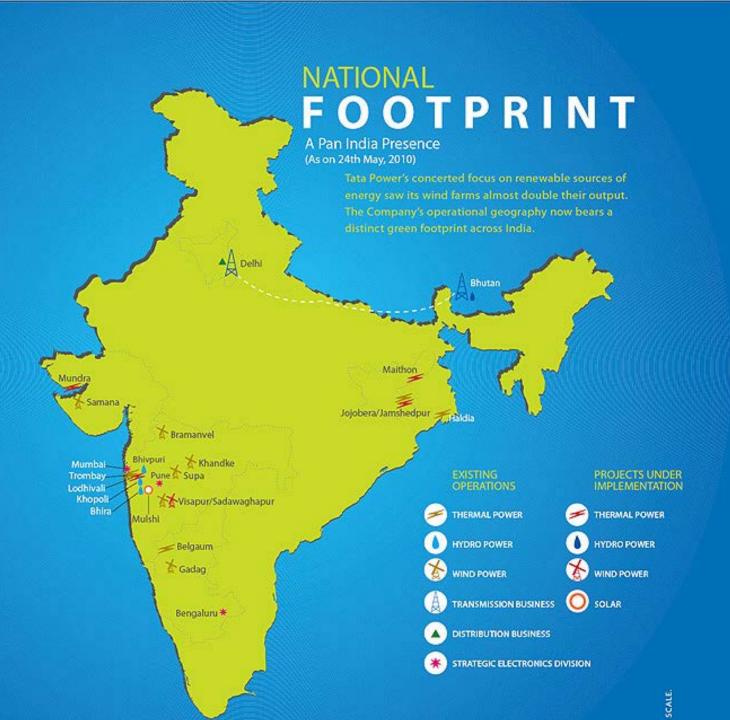
PI: Information on hand for Operational Analytics

Presented by:
Ranjith Ramachandran
Chandra Prakash Dewangan

AGENDA



- Information Enhancement
 - ABT System.
 - Auto Reports.
 - Enhancement of data.
- Performance Monitoring, Analysis & Improvement
 - Plant Performance Monitoring.
 - Plant Performance Improvement.



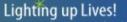


XISTING OPERATIONS

Mumbai, Maharashtra	
(Trombay - 1330 MW + Unit 8 - 250 MW + Hydro - 447 MW)	2027 MW
Jojobera, Jharkhand	428 MW
Power House # 6, Jamshedpur	120 MW
Belgaum, Karnataka	81 MW
Haldia, West Bengal	120 MW
Supa, Maharashtra	17 MW
Khandke, Maharashtra	50 MW
Bramanvel, Maharashtra	11 MW
Gadag, Karnataka	50 MW
Samana, Gujarat	50 MW
Sadawaghapur, Maharashtra	18 MW
Visapur, Maharashtra	4 MW
NDPL (Distribution)	1259 MW
Powerlinks (Tala Transmission)	1200 KM

PROJECTS UNDER IMPLEMENTATION

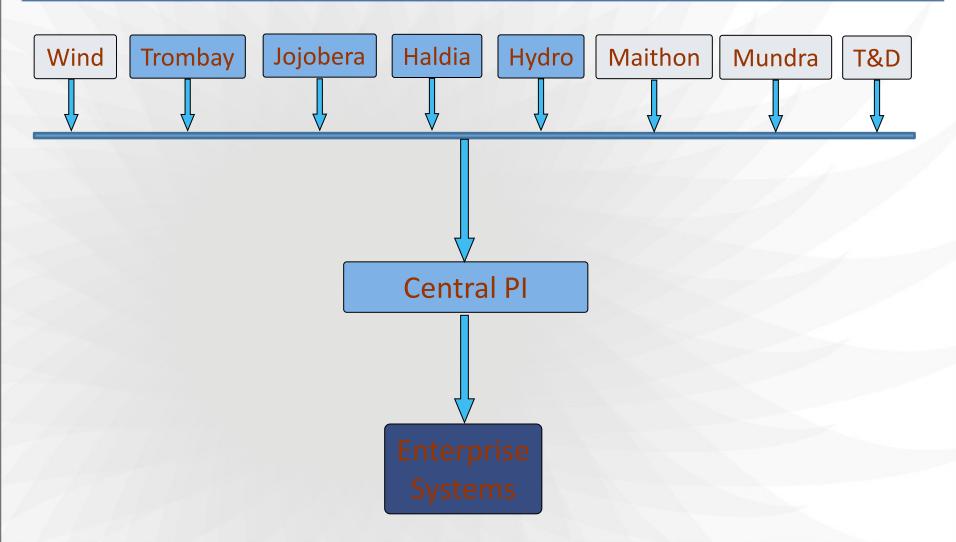
Thermal Projects	
Mundra, Gujarat 4	000 MW
Maithon, Jharkhand 1	050 MW
Jojobera	120 MW
Lodhivali	40 MW
Renewables Visapur, Maharashtra (Wind)	94 MW
Mulshi, Maharashtra (Solar)	3 MW
Hydro Project	
Bhutan	114 MW





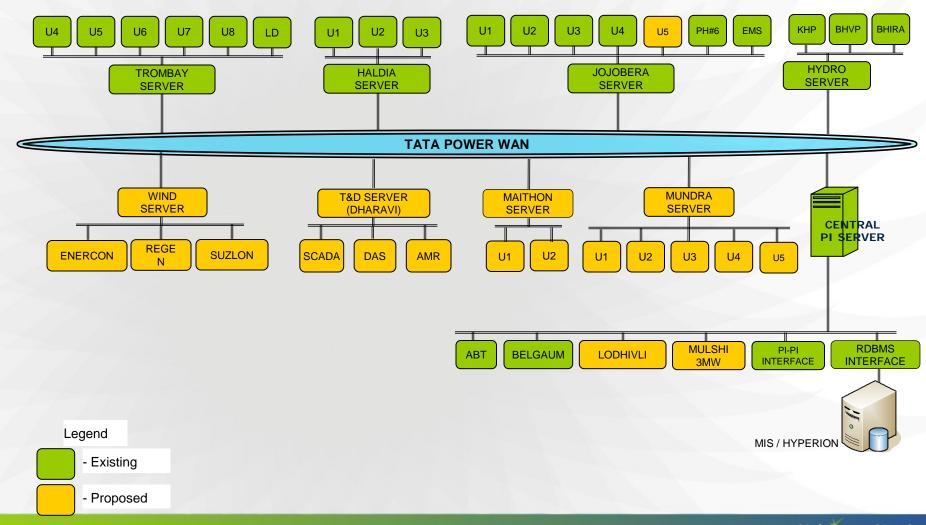


PI System Integration



PI System - Network





PI System Monitoring



		PI SYSTEM	OVERVIEW		
TROMBAY	HYDRO	JOJOBERA	HALDIA	MAITHON	MUNDRA
PI SERVER1 Primary	PI SERVER1 Primary	PI SERVER1 Primary	PI SERVER1 Primary		
PI SERVER2 Secondary	PI SERVER2 Secondary	PI SERVER2 Secondary	PI SERVER2 Secondary		
COLLECTIVE	COLLECTIVE	COLLECTIVE	COLLECTIVE		
U4 INTERFACE	BHIVPURI IF	PHD IF	U1&2 MAX DNA IF		
U5 INTERFACE	BHIRA IF	PML IF	U3 MAX DNA IF		
U6 INTERFACE	KHOPOLI IF	PH6 IF	ROCKWELL IF		
U7 SIEMENS INTERFACE					
U7 HONEYWELL INTERFACE	HYDRO PI-PI IF	JOJOBERA PI-PI IF	HALDIA PI-PI IF		
U8 INTERFACE	PI-PI IF Primary IF	PI-PI IF Primary IF	PI-PI IF Primary IF		
LD INTERFACE					
BELGAUM INTERFACE					
RDBMS INTERFACE PI Web					



