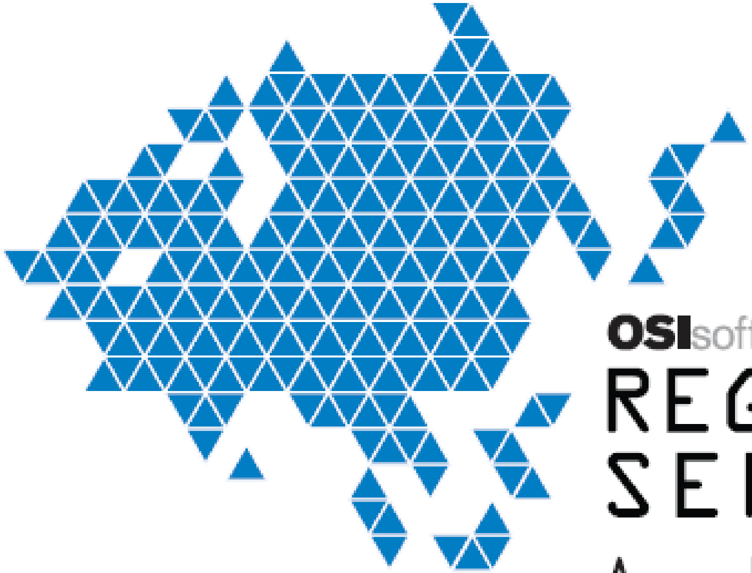

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REGIONAL SEMINAR 2011

APAC

THAILAND

JULY 26 - 29, 2011

THE WESTIN
GRANDE SUKHUMVIT HOTEL
BANGKOK

Use of Plant Performance Monitoring Using PI System to Increase Plant Reliability

Presented by:
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Tanjung Bin Power Plant,
Malakoff Corp Bhd
Malaysia

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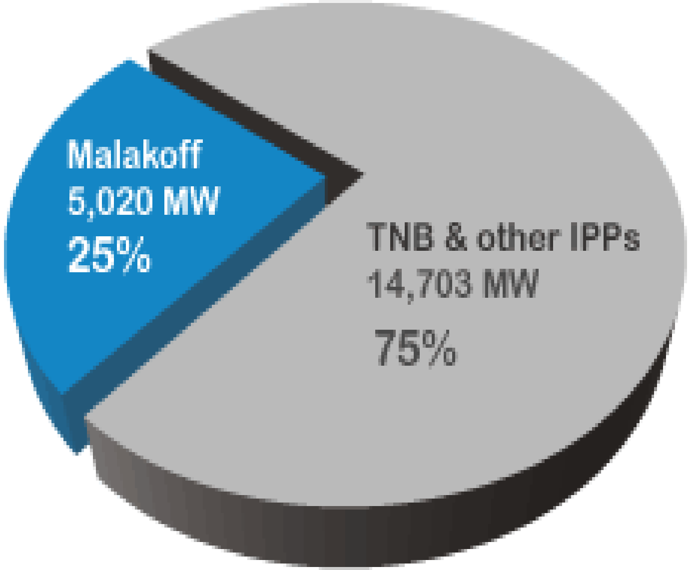
Agenda

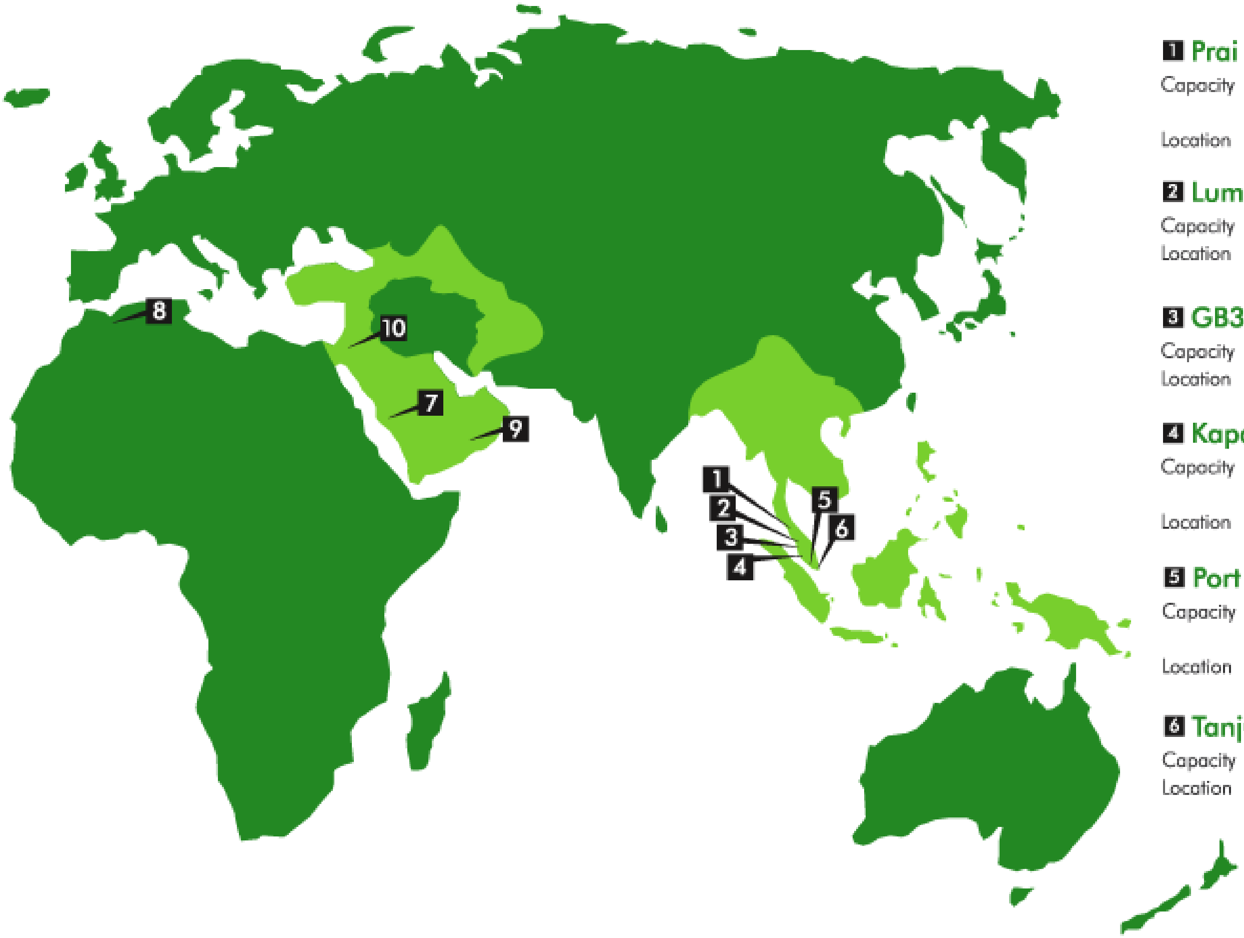
- Company introduction
- System architecture
- How the system works
- Case study
- The importance

Tanjung Bin Power Plant, TBPP

- Biggest Coal-fired Independent Power Producer in South East Asia
- 90% stake owned by Malakoff Corp Bhd
- Total of 2100MW generating capacity



Malakoff Power-Utility Entities



1 Prai Power Plant

Capacity : 350MW Combined Cycle Gas Turbine (CCGT)
Location : Penang, Malaysia

2 Lumut Power Plant

Capacity : 1,303MW CCGT
Location : Perak, Malaysia

3 GB3 Power Plant

Capacity : 640MW CCGT
Location : Perak, Malaysia

4 Kapar Power Station

Capacity : 2,420MW Coal, Oil and Gas
Location : Selangor, Malaysia

5 Port Dickson Power Plant

Capacity : 440MW Open Cycle Gas Turbine (OCGT)
Location : Negeri Sembilan, Malaysia

6 Tanjung Bin Power Plant

Capacity : 2,100MW Coal-fired
Location : Johor, Malaysia

7 Shuaibah-III

Capacity : 900 MW, 880,000 m3/day + 150,000 m3/day (expansion) water desalination
Location : Jeddah, Saudi Arabia

8 Algeria

Capacity : 200,000 m3/day water desalination
Location : Tlemcen, Algeria

9 Oman

Capacity : 242 MW
Location : Salalah, Oman

10 Jordan

Capacity : 1,680 MW
Location : Jordan

Nett Effective Capacity – 5,020 MW

Prai Power Plant (100%)
350MW
Combined cycle gas turbine
(baseload plant)

Lumut Power Plant (93.75%)
1,303MW
Combined cycle gas turbine
(baseload plant)

GB3 Power Plant (75%)
640MW
Combined cycle gas turbine
(baseload plant)

Tanjung Bin Power Plant (90%)
2,100MW
Coal-fired (baseload plant)

Kapar Power Station (40%)
2,420MW
Coal, oil and gas-fired
(baseload and peaking plant)

Port Dickson Power Station (25%)
440 MW
Open cycle gas turbine
(peaking plant)

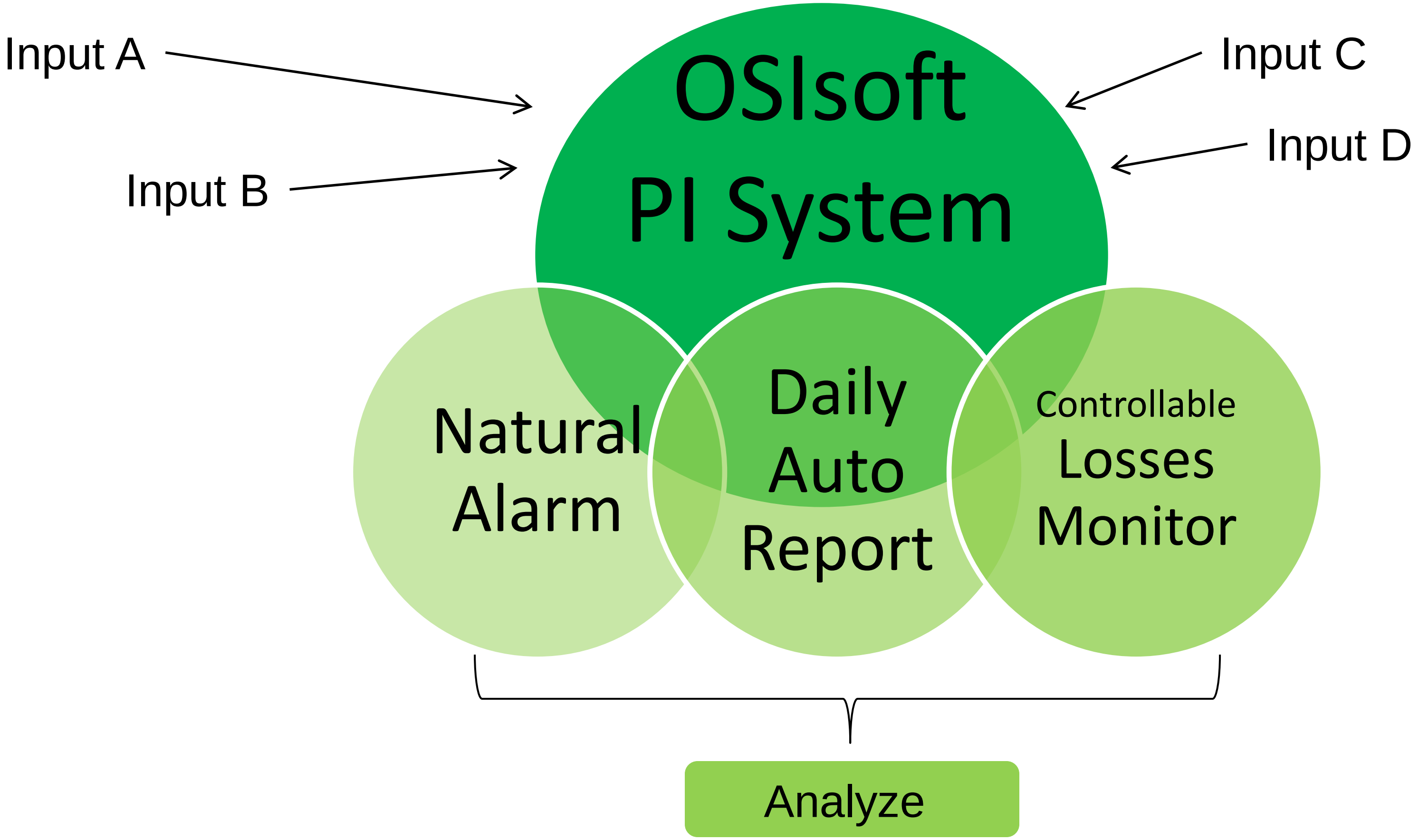
Problem Addressed

- Needs of turning data into **actionable information.**
- Not easy to track **sudden downtime** symptoms.
- Required to **avoid unnecessary** Forced Outage
- TBPP only eligible for **limited days** of unplanned outage, or else shall be penalized by TNB.

