

Power Plant Automation



YUTECH

YU Technologies Pvt. Ltd.

Registered Office:

315, A1, 22, Manishanagar, Off Sahyadrinagar,
Sangli – 416 416, Maharashtra, India.

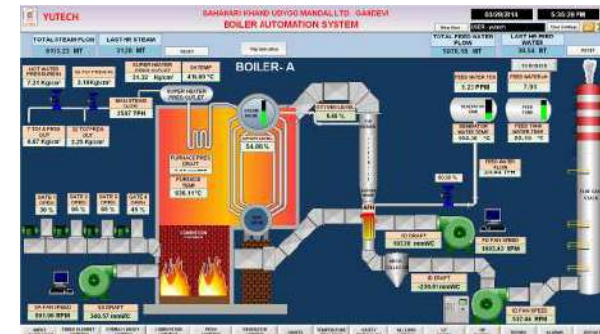
HO & Works:

B 8/5, MIDC, Miraj, 416 410, Distt: Sangli,
Maharashtra, India.

T: + 91 233 6451803 – 6; F: +91 233 2644042

E: info@yutech.in

W: www.yutech.in



Servicing the Sugar Industry since 1978

Agenda



- Need for Automation
- Automation Approach
- Automation Examples
- Why choose **YUTECH**
- Case Study and Value Analysis
- Concluding Remarks

Need for Automation



Energy savings by improved throughput, gain in performance and efficiency



Achieve the minimum cost of operations by streamlining operations and increasing Throughput



Save costs and money by optimising the resources like Steam, Fuel, Power and water.

Advantages of **YUTECH** Design

Boiler Automation and Load Balancing System:



- YUTECH Load Balancing Algorithm facilitates Continuous Maintained Steam Generation and Uniform Steam Flow.
- YUTECH Draft Fan Speed Algorithm facilitates Excellent Combustion Conditions hence Increased Efficiency thus Optimum Boiler Capacity Utilization and Reduced Carbon Footprint.
- Increased Steam to Fuel Ratio hence Fuel Saving.
- Reduced Thermal Shocks hence Longer Life Expectancy.

Loops of Boiler Automation



- De Aerator Level and Pressure Control.
- Three Element Control with Drum Pressure Compensation.
- Combustion Control.
- Load Balancing of two or more Boilers.
- Soot Blower Controls.
- Attemperator Control.
- Fuel and Ash Handling Control.
- Cooling Tower Control.
- DM Plant Control.
- Hotwell Control.
- Steam and Water Analytical System (SWAS)
- Continuous Blowdown (CBD) Level Control
- Intermediate Blowdown (IBD) Level Control

Most Important and Essential Feature:



Load Balancing of Two or more Boilers

It is often seen that in spite of having high end DCS / PAC / PLC Controls, the load balancing of multiple Boilers is always an issue and so is Combustion Control. This leads to several stresses and losses in Steam Generation including excess Fuel Consumption.

YUTECH's Most Important and Essential Features:



Draft Fan Speed Algorithm:

YUTECH has developed an Algorithm to set optimum speeds for the given Load Condition to ensure the best Combustion Condition.

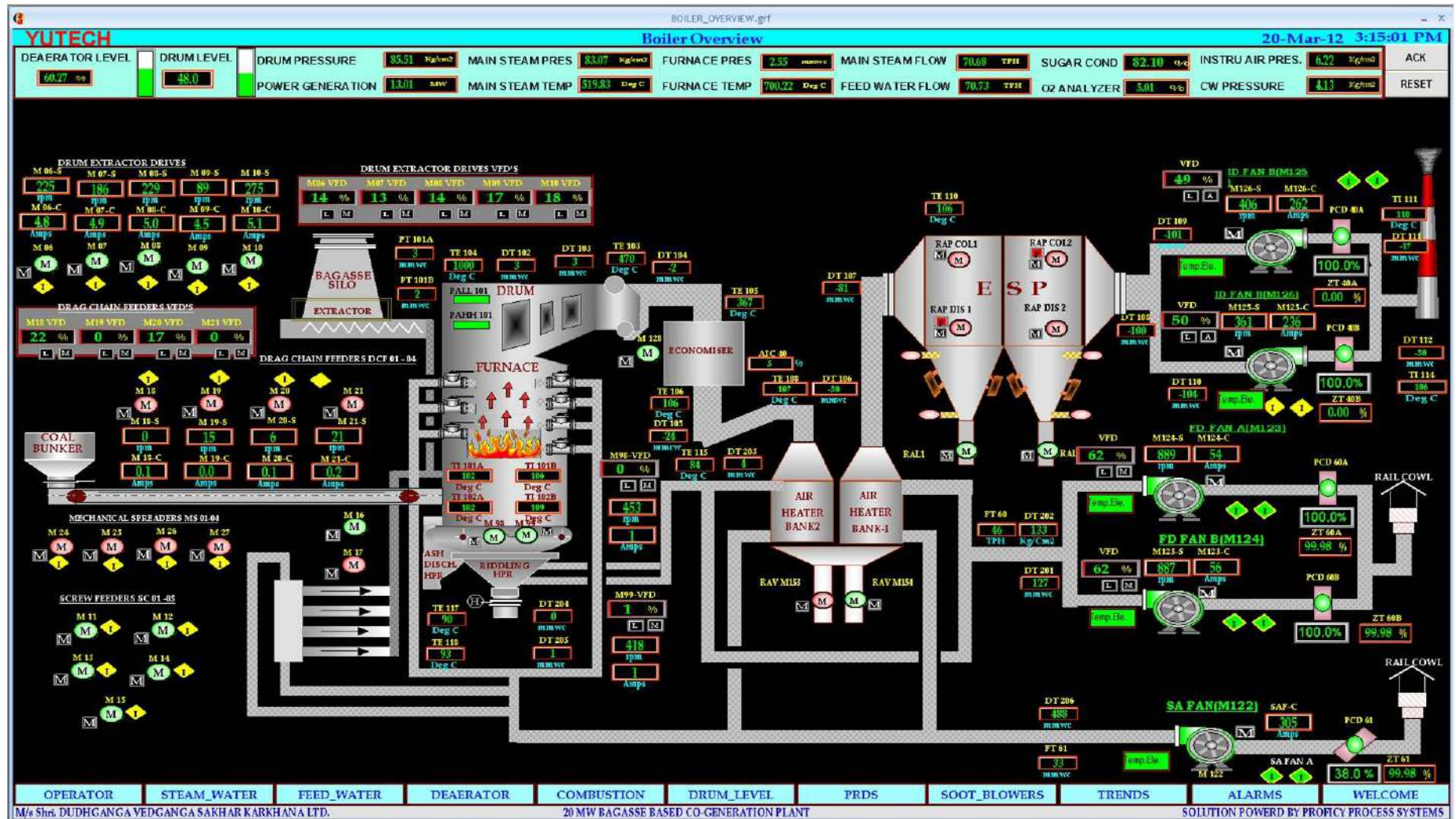
Boiler Load Balancing Algorithm of Two or more Boilers:

YUTECH has also developed a Special Totally Dedicated Algorithm for Load Balancing of Two or more Boilers.

Result:

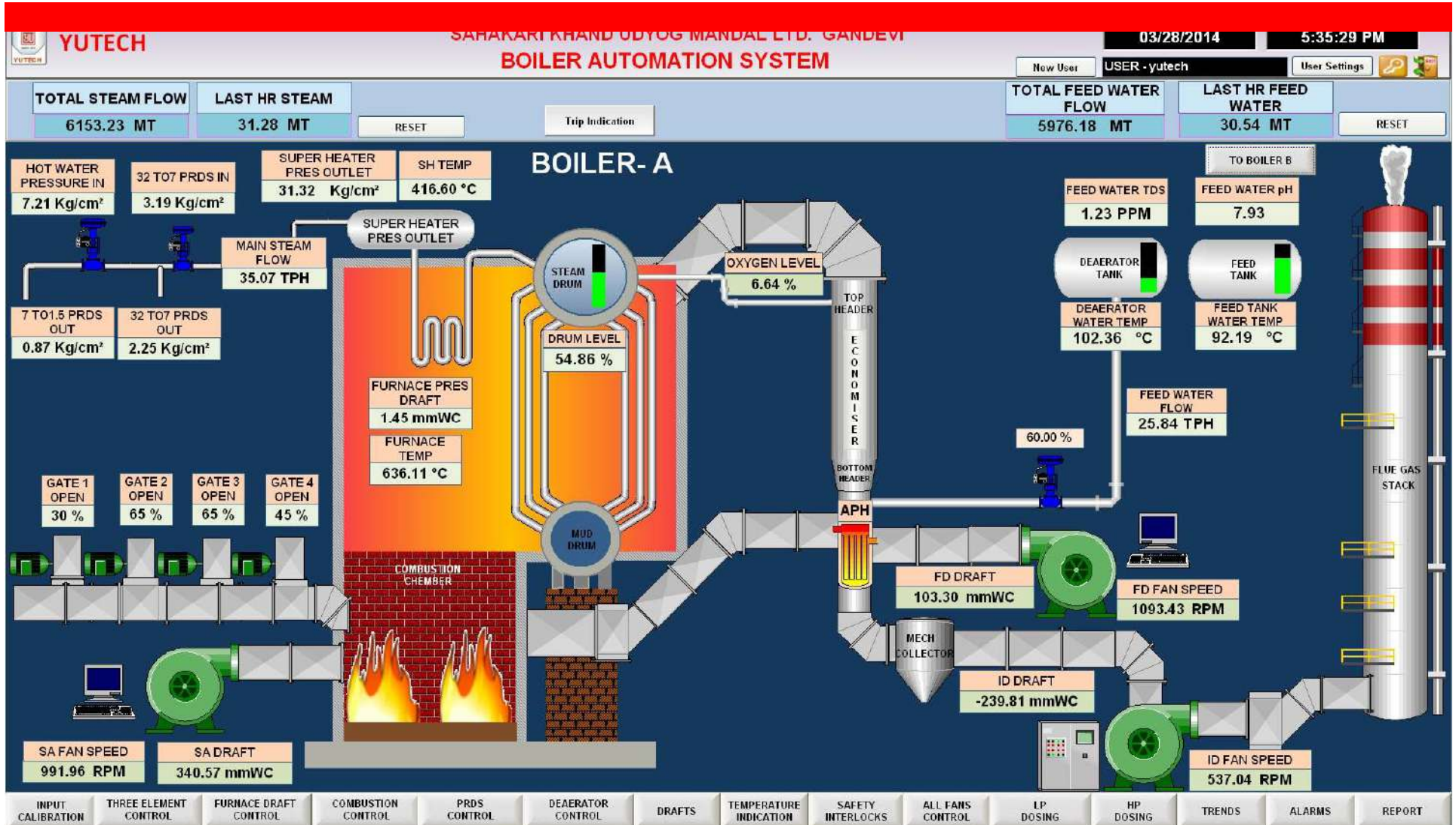
- Optimum Combustion Saves Fuel and improves Carbon Footprint by way of reducing CO while reducing Excess Air to the Furnace thus also saving Power for Draft Fans.
- All Boilers run at exactly the same desired loads and Steam Pressures of each Boiler are always within 0.05 Bar of each other.