PI System Monitoring



PML I/O RATE

148

JOJOBERA OVERVIEW

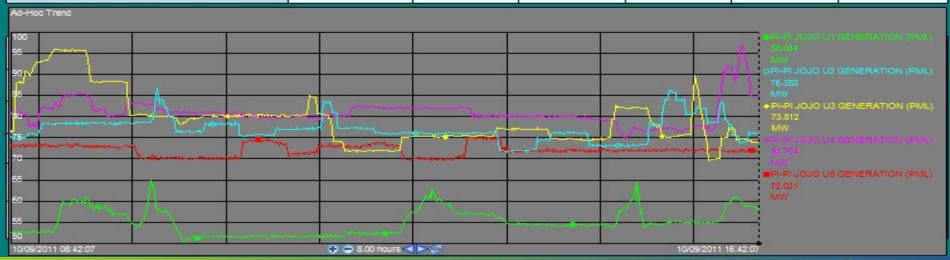
PH6 I/O RATE

0

INSTANTANEOUS VALUES

10/09/2011 16:41:30

PARAMETERS	STATION	UNIT 1	UNIT 2	UNIT 3	UNIT 4	UNIT 5
GENERATION (MW)	365	58	76	74	85	72
PLF (%)	67	86	64	62	71	60
REACTIVE POWER (MVAR)	109	26	29	24	21	
AUXILIARY CONSUMPTION (MW)	40.17	6.53	8.42	7.78	8.93	8.27
AUXILIARY CONSUMPTION (%)	11.20	11.06	11.06	10.41	10.54	11.22





PI System Monitoring



TATA POWER Lighting up Lives!

PLANT INFORMATION DASHBOARD



HOME TROMBAY

BHIVPURI

KHOPOLI

BHIRA

JOJOBERA

HALDIA

TROMBAY

BELGAUM

Instantaneous Values

08/03/2011 11:55:30

PARAMETERS	STATION	UNIT 4	UNIT 5	UNIT 6	UNIT 7 A	UNIT 7 B	UNIT 8
GENERATION (MW)	1220.85	0.11	477.21	403.30	113.84	66.29	156.88
PLF (%)	77.34	0.06	95.31	81.33	94.35	110.49	62.75
HEAT RATE (KCAL/KWH)	2396.99	0.00	2468.01	2390.23	1842.86		2847.29
FUEL COST (RS/KWHR)	3.13	0.00	2.13	5.36	1.50		2.32
COAL FLOW (TONS/HR)	335.86		249.96				88.24
GAS FLOW (TONS/HR)	54.07	0.00	0.00	28.98	25.15		
OIL FLOW (TONS/HR)	56.96	0.00	0.00	56.96			
CO2 EMISSION (TONS/HR)	1034.91	0.00	534.13	253.58	56.02		191.16
SO2 EMISSION (TONS/HR)	0.81	0.00	0.29	0.34			0.18
CW TEMP DIFF	9.54	0.00	11.19	11.45		9.09	6.32
AUX CONSUMPTION (MW)			23.32		3.79		10.69
AUX CONSUMPTION (%)			4.86		2.09		6.92

Previous Day Cumulative Values





ABT SYSTEM



ABT System



- * Acquisition of data from ABT System deployed for Mumbai Operations.
- * Accurate, reliable and wide acceptance.
- * My SQL database in the backend.
- * Web client with limited features available for monitoring. No tools for analysis purposes.
- * Not possible to import data into excel.
- * Report creation facility is not available.





- * RDBMS Interface connectivity with PI server
- * Immediate and time triggered data collection.
- * Easier to import into excel sheet for analysis.
- * Displays and trend making with ProcessBook.
- * Report creation became error free and less time consuming
- * Reports from PI being utilized by Load Control Centre for planning and forecasting.



AUTOMATED REPORTS







Daily operational and maintenance report on E-mail

- Created Visual Basic application which utilizes PI DataLink to generate reports.
- *Reports are in MS Excel format. The values are available as static. Hence, no need of PI DataLink on the recipients computer.
- Reports saved on a network drive.
- ❖ E-mail the report using PI notifications to a list of recipients by setting time based triggers.



Automated Reports

1	HE TATA PO	WER COMP	PANY LTD BE	LGAUM	
		DAILY - RE			
				Report for the Day	04/05/2011
DESCRIPTION	TODAY		MTD	YTD FY 10-11	YTD FY 09-10
GROSS GENERATION (MU)	0.588		1.774	35.628	
NET GENERATION (MU)	0.582		1.753	34.873	
AUX. CONSUMPTION (MU)	0.007	1.126	0.020	0.174	
TOTAL GEN. TARGET (MU)					
F.O. CONSUMPTION (MT)	121.688		347.530	7321.521	
L.O. CONSUMPTION (MU)	0		0.000	0.000	
PLANT LOAD FACTOR (%)	30.157		18.746	53.017	
AVAILABILITY FACTOR (%)	92.91999817			3	
EXCESS AVAILABILITY (MU)					
WATER CONSUMPTION (M3)	1523			1472371.875	
WATER STOCK (M3)					
OPPORTUNITY LOST (MU)					
DG SET RUNNING HOURS DE	TAILS	î.			
DG NUMBER	RUN HRS	RUN HOUR D	ETAILS FOR TH	E DAY	
	(CUMULATIVE)	RUN HRS	STOP HRS	STANDBY HRS	REMARKS
DG#1	43530	8	-		
DG#2	40874	8			
DG#3	40243	8			
DG#4	40000	8			
DG#5	42966	8		1	



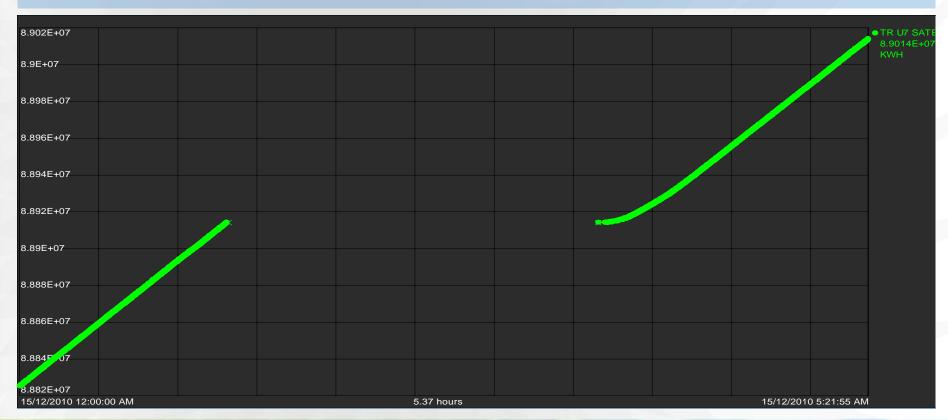
ENHANCEMENT OF DATA QUALITY

Solution to Energy Meter commn. error



Before

Energy meter communication problems during shutdown which results in error of the source data affecting calculations.



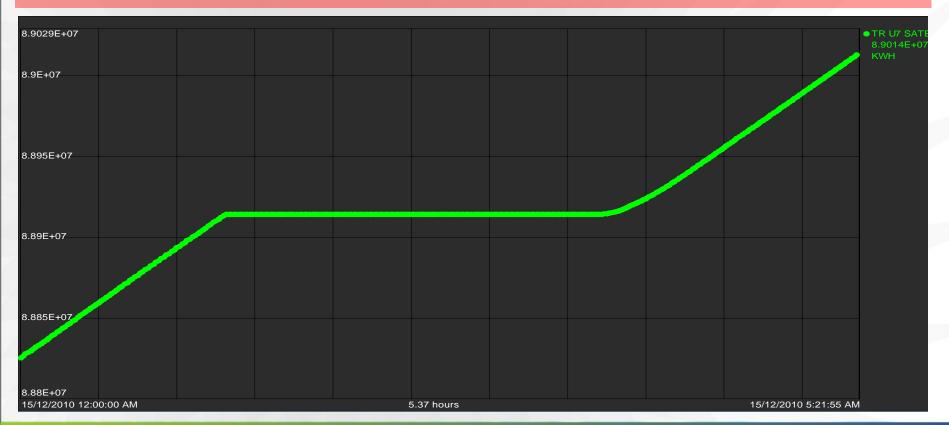


Solution to Energy Meter commn. error



After

Created a performance equation for storing the last reading of the energy meter and the same tag used for energy calculations.