Solution

Concept: Condition based monitoring system

Keep track real-time behavior of each critical machines



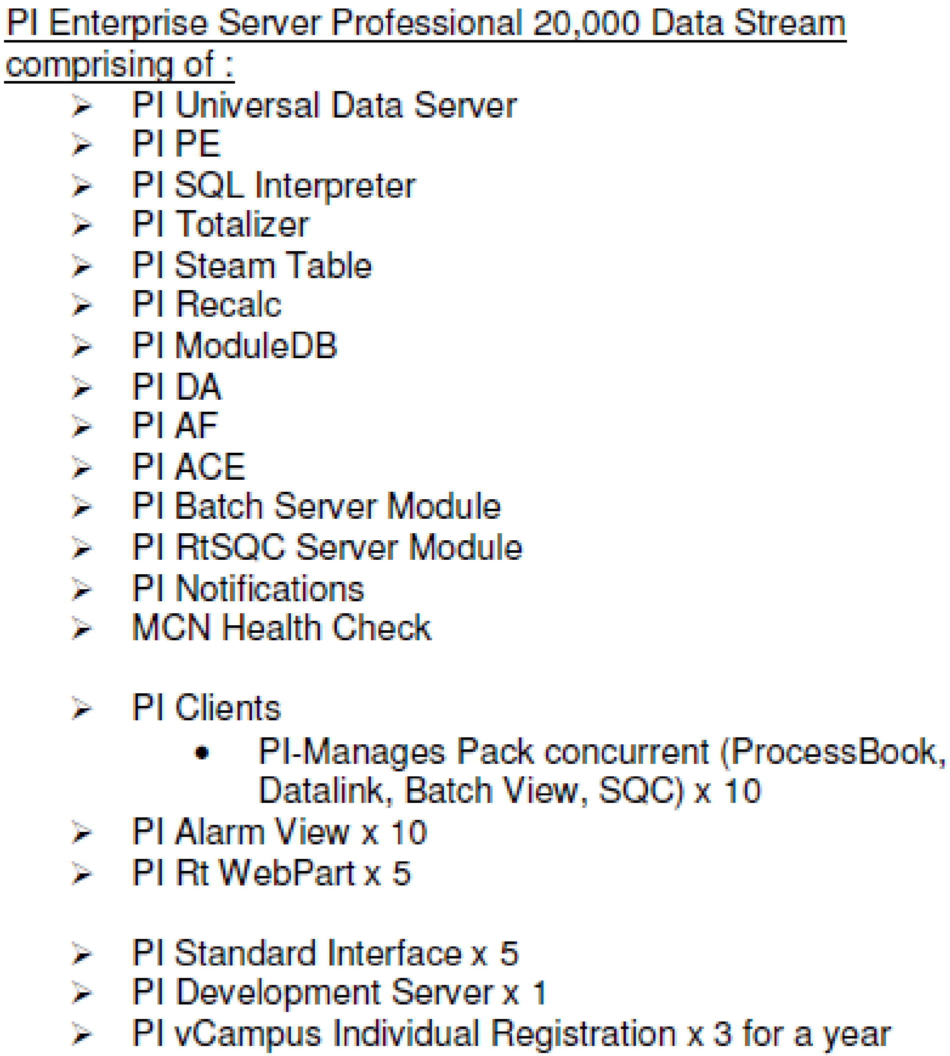
Solution (cont.)

- Real Time-WebPart via MS SharePoint
- **PI Process Book Predefined Display ✓**
- Notification via SMS and E-mail
- Advance Calculation Modules
- **Natural Alarm ✓**
- **Daily Auto Report ✓**
- Integrated and connected to Ealis and SRS
- Online Continuous Emission Monitoring Systems with DOE

Background of Initiative Project

- Introduce TPMS – TBP Performance Monitoring System in 2011.
- Based on OSIsoft PI System architecture.
- Develop to accommodate data storage and data analyzing for plant optimization.
- As a redundant data historian server for Toshiba LTDS/ISS.
- Combine basic tools for user interface – PB, Excel, IE.
- Starts recording reliable data since August 2010.

TBPP PI Features



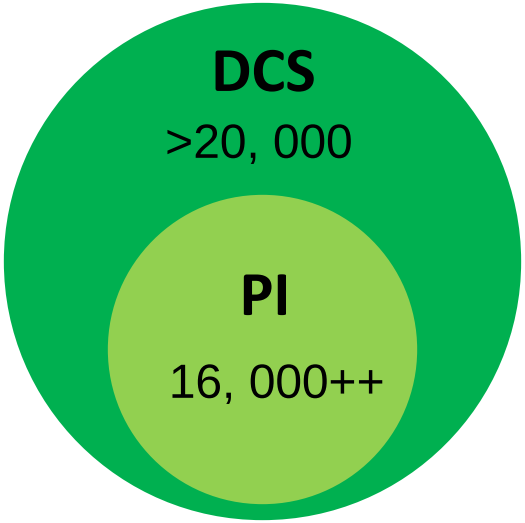
PI Enterprise Server Professional 20,000 Data Stream comprising of :

- PI Universal Data Server
- PI PE
- PI SQL Interpreter
- PI Totalizer
- PI Steam Table
- PI Recalc
- PI ModuleDB
- PI DA
- PI AF
- PI ACE
- PI Batch Server Module
- PI RtSQC Server Module
- PI Notifications
- MCN Health Check

- PI Clients
    - PI-Manages Pack concurrent (ProcessBook, Datalink, Batch View, SQC) x 10
- PI Alarm View x 10
- PI Rt WebPart x 5

- PI Standard Interface x 5
- PI Development Server x 1
- PI vCampus Individual Registration x 3 for a year

Objectives

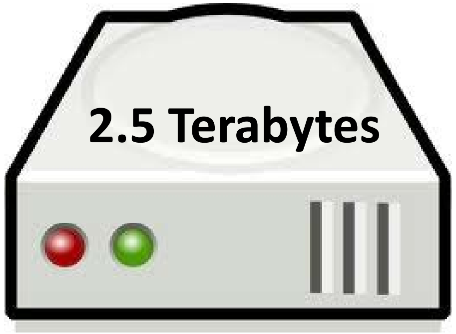


DCS

>20, 000

PI

16, 000++

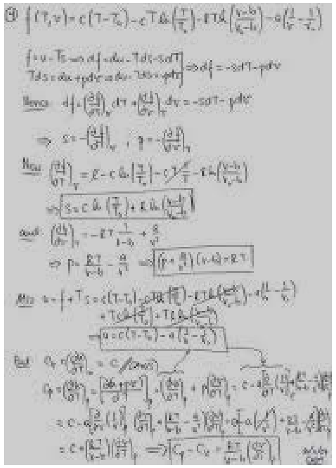


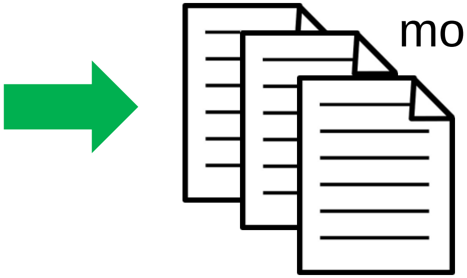
4 years of data storage
1GB archive for every 21 days

All-in-one monitor

Machine 1
Machine 2
Machine 3

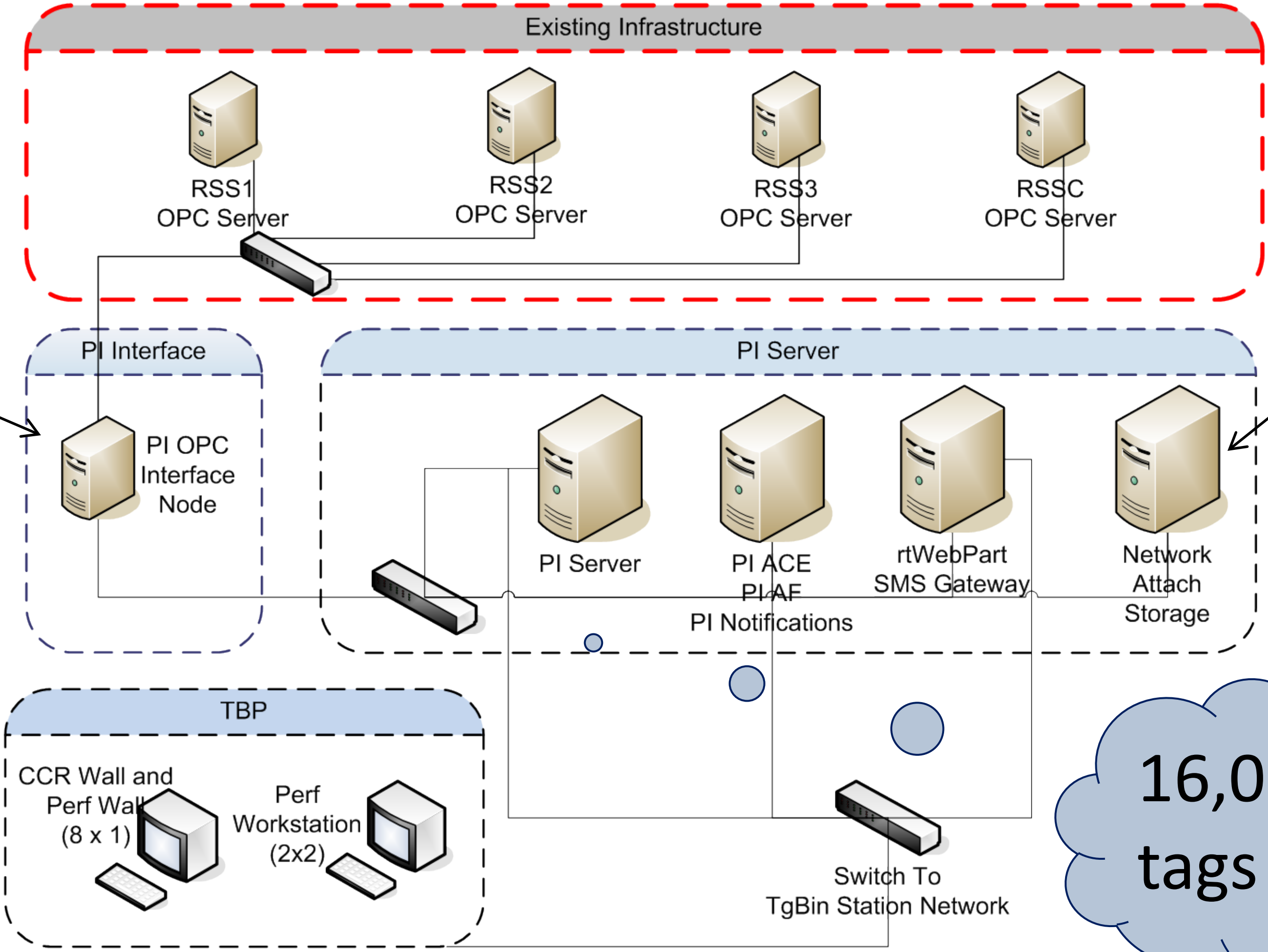
Machine A
Machine B
Machine C
Machine D





Pre-calculated
function
modules

PI System Architecture

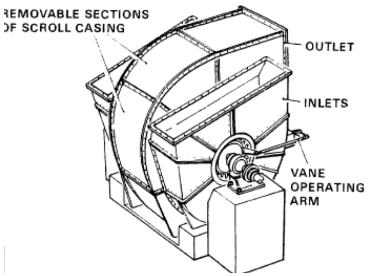


Data buffering
capability
~up to 1 day

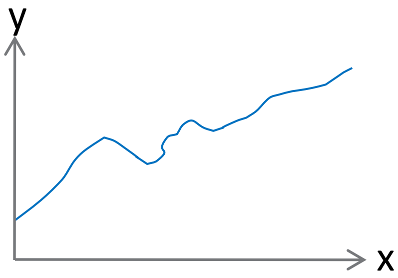
2.5 TB
capasity
~4yrs

16,000++
tags used

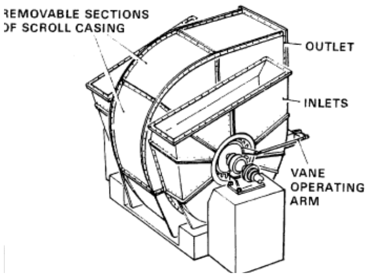
1. What is Natural Alarm?



