

Adding a new dimension to running the plant in the optimum way, made possible by PI System.

Mat Isa b. Osman
Stesen Janakuasa Sultan Azlan Shah.
Manjung, Perak.

24 October 2007

Intro – Stesen Janakuasa Sultan Azlan Shah, Manjung.



- A wholly owned subsidiary of TNB.
- Commercially Operation in 2003.
- 3 x 700 MW coal fired power plant.
- EPC by Alstom.
- Location : Teluk Rubiah, Manjung, Perak.

Glimpse Views of SJSAS



Look Ahead

Vision

To be the Region's Best
Independent Power Producer by Year 2010

Mission

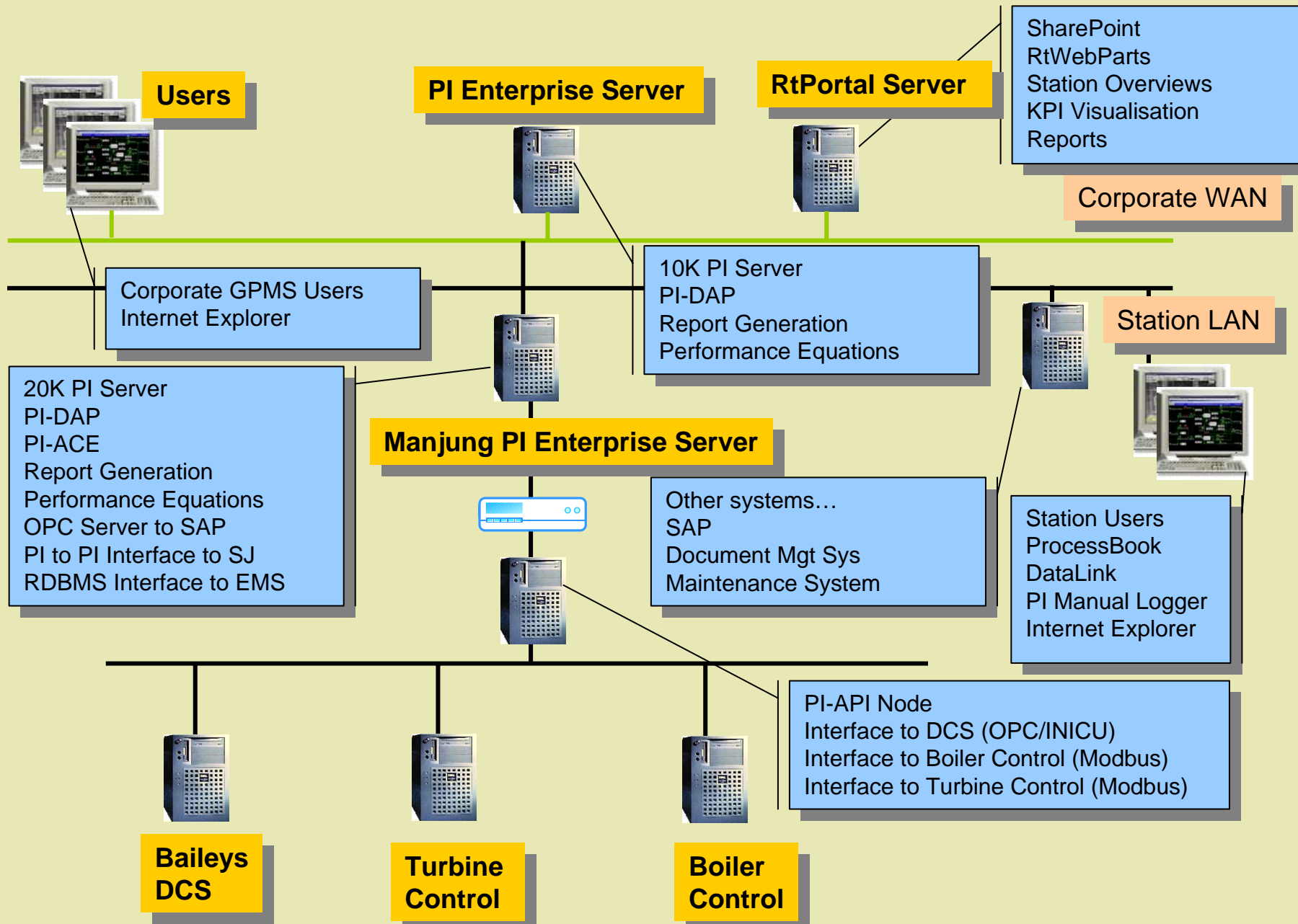
We are Committed to Adopt Service Excellence in Driving
our IPP Business to Deliver the Best Products, Services
and Customer Satisfaction



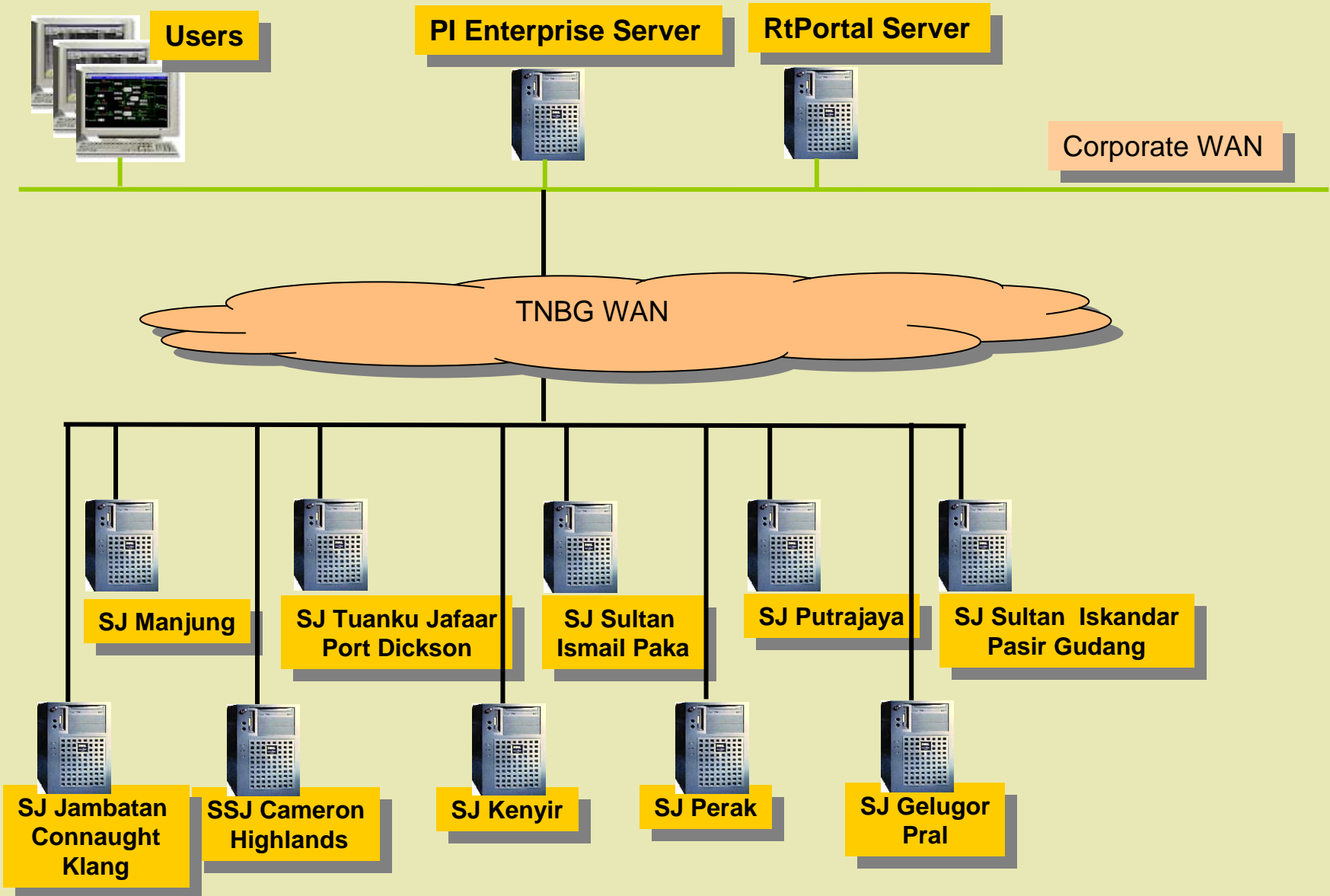
GPMS at SJSAS Manjung

- Plant information system via Portal accessible to every LAN users.
- Online real-time dispatch optimization
- E-mail alerts is useful in giving reminder on critical plant status.
- On line PI - Alarm System.
- Plant information is on the desktop for reports and troubleshooting task.
- More calculated data are available to PI-System users e.g. Integrator readings, auxiliary power consumption.