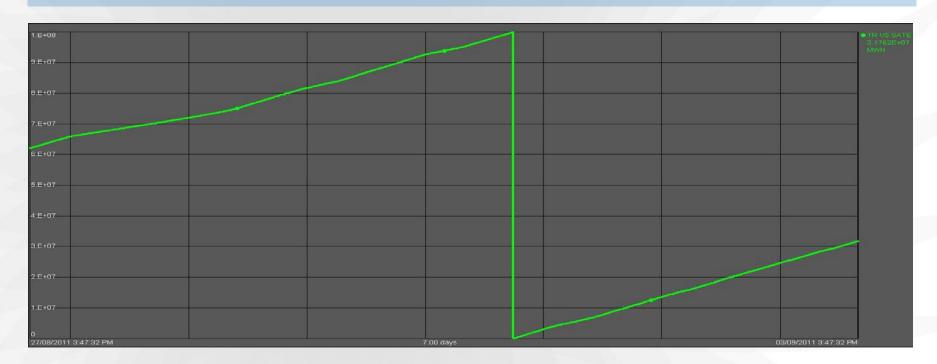


Energy Meter reset



Before

Energy meter resets to zero after reaching the maximum of cumulative reading which affects energy calculations.



Result: Negative



Energy Meter reset



After

Added a condition in performance equations to check for a meter reset for the entire day and provided two methods of calculation using an IF clause.

Modified PE

IF (TAGVAL('TR U7 SATEC STG KWH NO ERROR','T')-TAGVAL('TR U7 SATEC STG KWH NO ERROR','Y'))<0 THEN (TAGMAX('TR U7 SATEC STG KWH NO ERROR','Y','T')-TAGVAL('TR U7 SATEC STG KWH NO ERROR','Y')+TAGVAL('TR U7 SATEC STG KWH NO ERROR','T'))/1000000 ELSE (TAGVAL('TR U7 SATEC STG KWH NO ERROR','T')-TAGVAL('TR U7 SATEC STG KWH NO ERROR','T')-TAGVAL('TR U7 SATEC STG KWH NO ERROR','Y'))/1000000

Result: Accurate

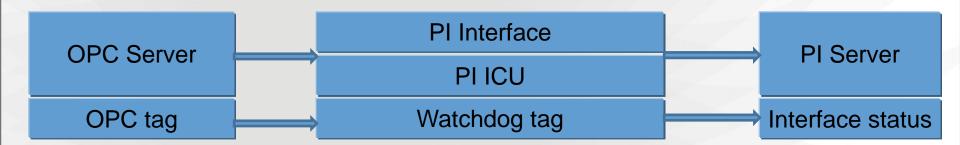


Multiple interface status



Before

Single tag for OPC interface status based on a particular watchdog. No direct monitoring over the data received from various functional areas.

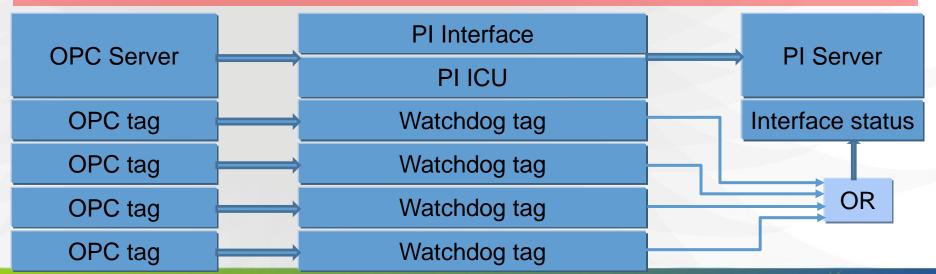


Multiple interface status



After

- Introduced the concept of multiple interface status tags using multiple watchdog from different functional areas.
- * Better monitoring over the plant.
- Improved the availability of plant data.
- Helps the plant engineers for immediate identification of the affected area.



Trigger based PE



Before

- Performance equations was clock scheduled and it was consuming more computing power and memory.
- It was not possible to output results at a pre defined time.

After

- Created Triggers for the desired time.
- Used triggers for event triggering of the calculated tags.
- Calculations are performed only onetime in a day which greatly reduced the system load and made the results accurate.



THERMAL POWER PLANT PERFORMANCE MONITORING

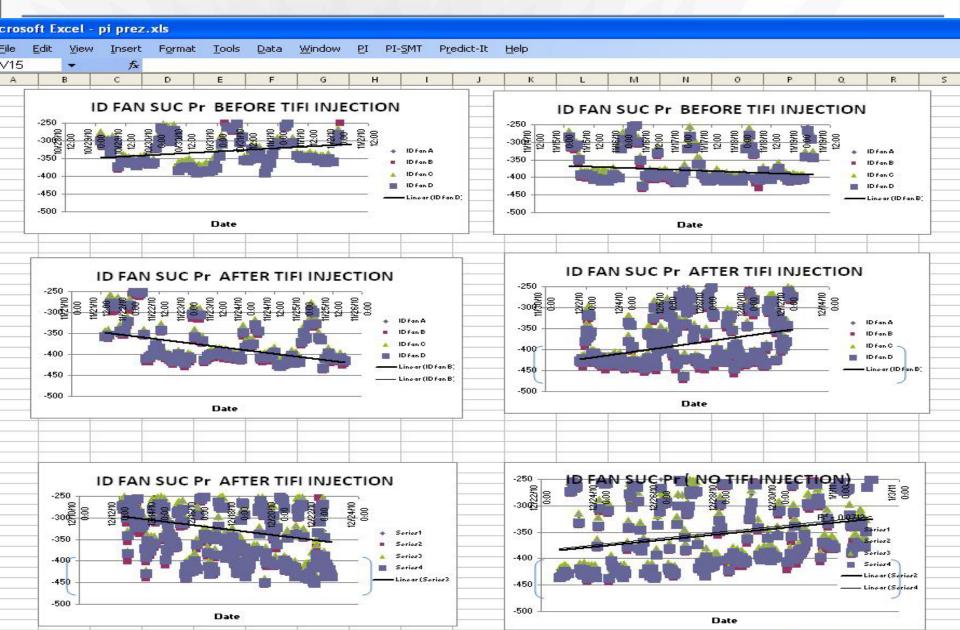
Performance Monitoring



- PI Data used for Monitoring Plant Performance
- ❖❖❖ "Before & After" Performance Analysis
- **Boiler & Turbine Efficiency Monitoring**
- Monitoring of Design vs. Actual Performance
- Performance Analysis at different operating conditions
- Dashboard / Report having Last Hour, Today, Last Day & Monthly data.