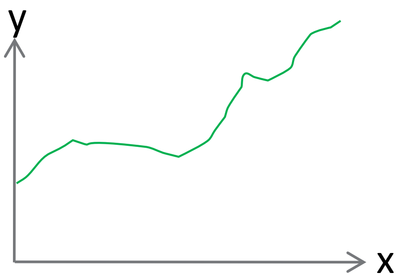
Fan A1



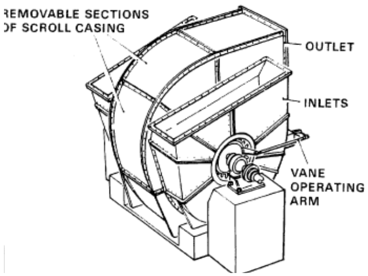
$y_1=ax_1^2+bx_1^2+c$



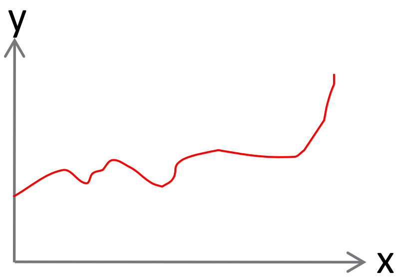
Fan A2



$y_2=ax_2^2+bx_2^2+c$



Fan A3

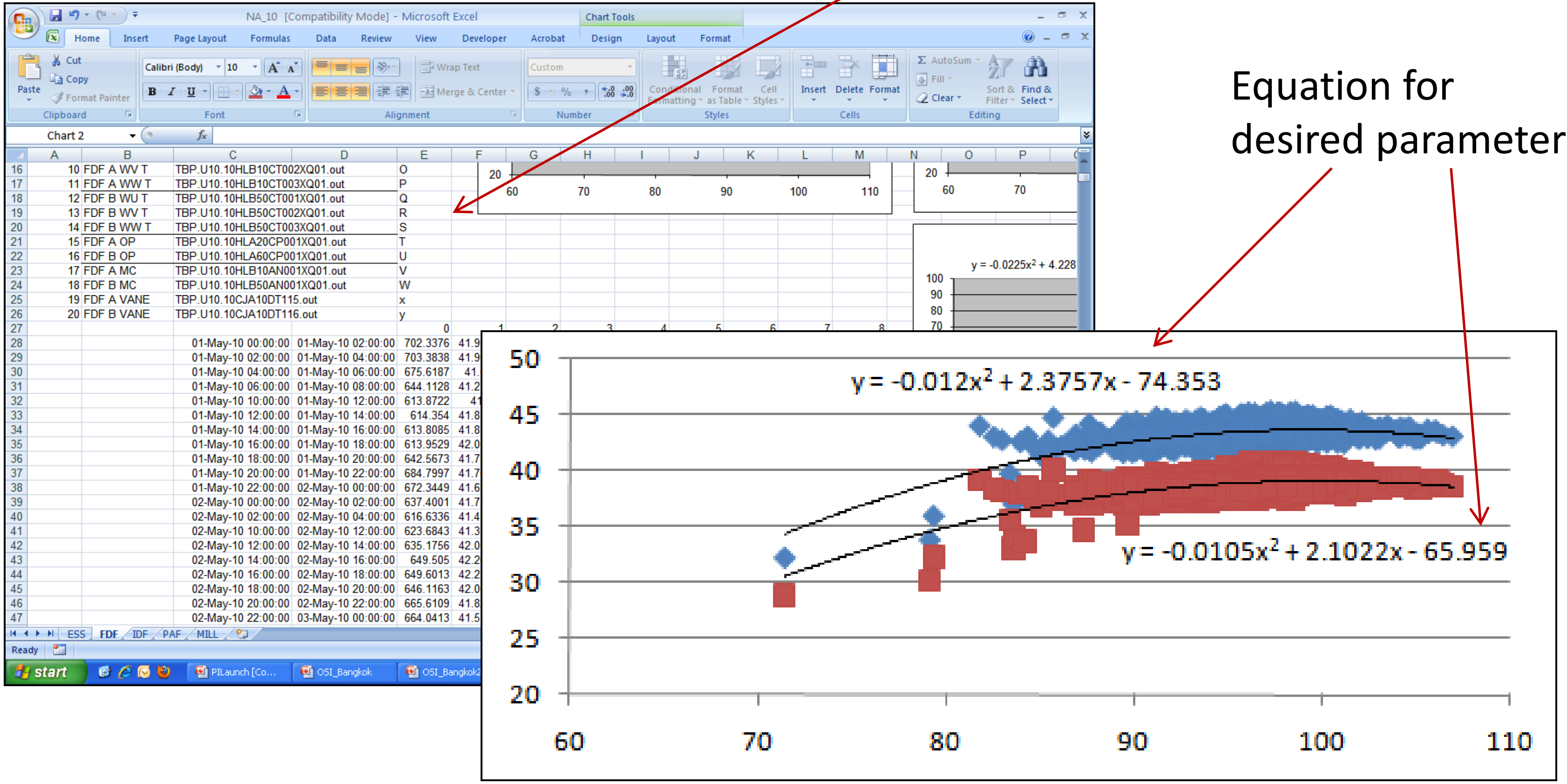


$y_3=ax_3^2+bx_3^2+c$

1. What is Natural Alarm?

Data collection from Data Link - Excel

Equation for desired parameters



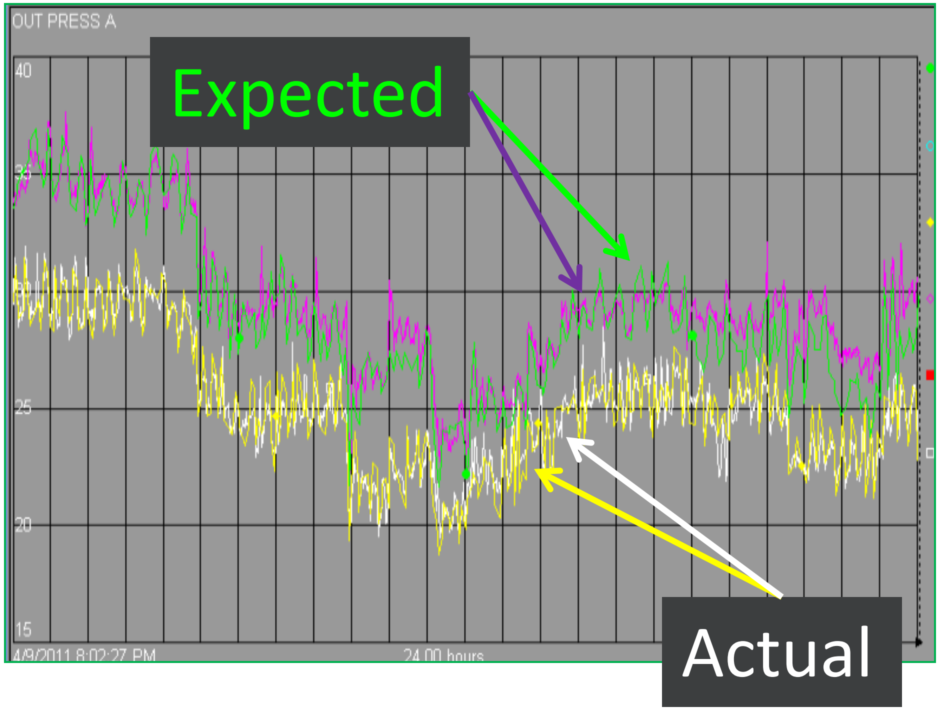
	A	B	C	D	E	F
16	10	FDF A WV T	TBP.U10.10HLB10CT002XQ01.out		O	
17	11	FDF A WW T	TBP.U10.10HLB10CT003XQ01.out		P	
18	12	FDF B WU T	TBP.U10.10HLB50CT001XQ01.out		Q	
19	13	FDF B WV T	TBP.U10.10HLB50CT002XQ01.out		R	
20	14	FDF B WW T	TBP.U10.10HLB50CT003XQ01.out		S	
21	15	FDF A OP	TBP.U10.10HLA20CP001XQ01.out		T	
22	16	FDF B OP	TBP.U10.10HLA60CP001XQ01.out		U	
23	17	FDF A MC	TBP.U10.10HLB10AN001XQ01.out		V	
24	18	FDF B MC	TBP.U10.10HLB50AN001XQ01.out		W	
25	19	FDF A VANE	TBP.U10.10CJA10DT115.out		x	
26	20	FDF B VANE	TBP.U10.10CJA10DT116.out		y	
27					0	1
28			01-May-10 00:00:00	01-May-10 02:00:00	702.3376	41.9
29			01-May-10 02:00:00	01-May-10 04:00:00	703.3838	41.9
30			01-May-10 04:00:00	01-May-10 06:00:00	675.6187	41.
31			01-May-10 06:00:00	01-May-10 08:00:00	644.1128	41.2
32			01-May-10 10:00:00	01-May-10 12:00:00	613.8722	41
33			01-May-10 12:00:00	01-May-10 14:00:00	614.354	41.8
34			01-May-10 14:00:00	01-May-10 16:00:00	613.8085	41.8
35			01-May-10 16:00:00	01-May-10 18:00:00	613.9529	42.0
36			01-May-10 18:00:00	01-May-10 20:00:00	642.5673	41.7
37			01-May-10 20:00:00	01-May-10 22:00:00	684.7997	41.7
38			01-May-10 22:00:00	02-May-10 00:00:00	672.3449	41.6
39			02-May-10 00:00:00	02-May-10 02:00:00	637.4001	41.7
40			02-May-10 02:00:00	02-May-10 04:00:00	616.6336	41.4
41			02-May-10 10:00:00	02-May-10 12:00:00	623.6843	41.3
42			02-May-10 12:00:00	02-May-10 14:00:00	635.1756	42.0
43			02-May-10 14:00:00	02-May-10 16:00:00	649.505	42.2
44			02-May-10 16:00:00	02-May-10 18:00:00	649.6013	42.2
45			02-May-10 18:00:00	02-May-10 20:00:00	646.1163	42.0
46			02-May-10 20:00:00	02-May-10 22:00:00	665.6109	41.8
47			02-May-10 22:00:00	03-May-10 00:00:00	664.0413	41.5