TNBG Architecture – Pilot Phase



TNBSG Architecture – In Progress




TNB Gen Div – GPMS Home Page

GPMS - Home - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address: http://genhqsvrgpmsweb/GPMS/default.aspx

Home Documents and Lists Create Site Settings Help Up to Team Web Site



Home Operational Market Share Financial Productivity Profitability Inventory Compliance Outage About Us

Home Sign In

Overview

Financial Year Data as of 01/04/2007 00:00:00

TNB Share Price: RM 11.80

CPU

Overall: **8.94**

Non-Fuel: **3.42**

(Cent/kWh)

UOR


1.30

(%)

Availability

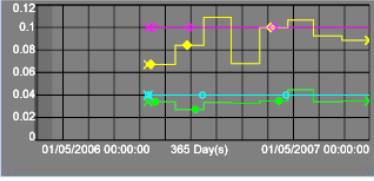
94.08

(%)




Region	CPU (Cent/kWh)	UOR (%)	Availability (%)
North	8.54	1.11	95.54
Central	5.20	1.13	95.31
South	2.22	1.79	93.71
East	7.41	1.79	93.08
West	12.22	1.13	94.90
North East	2.68	0.30	94.87
North West	10.55	1.13	89.40
South West	16.77	0.71	95.59
South East	6.81	0.34	94.11
Far East	10.57	1.79	93.91

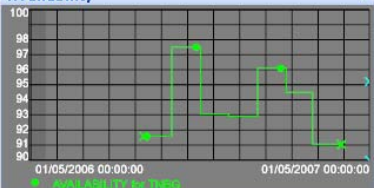
CPU (RM / kWh)



UOR



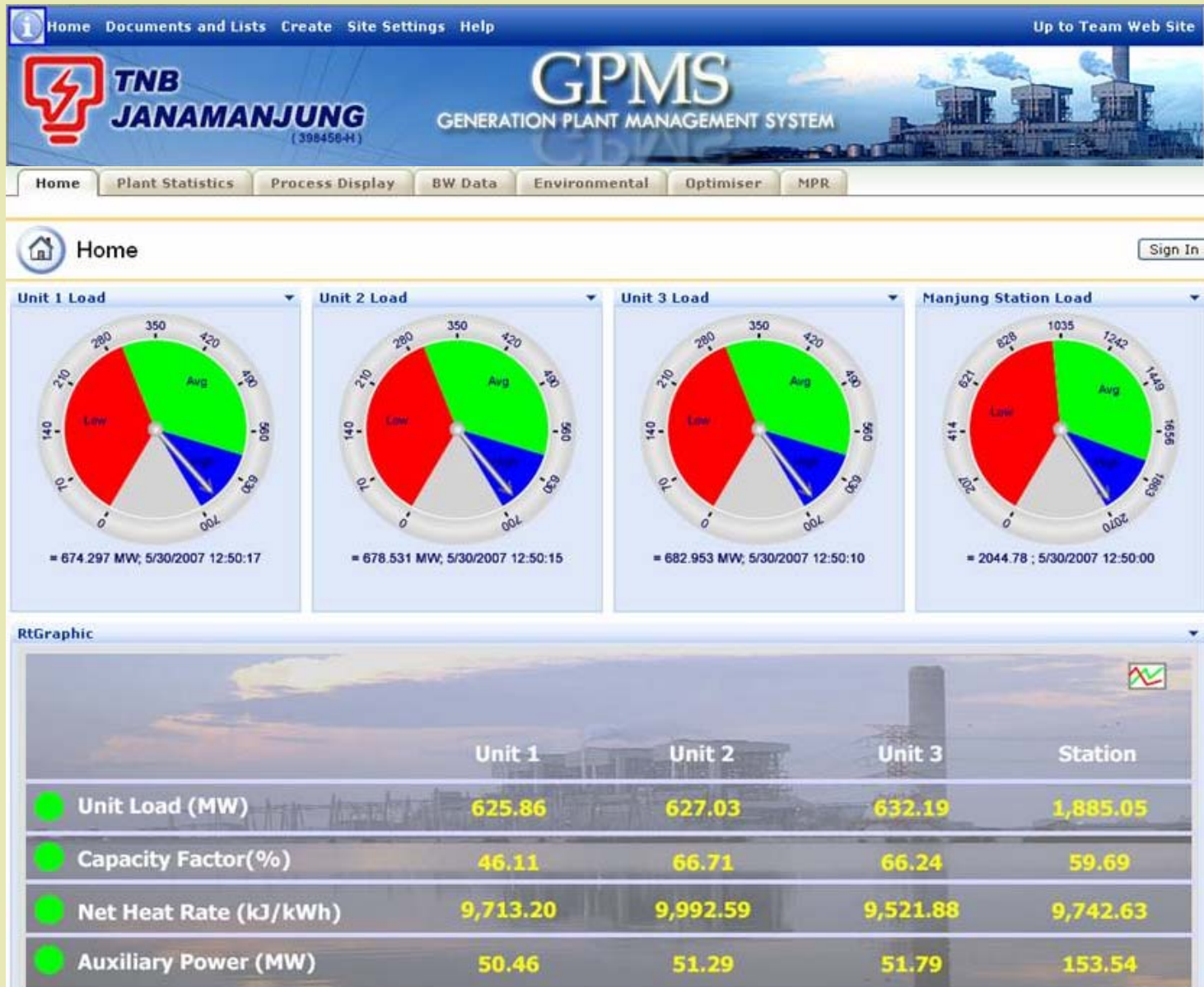
Availability



Productivity OPEX Utilisation Turnover Ratio (%) Heat Rate (kJ/kWh) Capacity Factor (%)

Done Trusted sites 12:58

Manjung's – GPMS Home Page



PI - Alarm System

- Online real-time alarm system
- Based on OEM Operating Instruction
- Advise operator on how and what action to take.
- Operator could record on which action has been acted on for future reference

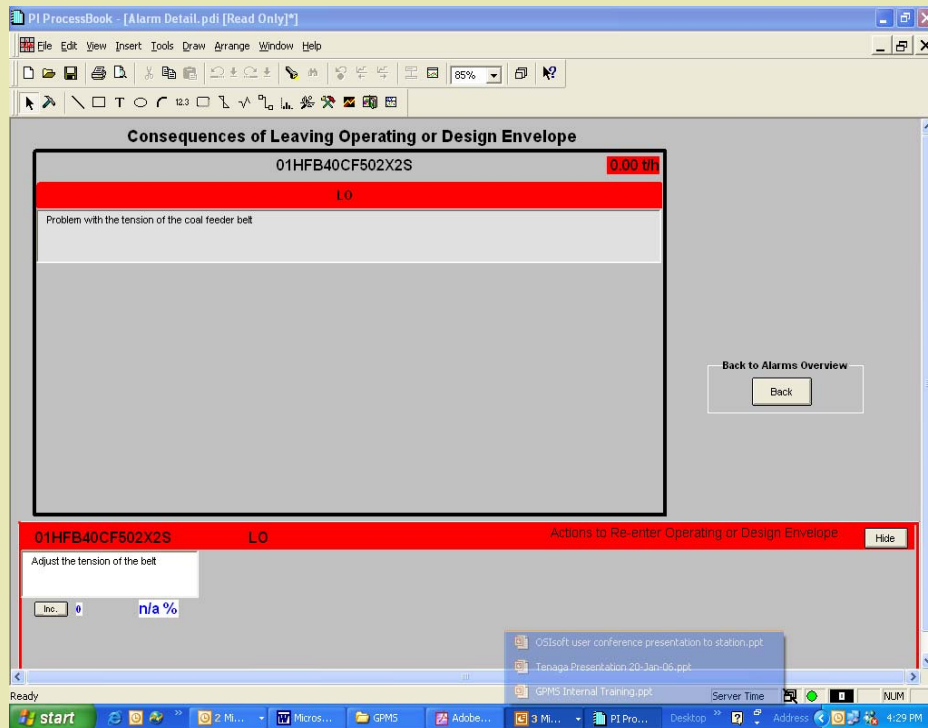
Online PI - Alarm System

Alarms Overview - Boiler 1 of 2

Alarm Maintenance									
Alarms Maintenance		Refresh		Boiler 1/2		Turbine & Generator		Auxiliaries	
01HAG01CF501X1T	01HAD01CL551X6T	01HAD01CP501X7T	01HAG01CF501	01HAG01CF501X2T	01HAG01CF502X2T	01HAG02CF501	01HAG02CF501X2T	01HAG02CP502X2T	01HAG03CF501
01HAG03CF501X2T	01HAG03CP502X2T	01HAG03CF501X7T	01HAG03CT501X7T	01HAJ61CF501X7T	01HBK11CF503X6T	01HFA10CL501X51	01HFA20CL501X51	01HFA30CL501X51	01HFA40CL501X51
01HFA50CL501X51	01HFA60CL501X51	01HFA70CL501X51	01HFB10CF502X2S	01HFB20CF502X2S	01HFB30CF502X2S	01HFB40CF502X2S	01HFB50CF502X2S	01HFB60CF502X2S	01HFB70CF502X2S
01HFC10CT502X6T	01HFC10CT502X6T	01HFC10CT503X6T	01HFC10CT504X6T	01HFC10CT505X6T	01HFC10CT506X6T	01HFC13CP504X2G	01HFC20CT501X6T	01HFC20CT502X6T	01HFC20CT503X6T
01HFC20CT504X6T	01HFC20CT505X6T	01HFC20CT506X6T	01HFC33CP504X2G	01HFC30CT501X6T	01HFC30CT502X6T	01HFC30CT503X6T	01HFC30CT504X6T	01HFC30CT505X6T	01HFC30CT506X6T
01HFC38CP504X2G	01HFC40CT501X6T	01HFC40CT502X6T	01HFC40CT503X6T	01HFC40CT504X6T	01HFC40CT505X6T	01HFC40CT506X6T	01HFC48CP504X2G	01HFC50CT501X6T	01HFC50CT502X6T
01HFC50CT503X6T	01HFC50CT504X6T	01HFC50CT505X6T	01HFC50CT506X6T	01HFC53CP504X2G	01HFC60CT501X6T	01HFC60CT502X6T	01HFC60CT503X6T	01HFC60CT504X6T	01HFC60CT505X6T
01HFC60CT506X6T	01HFC63CP504X2G	01HFC70CT501X6T	01HFC70CT502X6T	01HFC70CT503X6T	01HFC70CT504X6T	01HFC70CT505X6T	01HFC70CT506X6T	01HFC73CP504X2G	01HFE13CF501X2T
01HFE13CP502X6T	01HFE13CP502X6T	01HFE13CT501X2T	01HFE13CT501X6T	01HFE23CF501X2T	01HFE23CF501X6T	01HFE23CP502X6T	01HFE23CT501X2T	01HFE23CT501X6T	01HFE33CF501X2T
01HFE33CF501X6T	01HFE33CP502X6T	01HFE33CT501X2T	01HFE33CT501X6T	01HFE43CF501X2T	01HFE43CF501X6T	01HFE43CP502X6T	01HFE43CT501X2T	01HFE43CT501X6T	01HFE53CF501X2T
01HFE53CF501X6T	01HFE53CP502X6T	01HFE53CT501X2T	01HFE53CT501X6T	01HFE63CF501X2T	01HFE63CF501X6T	01HFE63CP502X6T	01HFE63CT501X2T	01HFE63CT501X6T	01HFE73CF501X2T
01HFE73CF501X6T	01HFE73CP502X6T	01HFE73CT501X2T	01HFE73CT501X6T	01HFV14CF503X52	01HFV24CF503X52	01HFV34CF503X52	01HFV44CF503X52	01HFV54CF503X52	01HFV64CF503X52