Screen Shot Overall Boiler

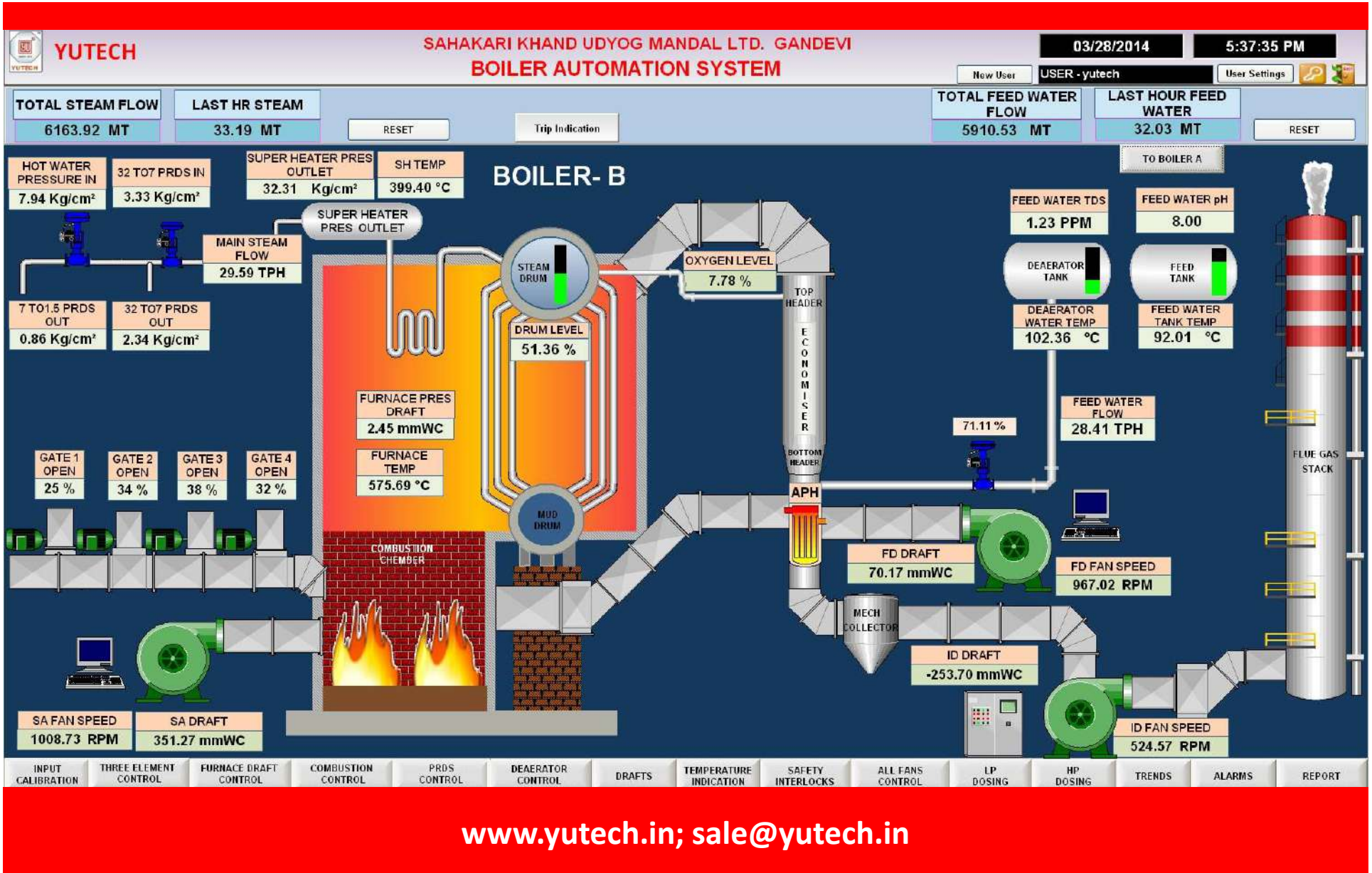


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Screen Shot Overall Boiler





Screen Shot Overall Boiler



Screen Shot Boiler Load Balancing

LOAD VIEW

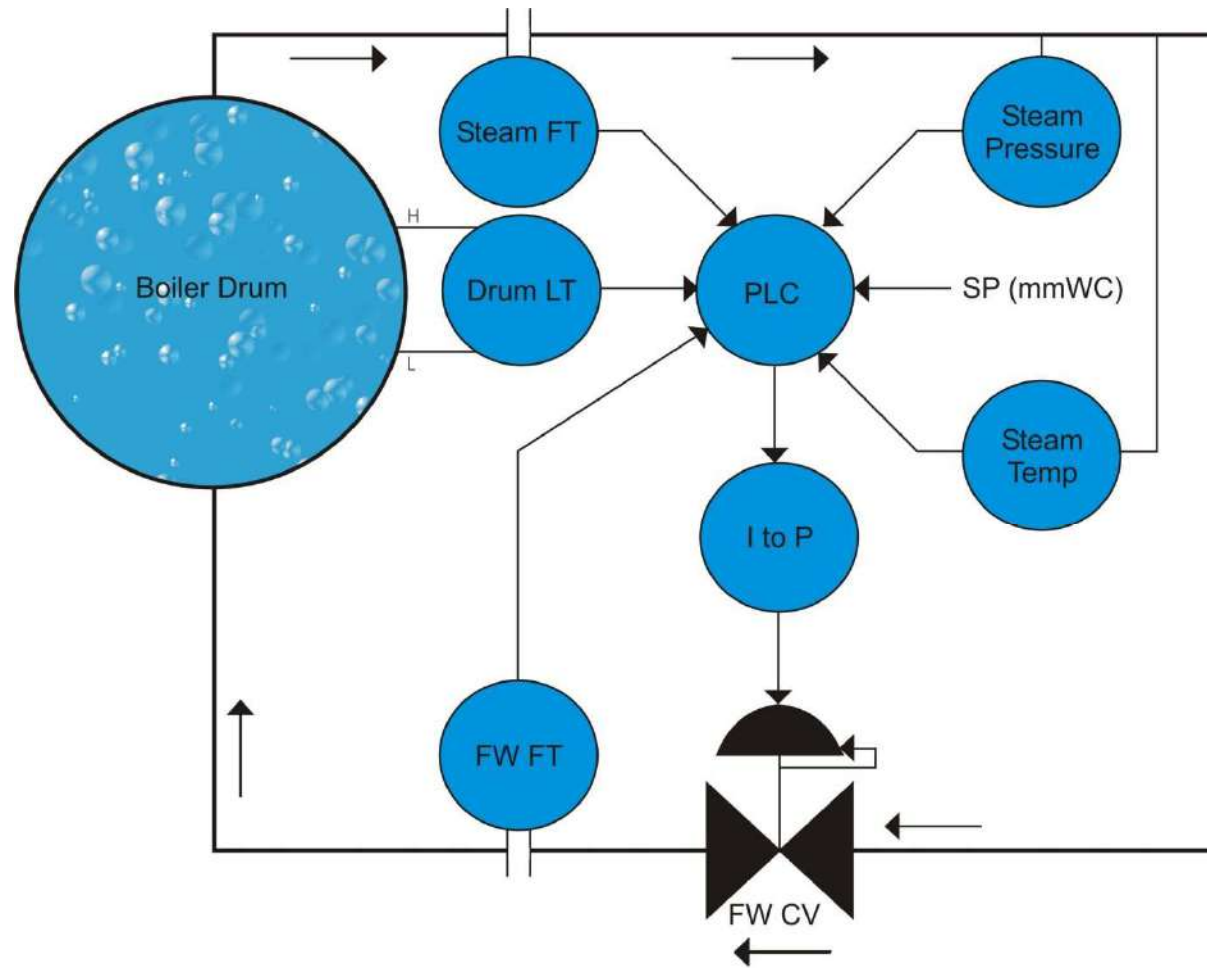
LOAD VIEW

BOILER A LOAD 		BOILER B LOAD 	
MAIN STEAM FLOW	STEAM HD PRES	MAIN STEAM FLOW	STEAM HD PRES
33.56 TPH	31.89 Kg/cm ²	33.46 TPH	31.91 Kg/cm ²
STEAM HEADER SET POINT	32.00	STEAM HEADER SET POINT	32.00