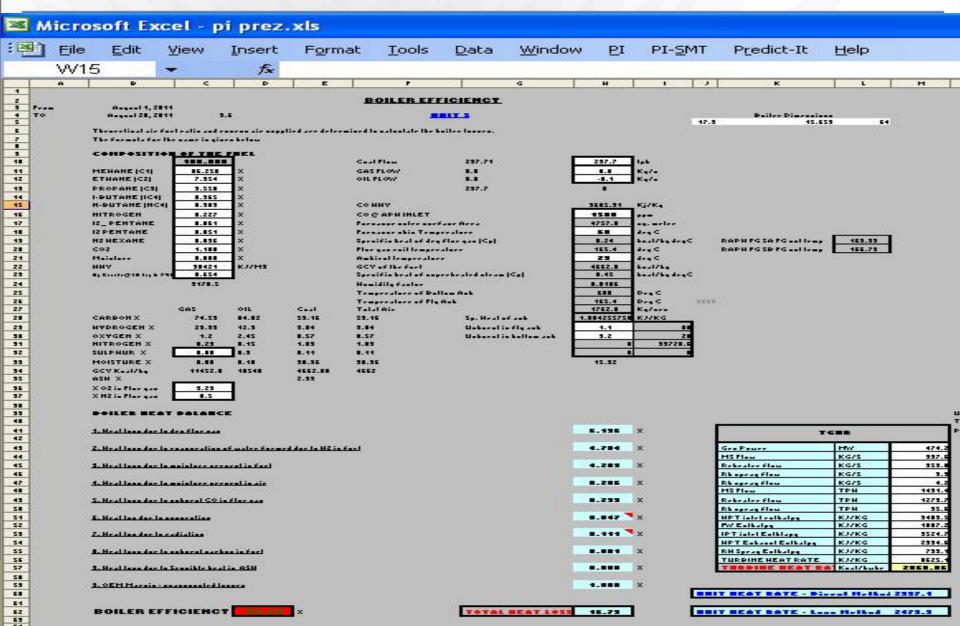
Performance Monitoring - "Before & After" Analysis





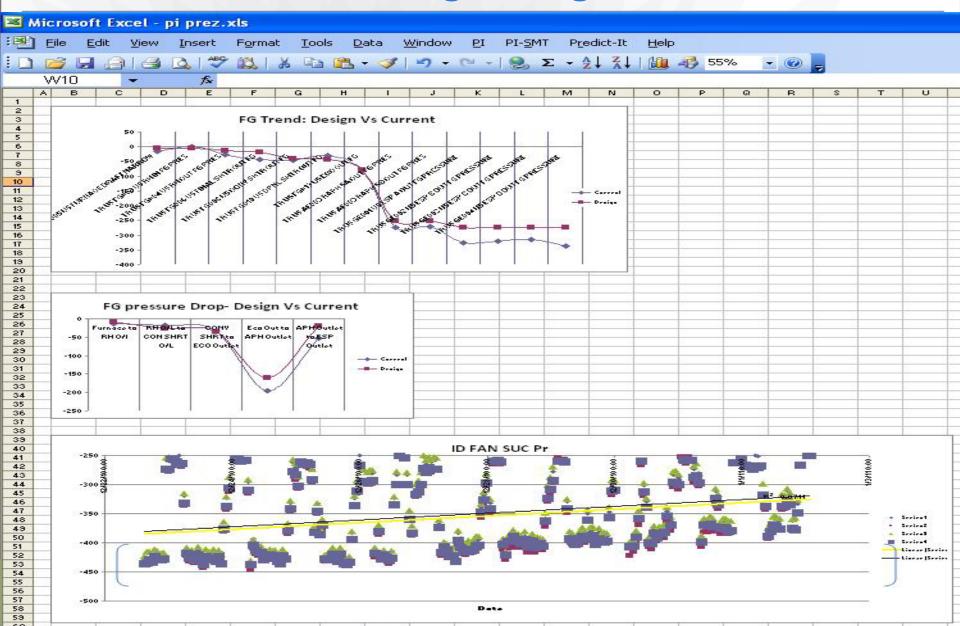
Performance Monitoring - Boiler & Turbine Efficiency TATA







Performance Monitoring - Design vs. Actual





-19.49

7.42

5.90

4.06

	Perf	orman	C	e Monitoring – D	iff. o	perati	ng co	nditio	ons T	ΓΛΤΛ
33 /	Aicrosoft E	xcel - pi prez.	xls							
: 3		View Insert		rmat <u>T</u> ools <u>D</u> ata <u>Window PI</u> PI- <u>S</u> MT	Predict-It H	lelp				
	K30	▼ f _x	- 1 - 1							
	A	В	С	D	Е	F	G	Н	1	1
-			-		Sunday, June	Monday, June	Tuesday, June	Wednesday,	Thursday, June	Friday, June
1				PI Tag name	12, 2011	13, 2011	14, 2011	June 15, 2011	16, 2011	17, 2011
2					Min. Load	Unit on full oil	Unit at 50% load	Unit at 70% Load	Unit at 75% Load	Unit at 50% Load
3	LOAD			TR U5 SATEC GEN MW	No Data	No Data	No Data	No Data	No Data	No Data
4	2-50-1-65			TR U5 EB009 U5 GENERATOR MW	207.39	480.86	249.58	346.72	383.64	265.13
5				TR U5 TFL2 TOTAL COAL FLOW	69.00	0.21	142.31	214.74	221.81	164.07
6	Coal flow				7.21	31.34	-0.10	-0.09	-0.09	-0.09
7	oil flow			TR U5 AA009 U#5 FD FAN5A MTR CURRENT	67.54	93.53	66.52	88.74	77.51	76.97
8		Current			65.33	84.38	64.83	78.06	73.18	71.50
9		NETHOLOGOUS S	_		53.47	209.28	47.72	185.58	130.10	131.24
10		Discharge pr.	A		77.17	224.44	65.78	205.80	156.29	153.18
11	FD fan		В		449.35	776.01	400.76	749.49	638.52	620.93
12		### ### ### ### ### ### ### ### ### ##			411.32	702.13	382.98	651.27	587.14	546.80
13	-	B TR U5 AA014 U5 FD FAN 5A DISCH PRES		7.04	0.79	4.42	6.17	5.22	6.65	
14		02	_		5.66	1.15	4.20	7.21	5.01	6.92
15			-		311.66	344.50	331.70	368.95	357.73	332.20
16		Air o/l temp.			305.35 23.19	345.47 95.23	324.70 22.59	370.74 78.13	360.73 68.54	330.09 76.84
17			-		14.49					
18		Air o/l pr.	_		79.59	112.25 135.20	21.33 87.25	95.75 165.95	62.75 152.11	71.56 117.63
_	RAPH		-		79.59	135.20			149.73	111.40
20	KAPH	Gas side DP			35.20	89.72	74.98 30.20	161.98 87.10	71.41	60.14
22	-		-		66.24	119.21	65.39	113.84	98.05	87.40
23	-	Air side DP			157.36	183.53	176.92	185.27	189.46	159.87
24		FGET	-		152.83	199.37	176.81	191.19	195.57	165.13
25	·	TOLI	17		130000000000000	460.36	439.46	490.11	468.31	445.18
26		Flue gas i/l tem	n n	TR U5 FG014 ECONOMISER OUT FLUE GAS TEN	298.90	335.10	312.42	351.17	345.02	318.41
27	Economiser	Flue gas o/l ten		TR US BOILER OUTPUT - FRH PART	268.90	305.10	282.42	321.17	315.02	288.41
28		riac gas o/r cen	T	TR U5 GA009 ID FAN 5A MTR CURRENT	142.85	142.99	0.33	165.45	151.64	0.24
29			A	TR U5 GB009 ID FAN 5B MTR CURRENT	159.43	144.01	148.23	161.76	152.89	175.51
30		Current	В	TR U5 GC009 ID FAN 5C MTR CURRENT	0.73	141.10	143.58	153.43	145.23	162.94
31			C	TR U5 GE001 U5 ESP A OUT FG PRESSURE	-152.65	-255.71	-169.40	-288.45	-272.55	-212.18
32		Š.	A	TR U5 GE002 U5 ESP B OUT FG PRESSURE	-150.39	-251.34	-167.37	-288.54	-266.54	-217.73
33			В	TR U5 GE003 U5 ESP C OUT FG PRESSURE	-160.20	-258.12	-178.90	-299.06	-285.03	-229.66
34	ID for	Suction pr	C	TR U5 GE004 U5 ESP D OUT FG PRESSURE	-173.69	-273.97	-195.79	-308.86	-289.17	-240.44
35	ID fan		D	TR U5 GA016 ID FAN 5A OUT FG TEMP	130.65	155.24	45.31	157.96	150.98	110.42
36	1		A	TR U5 GB016 ID FAN 5B OUT FG TEMP	130.43	170.10	150.09	184.36	177.12	135.16
37		0/1 +	В	TR U5 GC016 ID FAN 5C OUT FG TEMP	129.69	169.36	149.35	183.62	176.38	134.42
38]	0/L temp.	C	TR U5 GD016 ID FAN 5D OUT FG TEMP	125.48	164.66	155.01	165.16	159.30	140.16
20	1		-	TRUE FACCE HE SUBDIAGE BRAST MARROW	22.40	02.05	40.00	42.00	20.54	40.40