- Online real-time alarm system
- Based on OEM Operating Instruction
- Advise operator on how and what action to take.
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Online PI - Alarm System

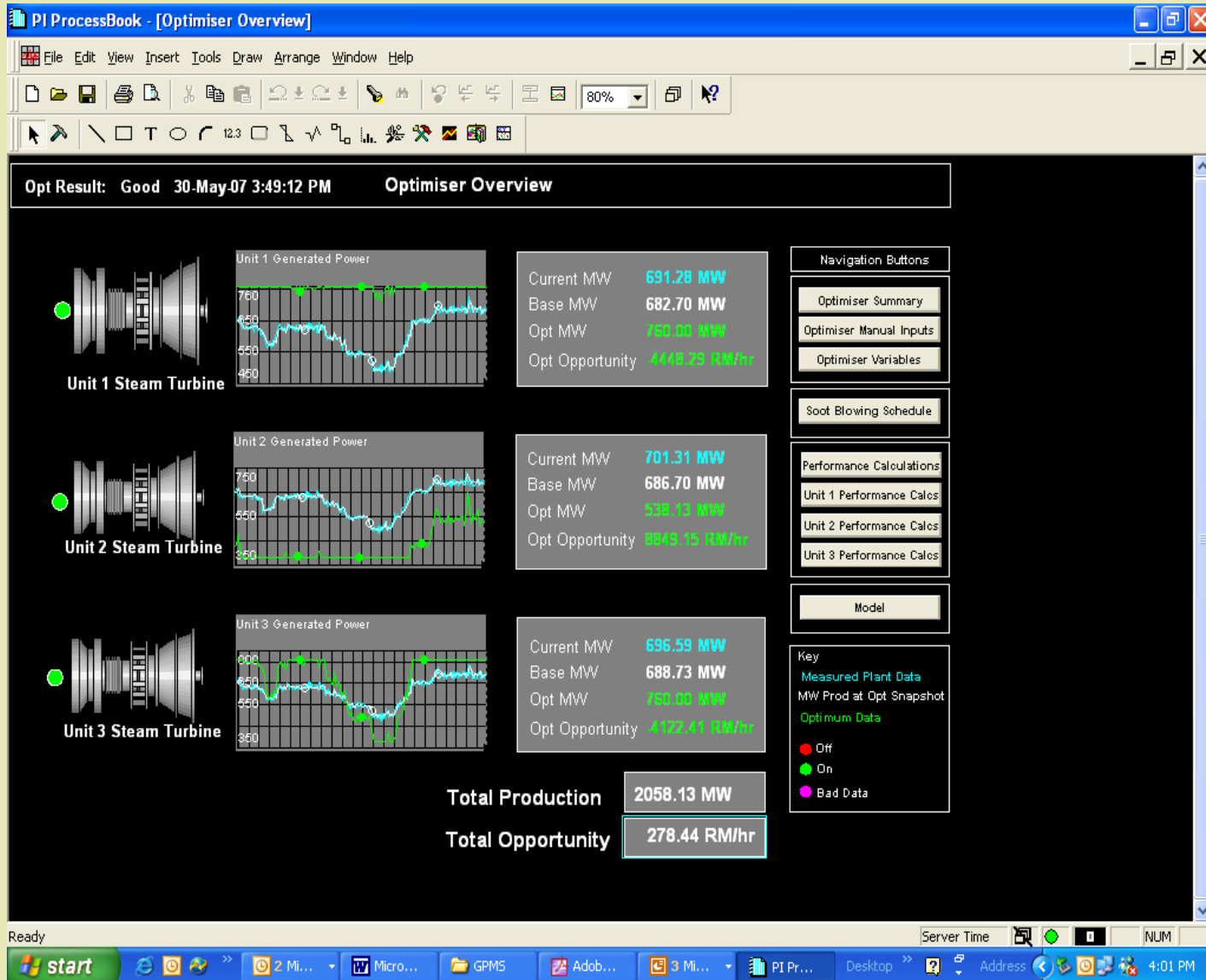


- Online real-time alarm system
- Based on OEM Operating Instruction
- Advise operator on how and what action to take.
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Plant AMS Optimiser

- ❑ Online real-time dispatch optimization
- ❑ Online performance monitoring calculations based on ASME for all major equipment e.g. Boiler Efficiency, Heat Exchanger Effectiveness, etc.
- ❑ Sootblowing calculations consist of frequent assessment of the heat transfer values for the various exchanger banks.

Online real-time Dispatch Optimization



Plant Heatrate Monitoring

The screenshot displays the 'PI ProcessBook - [Performance Calculations]' window. The main content area is titled 'Overall Performance Calculations' and shows a table of performance metrics for the overall plant and three individual units. The 'Measured' column values are circled in red. A navigation sidebar on the right contains buttons for 'Optimiser Overview', 'Optimiser Manual Inputs', 'Optimiser Variables', 'Soot Blowing Schedule', 'Model', and 'Unit Performance Calculations'. The Windows taskbar at the bottom shows the system time as 2:37 PM on 01-Mar-07.

Opt Result: Good 01-Mar-07 2:26:33 PM **Overall Performance Calculations**

Overall Plant	Units	Measured	What If
Gross Heat Rate	kJ/kWh	9,713	9,315
Net Heat Rates	kJ/kWh	10,417	9,990
Gross Efficiency	%	37.06	38.65
Net Efficiency	%	34.56	36.04
Heat Rate Deviation Cost	RM	5,954.17	
Auxiliary Power Consumption MW		91.58	
Auxiliary Power Consumption %		6.76	

Unit 1 Heat Rates	Units	Measured
Gross Heat Rate	kJ/kWh	0
Net Heat Rate	kJ/kWh	0
Heat Rate Deviation Cost	RM	0.00
Auxiliary Power Consumption MW		0.00
Auxiliary Power Consumption %		0.00

Unit 2 Heat Rates	Units	Measured
Gross Heat Rate	kJ/kWh	9,557
Net Heat Rate	kJ/kWh	10,248
Heat Rate Deviation Cost	RM	8,794.10
Auxiliary Power Consumption MW		45.89
Auxiliary Power Consumption %		6.74

Unit 3 Heat Rates	Units	Measured
Gross Heat Rate	kJ/kWh	9,871
Net Heat Rate	kJ/kWh	10,588
Heat Rate Deviation Cost	RM	-2,836.93
Auxiliary Power Consumption MW		45.68
Auxiliary Power Consumption %		6.77

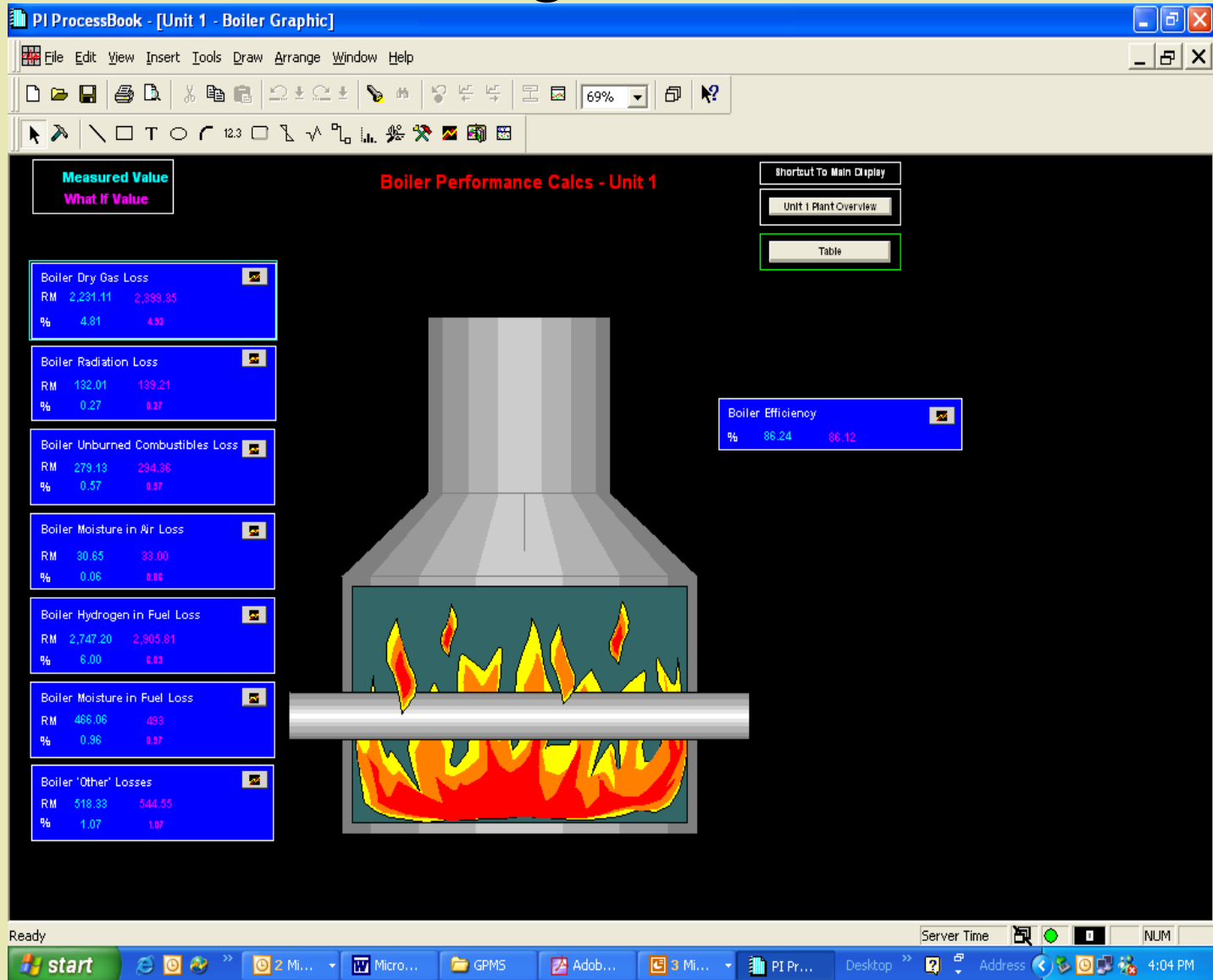
Navigation Buttons:

- Optimiser Overview
- Optimiser Manual Inputs
- Optimiser Variables
- Soot Blowing Schedule
- Model
- Unit Performance Calculations
 - Unit 1 Performance Calculations
 - Unit 2 Performance Calculations
 - Unit 3 Performance Calculations

Server Time: NUM

Windows Taskbar: start, Inbox - Microso..., Microsoft Excel, Microsoft Powe..., PI ProcessBook..., Desktop, Address, 2:37 PM

Online performance monitoring calculations



Auxiliary Power Consumption Calculation

PI ProcessBook - [Performance Calculations]

Connections Back Next

69%

Opt Result: Good 01-Mar-07 2:26:33 PM

Overall Performance Calculations

Overall Plant	Units	Measured	What If
Gross Heat Rate	kJ/kWh	9,713	9,315
Net Heat Rates	kJ/kWh	10,417	9,990
Gross Efficiency	%	37.06	38.65
Net Efficiency	%	34.56	36.04
Heat Rate Deviation Cost	RM	5,354.17	
Auxiliary Power Consumption MW		31.58	
Auxiliary Power Consumption %		6.76	

Unit 1 Heat Rates	Units	Measured
Gross Heat Rate	kJ/kWh	0
Net Heat Rate	kJ/kWh	0
Heat Rate Deviation Cost	RM	0.00
Auxiliary Power Consumption MW		0.00
Auxiliary Power Consumption %		0.00

Unit 2 Heat Rates	Units	Measured
Gross Heat Rate	kJ/kWh	9,557
Net Heat Rate	kJ/kWh	10,248
Heat Rate Deviation Cost	RM	8,791.10
Auxiliary Power Consumption MW		45.89
Auxiliary Power Consumption %		6.74

Unit 3 Heat Rates	Units	Measured
Gross Heat Rate	kJ/kWh	9,871
Net Heat Rate	kJ/kWh	10,588
Heat Rate Deviation Cost	RM	2,836.38
Auxiliary Power Consumption MW		45.68
Auxiliary Power Consumption %		6.77

Navigation Buttons:

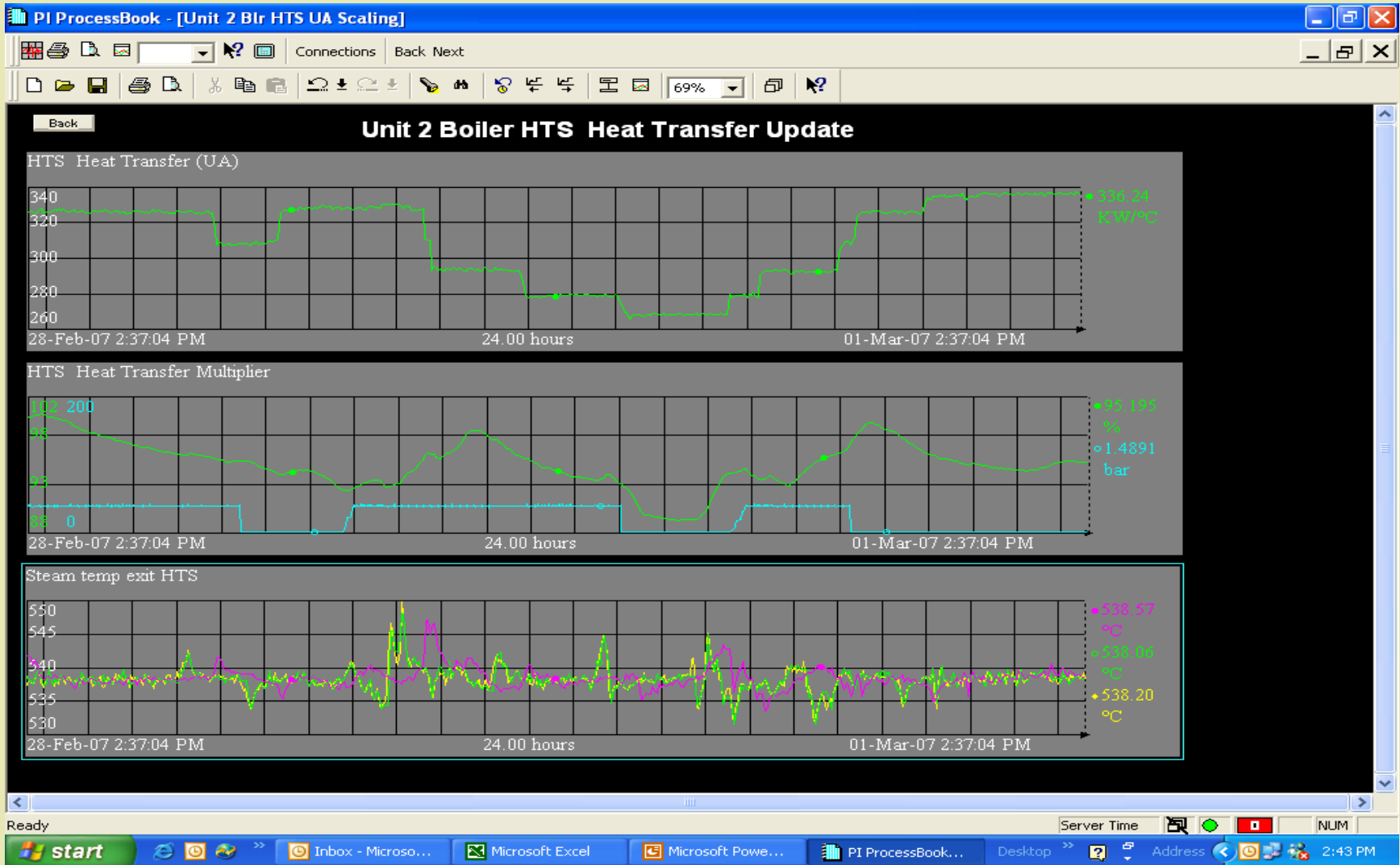
- Optimizer Overview
- Optimizer Manual Inputs
- Optimizer Variables
- Soot Blowing Schedule
- Model
- Unit Performance Calc:

 - Unit 1 Performance Calc
 - Unit 2 Performance Calc
 - Unit 3 Performance Calc

Server Time NUM

start | Inbox - Microso... | Microsoft Excel | Microsoft Powe... | PI ProcessBook... | Desktop | Address | 2:37 PM

Boiler Heat Transfer Multiplier Monitoring (tube cleanliness)



Usage of PI ProcessBook and PI-Datalink in Manjung

- ❑ Personal screens were developed by individuals according to their needs.
- ❑ Tedious data taking task is made easy by PI-Datalink.
- ❑ Calculated data feature in PI-Datalink help user to calculate data to useful common statistical results. Installation of expensive equipment is not longer required. E.g. convert flow reading to a totalised data.