COMBINED BOILER LOAD	67.03	Tones
DIFFERENCE IN MS FLOW (LOAD)	0.10	Tones
DIFFERENCE HEADER PRESSURE	0.02	kg/cm ²

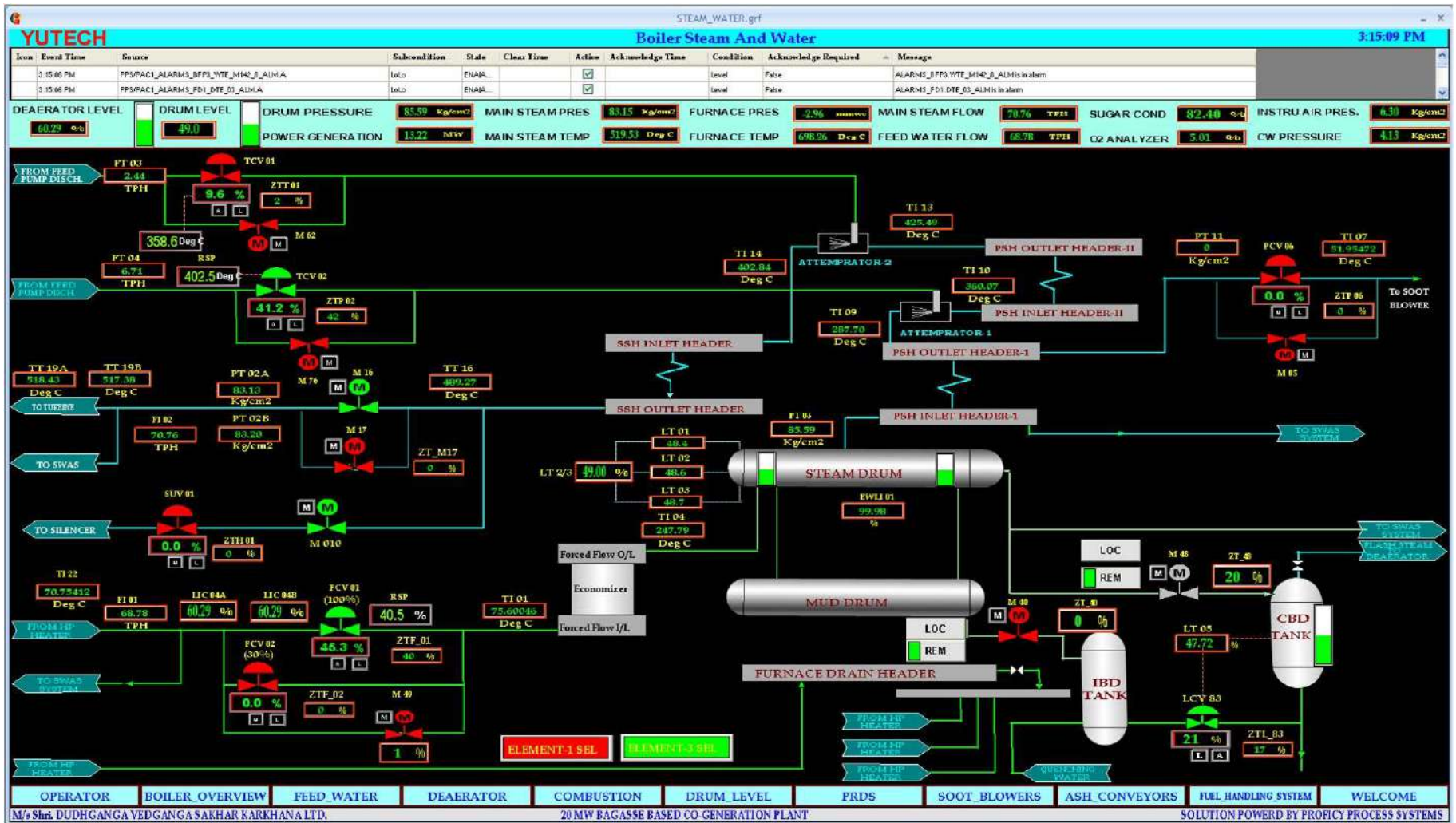
CLOSE

3 Element Control



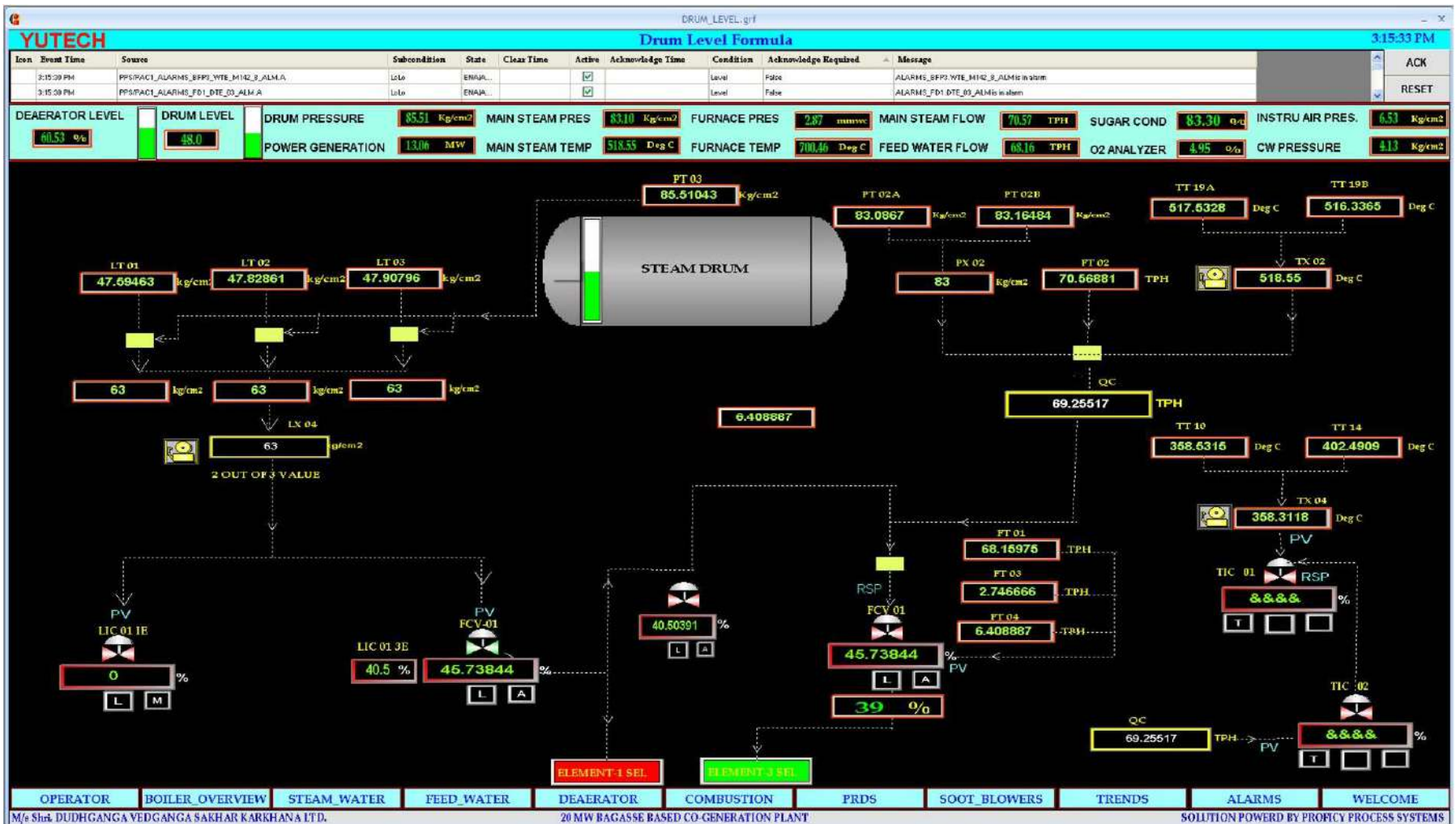
Advanced Three Element Control

Screen Shot Boiler Steam and Water Controls



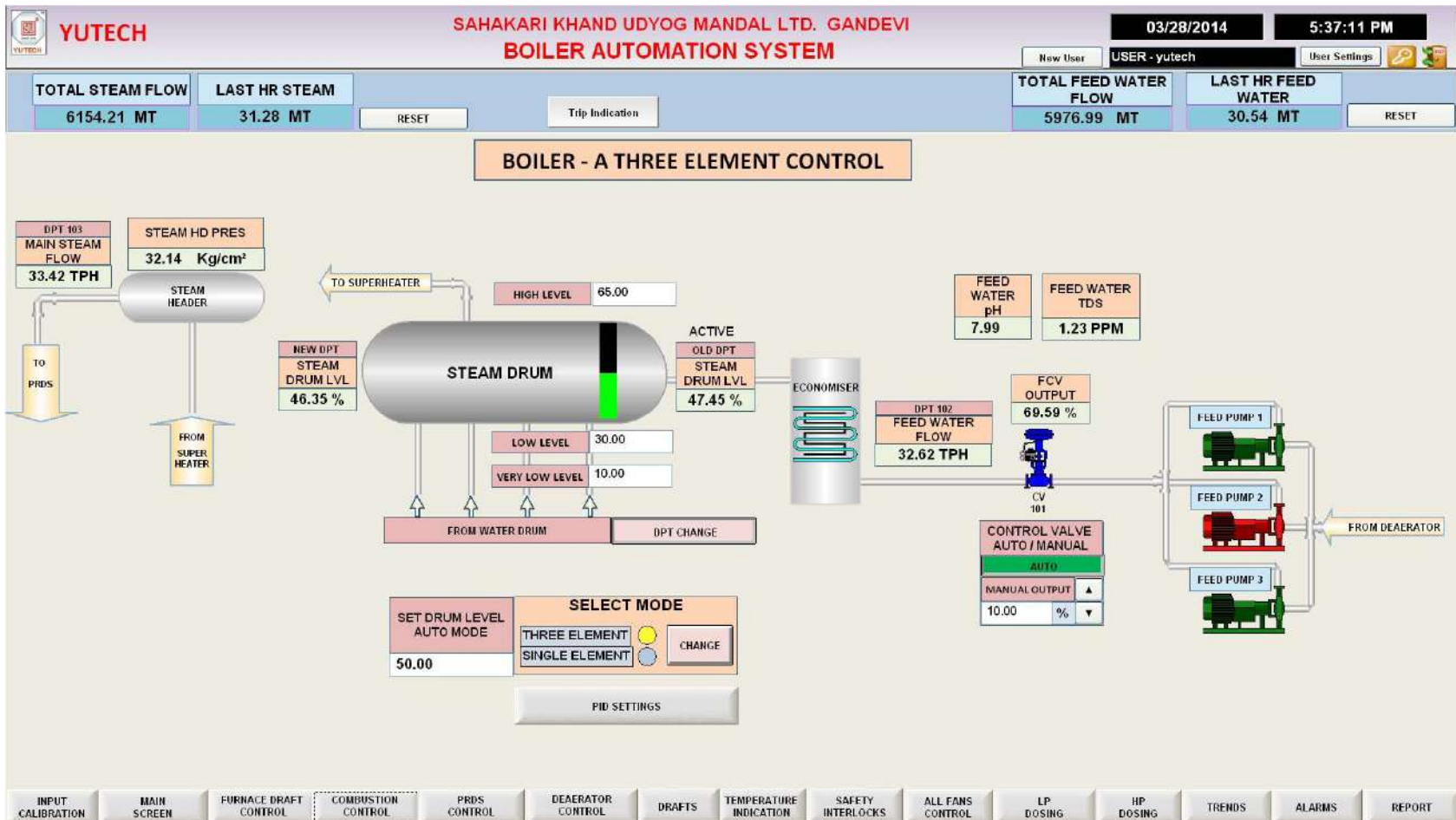
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Screen Shot of 3 Element Controls