-23.25

2.79

1.96

42.76

-19.20

14.36

11.28

3.08

-13.69

13.61

7.51

0.07

-20.61

8.47

7.72

30.11

-22.18

15.10

3.62

50.09

D TR U5 FA005 U5 FURNACE DRAFT NARROW

TR U5 AIBG03 BURNER TILT POSITION 3

TR U5 AISF01N SH SPR FLOW (N)

TR U5 AIRF01N RH SPR FLOW (N)

39

40

41

42

Spray

Furnace draft

SH spray

RH spray

Performance Monitoring - Dashhoard

0.1

0.3

2.9

148

0

144

144

12.5

11.53

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0.32

6.84

-0.93

-0.51

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0.00

11.24

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160.17

0.00

10 TR U5 HP HEATER 6 TTD

11 TR U5 HP HEATER 5 TTD

12 TR U5 LP HEATER 3 TTD

13 TR U5 LP HEATER 2 TTD

14 PRESS

20 RAPH 5A

21 RAPH 5B

TR U5 SA003 U5 THROTTLE STEAM

15 TR U5 PE003 U5 BFPT 5C IN STM FLOW

16 TR U5 PD003 U5 BFPT 5B IN STM FLOW

17 TR U5 RA007 U5 MAKE UP WATER FLOW

TR U5 FGET5AAVG FLUE GAS EXIT TEMP

TR U5 FGET5BAVG FLUE GAS EXIT TEMP

18 TR U5 AISF01N SH SPR FLOW (N)

19 TR U5 AIRF01N RH SPR FLOW (N)

22 TR U5 CEAIRP EXCESS AIR



0.2

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	A4 ▼	R PRESS	URE	χ			3 8		-	
	A	В	С	D	E	F	G	Н	I	
		Design	Current			ALERT	Last			Ţ
1	Parameters	Value	Value	Deviation	KCAL/KWH	(KCAL/KWH)	Hour	Today	Yesterday	m
2	TR U5 SATEC GEN MW		479.24				438.0	488.6	479.2	
3	TR U5 HEAT RATE	2489	2450.82	38.18		3	2447.0	2348.3	1709.6	1
	TR U5 RA001 U5 CONDENCER PRESSURE	-0.91	-0.93	-0.02	-17.61	ок	-0.930	-0.926	-0.926	- 2

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		Design	Current			ALERT	Last			This
1	Parameters	Value	Value	Deviation	KCAL/KWH	(KCAL/KWH)	Hour	Today	Yesterday	mont
2	TR U5 SATEC GEN MW		479.24				438.0	488.6	479.2	431
3	TR U5 HEAT RATE	2489	2450.82	38.18			2447.0	2348.3	1709.6	1993

	A	В	С	D	E	F	G	Н	1	J
1	Parameters		Current Value	Deviation	KCAL/KWH	ALERT (KCAL/KWH)	Last Hour	Today	Yesterday	This mont
2	TR U5 SATEC GEN MW		479.24				438.0	488.6	479.2	431
3	TR U5 HEAT RATE	2489	2450.82	38,18			2447.0	2348.3	1709.6	1993
	TR U5 RA001 U5 CONDENCER				17.01				0.000	2.0

	A	В	C	D	E	F	G	H	l l	J
1	Parameters		Current Value	Deviation	KCAL/KWH	ALERT (KCAL/KWH)	Last Hour	Today	Yesterday	This montl
2	TR U5 SATEC GEN MW		479.24				438.0	488.6	479.2	431
3	TR U5 HEAT RATE	2489	2450.82	38.18			2447.0	2348.3	1709.6	1993
	TR U5 RA001 U5 CONDENCER		The state of the s						167 (370345)	DOS SATIS
4	PRESSURE	-0.91	-0.93	-0.02	-17.61	0K	-0.930	-0.926	-0.926	-0.93
5	TR U5 BD008 SHRT OUT 1 STM TEMP	541	550.73	-9.73	-9.69	OK	544.5	545.1	545.2	536
W.S.	TO US DO AGO OUDT OUT A BLOTH TEND		* ************************************	100	23222	1 CONTRACTOR 1			E0.4.4	E00

		Design	Current			ALERT	Last			This
1	Parameters	Value	Value	Deviation	KCAL/KWH	(KCAL/KWH)	Hour	Today	Yesterday	month
2	TR U5 SATEC GEN MW		479.24				438.0	488.6	479.2	431.4
3	TR U5 HEAT RATE	2489	2450.82	38.18			2447.0	2348.3	1709.6	1993.9
	TR U5 RA001 U5 CONDENCER						-		ter erranner	765 5974750
4	PRESSURE	-0.91	-0.93	-0.02	-17.61	ok	-0.930	-0.926	-0.926	-0.932
5	TR U5 BD008 SHRT OUT 1 STM TEMP	541	550.73	-9.73	-9.69	oK	544.5	545.1	545.2	536.1
6	TR U5 BD009 SHRT OUT 2 IN STM TEMP	541	531.67	9.33	9.29	9.29	531.6	531.3	534.1	529.8
7	TR U5 BE009 RH OUT STM TEMP(EAST)	541	542.32	-1.32	-0.90	oK	539.4	541.0	542.2	533.6
8	TR U5 BE010 RH OUT STM TEMP(WEST)	541	549.23	-8.23	-5.63	0K	547.8	547.3	546.4	539.4
9	TR U5 BE001 U5 RH OUT STM PRES	35	35.26	-0,26	0.00	OK	32.2	36.2	35.5	31.8

-3.83

-3.51

-140

-1.82

1.00

0.00

-12.50

0.31

3.26

-1.91

-1.75

2.39

-1.27

0.00

21.25

21.29

20.12

-5.91

0.31

3.26

OK

OK

OK

2.39

OK.

OK

OK

21.25

21.29

20.12

OK



PERFORMANCE IMPROVEMENT INITIATIVE SANKALP

SANKALP



- Structured, Time bound, Team based program with top management support & bottom up approach to impact the company's bottom line with minimal investment in shortest possible time.
- Uses the creativity and energy of the people of Tata Power and all its stakeholders
- Utilizes Online Data from PI System to take informed decisions.