$y = -0.012x^2 + 2.3757x - 74.353$

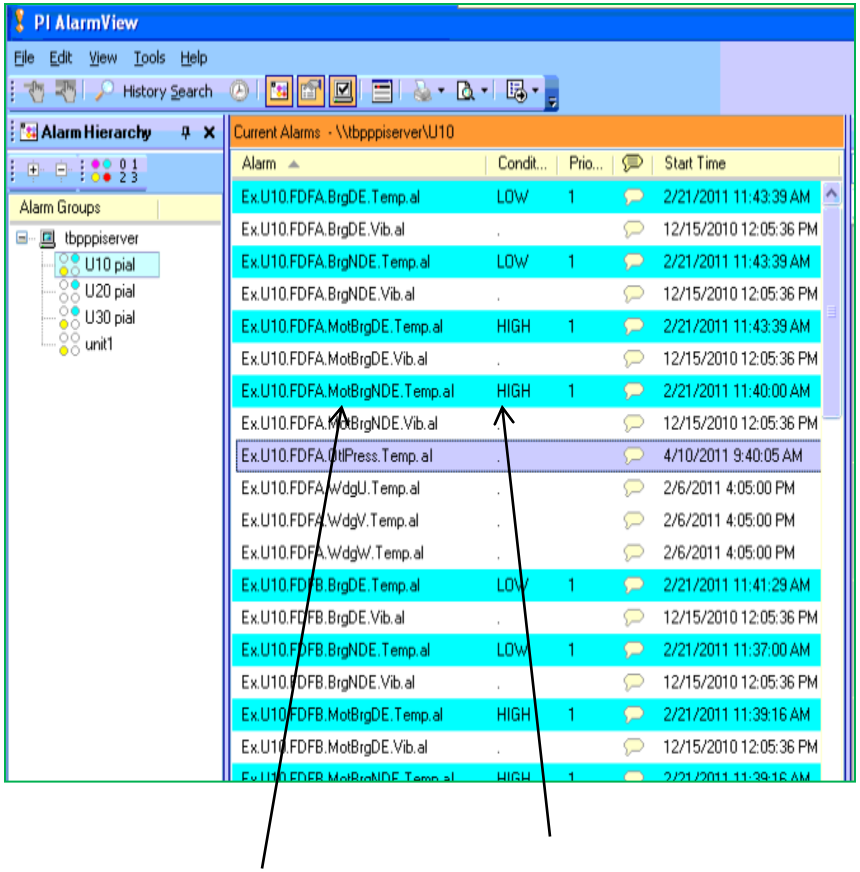
$y = -0.0105x^2 + 2.1022x - 65.959$

1. What is Natural Alarm?

In ProcessBook



In PI AlarmView



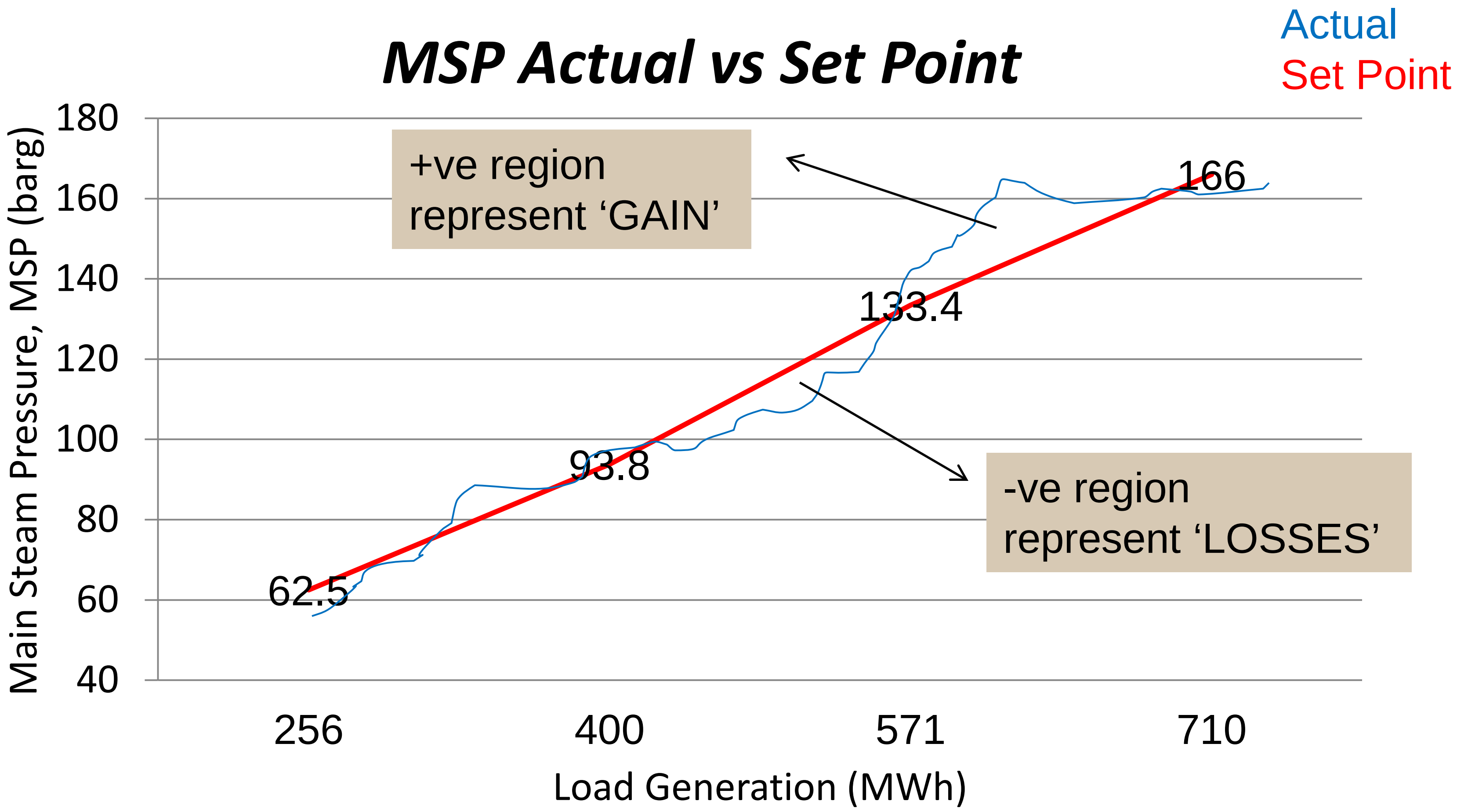
Current Alarms - \\tbpppiserver\U10

Alarm	Condit...	Prio...	🗨	Start Time
Ex.U10.FDFA.BrgDE.Temp.al	LOW	1	🗨	2/21/2011 11:43:39 AM
Ex.U10.FDFA.BrgDE.Vib.al	.		🗨	12/15/2010 12:05:36 PM
Ex.U10.FDFA.BrgNDE.Temp.al	LOW	1	🗨	2/21/2011 11:43:39 AM
Ex.U10.FDFA.BrgNDE.Vib.al	.		🗨	12/15/2010 12:05:36 PM
Ex.U10.FDFA.MotBrgDE.Temp.al	HIGH	1	🗨	2/21/2011 11:43:39 AM
Ex.U10.FDFA.MotBrgDE.Vib.al	.		🗨	12/15/2010 12:05:36 PM
Ex.U10.FDFA.MotBrgNDE.Temp.al	HIGH	1	🗨	2/21/2011 11:40:00 AM
Ex.U10.FDFA.MotBrgNDE.Vib.al	.		🗨	12/15/2010 12:05:36 PM
Ex.U10.FDFA.OtlPress.Temp.al	.		🗨	4/10/2011 9:40:05 AM
Ex.U10.FDFA.WdgU.Temp.al	.		🗨	2/6/2011 4:05:00 PM
Ex.U10.FDFA.WdgV.Temp.al	.		🗨	2/6/2011 4:05:00 PM
Ex.U10.FDFA.WdgW.Temp.al	.		🗨	2/6/2011 4:05:00 PM
Ex.U10.FDFB.BrgDE.Temp.al	LOW	1	🗨	2/21/2011 11:41:29 AM
Ex.U10.FDFB.BrgDE.Vib.al	.		🗨	12/15/2010 12:05:36 PM
Ex.U10.FDFB.BrgNDE.Temp.al	LOW	1	🗨	2/21/2011 11:37:00 AM
Ex.U10.FDFB.BrgNDE.Vib.al	.		🗨	12/15/2010 12:05:36 PM
Ex.U10.FDFB.MotBrgDE.Temp.al	HIGH	1	🗨	2/21/2011 11:39:16 AM
Ex.U10.FDFB.MotBrgDE.Vib.al	.		🗨	12/15/2010 12:05:36 PM
Ex.U10.FDFB.MotBrgNDE.Temp.al	HIGH	1	🗨	2/21/2011 11:39:16 AM

Parameters

Status
LOW, HIGH, LOLO, HIHI

2. What is Controllable Losses?

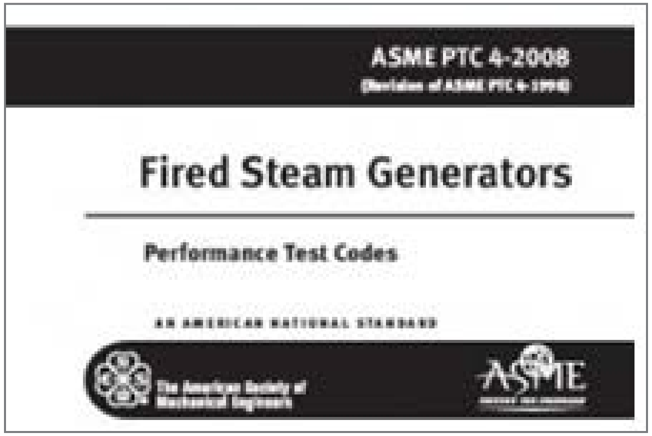


+ve region represent ‘GAIN’

-ve region represent ‘LOSSES’

2. What is Controllable Losses?

Formulas are taken from ASME PTC 4

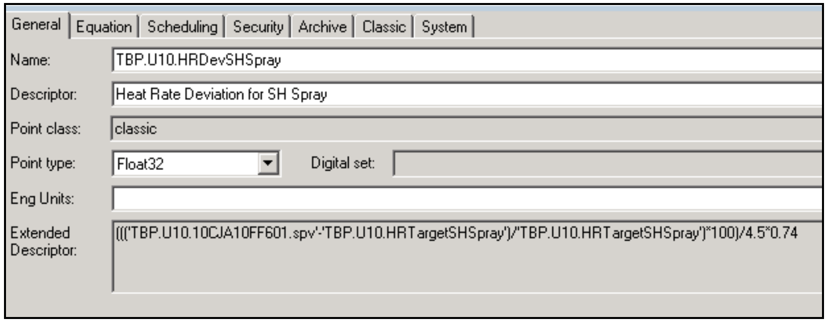


ASME PTC 4-2008
(Revision of ASME PTC 4-1998)