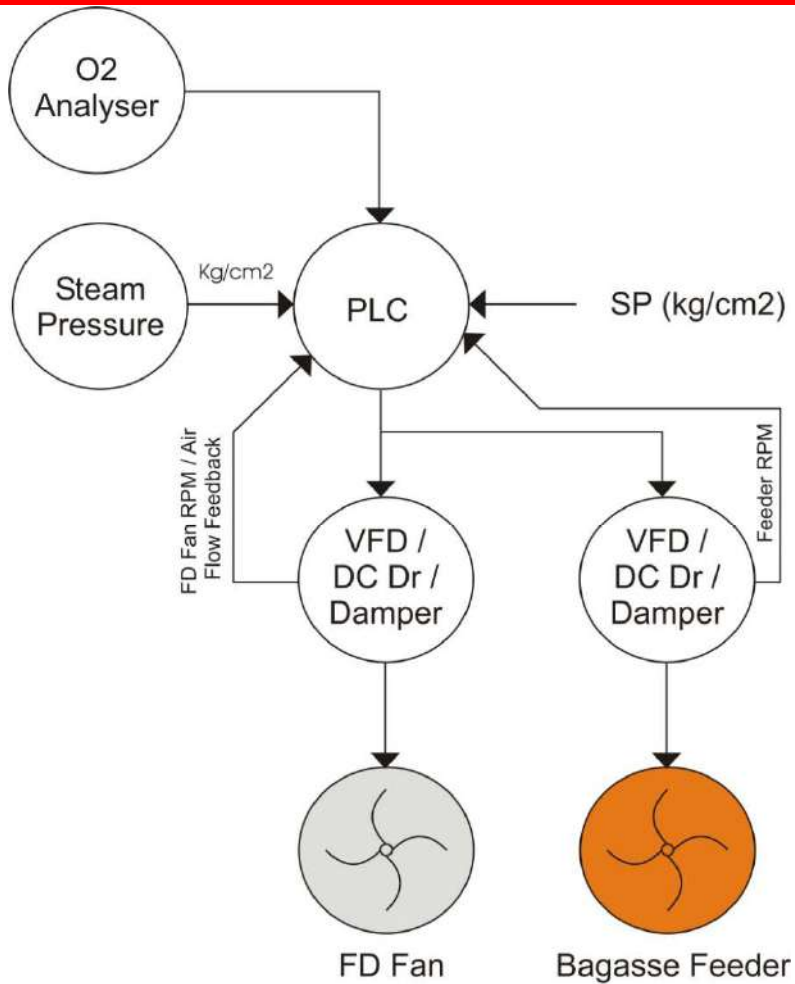


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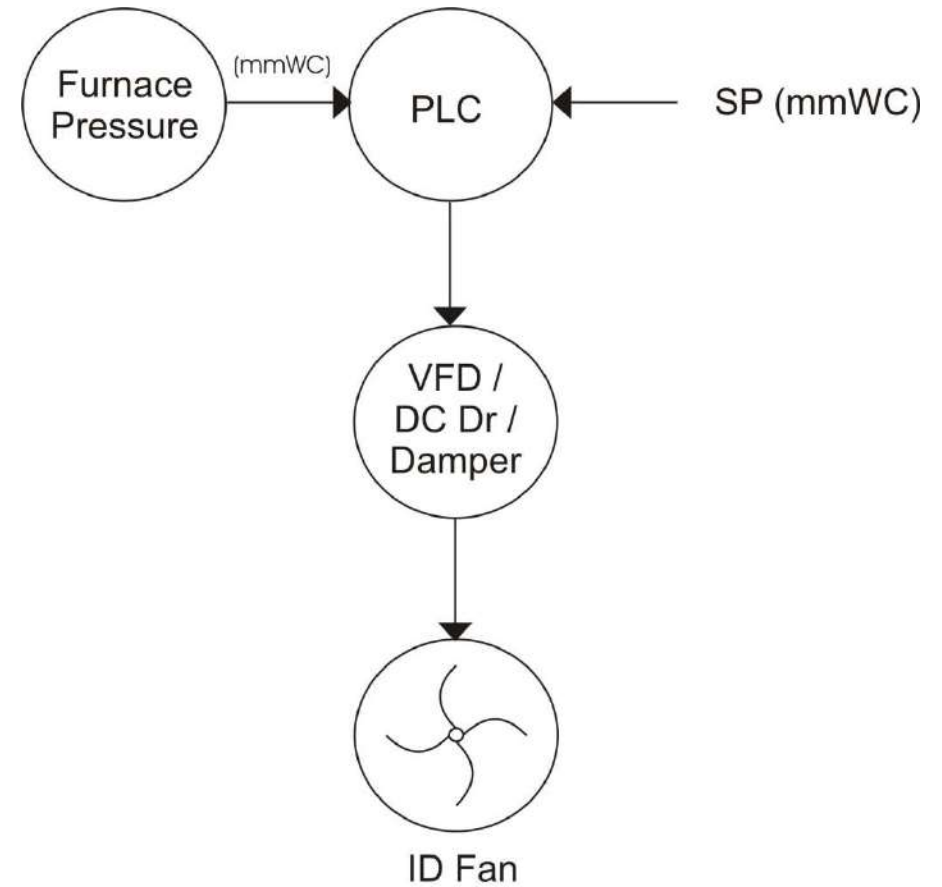
Screen Shot of 3 Element Controls



Combustion Controls



Advanced Combustion Control Loop



ID Fan Control Loop

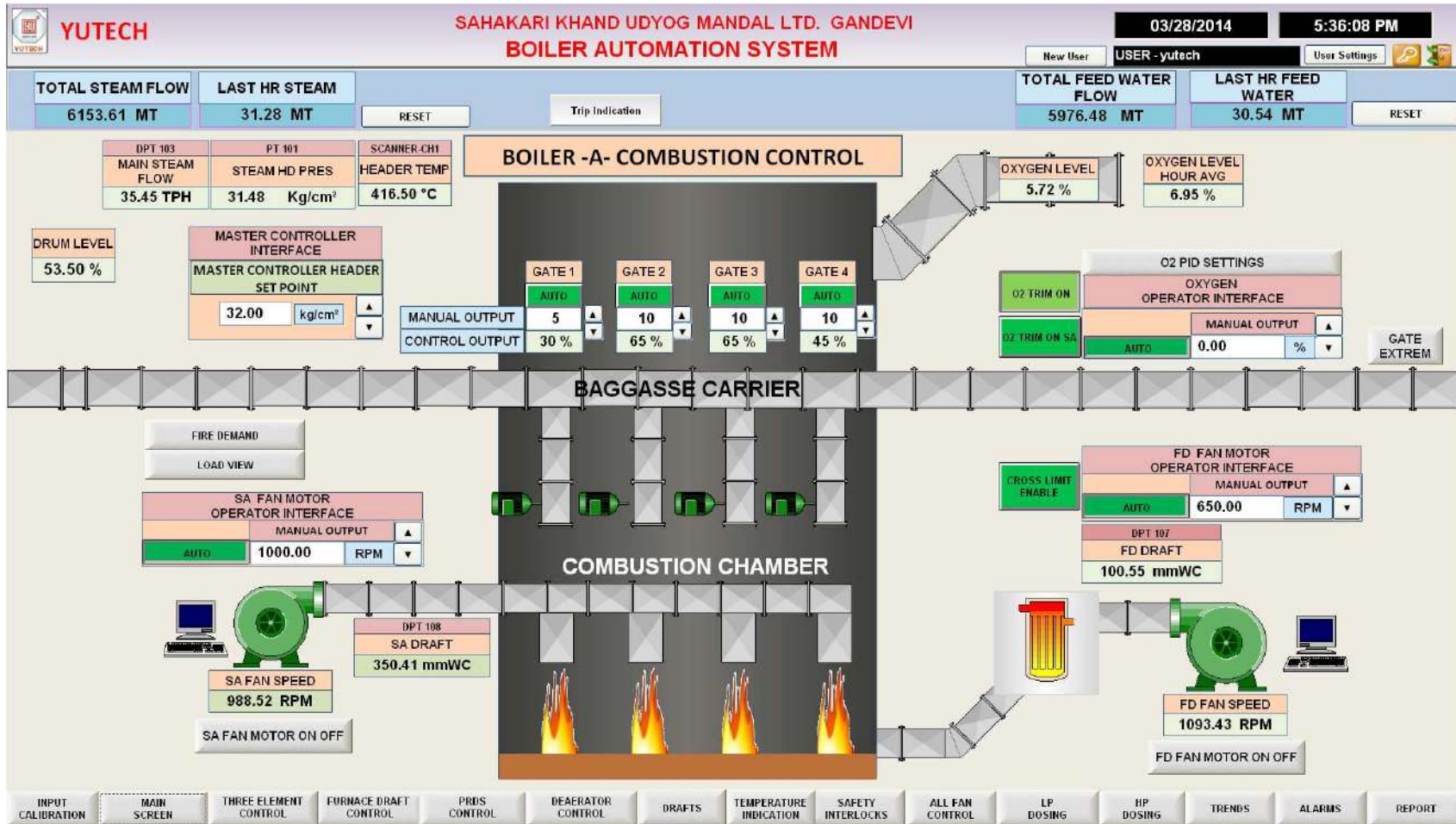
Screen Shot Combustion Controls



YUTECH having developed the Combustion Control Loop with Draft Fan Speed Algorithm take Great Pride in claiming huge Fuel Savings:

- **All fuel Gates, Rotary Feeders, Hoppers are controlled in Fully Automatic Mode with Position or RPM Feedback.**
- **All Draft Fans are controlled in Fully Automatic Mode with Variable Speed Drives.**
- **YUTECH Draft Fan Speed Algorithm sets all the Fans at Exact Speeds to create the best suited Combustion Environment.**
- **Combustion Control gets its Command from the Boiler Load to maintain Set Load.**
- **If Two or more Boilers have a common SH Steam Header then YUTECH Load Balancing System maintains Steam Pressures of all the Boilers within 0.05 Bar of each other.**