Online Data for 500 MW Coal Fired Unit



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100			05 CB003 MILL 5B												
	A	В	С	Formula Bar	Е	F	G	Н	L	J	K	L			
1	09-Sep-11 11:38:49		482.02								Design Coal CV	51			
2	Load MW	Coal TPH	Steam flow Kg/Sec	Coal Flow TPH	CM status	Current Amps	Coal Air Temp	PA In temp	PA Flow	Bowl DP (Bar)	Coal CV	42			
3	486.69	222.05	446.52	0.00	OFF	0.00	Bad	Bad	0.00	9	Oil CV	105			
4	Plant Load Factor	FG flow TPH	HRH Steam Flow	37.66	ON	40.59	Bad	198.18	0	166	FG CV	130			
5	97.23%	0.00	362.65	37.87	37.87 ON		58.20	234.68	0.00	160	Unit 5 Heat Rate	2483.70			
6	Air Flow	LC Oil	Deaerator Pr	37.86	37.86 ON		64.25	244.52	22.7776413	152	Drum Pr.	173.			
7	1772.32	4.05	6.30	37.96 ON		45.28	Bad	245.28	17.5363369	166	Boiler out Pr	163.			
8	Ratio of Air / load	Makeup	Total Flue Gas	32.84 ON		45.66	64.28	236.60	1.972032309	150	Throttle Pr.	151.			
9	3.64	53.02	53.02 717.79		ON	43.18	64.30	249.05	21.52795601	206	MS Pr. Bef SV	149.			
10	Sp Steam cons	3.60		0.25	ON	30.05	59.43	69.65	35.00	55	HP Drum Stage Pr.	147.			
11	3.30	MS temp	RH Temp	-	In Service	LRSB No	0		128	HP Exhaust Pr.	38.				
12	North	550.45	538.01	ESP O/L Pr.	BFP	flow	Soot Blowing	Pressure	22.95		HP Exhaust Temp.	334.			
13	South	531.96	548.96	-352.40	7.73	4.56	Steam	Flow	0.77		RH in Steam Pr				
14	Spray	0.00	12.78	-343.36	264.02	18.01		CW Inlet Temp	28.96		RH Out Steam Pr	35.			
15	Sp Coal Cons	0.456		-339.97	264.26	16.80		Cvv miet remp	20.50		RH Steam aft SV	34.			
16	Design Mkcal	1199	2.398	-357.69	536.02			CW Outlet Temp	41.17		RH Steam aft CV	31.			
17	Actual Mkcal	1097	2.254		FG	SA	Temp	CV Oddet remp	72.27		Vacuum	-0.9			
18	Expected Coal TPH	282		RAPH 5A	197.01	71.22	158.2	Diss. 02	52.74		HP CV 1 Position	90.			
	Oil Equivalent to	36		RAPH 5B	194.94	102.85	159.2				HP CV 2 Position	94.			
19	Coal TPH	30		MAINSO	154.54	102.00	155.2	Condensor			THE CV 2 TOSHION	J4.			
	Gas Equivalent to	0		Economiser FG temp			158.7	Conductivity	2.54		HP CV 3 Position	100			
20	Coal TPH	v		200	onomiser ro te	p	156.7	Conductivity			THE CV 5 F OSHION	100.			
21	Excess Air	2.8	3.3	IN	OUT	DT					HP CV 4 Position	86.			
22		3.8		419.69	335.02	84.67		,			Vac Pump status	ON			
23				250.39	294.08	43.69					vac vanip status	N_ON			
24	FD Fan Current	79.90	78.44	177.84	Water In	Water Out	Ext Pr	Ext Temp	Drain Temp	TTD	DCA				
	FD Fan Flow Kg/S	649.86	655.94	H P Heater 6	208.1	250.4	39.0	333.2	214.4	-0.33	5.78	#NAME			
26	PA Fan Current	187.28	183.66	H P Heater 5	171.6	208.1	16.9	442.0	175.9	6.27	3.46	#NAME			
	PA Fan Flow M ³ /S	118.68	119.52	Dearator	132.8	167.2	5.9	330.1				#NAME -			
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History Data for analysis