Fired Steam Generators

Performance Test Codes

AN AMERICAN NATIONAL STANDARD



Name: TBP.U10.HRDevSHSpray

Descriptor: Heat Rate Deviation for SH Spray

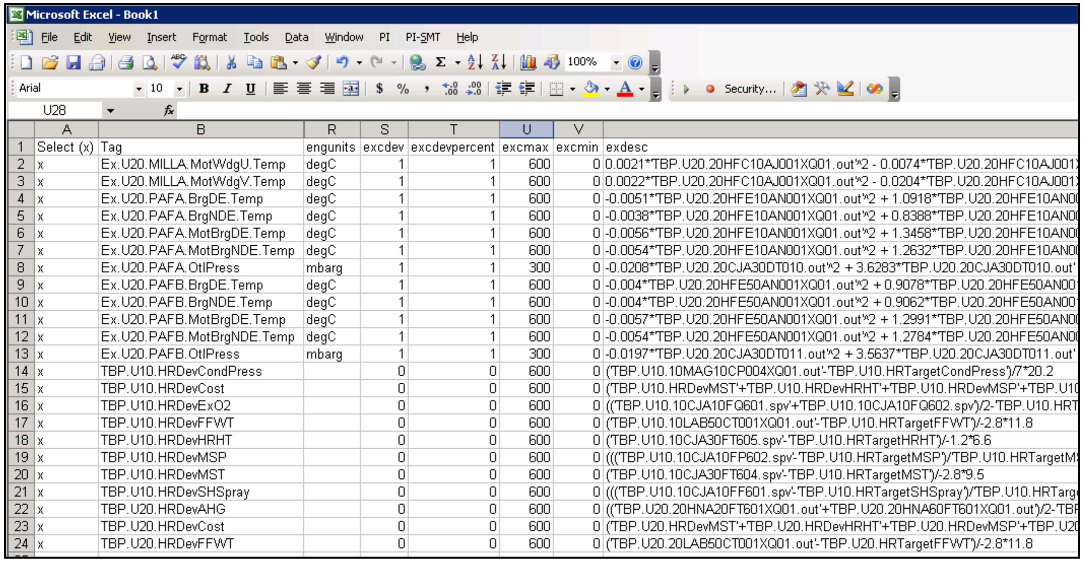
Point class: classic

Point type: Float32

Digital set:

Eng Units:

Extended Descriptor: ((('TBP.U10.10CJA10FF601.spv'-'TBP.U10.HRTargetSHSpray')/'TBP.U10.HRTargetSHSpray')*100)/4.5*0.74

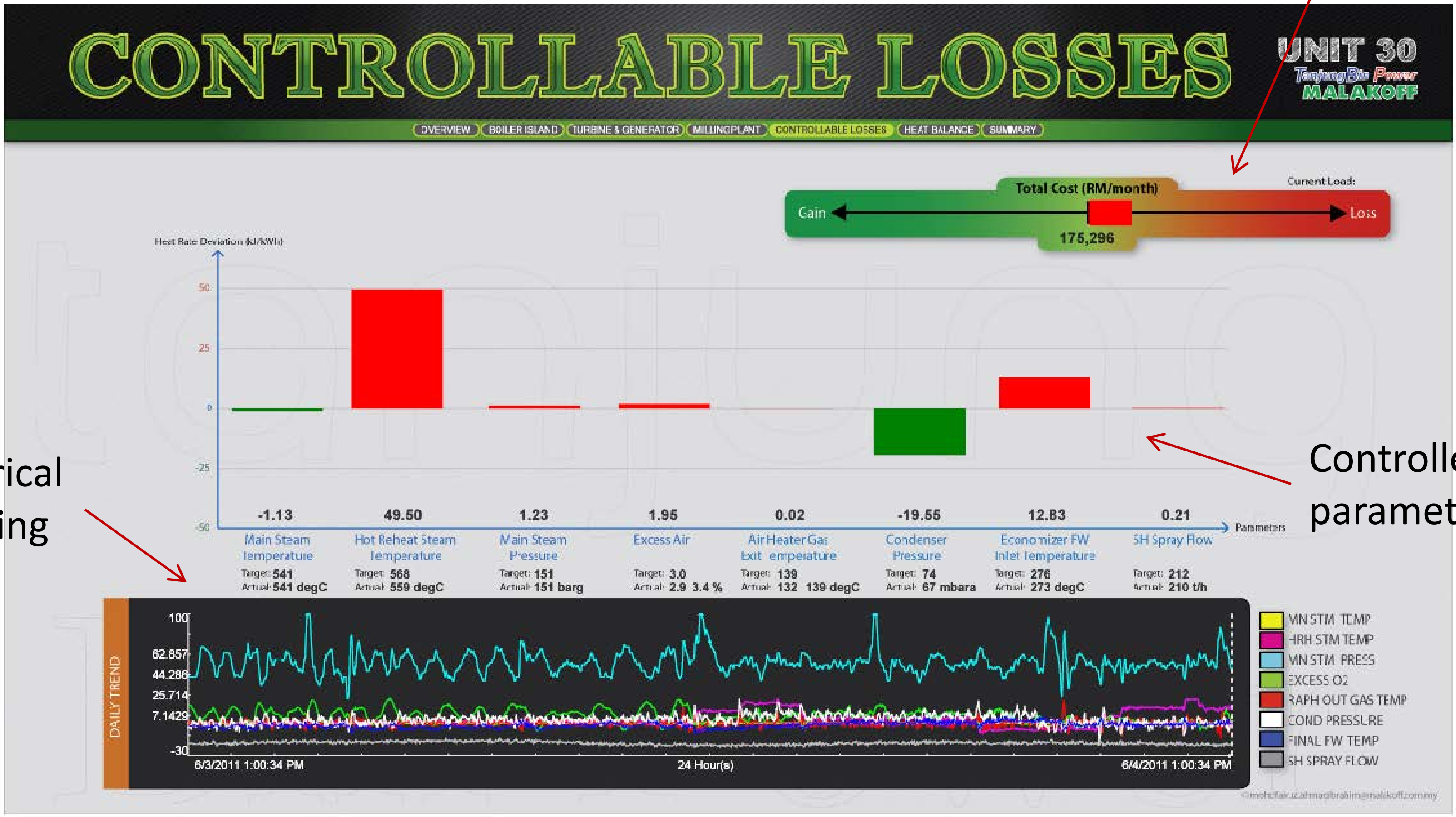


	A	B	R	S	T	U	V	
1	Select (x)	Tag	engunits	excdev	excdevpercent	excmax	excmin	exdesc
2	x	Ex.U20.MILLA.MotWdgU.Temp	degC	1	1	600	0	0.0021*TBP.U20.20HFC10AJ001XQ01.out'^2 - 0.0074*TBP.U20.20HFC10AJ001
3	x	Ex.U20.MILLA.MotWdgV.Temp	degC	1	1	600	0	0.0022*TBP.U20.20HFC10AJ001XQ01.out'^2 - 0.0204*TBP.U20.20HFC10AJ001
4	x	Ex.U20.PAFA.BrgDE.Temp	degC	1	1	600	0	-0.0051*TBP.U20.20HFE10AN001XQ01.out'^2 + 1.0918*TBP.U20.20HFE10AN0
5	x	Ex.U20.PAFA.BrgNDE.Temp	degC	1	1	600	0	-0.0038*TBP.U20.20HFE10AN001XQ01.out'^2 + 0.8388*TBP.U20.20HFE10AN0
6	x	Ex.U20.PAFA.MotBrgDE.Temp	degC	1	1	600	0	-0.0056*TBP.U20.20HFE10AN001XQ01.out'^2 + 1.3458*TBP.U20.20HFE10AN0
7	x	Ex.U20.PAFA.MotBrgNDE.Temp	degC	1	1	600	0	-0.0054*TBP.U20.20HFE10AN001XQ01.out'^2 + 1.2632*TBP.U20.20HFE10AN0
8	x	Ex.U20.PAFA.OtlPress	mbarg	1	1	300	0	-0.0208*TBP.U20.20CJA30DT010.out'^2 + 3.6283*TBP.U20.20CJA30DT010.out'
9	x	Ex.U20.PAFB.BrgDE.Temp	degC	1	1	600	0	-0.004*TBP.U20.20HFE50AN001XQ01.out'^2 + 0.9078*TBP.U20.20HFE50AN00
10	x	Ex.U20.PAFB.BrgNDE.Temp	degC	1	1	600	0	-0.004*TBP.U20.20HFE50AN001XQ01.out'^2 + 0.9062*TBP.U20.20HFE50AN00
11	x	Ex.U20.PAFB.MotBrgDE.Temp	degC	1	1	600	0	-0.0057*TBP.U20.20HFE50AN001XQ01.out'^2 + 1.2991*TBP.U20.20HFE50AN0
12	x	Ex.U20.PAFB.MotBrgNDE.Temp	degC	1	1	600	0	-0.0054*TBP.U20.20HFE50AN001XQ01.out'^2 + 1.2784*TBP.U20.20HFE50AN0
13	x	Ex.U20.PAFB.OtlPress	mbarg	1	1	300	0	-0.0197*TBP.U20.20CJA30DT011.out'^2 + 3.5637*TBP.U20.20CJA30DT011.out'
14	x	TBP.U10.HRDevCondPress		0	0	600	0	('TBP.U10.10MAG10CP004XQ01.out'-'TBP.U10.HRTargetCondPress')/7*20.2
15	x	TBP.U10.HRDevCost		0	0	600	0	('TBP.U10.HRDevMST'+'TBP.U10.HRDevHRHT'+'TBP.U10.HRDevMSP'+'TBP.U1
16	x	TBP.U10.HRDevExO2		0	0	600	0	(('TBP.U10.10CJA10FQ601.spv'+'TBP.U10.10CJA10FQ602.spv')/2-'TBP.U10.HRT
17	x	TBP.U10.HRDevFFWT		0	0	600	0	('TBP.U10.10LAB50CT001XQ01.out'-'TBP.U10.HRTargetFFWT')/-2.8*11.8
18	x	TBP.U10.HRDevHRHT		0	0	600	0	('TBP.U10.10CJA30FT605.spv'-'TBP.U10.HRTargetHRHT')/-1.2*6.6
19	x	TBP.U10.HRDevMSP		0	0	600	0	((('TBP.U10.10CJA10FP602.spv'-'TBP.U10.HRTargetMSP')/'TBP.U10.HRTargetM
20	x	TBP.U10.HRDevMST		0	0	600	0	('TBP.U10.10CJA30FT604.spv'-'TBP.U10.HRTargetMST')/-2.8*9.5
21	x	TBP.U10.HRDevSHSpray		0	0	600	0	((('TBP.U10.10CJA10FF601.spv'-'TBP.U10.HRTargetSHSpray')/'TBP.U10.HRTarg
22	x	TBP.U20.HRDevAHG		0	0	600	0	(('TBP.U20.20HNA20FT601XQ01.out'+'TBP.U20.20HNA60FT601XQ01.out')/2-'TB
23	x	TBP.U20.HRDevCost		0	0	600	0	('TBP.U20.HRDevMST'+'TBP.U20.HRDevHRHT'+'TBP.U20.HRDevMSP'+'TBP.U2
24	x	TBP.U20.HRDevFFWT		0	0	600	0	('TBP.U20.20LAB50CT001XQ01.out'-'TBP.U20.HRTargetFFWT')/-2.8*11.8