Screen Shot Combustion Controls



Screen Shot Combustion Controls



YUTECH

SAHAKARI KHAND UDYOG MANDAL LTD. GANDEVI

BOILER AUTOMATION SYSTEM

03/17/2014
7:12:44 PM

New User
USER - yutech
User Settings

TOTAL STEAM FLOW
1251.13 MT

LAST HR STEAM
0.00 MT

TOTAL FEED WATER FLOW
1235.25 MT

LAST HR FEED WATER
0.00 MT

BOILER - A FURNACE DRAFT CONTROL

DPT 101
FURNACE PRES DRAFT
5.44 mmWC

FURNACE TEMP
84.03 °C

COMBUSTION CHAMBER

FURNACE DRAFT PID OPERAOTR INTERFACE	
FURNACE DRAFT	AUTO
SET POINT	MANUAL SPEED ▲
0.00	500 RPM ▼

FROM MECH COLLECT

DPT 109
ID DRAFT
-134.26 mmWC

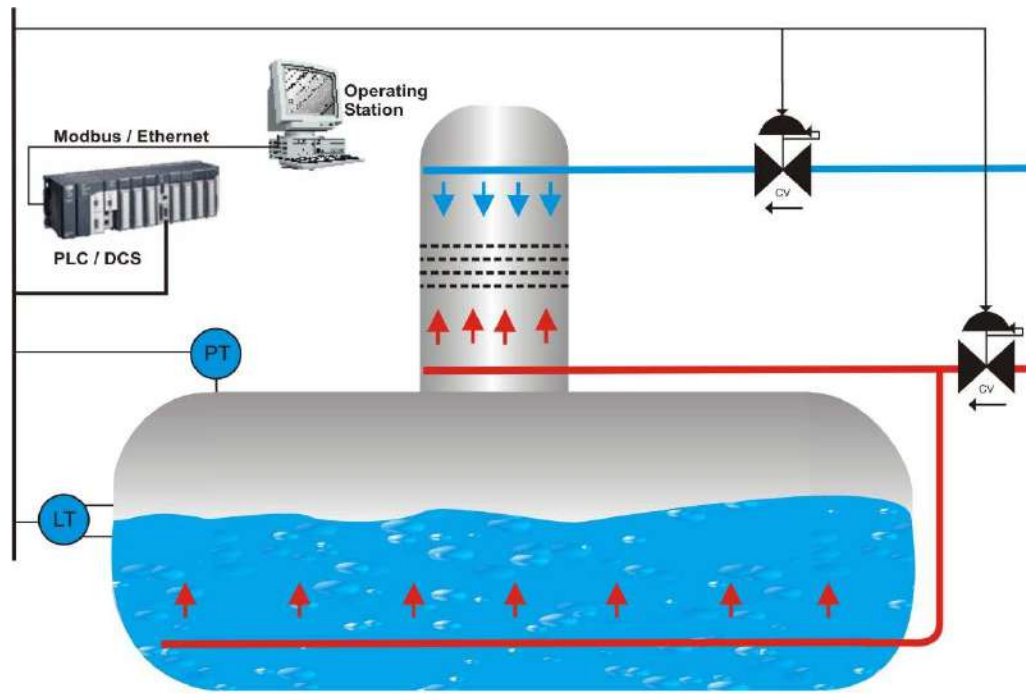
ID FAN SPEED
223.16 RPM

FLUE GAS STACK

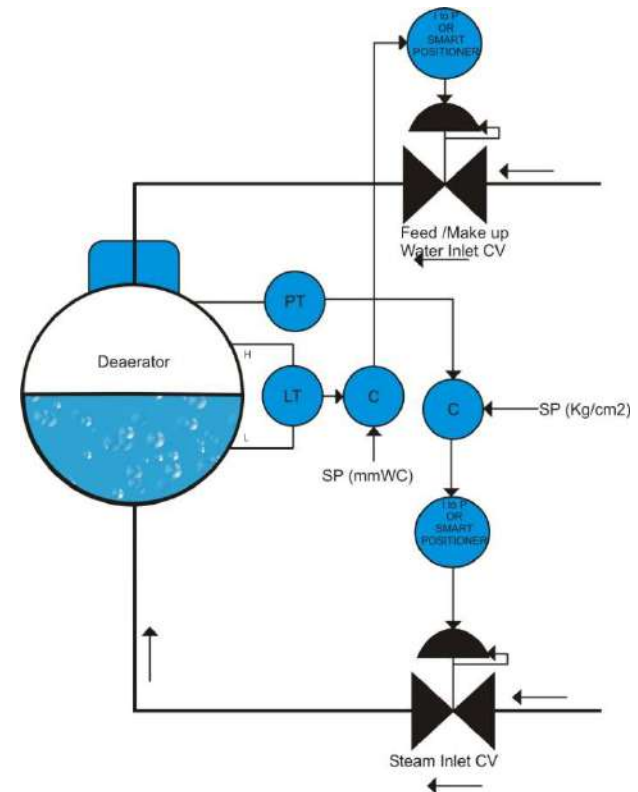
INPUT CALIBRATION	MAIN SCREEN	THREE ELEMENT CONTROL	COMBUSTION CONTROL	PRDS CONTROL	DEAERATOR CONTROL	DRAFTS	TEMPERATURE INDICATION	SAFETY INTERLOCKS	ALL FANS CONTROL	LP DOSING	HP DOSING	TRENDS	ALARMS	REPORT
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De Aerator Overall Schematic and Line Diagram