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1 Duration	8 7-Sep-11	9-Sen-11	D	E	F	G	Н	18	J	К	- D	М	N	0	Р	Q	B	S	Т	U	٧	AA	AB	AC	AL	AM	AN	AO	AP	
2 Time	Load	Coal					Mak		Loss	Yac		B Flor		emp	H Avg Ten							l Avg Ten			uction F		FG		Avq	in
3 12:48 PM 4 1:48 PM	351.6 355.5	0.3	14.4 14.5	7.2	318.4 325.2	3.26 3.29	8.83 5.95	2.77% 1.83%	0.0	-0.960 -0.945	63 56	0.8	545.1 542.3	530.5 527.6	537.8 534.9	0.5	4.8	523.2 515.7	525.1 520.8	542.7 540.1	542.8 540.5	533.5 529.3	6.0 5.8	13.7	-205.4 -205.7	135.5 135.5	131.3 131.0	128.8 128.7	130.1 129.8	-1
5 2:48 PM	353.4	0.3	14.4	7.2	321.5	3.27	5.27	1.64%	0.0	-0.944	54	0.7	541.8	527.7	534.8	0.0	5.0	514.6	522.1	538.5	540.1	528.8	5.7	16.3	-203.6	134.3	130.6	128.2	129.4	_1
6 3:48 PM 7 4:48 PM		0.3	14.5 19.4	6.8 3.6	316.5 340.0	3.28 3.26	4.92 5.92	1.56%	0.0	-0.943 -0.938	56 56	0.7	539.8 540.1	533.6 530.0	536.7 535.0	0.9	3.3 4.7	525.0 526.0	525.7 529.8	528.4 533.5	528.4 536.0	526.9 531.3	5.7 5.9	17.6 15.0	-199.3 -218.3	133.7 138.9	129.3 129.8	127.6 128.6	128.4 129.2	-1
8 5:48 PM	367.0	0.3	22.6	0.0	336.7	3.30	7.46	2.22%	0.0	-0.938	57	0.7	538.7	523.8	531.3	0.0	8.3	518.2	522.1	530.6	529.5	525.1	5.8	18.9	-205.9	136.4	129.3	128.6	128.9	-1
9 6:48 PM 10 7:48 PM		0.3	22.8 22.8	0.0	336.7 337.1	3.28 3.26	7.13 9.84	2.12%	0.0 3.3	-0.942 -0.940	56 58	0.7	542.9 546.6	527.4 531.8	535.1 539.2	0.0	4.6 0.8	524.5 531.8	526.1 533.1	534.6 546.7	534.7 551.5	530.0 540.8	4.3 2.5	13.0 4.6	-212.5 -212.6	136.8 135.2	129.0 129.5	128.4 128.3	128.7 128.9	-1
10 7:48 PM		0.3	22.7	0.0	337.1	3.25	8.43	2.50%	0.0	-0.940	58	0.8	546.4	530.3	538.3	0.0	1.6	530.6	533.1	548.4	551.5	540.8 540.9	2.5	4.5	-210.7	136.0	130.1	128.4	129.2	-1
12 9:47 PM		0.3	22.7	0.0	337.2	3.25	5.39	1.60%	0.0	-0.941	54	0.9	545.4	528.7	537.0	0.0	2.8	529.3	533.1	548.6	551.5	540.6	2.5	4.5	-210.8	137.0	130.0	128.6	129.3	-1
13 10:47 PM 14 11:47 PM		0.3	21.7 17.7	0.0	323.5 252.5	3.25 3.23	7.77 5.07	2.40%	0.0	-0.942 -0.948	55 60	1.0	545.2 552.6	526.9 535.8	536.1 544.2	0.0	3.7 0.0	526.1 521.5	531.1 523.7	547.5 548.4	551.4 547.3	539.0 535.2	2.5	4.5 6.2	-201.2 -170.3	134.5 127.1	129.7 127.1	128.3 125.6	129.0 126.3	-1
15 12:47 AM	311.5	0.3	19.4	0.0	279.5	3.23	5.74	2.05%	0.0	-0.944	60	1.0	549.6	537.4	543.5	0.0	0.0	534.4	537.8	546.3	544.9	540.9	2.4	4.3	-188.0	132.6	126.0	125.2	125.6	-2
16 1:47 AM 17 2:47 AM		0.3	17.8 17.8	0.0	258.8 258.1	3.23	7.05 5.61	2.72%	0.0	-0.946 -0.947	64 66	1.0	548.6 540.6	535.8 527.1	542.2 533.9	0.3	0.0 5.8	524.6 510.7	527.3 513.1	544.2 535.8	543.2 538.4	534.8 524.5	2.9	7.3	-170.9 -166.4	128.4 128.4	126.2 125.1	125.1 123.7	125.6 124.4	-2
18 3:47 AM	284.9	0.3	18.0	0.0	259.9	3.28	6.38	2.45%	0.0	-0.945	65	1.0	543.0	529.1	536.0	0.0	3.8	513.8	519.0	537.4	540.6	527.7	2.3	10.9	-167.8	129.1	124.5	123.2	123.9	-2
19 4:47 AM 20 5:47 AM		0.3	18.0 17.9	0.0	259.8 259.2	3.27 3.26	6.12 6.34	2.35%	0.0	-0.946 -0.945	66 66	1.0	543.6 544.3	531.5 534.0	537.6 539.1	0.0	2.3	516.8 518.4	522.0 522.1	541.8 544.4	540.8 541.1	530.3 531.5	2.3	9.1	-169.2 -168.9	129.4 128.2	124.5 124.5	122.9 123.0	123.7 123.8	-2
20 5:47 AM 21 6:47 AM	286.2 286.5	0.3	17.9	0.0	258.4	3.25	6.20	2.45%	0.0	-0.953	65	1.0	545.0	536.4	540.7	0.0	0.8	520.7	522.1	543.2	541.3	531.8	2.3	8.2	-168.8	127.5	124.5	123.4	124.0	-2
22 7:46 AM		0.3	17.9	0.0	258.4	3.24	7.34	2.84%	0.0	-0.951	66	1.0	544.1	536.9	540.5	0.0	0.0	525.2	526.3	540.7	541.0	533.3	2.3	7.3	-171.2	128.2	124.6	123.5	124.0	-2
23 8:46 AM 24 9:46 AM		0.3	20.3	0.0	289.3 415.3	3.27	6.10 7.01	2.11%	0.0	-0.948 -0.937	65 55	1.0	544.1 520.4	538.6 521.3	541.3 520.8	0.0	18.2	528.6 532.4	528.4 535.6	542.8 530.0	543.0 528.3	535.7 531.6	3.4 2.9	7.7	-196.3 -263.2	135.4 149.5	125.6 133.3	123.9 132.9	124.7 133.1	-1
25 10:46 AM	458.1	0.3	28.1	0.0	433.3	3.40	11.71	2.70%	10.7	-0.936	57	1.0	523.5	510.6	517.1	0.0	21.8	526.0	530.3	526.7	526.0	527.3	2.8	12.2	-258.5	146.5	136.2	136.4	136.3	=
26 11:46 AM 27 12:46 PM		0.4	28.3 28.3	0.0	437.7 435.1	3.40 3.38	11.73 8.16	2.68%	10.8	-0.939 -0.935	41 38	1.0	521.9 528.2	508.5 513.8	515.2 521.0	0.0	23.6	522.4 531.0	523.7 534.3	525.7 531.9	525.0 532.1	524.2 532.3	2.8	14.2	-258.2 -260.0	146.6 147.1	135.8 135.2	135.9 135.4	135.8 135.3	
28 1:46 PM	466.6	0.4	28.3	0.0	439.5	3.39	6.30	1.43%	0.0	-0.934	42	1.0	522.5	510.0	516.3	0.0	22.6	524.6	532.5	527.2	529.4	528.4	2.8	11.4	-257.6	146.7	133.7	135.2	134.5	
29 2:46 PM	462.1	0.4	28.2	0.0	437.0	3.40	7.41	1.70%	0.0	-0.934	45	1.0	522.1	508.9	515.5	0.0	23.3	522.5	522.3	526.9	527.3	524.7	2.9	13,8	-256.6	145.0	133.9	135.3	134.6	
30 3:46 PM 31 4:46 PM		0.4	28.2 28.3	0.0	436.2 438.9	3.40 3.42	10.61	2.43%	6.4	-0.933 -0.929	48 51	1.0	522.2 522.4	508.8 509.1	515.5 515.8	0.0	23.3	522.1 522.3	522.4 522.1	525.7 524.2	525.7 518.4	524.0 521.7	2.9	14.3 15.8	-256.7 -258.1	145.0 146.0	133.6 132.6	135.0 134.2	134.3	-1
32 5:46 PM	461.8	0.4	28.3	0.0	437.5	3.41	12.22	2.79%	12.8	-0.929	50	1.0	522.6	509.4	516.0	0.0	22.8	523.7	523.2	526.3	526.7	525.0	2.9	13.7	-259.0	146.5	132.4	133.8	133.1	-1
33 6:45 PM 34 7:45 PM		0.4 14.8	28.4 26.6	0.0	429.1 415.7	3.38 3.45	12.03 15.31	2.80%	12.0 25.0	-0.928 -0.931	51 57	1.0	529.7 511.7	515.8 505.4	522.8 508.6	0.0	16.4	530.9 505.1	535.3 509.1	533.9 507.4	532.0 506.6	533.0 507.0	3.8 4.9	10.2	-277.2 -269.4	148.6 142.0	141.6 165.5	142.7 169.0	142.2 167.3	- 1
35 8:45 PM		89.6	18.3	0.0	434.4	3.55	11.75	2.70%	10.9	-0.933	56	1.0	499.6	494.3	496.9	0.0	41.0	494.8	497.5	500.4	498.6	497.8	2.8	31.4	-293.6	153.4	152.1	155.2	153.7	
36 9:45 PM		127.6	14.4	0.0	414.1	3.34	11.80	2.85%	11.1	-0.934	55	1.0	539.6	529.7	534.6	0.7	5.2	531.4	534.3	535.8	534.5	534.0	6.0	13.5	-371.5	175.3	147.0	151.3	149.2	-3
37 10:45 PM 38 11:45 PM		146.7 157.1	12.2 7.8	0.0	414.6 371.3	3.29 3.31	11.36 10.83	2.74%	9.3 7.2	-0.934 -0.939	52 56	1.0 0.9	536.5 537.4	530.9 532.0	533.7 534.7	1.0 3.2	6.1 5.5	531.2 529.4	534.9 532.1	537.6 529.5	538.7 529.2	535.6 530.1	6.4 5.5	13.1 15.1	-346.2 -262.7	168.3 149.7	146.7 149.7	151.1 155.9	148.9 152.8	E
39 12:45 AM	349.4	172.4	2.3	0.0	308.8	3.18	5.08	1.65%	0.0	-0.941	62	1.0	542.5	540.4	541.4	11.8	1.8	535.2	538.2	535.2	534.9	535.9	5.8	11.9	-230.0	142.6	144.2	152.2	148.2	2
40 1:45 AM 41 2:45 AM	299.1 353.4	145.3 192.1	3.1 0.5	0.0	265.5 311.5	3.20 3.17	9.50 8.52	3.58% 2.73%	2.0	-0.944 -0.942	81 79	1.0	545.8 542.8	541.1 543.2	543.4 543.0	17.2 24.0	2.6 3.6	539.4 543.9	540.8 547.7	542.5 540.4	544.2 540.4	541.7 543.1	5.8 10.6	10.4	-220.9 -271.6	142.0 154.9	141.9 142.9	149.5 145.8	145.7 144.4	-(
42 3:45 AM	350.8	201.8	0.0	0.0	309.6	3.18	6.85	2.21%	0.0	-0.944	58	1.1	543.3	540.4	541.8	21.6	3.3	544.3	548.9	540.2	540.0	543.3	8.9	16.2	-275.9	156.3	142.8	144.8	143.8	-2
43 4:44 AM 44 5:44 AM		230.9 233.3	0.0	0.0	360.6 366.7	3.22 3.21	7.61 8.25	2.11%	0.0	-0.939 -0.939	60 57	1.1	542.2 542.7	539.7 541.0	540.9 541.9	18.1 14.0		540.4 541.1	545.5 545.1	540.9 540.3	539.8 539.8	541.6 541.6	10.0 9.6	18.0 17.3	-312.3 -293.6	163.6 157.1	146.7 152.5	148.1 153.7	147.4 153.1	1
45 6:44 AM		235.3	-0.1	0.0	385.5	3.23	7.96	2.25%	0.0	-0.936	54	1.2	543.6	540.1	541.8	9.3	1.4	538.7	544.7	540.7	540.6	541.2	9.1	16.5	-285.4	154.7	153.0	154.4	153.7	
46 7:44 AM		218.7	-0.1	0.0	368.1	3.24	11.85	3.22%	11.3	-0.938	57	1.2	542.7	535.7	539.2	4.7	1.5	535.2	538.3	538.0	538.4	537.5	7.6	13.7	-269.6	151.3	153.9	154.9	154.4	8
47 8:44 AM 48 9:44 AM	370.4 347.2	201.5 192.5	-0.1 -0.1	0.0	331.5 311.5	3.22 3.23	8.25 10.36	2.49%	0.0 5.4	-0.943 -0.942	62	1.1	544.6 543.0	540.0 538.1	542.3 540.5	5.8 3.1	0.9	539.4 533.2	540.2 535.5	540.3 538.3	540.6 539.0	540.1 536.5	6.5 5.7	11.8	-236.1 -225.4	144.5 141.5	148.8 147.7	150.1 149.2	149.5 148.4	2
49 10:44 AM	427.5	225.6	1.7	0.0	391.0	3.29	9.81	2.51%	3.2	-0.931	63	0.9	537.9	530.9	534.4	6.6	6.3	533.6	535.1	537.7	536.9	535.8	8.6	16.9	-284.1	155.7	150.9	151.9	151.4	E
50 11:44 AM Last 48	1 Samuel Control	221.9	3.9	0.0	445.6	3.35	11.55	2.59%	10.1	-0.924	51	0.8	536.7	519.4	528.0	0.0	11.4	527.3	528.2	539.3 Fac. o	539.3	533.5	7.5	16.5	-326.2	163.3	153.4	154.6	154.0	
52 Hrs	381.7	62.9	16.0	0.7	350.2		8.4	2.40%		-0.940	57.6	0.9	537.5	527.5	532.5	3.0	8.2	526.7	529.6	536.0	536.1	532.1	4.7	12.9	-237.6	143.2	136.9	137.5	137.2	
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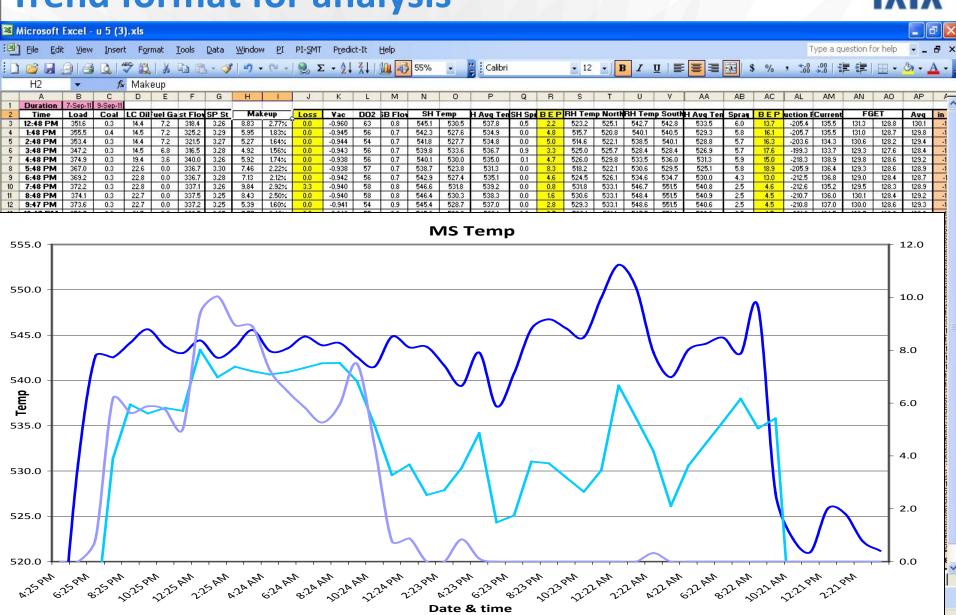
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Trend format for analysis