Sample CL equation created for PE tags

2. What is Controllable Losses?

Gain/Loss meter

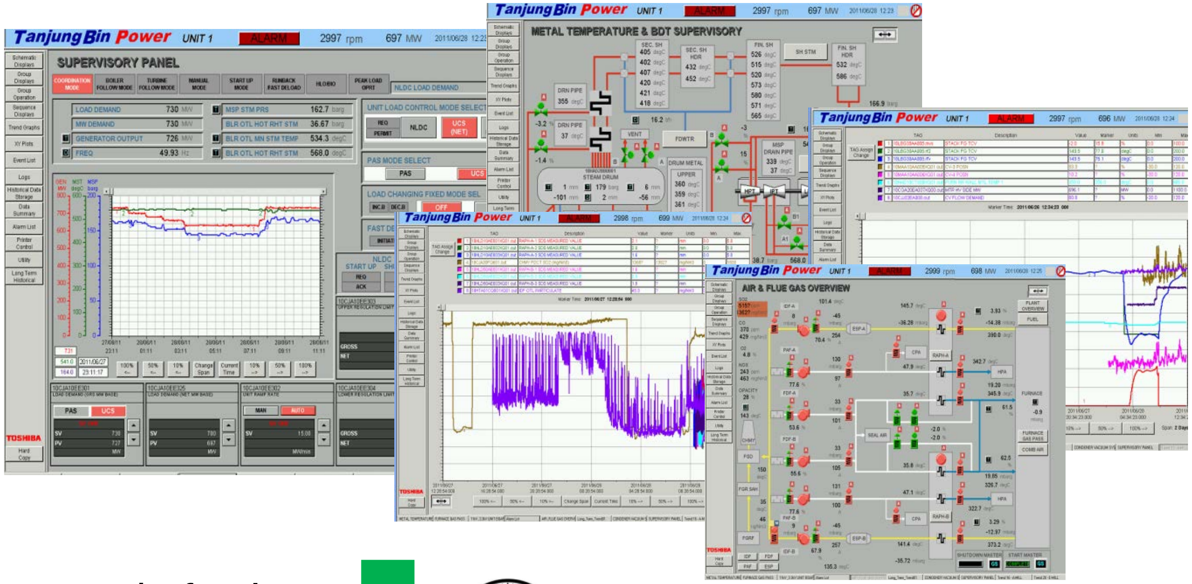


	-1.13	49.50	1.23	1.95	0.02	-19.55	12.83	0.21
	Main Steam Temperature	Hot Reheat Steam Temperature	Main Steam Pressure	Excess Air	Air Heater Gas Exit Temperature	Condenser Pressure	Economizer FW Inlet Temperature	SH Spray Flow
Target:	541	568	151	3.0	139	74	276	212
Actual:	541 degC	559 degC	151 barg	2.9 3.4 %	132 139 degC	67 mbara	273 degC	210 t/h

Historical trending

Controlled parameters

3. What is Daily Auto Report?

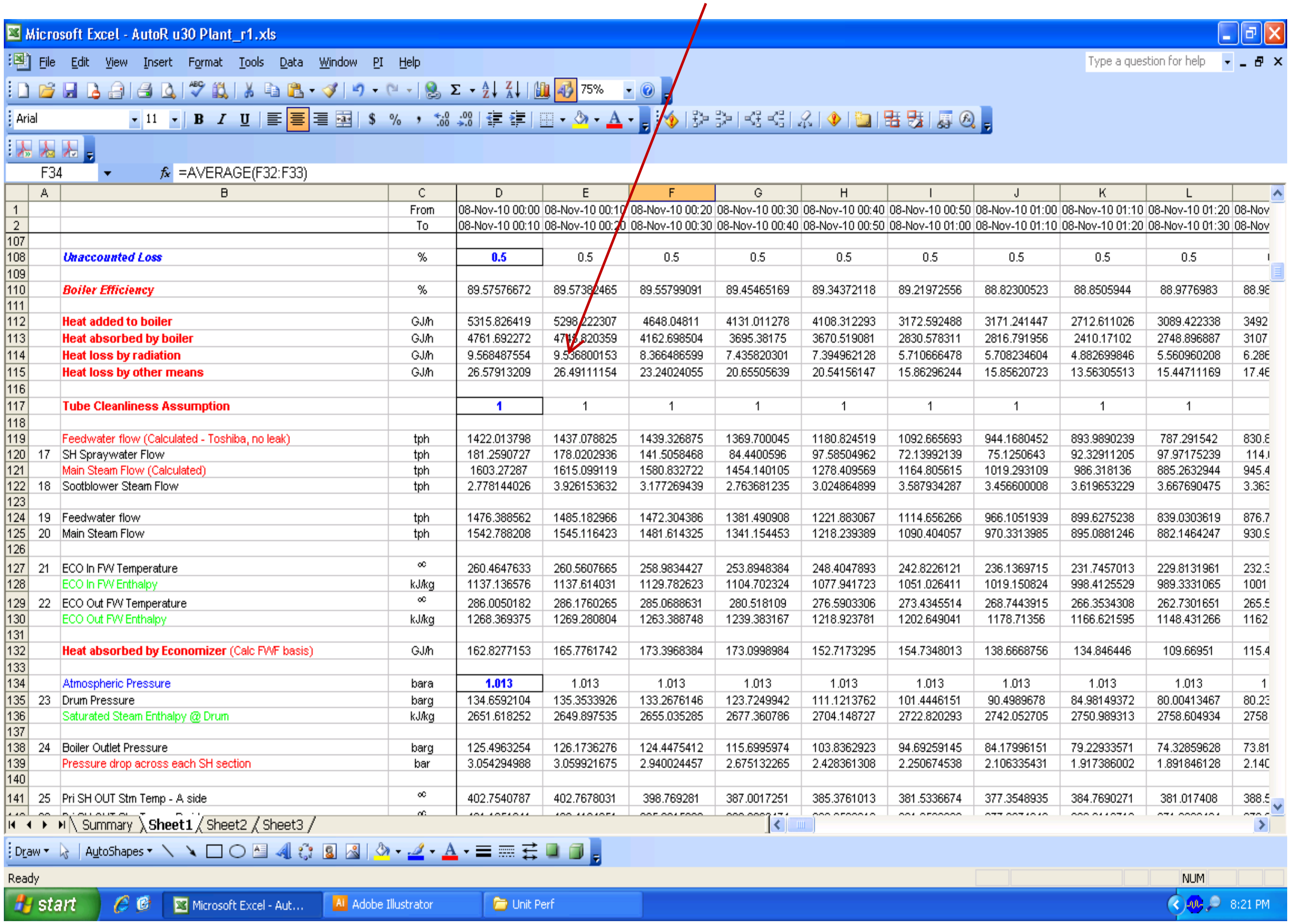


Thousand of calcs
Time consuming
Eliminate human error

Analyze

3. What is Daily Auto Report?

10 minutes interval calculated average



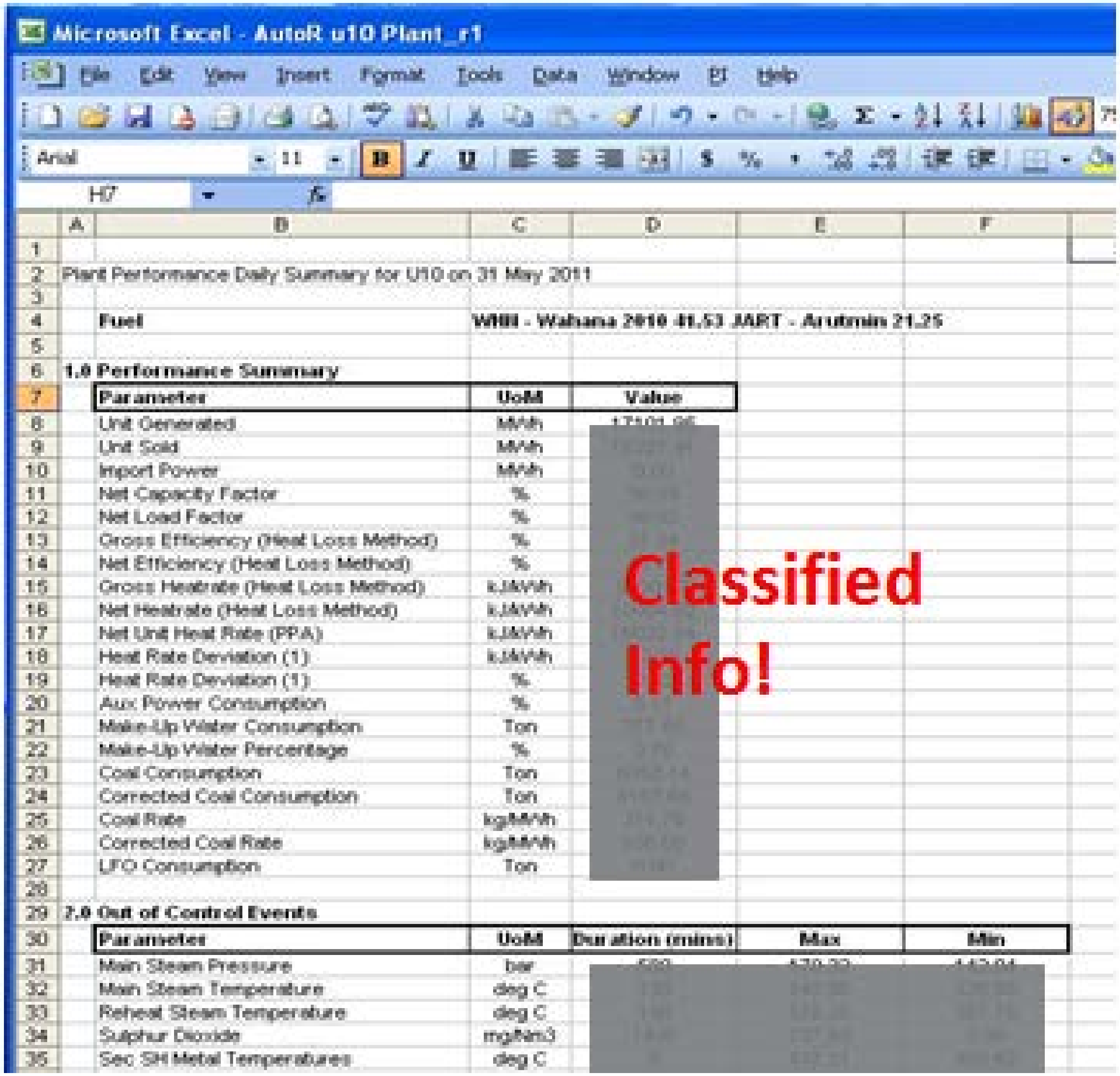
F34 =AVERAGE(F32:F33)