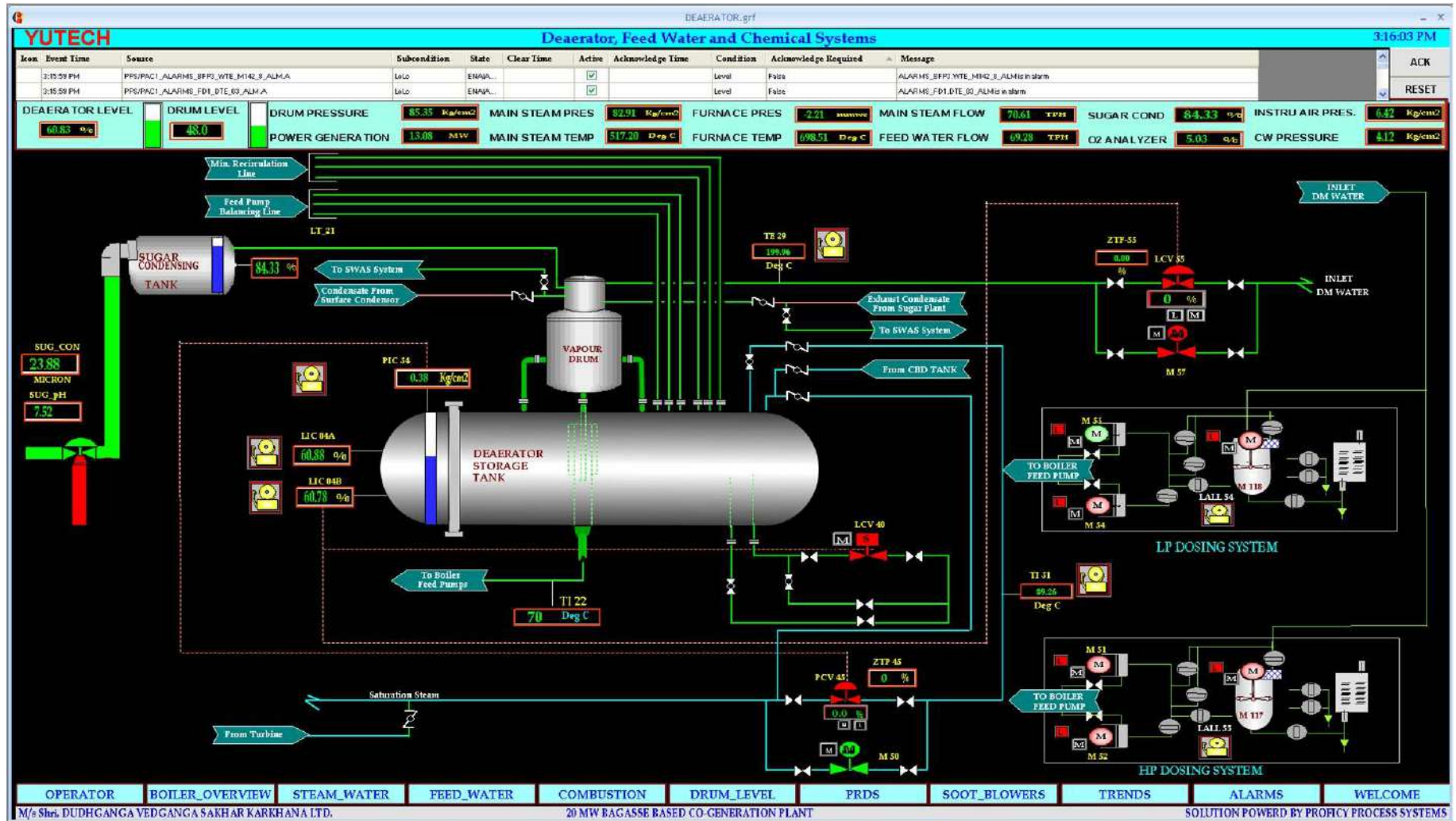


Deaerator Pressure and Level Control

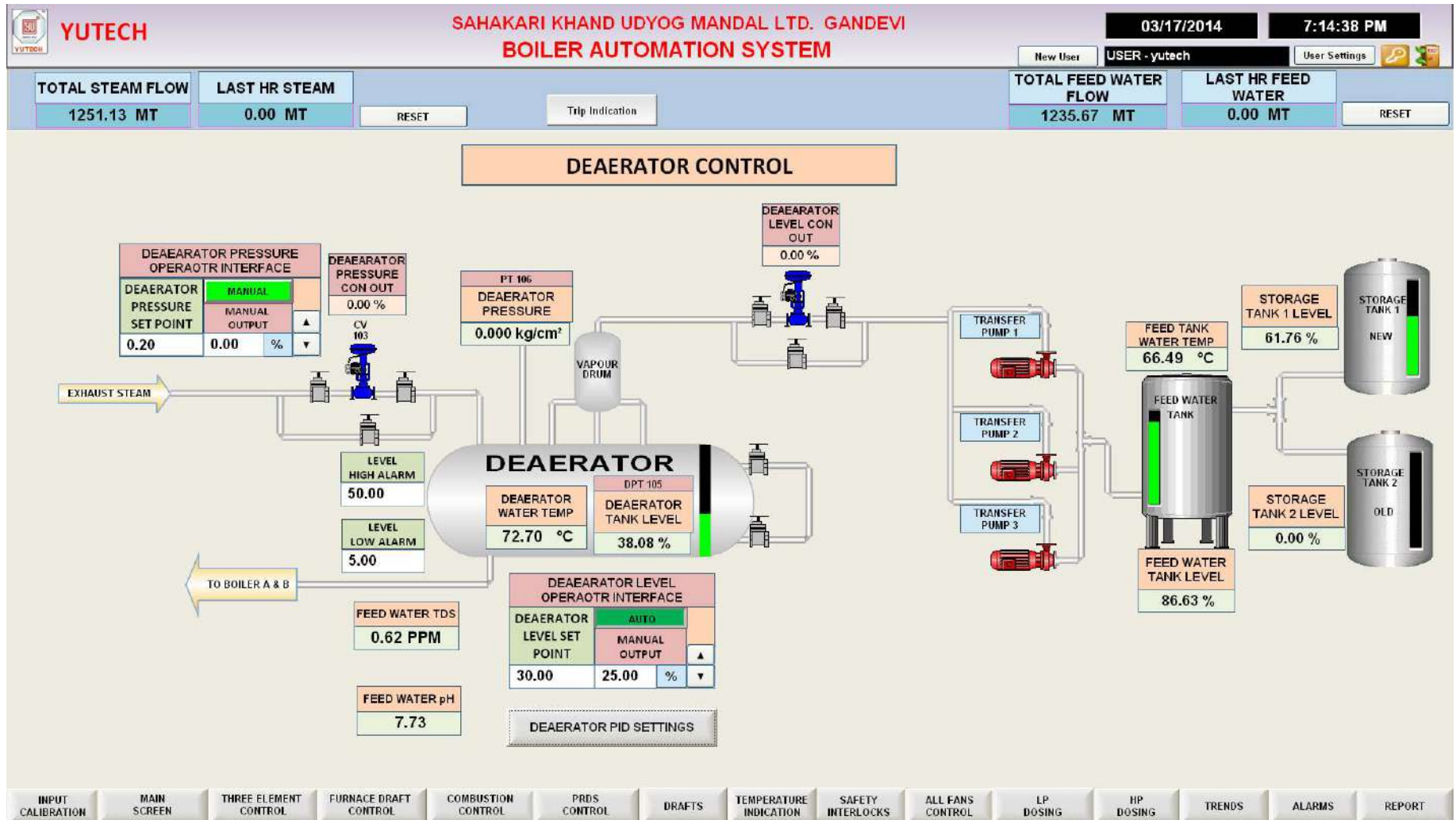


Boiler Deaerator Control

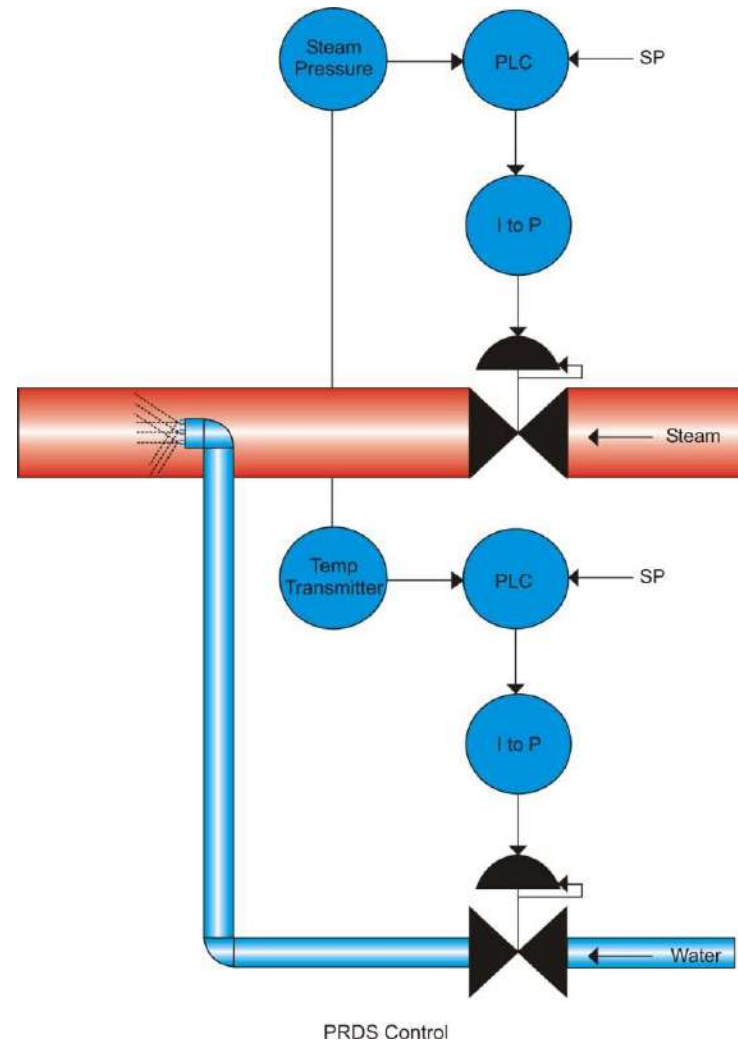
Screen Shot De Aerator Controls



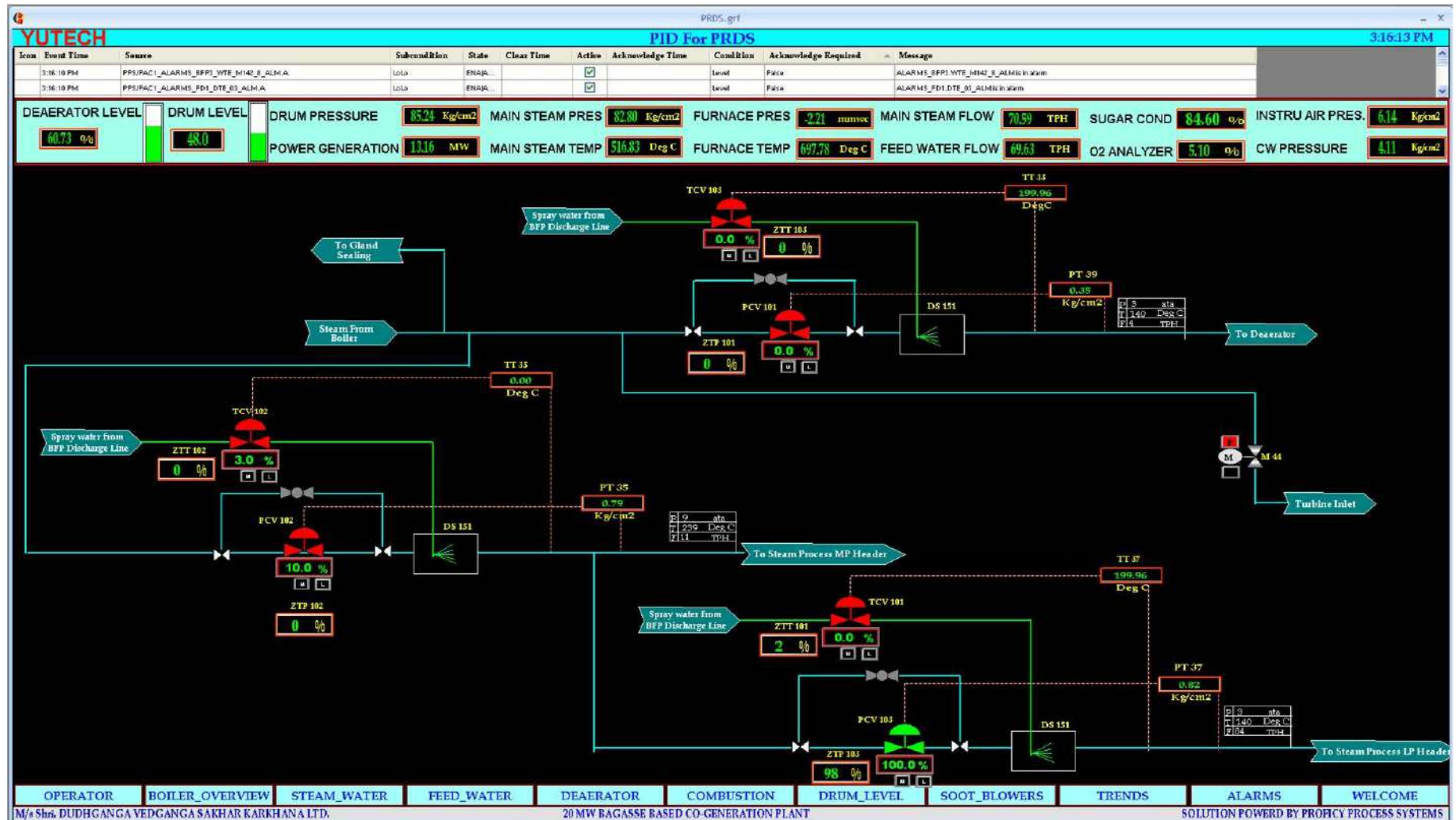
Screen Shot De Aerator Controls



Pressure Reducing and De-Superheating Station (PRDS)