Personalised Monitoring Screen (1/3)

PI ProcessBook - [Snapshot]

Connections Back Next

99%

SNAPSHOT of PLANT MAIN PARAMETERS

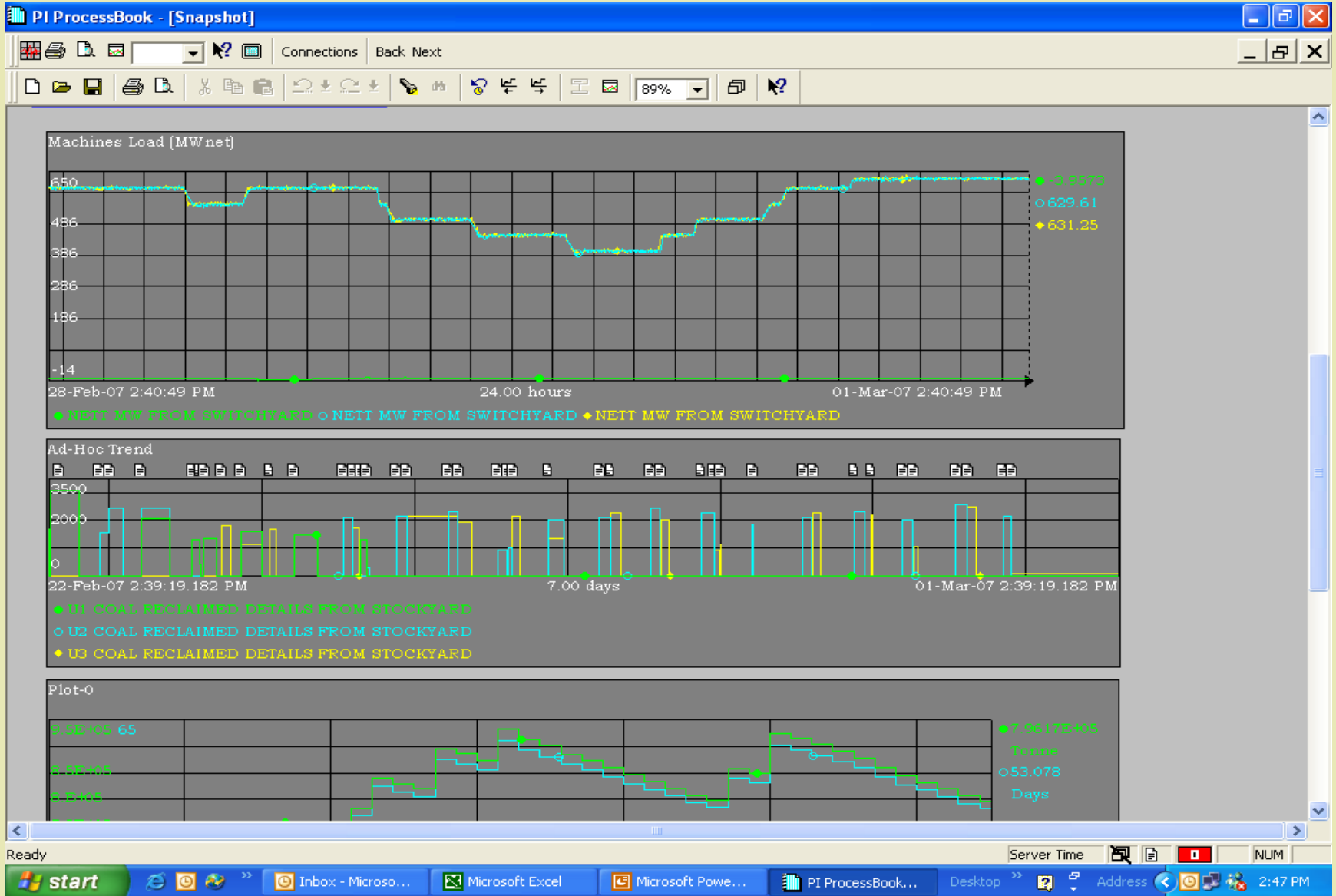
UNIT 1		UNIT 2		UNIT 3	
Load	-4 MW	Load	629 MW	Load	631 MW
MS Temperature	88 °C	MS Temperature	539 °C	MS Temperature	538 °C
MS Pressure	0 bar	MS Pressure	169 bar	MS Pressure	170 bar
RH Temperature	76 °C	RH Temperature	535 °C	RH Temperature	538 °C
RH Pressure	0 bar	RH Pressure	36 bar	RH Pressure	32 bar
MS Pressure Deviation	0.00 bar	MS Pressure Deviation	-0.06 bar	MS Pressure Deviation	1.09 bar
Condenser Vacuum	1010 mbar-A	Condenser Vacuum	79 mbar-A	Condenser Vacuum	76 mbar-A
Mill 10 Coal Flow	0.0 t/h	Mill 10 Coal Flow	53.0 t/h	Mill 10 Coal Flow	53.6 t/h
Mill 20 Coal Flow	0.0 t/h	Mill 20 Coal Flow	52.8 t/h	Mill 20 Coal Flow	53.7 t/h
Mill 30 Coal Flow	0.0 t/h	Mill 30 Coal Flow	51.6 t/h	Mill 30 Coal Flow	52.8 t/h
Mill 40 Coal Flow	0.0 t/h	Mill 40 Coal Flow	50.5 t/h	Mill 40 Coal Flow	53.1 t/h
Mill 50 Coal Flow	0.0 t/h	Mill 50 Coal Flow	51.9 t/h	Mill 50 Coal Flow	52.7 t/h
Mill 60 Coal Flow	0.0 t/h	Mill 60 Coal Flow	0.0 t/h	Mill 60 Coal Flow	52.4 t/h
Mill 70 Coal Flow	0.0 t/h	Mill 70 Coal Flow	51.9 t/h	Mill 70 Coal Flow	0.0 t/h
Total Coal Flow	0.0 t/h	Total Coal Flow	310.5 T/h	Total Coal Flow	316.4 T/h
SH Spraywater Flow	0 t/h	SH Spraywater Flow	54 t/h	SH Spraywater Flow	73 t/h
BFP 1 Current	-0 AMPS	BFP 1 Current	559 AMPS	BFP 1 Current	515 AMPS
BFP 2 Current	-2 AMPS	BFP 2 Current	531 AMPS	BFP 2 Current	-1 AMPS
BFP 3 Current	-2 AMPS	BFP 3 Current	-0 AMPS	BFP 3 Current	546 AMPS
BCP 1 Current	-0 AMPS	BCP 1 Current	72 AMPS	BCP 1 Current	72 AMPS
BCP 2 Current	94 AMPS	BCP 2 Current	73 AMPS	BCP 2 Current	73 AMPS
BCP 3 Current	-0 AMPS	BCP 3 Current	0 AMPS	BCP 3 Current	0 AMPS
Drum Lvl (Protection)	-208 mm	Drum Lvl (Protection)	-249 mm	Drum Lvl (Protection)	-262 mm
Drum Lvl (Control)	-198 mm	Drum Lvl (Control)	-192 mm	Drum Lvl (Control)	-194 mm
Dust Emission	5 mg/Nm ³	Dust Emission	29 mg/Nm ³	Dust Emission	108 mg/Nm ³

Ready

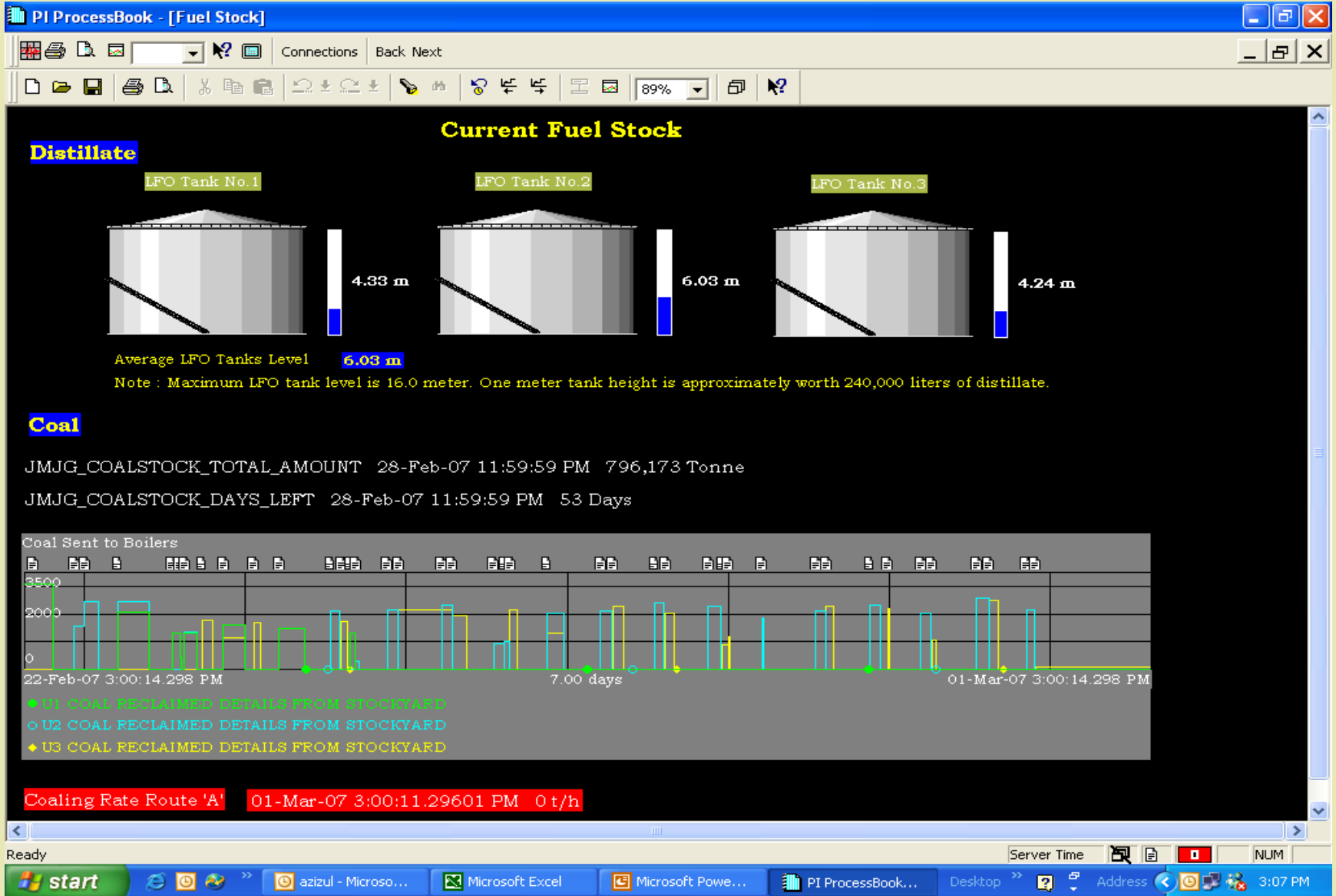
Server Time NUM

start | Inbox - Microso... | Microsoft Excel | Microsoft Powe... | PI ProcessBook... | Desktop | Address | 2:46 PM