	A	B	C	D	E	F	G	H	I	J	K	L	
1			From	08-Nov-10 00:00	08-Nov-10 00:10	08-Nov-10 00:20	08-Nov-10 00:30	08-Nov-10 00:40	08-Nov-10 00:50	08-Nov-10 01:00	08-Nov-10 01:10	08-Nov-10 01:20	08-Nov
2			To	08-Nov-10 00:10	08-Nov-10 00:20	08-Nov-10 00:30	08-Nov-10 00:40	08-Nov-10 00:50	08-Nov-10 01:00	08-Nov-10 01:10	08-Nov-10 01:20	08-Nov-10 01:30	08-Nov
107													
108		***Unaccounted Loss***	%	**0.5**	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
109													
110		***Boiler Efficiency***	%	89.57576672	89.57382465	89.55799091	89.45465169	89.34372118	89.21972556	88.82300523	88.8505944	88.9776983	88.98
111													
112		**Heat added to boiler**	GJ/h	5315.826419	5298.222307	4648.04811	4131.011278	4108.312293	3172.592488	3171.241447	2712.611026	3089.422338	3492
113		**Heat absorbed by boiler**	GJ/h	4761.692272	4745.820359	4162.698504	3695.38175	3670.519081	2830.578311	2816.791956	2410.17102	2748.896887	3107
114		**Heat loss by radiation**	GJ/h	9.568487554	9.536800153	8.366486599	7.435820301	7.394962128	5.710666478	5.708234604	4.882699846	5.560960208	6.286
115		**Heat loss by other means**	GJ/h	26.57913209	26.49111154	23.24024055	20.65505639	20.54156147	15.86296244	15.85620723	13.56305513	15.44711169	17.46
116													
117		**Tube Cleanliness Assumption**		**1**	1	1	1	1	1	1	1	1	
118													
119		Feedwater flow (Calculated - Toshiba, no leak)	tph	1422.013798	1437.078825	1439.326875	1369.700045	1180.824519	1092.665693	944.1680452	893.9890239	787.291542	830.8
120	17	SH Spraywater Flow	tph	181.2590727	178.0202936	141.5058468	84.4400596	97.58504962	72.13992139	75.1250643	92.32911205	97.97175239	114.
121		Main Steam Flow (Calculated)	tph	1603.27287	1615.099119	1580.832722	1454.140105	1278.409569	1164.805615	1019.293109	986.318136	885.2632944	945.4
122	18	Sootblower Steam Flow	tph	2.778144026	3.926153632	3.177269439	2.763681235	3.024864899	3.587934287	3.456600008	3.619653229	3.667690475	3.363
123													
124	19	Feedwater flow	tph	1476.388562	1485.182966	1472.304386	1381.490908	1221.883067	1114.656266	966.1051939	899.6275238	839.0303619	876.7
125	20	Main Steam Flow	tph	1542.788208	1545.116423	1481.614325	1341.154453	1218.239389	1090.404057	970.3313985	895.0881246	882.1464247	930.9
126													
127	21	ECO In FW Temperature	°C	260.4647633	260.5607665	258.9834427	253.8948384	248.4047893	242.8226121	236.1369715	231.7457013	229.8131961	232.3
128		ECO In FW Enthalpy	kJ/kg	1137.136576	1137.614031	1129.782623	1104.702324	1077.941723	1051.026411	1019.150824	998.4125529	989.3331065	1001
129	22	ECO Out FW Temperature	°C	286.0050182	286.1760265	285.0688631	280.518109	276.5903306	273.4345514	268.7443915	266.3534308	262.7301651	265.5
130		ECO Out FW Enthalpy	kJ/kg	1268.369375	1269.280804	1263.388748	1239.383167	1218.923781	1202.649041	1178.71356	1166.621595	1148.431266	1162
131													
132		**Heat absorbed by Economizer** (Calc FWF basis)	GJ/h	162.8277153	165.7761742	173.3968384	173.0998984	152.7173295	154.7348013	138.6668756	134.846446	109.66951	115.4
133													
134		Atmospheric Pressure	bara	**1.013**	1.013	1.013	1.013	1.013	1.013	1.013	1.013	1.013	1
135	23	Drum Pressure	barg	134.6592104	135.3533926	133.2676146	123.7249942	111.1213762	101.4446151	90.4989678	84.98149372	80.00413467	80.23
136		Saturated Steam Enthalpy @ Drum	kJ/kg	2651.618252	2649.897535	2655.035285	2677.360786	2704.148727	2722.820293	2742.052705	2750.989313	2758.604934	2758
137													
138	24	Boiler Outlet Pressure	barg	125.4963254	126.1736276	124.4475412	115.6995974	103.8362923	94.69259145	84.17996151	79.22933571	74.32859628	73.81
139		Pressure drop across each SH section	bar	3.054294988	3.059921675	2.940024457	2.675132265	2.428361308	2.250674538	2.106335431	1.917386002	1.891846128	2.140
140													
141	25	Pri SH OUT Stm Temp - A side	°C	402.7540787	402.7678031	398.769281	387.0017251	385.3761013	381.5336674	377.3548935	384.7690271	381.017408	388.5

Up to
1000+ rows

3. What is Daily Auto Report?

Result summarized
in one page



Plant Performance Daily Summary for U10 on 31 May 2011

Fuel **WBB - Wahana 2010 41.53 JART - Arutmin 21.25**

1.0 Performance Summary

Parameter	**UoM**	**Value**
Unit Generated	MWh	[redacted]
Unit Sold	MWh	[redacted]
Import Power	MWh	[redacted]
Net Capacity Factor	%	[redacted]
Net Load Factor	%	[redacted]
Gross Efficiency (Heat Loss Method)	%	[redacted]
Net Efficiency (Heat Loss Method)	%	[redacted]
Gross Heatrate (Heat Loss Method)	kJ/kWh	[redacted]
Net Heatrate (Heat Loss Method)	kJ/kWh	[redacted]
Net Unit Heat Rate (PPA)	kJ/kWh	[redacted]
Heat Rate Deviation (1)	kJ/kWh	[redacted]
Heat Rate Deviation (1)	%	[redacted]
Aux Power Consumption	%	[redacted]
Make-Up Water Consumption	Ton	[redacted]
Make-Up Water Percentage	%	[redacted]
Coal Consumption	Ton	[redacted]
Corrected Coal Consumption	Ton	[redacted]
Coal Rate	kg/MWh	[redacted]
Corrected Coal Rate	kg/MWh	[redacted]
LFO Consumption	Ton	[redacted]

2.0 Out of Control Events

Parameter	**UoM**	**Duration (mins)**	**Max**	**Min**
Main Steam Pressure	bar	[redacted]	[redacted]	[redacted]
Main Steam Temperature	deg C	[redacted]	[redacted]	[redacted]
Reheat Steam Temperature	deg C	[redacted]	[redacted]	[redacted]
Sulphur Dioxide	mg/Nm3	[redacted]	[redacted]	[redacted]
Sec SH Metal Temperatures	deg C	[redacted]	[redacted]	[redacted]

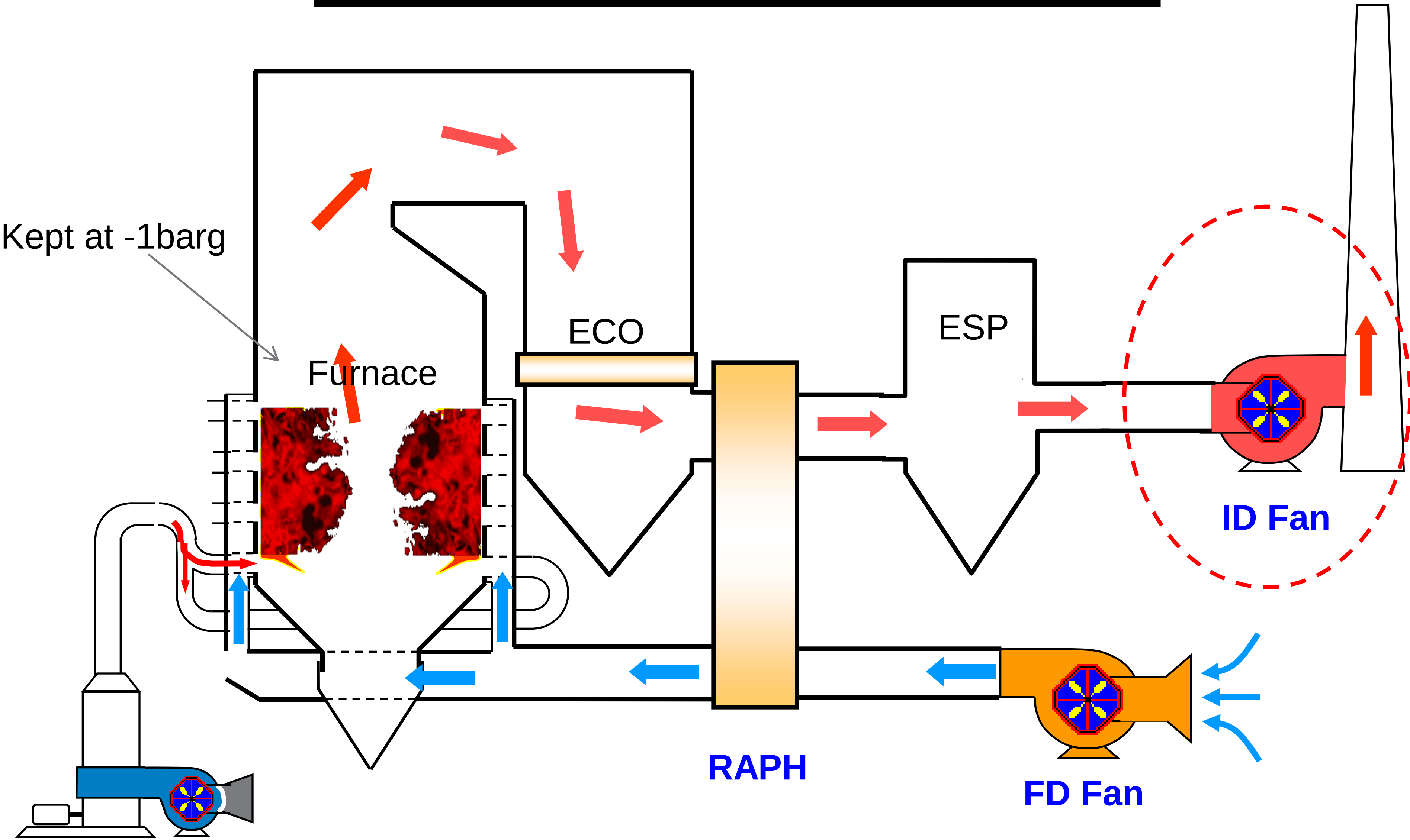
Classified Info!

Case Study

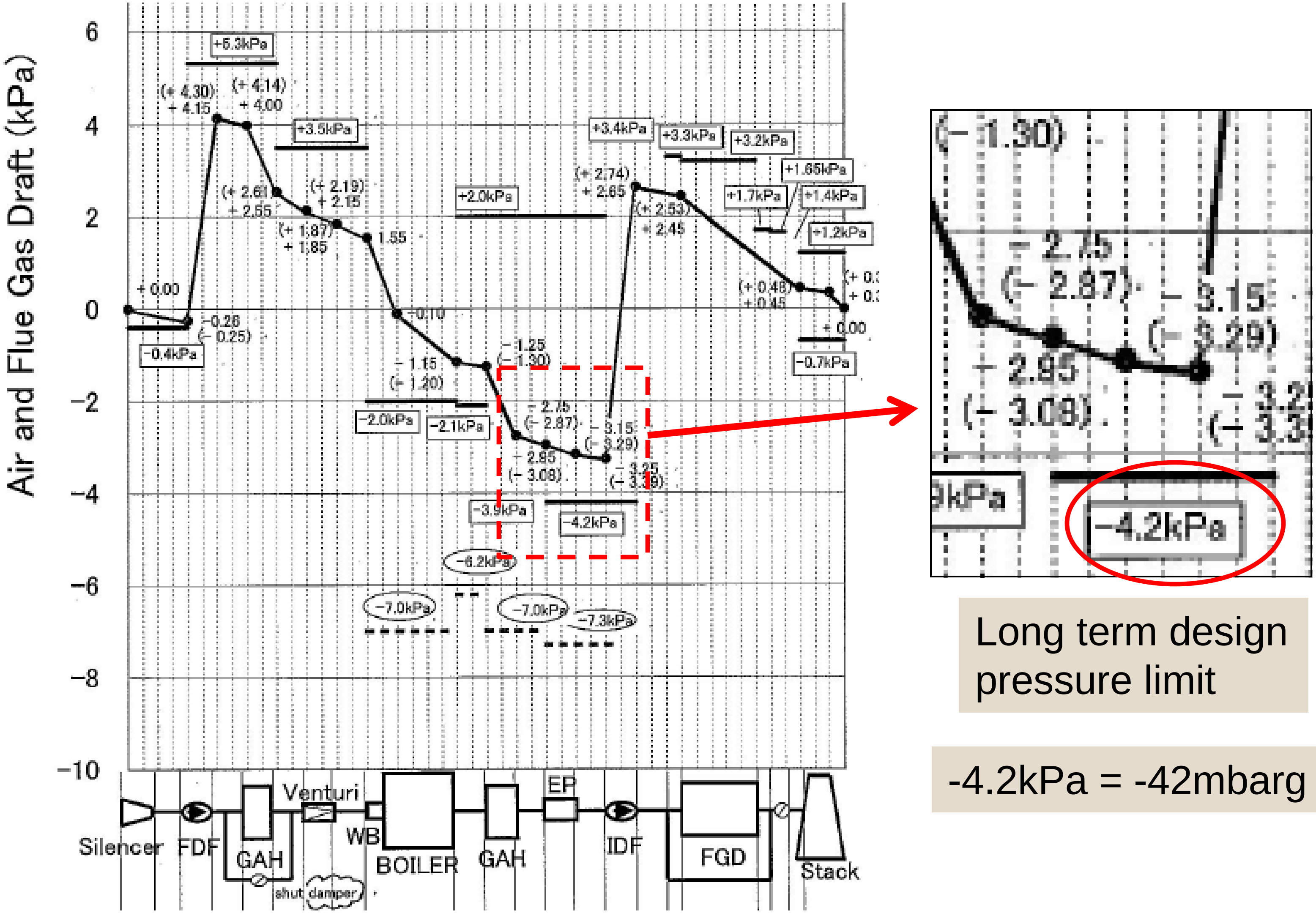
- Background: U10 ID Fan suction pressure are operated almost at its critical limit.
- Analysis: Actual pressure starting to deviate almost 5-10mbarg than predicted pressure.