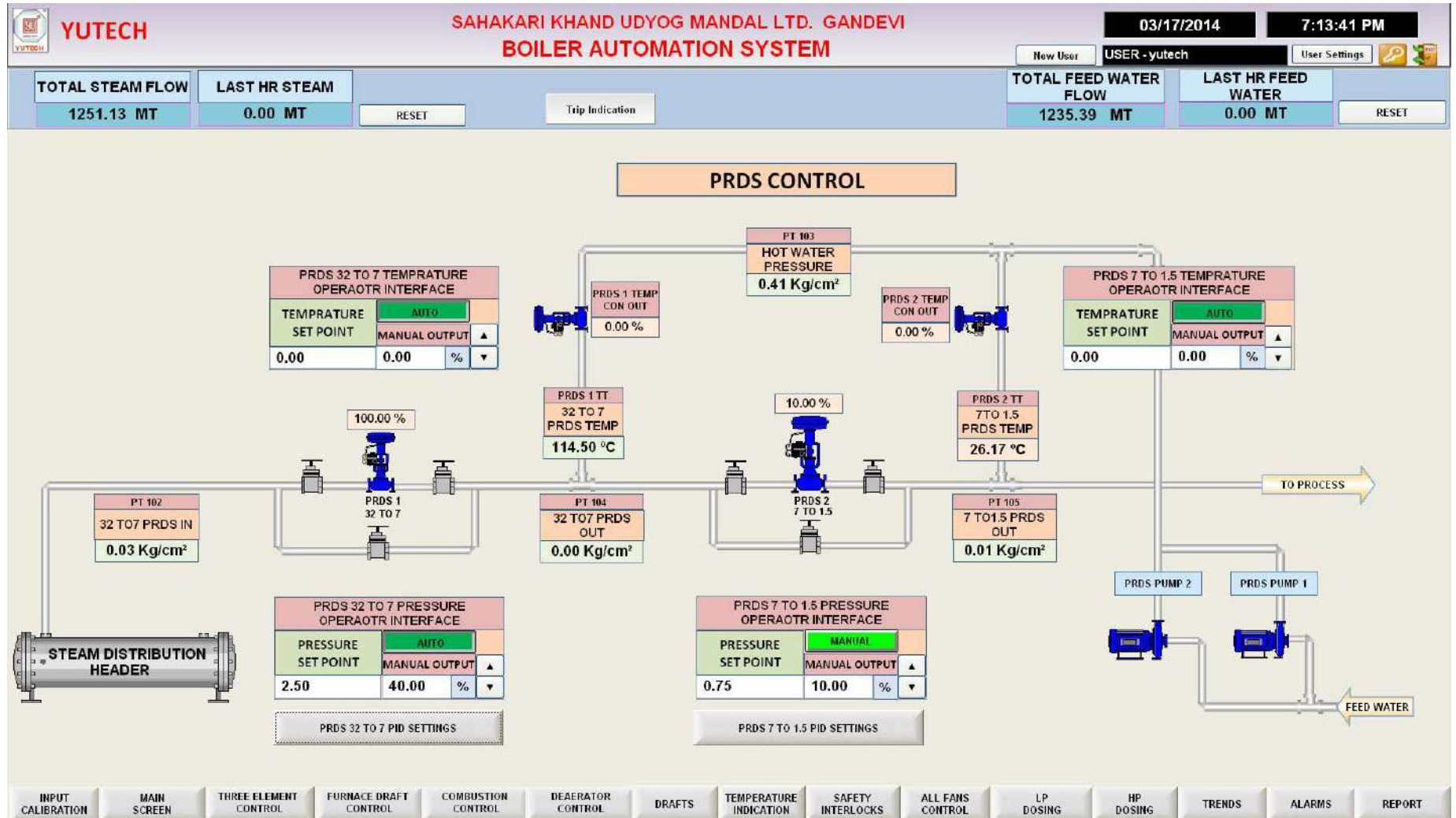


Screen Shot of PRDS



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Screen Shot of PRDS



Field Instruments Installation



Impulse Tubing
and Condensing
Pots for Drum
Level Sensing



DPT for Drum
Level Sensing



Control Valve



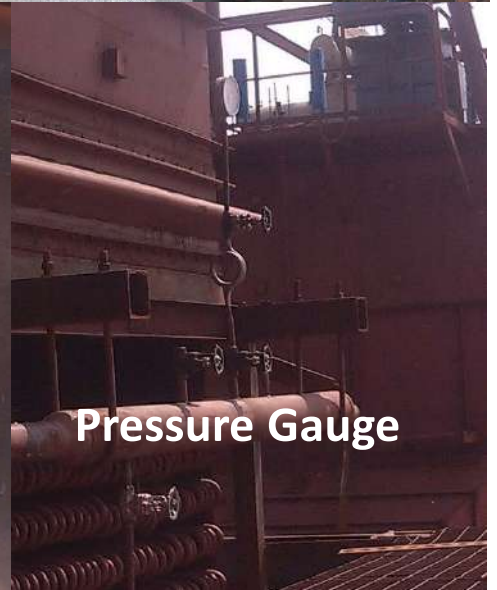
Cable Routing



DPT for Flow
Sensing



Tubing for Draft
Gauges



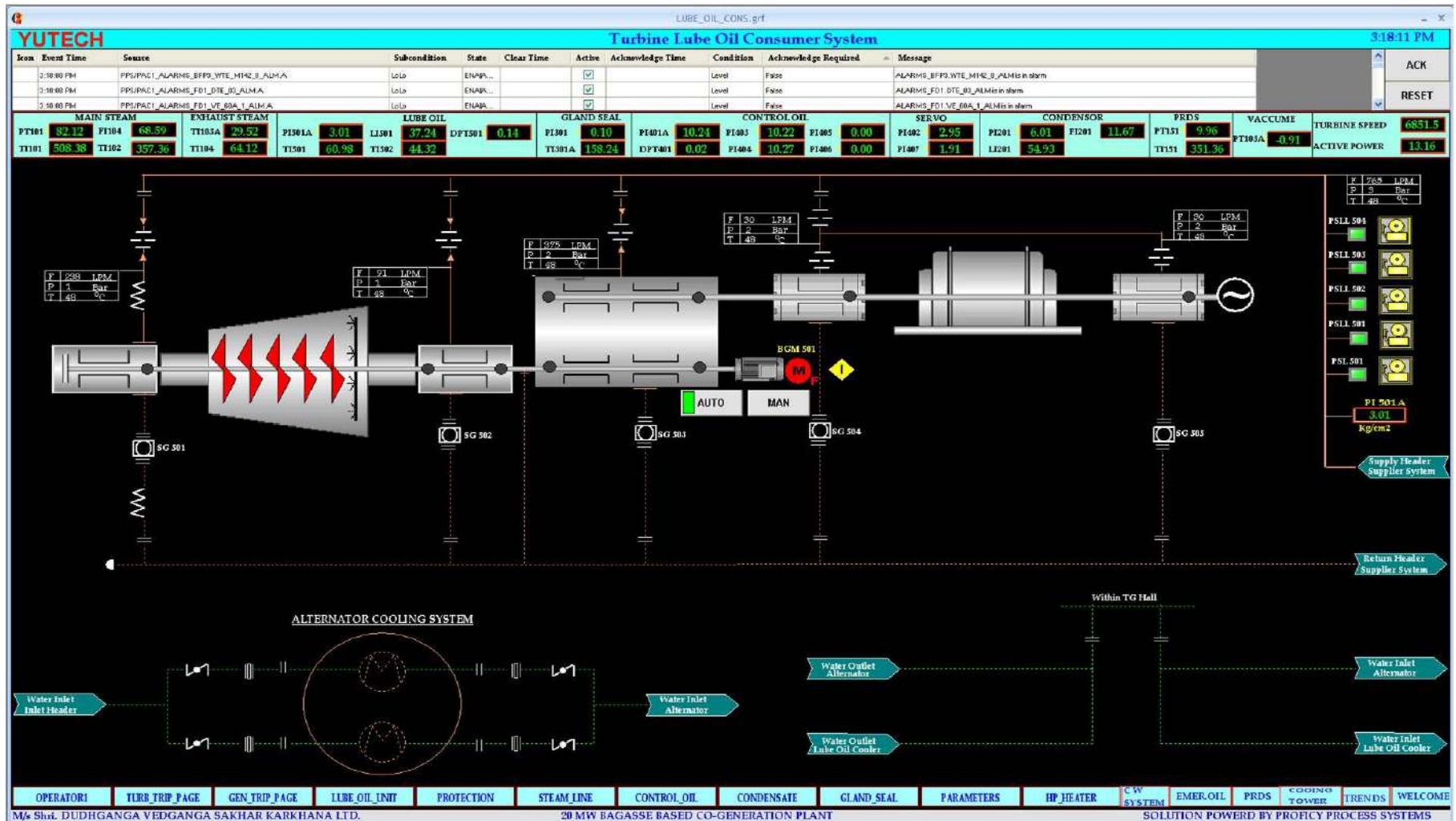
Pressure Gauge

CoGen Power Plant and Field Instruments Installation



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Screen Shot Turbine Protection System



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Screen Shot Turbine Governor Parameters



PARAMETERS.grf

YUTECH Governor Controlling Parameters

Icon	Event Time	Source	Subcondition	State	Clear Time	Active	Acknowledge Time	Condition	Acknowledge Required	Message	ACK
	3:10:53 PM	PPSPAC1_ALARMS_BFP1_WTE_M142_8_ALM.A	Lite	ENAJA...		<input checked="" type="checkbox"/>		Level	False	ALARMS_BFP1_WTE_M142_8_ALM is in alarm	
	3:10:53 PM	PPSPAC1_ALARMS_FD1_DTE_03_ALM.A	Lite	ENAJA...		<input checked="" type="checkbox"/>		Level	False	ALARMS_FD1_DTE_03_ALM is in alarm	
	3:10:53 PM	PPSPAC1_ALARMS_FD1_VE_00A_1_ALM.A	Lite	ENAJA...		<input checked="" type="checkbox"/>		Level	False	ALARMS_FD1_VE_00A_1_ALM is in alarm	

MAIN STEAM			EXHAUST STEAM			LUBE OIL			GLAND SEAL			CONTROL OIL			SERVO			CONDENSOR			PRDS	VACCUME	TURBINE SPEED						
PT101	81.65	FI104	68.85	TI101A	29.60	PI501A	3.00	LJ501	37.24	DPT301	0.14	PI301	0.10	PI501A	10.21	PI403	10.15	PI405	0.00	PI502	2.96	PI201	6.00	PI201	11.52	PT151	9.90	TURBINE SPEED	6839.3
TI101	504.44	TI102	357.66	TI104	64.19	TI501	60.93	TI502	44.32	TI301A	158.44	DPT401	0.02	PI404	10.22	PI406	0.00	PI407	1.92	LJ201	55.00	TI151	351.50	TI103A	-0.91	VACCUME		ACTIVE POWER	13.15

Turbine Operation Parameters

Speed/Load Raise

Speed/Load Lower

Governor & Alarm Reset

Governor Run Command

Halt / Continue Start

Governor L/R SEL Mode

Remote Aux. Setpoint Enable-Disable Mode

Start Permissive Status

Emergency Shutdown Command

Turbine Monitoring Parameters

Actual Speed Rpm

Actual Load MW

Remote Load Setpoint MW

Speed Input-1 Sensor Rpm

Speed Input-2 Sensor Rpm

Actual Demand - HP %

Valve Limiter - HP %

Actual Demand - LP %

Valve Limiter - LP %

Highest Speed Reached Rpm

COMMAND TO EXCITATION SYSTEM

PF901 Mode ON Command	<input type="text" value="ON"/>	AVR001 ON Command	<input type="text" value="ON"/>
PF902 Mode OFF Command	<input type="text" value="OFF"/>	AVR002 OFF Command	<input type="text" value="OFF"/>
		AVR003 MANUAL Command	<input type="text" value="MAN"/>
		AVR003 AUTO Command	<input type="text" value="AUTO"/>

OPERATORI	TURB_TRIP_PAGE	GEN_TRIP_PAGE	LUBE_OIL_UNIT	LUBE_OIL_CONS	STEAM_LINE	CONTROL_OIL	CONDENSATE	GLAND_SEAL	PROTECTION	HP_HEATER	CW_SYSTEM	EMER_OIL	PRDS	CONDENS_TOWER	TRENDS	WELCOME
M/s Shri. DUDHGANGA VEDGANGA SAHAKARI SAKHAR KHARKHANA LTD.										20 MW BAGASSE BASED CO-GENERATION POWER PLANT				SOLUTION POWERED BY PROFICY PROCESS SYSTEMS		

Screen Shot Fuel Handling System



FUEL_HANDLING_SYSTEM.grf

Fuel Handling System

Icon	Event Time	Source	Subcondition	State	Clear Time	Active	Acknowledge Time	Condition	Acknowledge Required	Message	ACK	RESET
	2:20:15 PM	PPSPAC1_ALARMS_EFF9_YTE_M1H2_B_ALM.A	LtLe	ENAJA...		<input checked="" type="checkbox"/>		Level	False	ALARMS_EFF9_YTE_M1H2_B_ALM is in alarm		
	2:20:15 PM	PPSPAC1_ALARMS_FD1_DTE_03_ALM.A	LtLe	ENAJA...		<input checked="" type="checkbox"/>		Level	False	ALARMS_FD1_DTE_03_ALM is in alarm		
	2:20:15 PM	PPSPAC1_ALARMS_FD1_VE_80A_1_ALM.A	LtLe	ENAJA...		<input checked="" type="checkbox"/>		Level	False	ALARMS_FD1_VE_80A_1_ALM is in alarm		