SH Temp



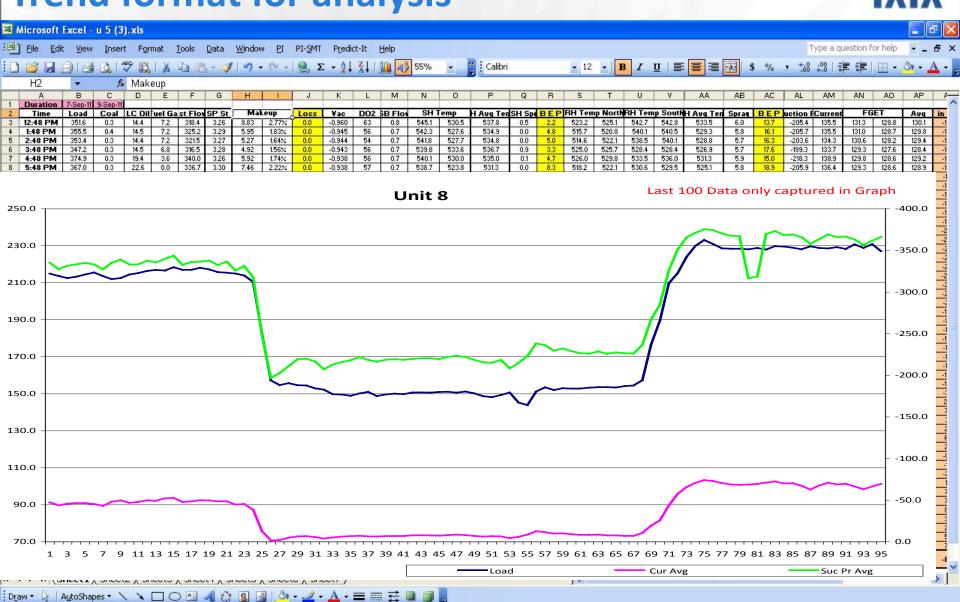
SH Spr



SH Temp

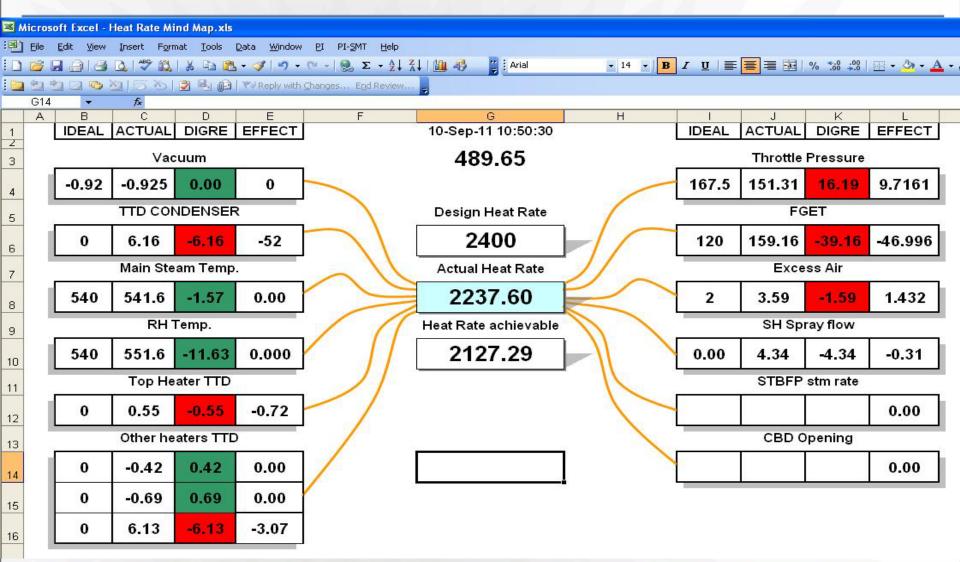
Trend format for analysis





Predictive Analysis





Questions







Thank you

We take pride in Lighting up Lives!