- Cause: Due to flow path blockage within Economizer and RAPH area.
- Solution: Support firing of LFO during high load and continuous SB activities needed at RAPH.

Operation of Draught Sys.



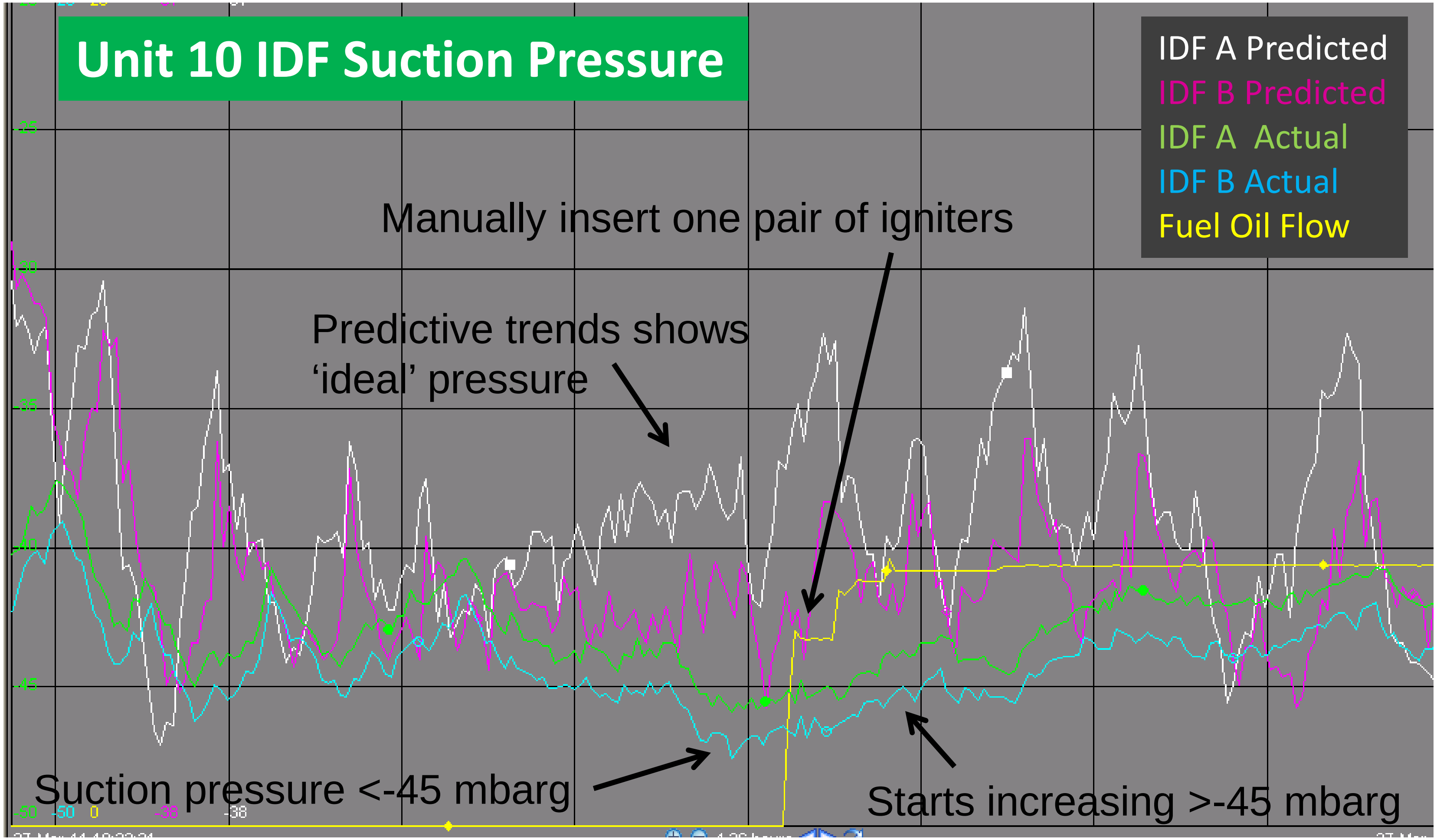
Fan Pressure Limitation



Long term design pressure limit

-4.2kPa = -42mbarg

Parameters Correlation using Nat. Alarm



Unit 10 IDF Suction Pressure

- IDF A Predicted
- IDF B Predicted
- IDF A Actual
- IDF B Actual
- Fuel Oil Flow

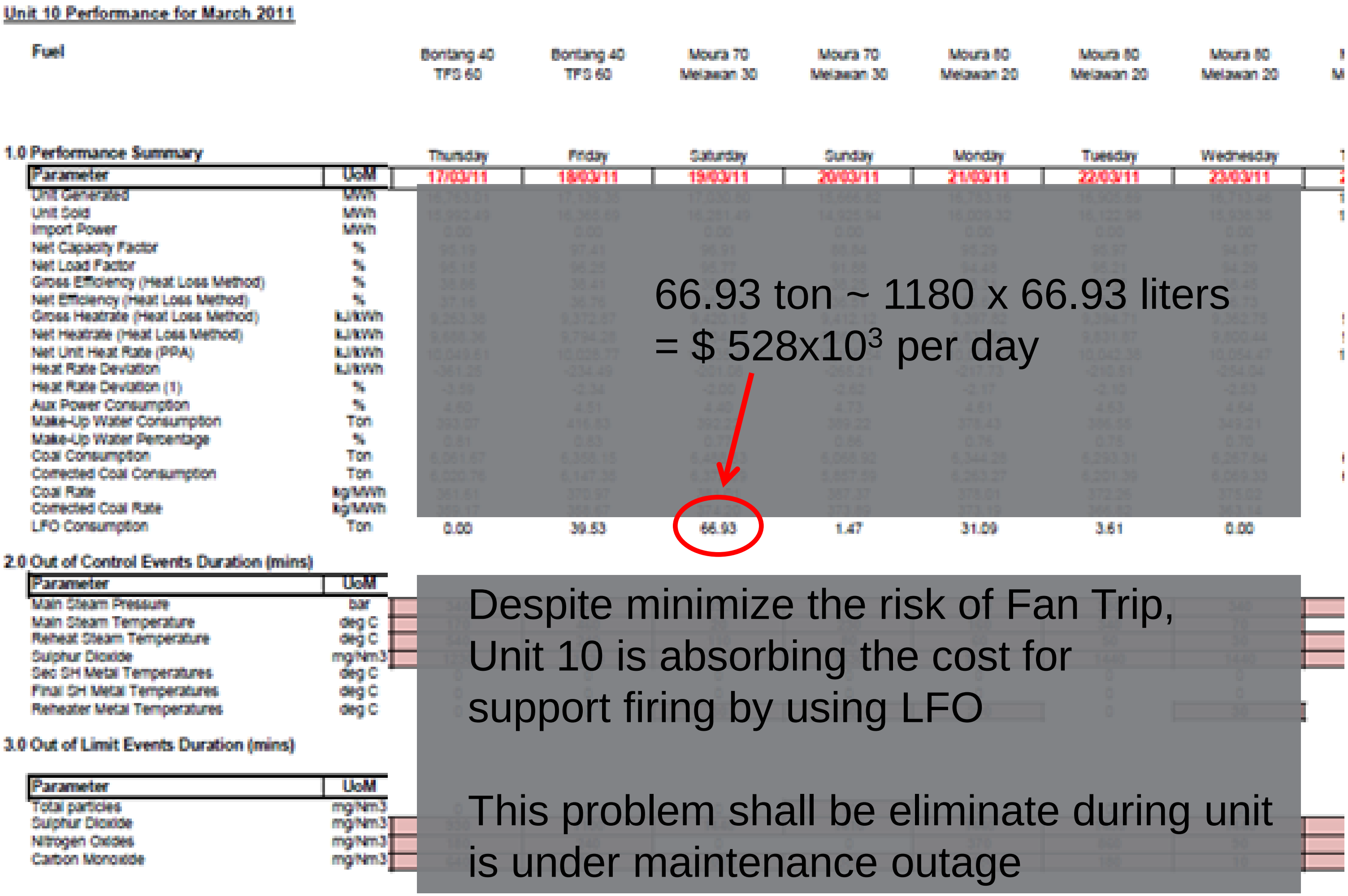
Manually insert one pair of igniters

Predictive trends shows ‘ideal’ pressure

Suction pressure <-45 mbarg

Starts increasing >-45 mbarg

Performance Summary from AutoR



Unit 10 Performance for March 2011

Fuel		Bontang 40 TFS 60	Bontang 40 TFS 60	Moura 70 Melawan 30	Moura 70 Melawan 30	Moura 80 Melawan 20	Moura 80 Melawan 20	Moura 80 Melawan 20

1.0 Performance Summary

Parameter	UoM	Thursday 17/03/11	Friday 18/03/11	Saturday 19/03/11	Sunday 20/03/11	Monday 21/03/11	Tuesday 22/03/11	Wednesday 23/03/11
Unit Generated	MWh							
Unit Sold	MWh							
Import Power	MWh							
Net Capacity Factor	%							
Net Load Factor	%							
Gross Efficiency (Heat Loss Method)	%							
Net Efficiency (Heat Loss Method)	%							
Gross Heatrate (Heat Loss Method)	kJ/kWh							
Net Heatrate (Heat Loss Method)	kJ/kWh							
Net Unit Heat Rate (PPA)	kJ/kWh							
Heat Rate Deviation	kJ/kWh							
Heat Rate Deviation (1)	%							
Aux Power Consumption	%							
Make-Up Water Consumption	Ton							
Make-Up Water Percentage	%							
Coal Consumption	Ton							
Corrected Coal Consumption	Ton							
Coal Rate	kg/MWh							
Corrected Coal Rate	kg/MWh							
LFO Consumption	Ton	0.00	39.53	66.93	1.47	31.09	3.61	0.00

66.93 ton ~ 1180 x 66.93 liters

= $ 528x10^3 per day

2.0 Out of Control Events Duration (mins)

Parameter	UoM
Main Steam Pressure	bar
Main Steam Temperature	deg C
Reheat Steam Temperature	deg C
Sulphur Dioxide	mg/Nm3
Sec SH Metal Temperatures	deg C
Final SH Metal Temperatures	deg C
Reheater Metal Temperatures	deg C

3.0 Out of Limit Events Duration (mins)

Parameter	UoM
Total particles	mg/Nm3
Sulphur Dioxide	mg/Nm3
Nitrogen Oxides	mg/Nm3
Carbon Monoxide	mg/Nm3

Despite minimize the risk of Fan Trip, Unit 10 is absorbing the cost for support firing by using LFO

This problem shall be eliminate during unit is under maintenance outage

The importance

- Mech. Engr – early failure detection maintenance practice
- Operators – able to plan changeover machine duty
- Perf. Engr – shall analyze periodically performance of each importance parameters
- Deliver information to personnel more effectively; visually more pleasing, more content and more transparent.

Questions?

Thank you

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