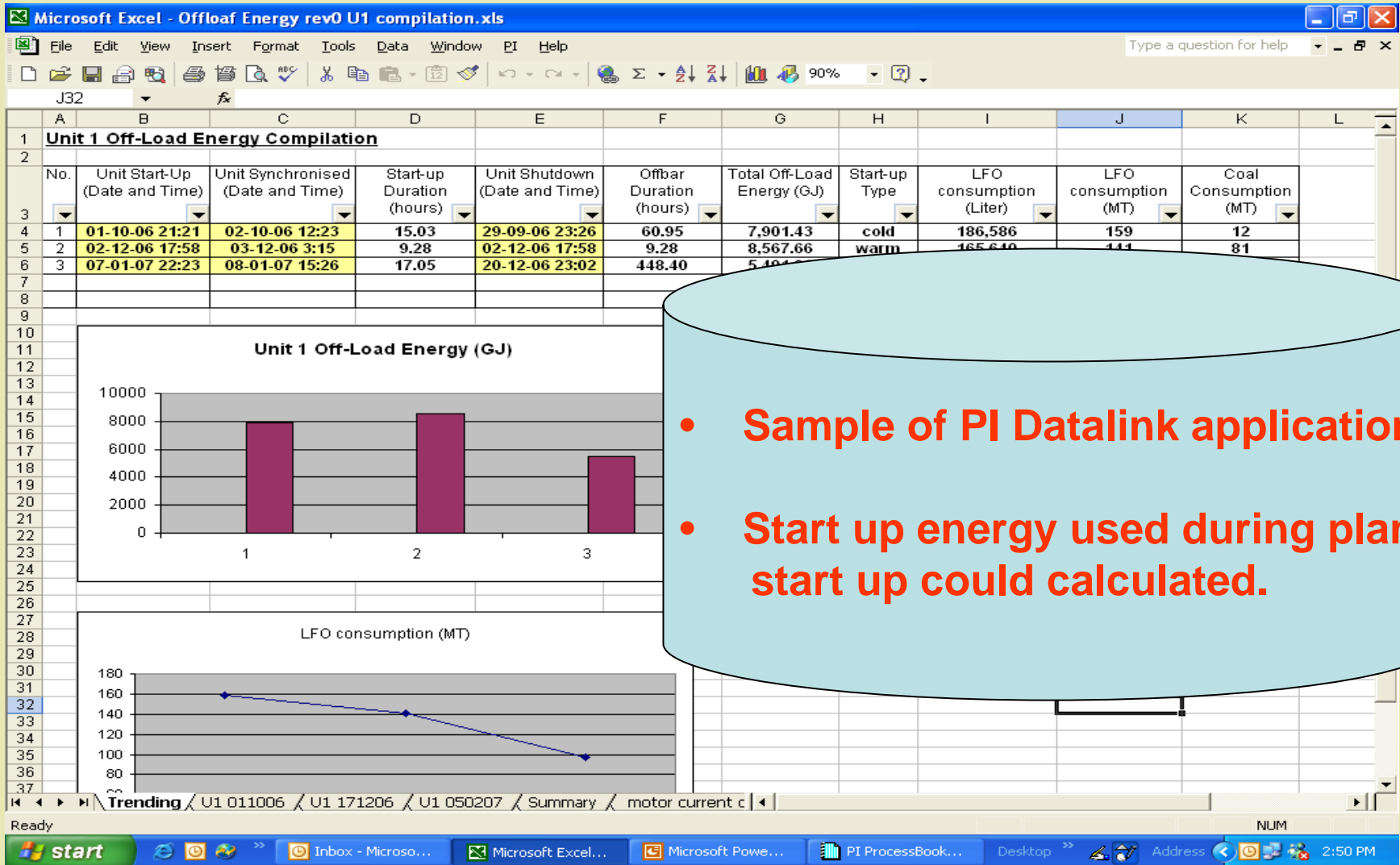
Personalised Monitoring Screen (2/3)



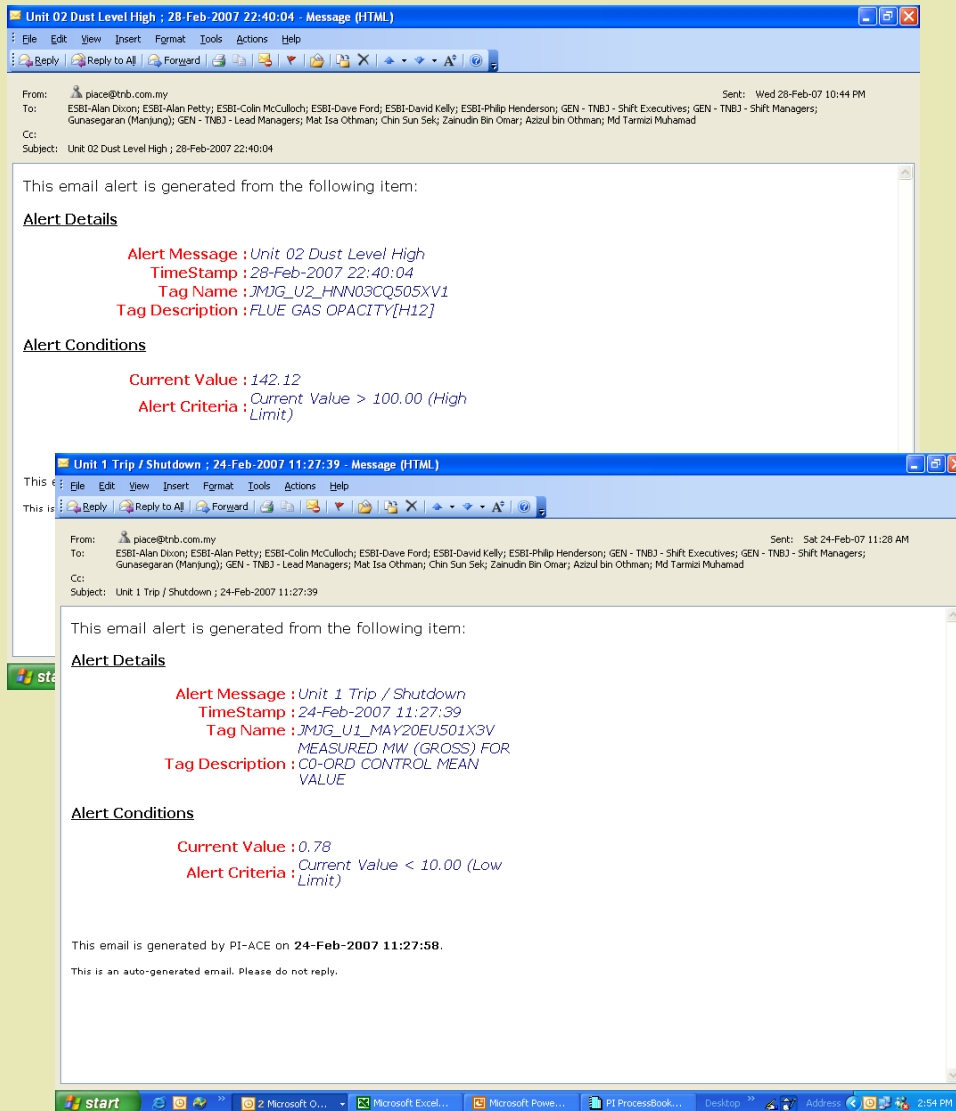
Personalised Monitoring Screen (3/3)



Report - Offline Energy (Start up Energy Requirement)



E-mail Alerts



- PI will generate e-mail alerts on critical plant status.
- Trigger set point can be customised as required.
- Information now available in your mail box even away from site.

Easy Distillate Consumption Monitoring (1/2)

U3 START-UP 23/02/07 AFTER RESERVE SHUTDOWN - Message (HTML)

File Edit View Insert Format Tools Actions Help

Reply Reply to All Forward

From: Azizul bin Othman
To: Chin Sun Sek; Ros 'Azman Mohamad
Cc: Mat Isa Othman; Zainudin Bin Omar; M...
Subject: U3 START-UP 23/02/07 AFTER RE...

Sent: Sun 25-Feb-07 1:06 PM

Ross, like previously, ca... energy and RM terms. - TQ, ao.

- Fuel consumption during plant start-up is easily calculated.
- Data convey to Operator for post mortem info for improvement process.

start | 2 Microsoft O... | Microsoft Excel... | Microsoft Powe... | PI ProcessBook... | Desktop | Address | 2:56 PM

Easy Distillate Consumption Monitoring (2/2)

Microsoft Excel - LFO cost.xls

Type a question for help

F33

	A	B	C	D	E	F	G
1		LFO Consumption for Start-Up (GJ)					
2							
3		Plant	UNIT 3			0	
4		Unit Start-Up	01-01-07 0:00			01-01-07 0:00	
5		Unit Synchronised	01-02-07 0:00			01-02-07 0:00	
6		Duration	744.00	hr		744.00	hr
7							
8		LFO Average Flow Rate	0.060854801	ton/hr	JMJG_U1_HJF07CF501X3V	0.387158602	ton/hr
9			60.85	kg/hr		387.16	kg/hr
10			71.59	liter/hr		455.48	liter/hr
11			53,265.85	liter		338,877.65	liter
12			45.28	ton		288.05	ton
13			106,531.70	LFO cost during start up.		677,755.29	LFO cost during
14			42,814	kJ/kg (CV used)		42,814	kJ/kg (CV used)
15			2,605,437.44	kJ/hr		16,575,808.38	kJ/hr
16			1,938,445,454.19	kJ		12,332,401,432.05	kJ
17			1,938.45	GJ		12,332.40	GJ
18							
19							
20							
21							
22		LFO Totaliser Reading at Start Time	1,240.60	ton			
23		LFO Totaliser Reading at Stop Time	1,285.67	ton			
24		LFO Consumption	45.07	ton			
25		<i>Distillate density of 0.85kg/liter</i>	53,027.34	liter			
26			45,073.24	kg			
27			60.58	kg			
28			42,814	kJ			
29			2,593,771.22	kJ			
30			1,929,765,791.02	kJ			
31			1,929.77	GJ			
32							
33							
34							

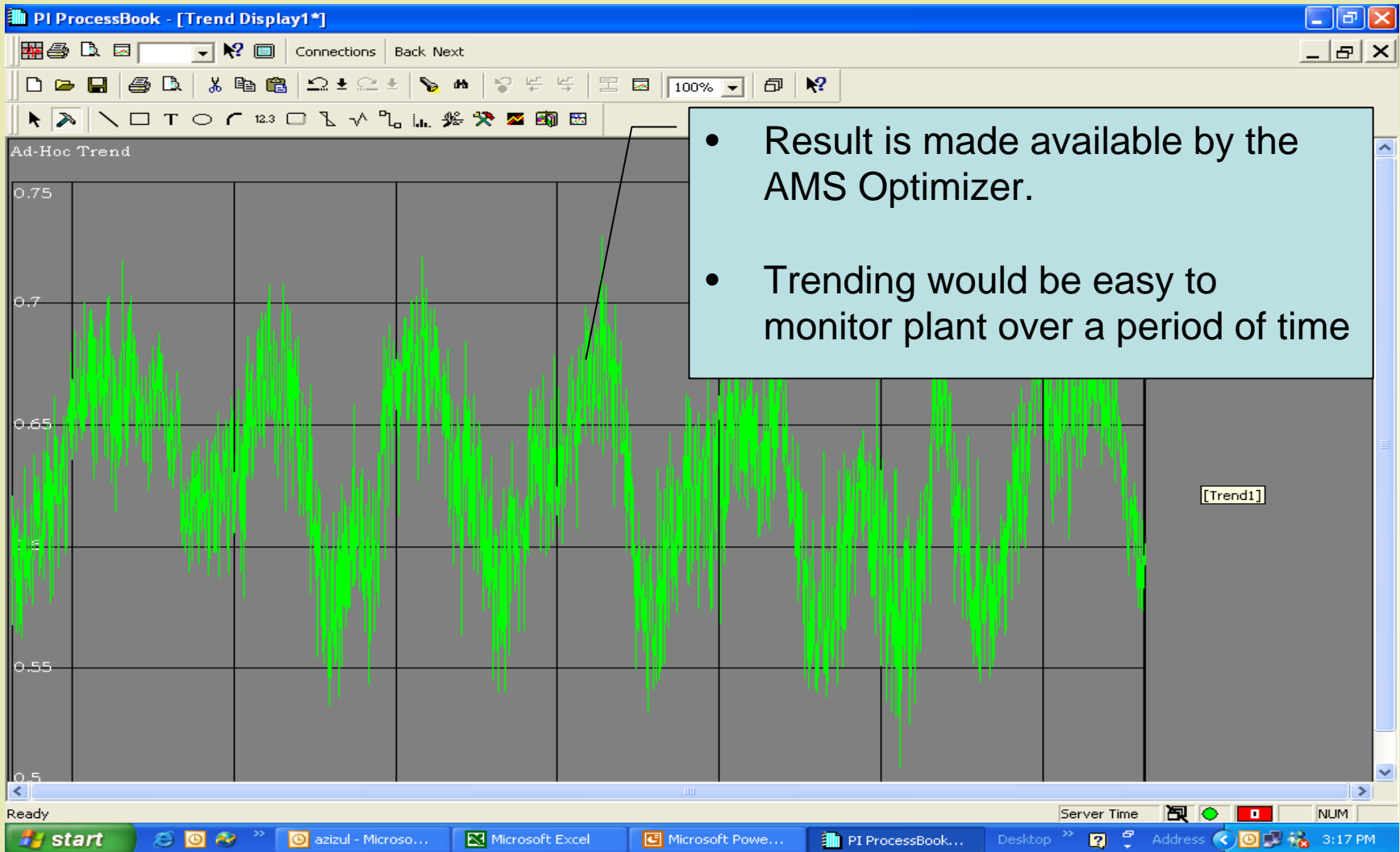
Ready

start 2 Microsoft O... 3 Microsoft E...

Distillate consumption calculation using PI- Datalink

Expensive equipment is not longer require

Plant Condition Monitoring (Condenser Effectiveness)



Coal Performance Tracking

Microsoft Excel - Coal Performance Database.xls

File Edit View Insert Format Tools Data Window PI Help

G11

	A	B	C	D	E	F
1	Main Parameters Related to Coal Performance.			UNIT 1		
2						
3	This analysis was performed for operation between		06-Jul-07 09:00	to	06-Jul-07 17:00	
4	BONTANG 316					
5						
6			Minimum	Maximum	Average	
7	Unit Load	MWn	541.6	667.3	593.6	
8	Total Coal Flow	Ton/hr	207.8	283.4	239.0	
9	No of Mills in service	No.	5	5	5	
10	Average Coal Flow	Ton/hr	41.6	56.7	47.8	
11	Average PA temperature to Mills	degC	165.1	194.3	179.7	
12	Average PC pipe temperatures	degC	58.2	62.0	59.8	
13	Mill Differential Pressure	kpa	2.3	2.9	2.6	
14	Mill Motor Power	kW	411.1	458.7	430.0	
15	Mill Motor Current	Amp	84.6	94.1	88.5	
16	Mill Motor Winding Temp	degC	64.8	68.2	66.7	
17	SH steam pressure	bar	146.0	180.0	159.9	
18	SH steam temperature	degC	528.7	553.9	540.2	
19	RH steam pressure	bar	28.2	34.8	30.9	
20	RH steam temperature	degC	518.6	560.7	538.8	
21	Superheater Spraywater Flow	Ton/hr	0.0	160.5	102.9	
22	Main Steam Pressure Deviation	bar	-5.6	4.4	0.0	
23	LH Gas Air Heater Gas Outlet Temperature	degC	138.8	154.3	147.7	
24	RH Gas Air Heater Gas Outlet Temperature	degC	157.7	164.1	161.1	
25	Mill Loading	kW/Ton	8.1	10.7	8.9	
26	SO2 levels	mg/Nm3	327.1	447.0	392.0	
27	Dust Level	mg/Nm3	3.5	173.0	5.9	
28	Boiler Efficiency	%	87.0	87.8	87.3	
29	Plant Heat Rate	kJ/kWh	9236.4	11129.5	10231.1	
30	Auxiliary Power Consumption	%	7.2	7.9	7.6	
31	NOTE :					
32	Important Plant Parameters	Verdict	Comment/Remarks			
33	1. SH Steam Temperature	NORMAL	OK			
	2. Reheat Steam Temperature.	NORMAL	OK			

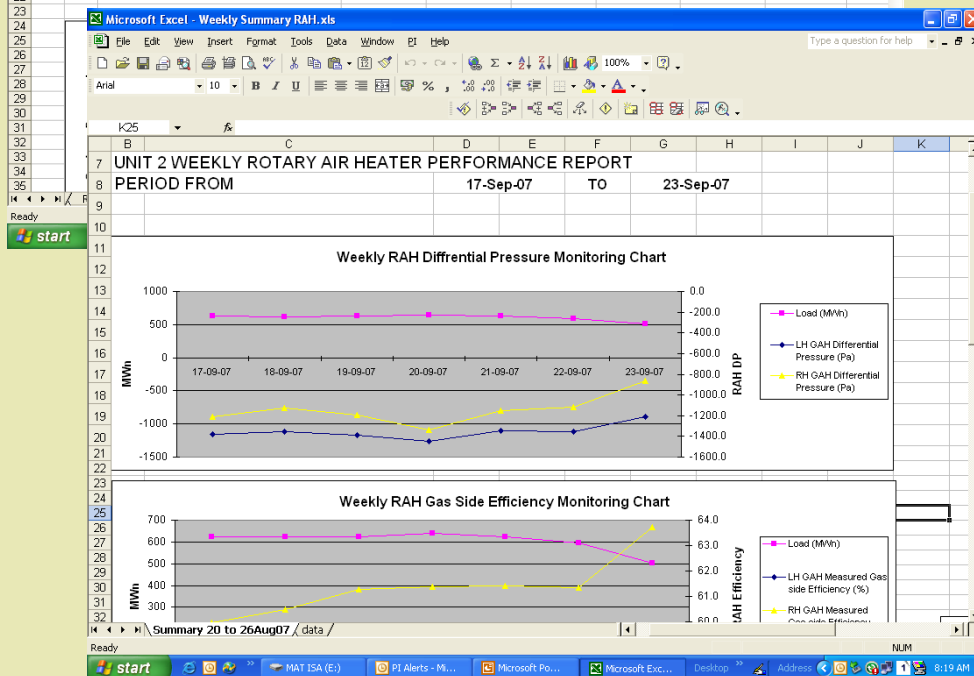
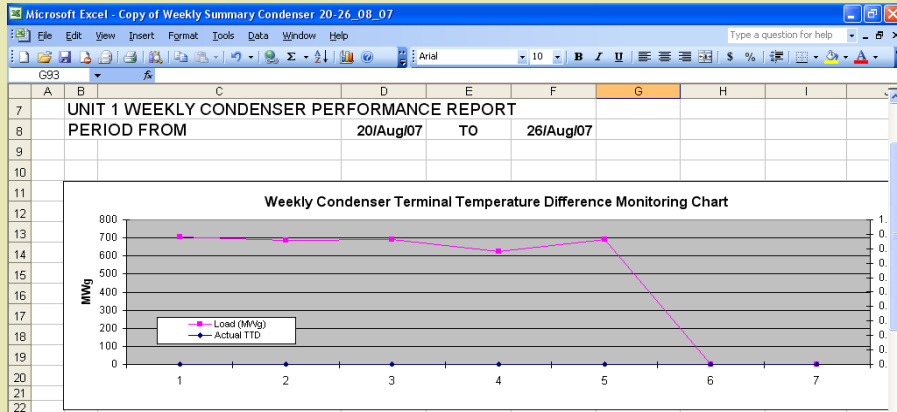
Ready

start Inbo... 2 M... Micro... PI Pr... Tank... Scan... Desktop Address 9:02 AM

This spreadsheet is a summary of tedious data collection task.

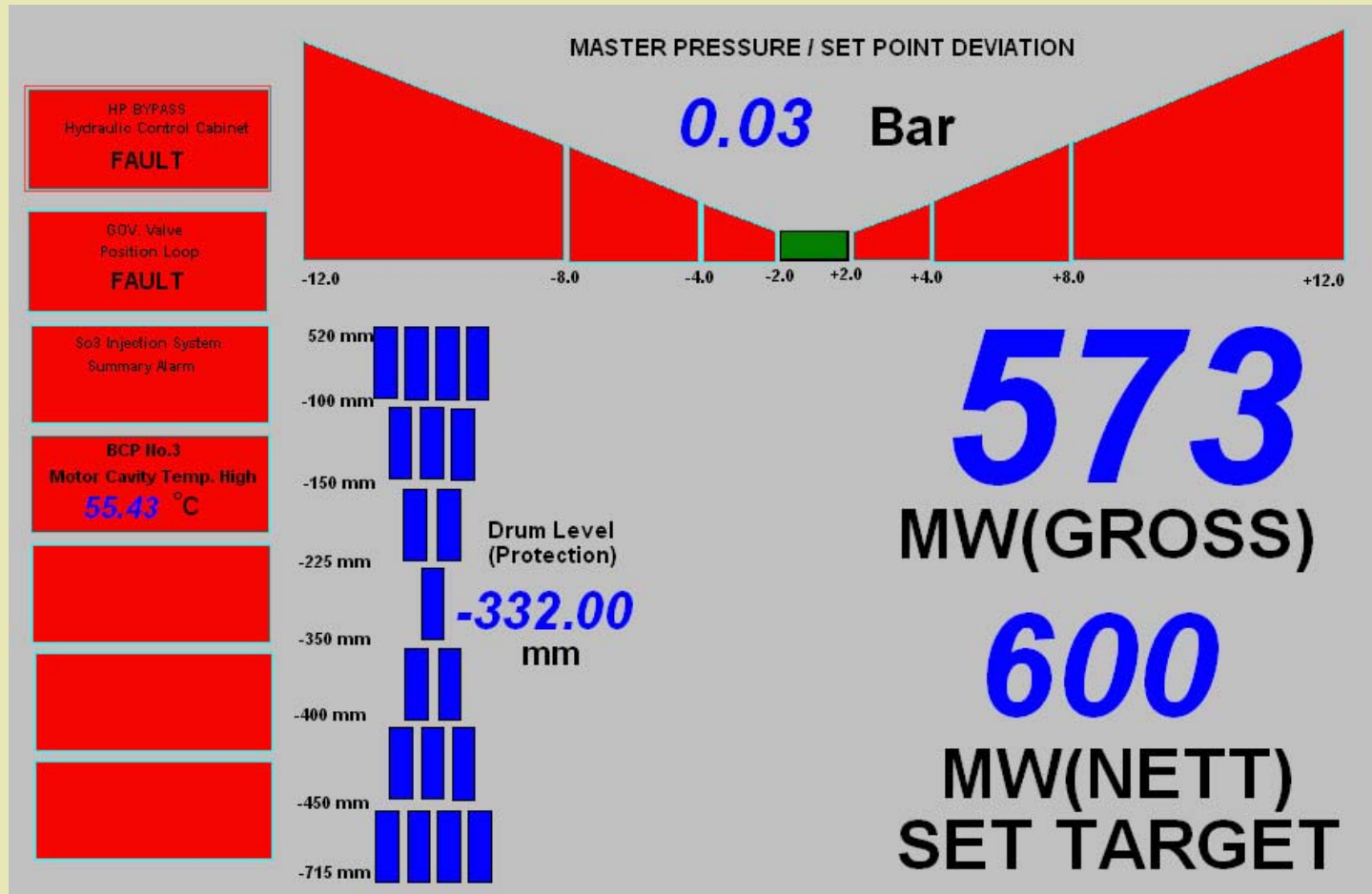
NOW is achievable within few clicks

Weekly Performance Report



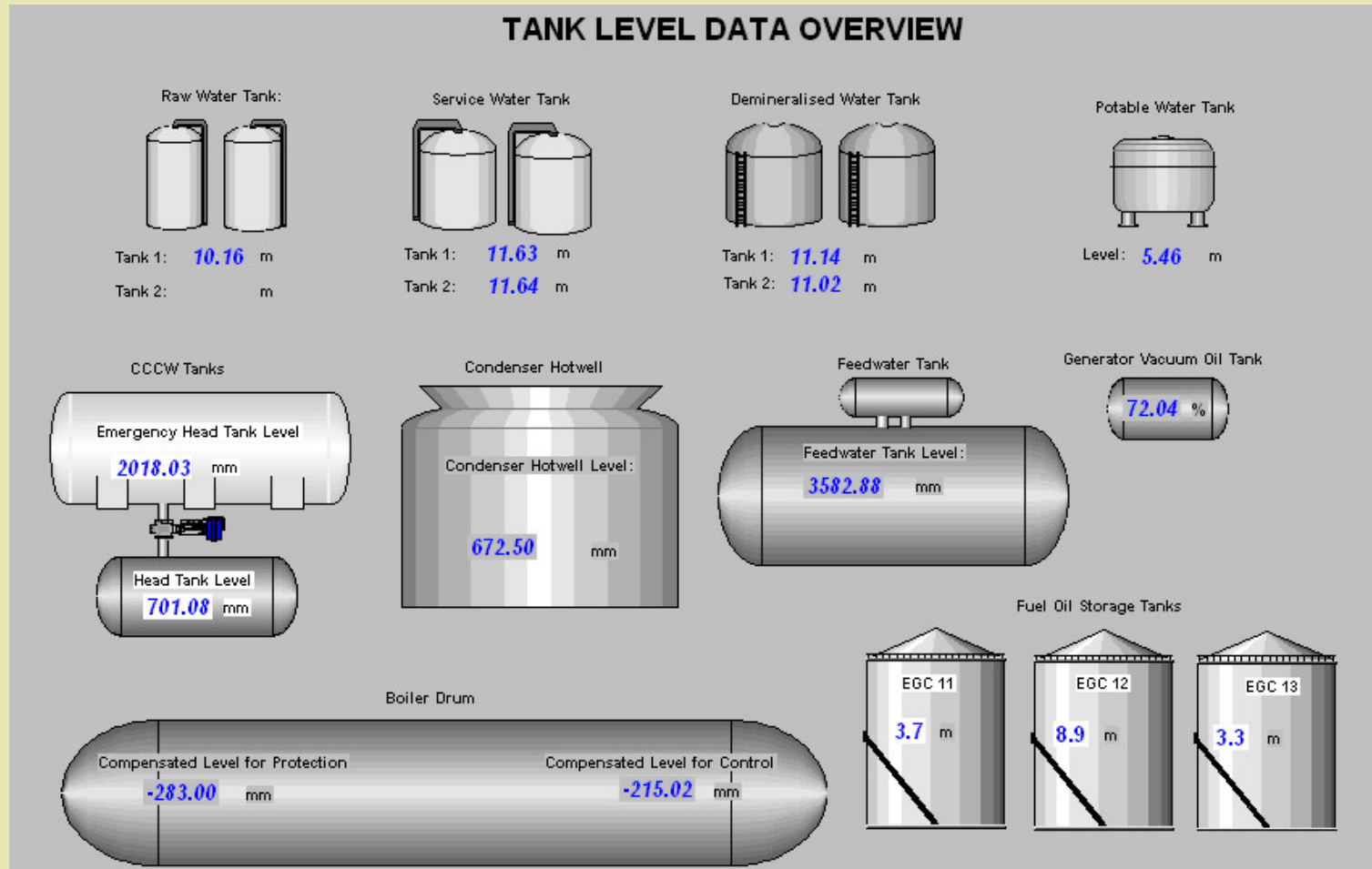
Data extraction is effortless by using PI Datalink in Microsoft Excel Environment.

Customised Plant Information Display



Above display which currently in use was designed by Plant Operator

Customised Plant Information Display



Above display which currently in use was designed by Plant Operator

In Conclusion

- ❑ Remote monitoring which made possible by PI System would enhance plant operation.
- ❑ Plant information is on your desktop readily available for reports and troubleshooting task.
- ❑ The PI System brings all operational data into a single system that can deliver it to users at all levels of the company – from the plant floor to the enterprise level.



**Thank You
For Your Attention**