Coal Conveyors

BELT	PULL CARD	BELTSWAY	ZSS
CC-1	●	●	●
CC-2	●	●	●
DCC-3	●	●	●

Baggase Conveyors

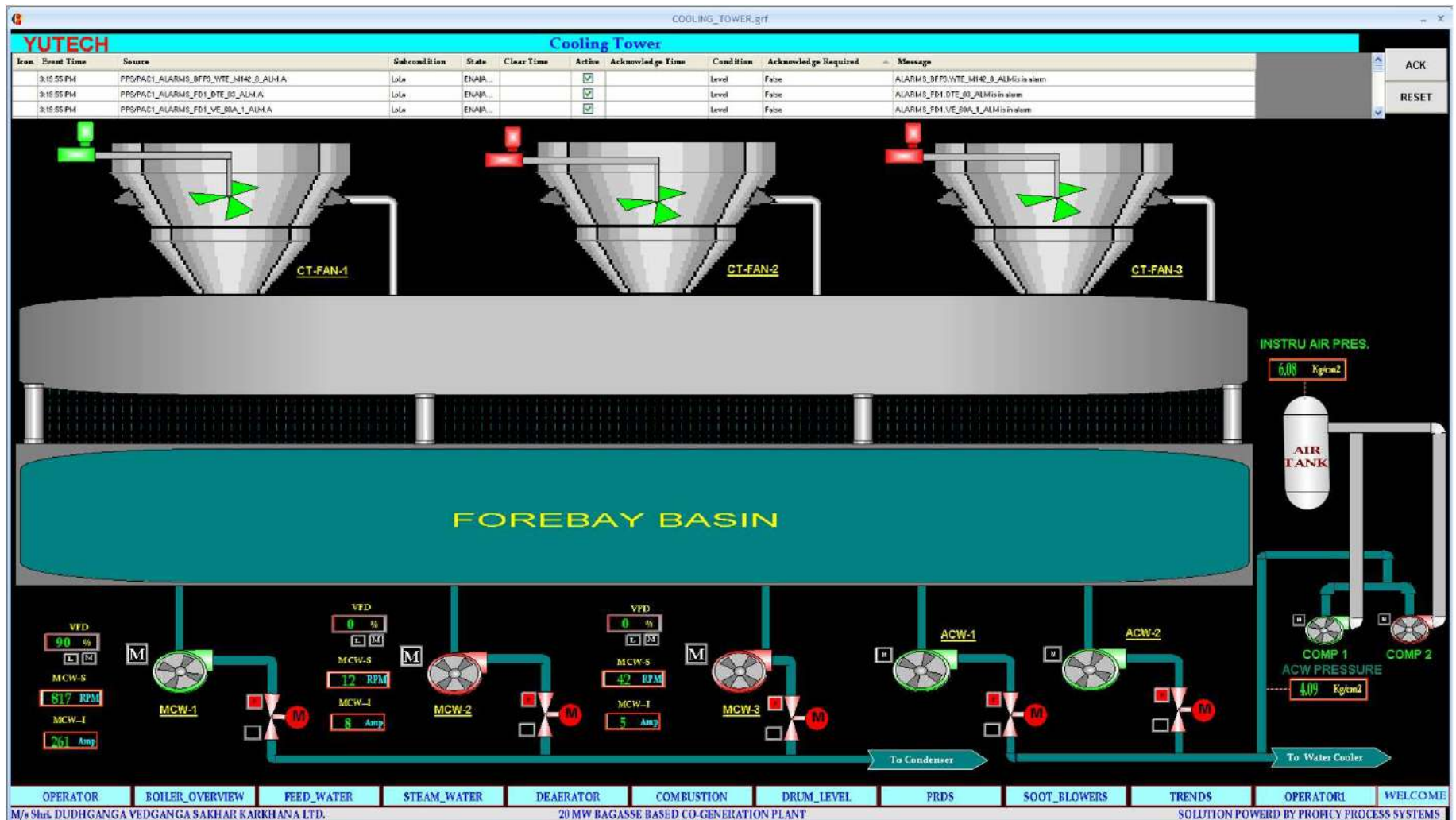
BELT	PULL CARD	BELTSWAY	ZSS
BC-1	●	●	●
BC-2	●	●	●
EXBC-3	●	●	●
EXBC-4	●	●	●
UNBC-5	●	●	●
BC-6	●	●	●
BC-7	●	●	●
BC-8	●	●	●

OPERATOR
BOILER_OVERVIEW
FEED_WATER
STEAM_WATER
DEAERATOR
COMBUSTION
DRUM_LEVEL
PRDS
SOOT_BLOWERS
TRENDS
WELCOME

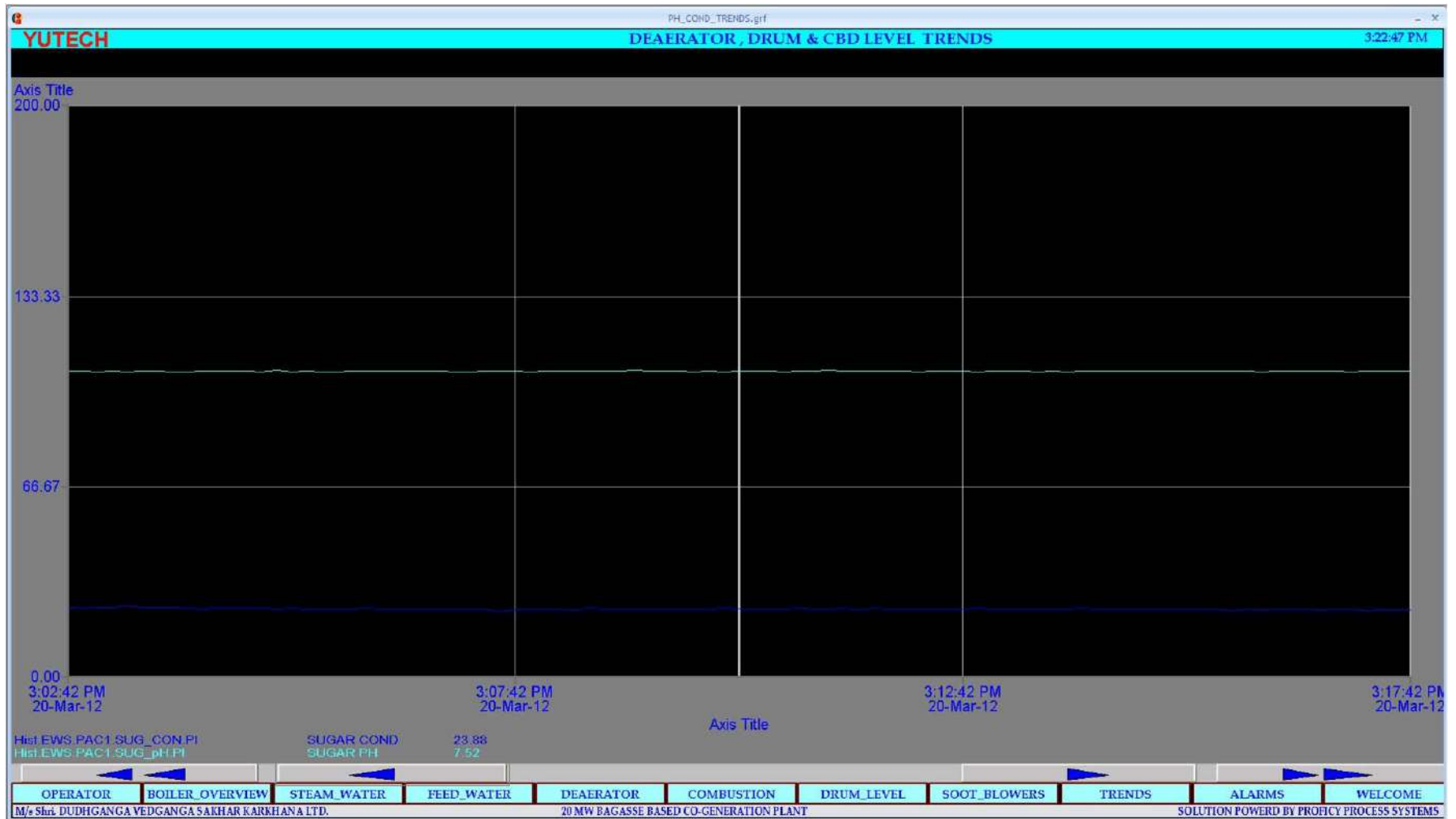
M/e Shri. DUDHGANGA YEDGANGA SAKHANA LTD. 20 MW BAGASSE BASED CO-GENERATION PLANT SOLUTION POWER BY PROFICY PROCESS SYSTEMS

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Screen Shot Cooling Tower Controls



Screen Shot Trends



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Centralized Sugar Plant Automation Control Rooms:



Centralized Sugar Plant Automation Control Rooms:



Centralized Sugar Plant Automation Pictures:



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Superior Quality Norms and Protection for Automation Systems:



- ✓ **UPS System**
- ✓ **Built-In Panel Isolation Transformer for Mains Power Supply**
- ✓ **RCD for Mains Power Supply**
- ✓ **MCB for Each Power Distribution Head**
- ✓ **EMI / RFI Filter for Mains Power Supply**
- ✓ **Switching Surge Arrestor for Controller Power Supply Head**
- ✓ **Isolation Barrier for all Analogue I/Os**
- ✓ **Potential Free Relay for all Digital I/Os**
- ✓ **Fuse TBs for all Digital I/Os**

Concluding Remarks



Proper Combustion reaction in the Furnace Improves Boiler Efficiency, this in turn improves Steam to Fuel Ratio and leads to Fuel Saving. This can be demonstrated by Equation below:

$$\text{Steam to Fuel Ratio} = \frac{\text{Fuel GCV} \times \text{Boiler Efficiency}}{H - h}$$

Where

H = Enthalpy of Superheated Steam

h = Enthalpy of Feed Water

Our focus on maintaining higher temperature at De-Aerator further improves the above equation.

Concluding Remarks



Power Plant Automations Ensure Higher Efficiency:

- **Improved Efficiency by 3-5%.**
- **Improved Steam to Fuel Ratio due to increase in FW Temperature and increase in Boiler Efficiency (Please see Fuel Ratio Equation).**
- **Optimum Combustion Reduces Un-burnt Fuel Losses This is evident from:**
 - **Decrease in Oxygen and Increase in Carbon Dioxide Percentage in Flue Gas and at the same time reduction in Excess Air Percentage.**
 - **Reduction in Flue Gas Carbon Monoxide Percentage.**
- **Reduction in Excess Air means optimum usage of Fan Drives and thus Power Saving.**
- **Maintained Steam Drum Level with Pressure Compensation Ensures Optimum Steam Generation while compensating for Shrink and Swell in the Drum Level.**

Concluding Remarks



Power Plant Automations Further Ensure:

- **Reduction in Clinker Formation due to good combustion condition.**
- **Reduces Thermal Shocks and Improves Life Expectancy.**
- **Energy Savings in Electricity, Fuel and Other Natural Resources.**
- **Equipment Protection.**
- **All Key Performance Indicators are Highlighted and Recorded.**
- **Faults are easily identified.**
- **Ensure Maximum Up Time.**

THANK YOU!
For your time and Presence

SAVE FUEL
REDUCE CARBON FOOTPRINT
MAKE THE WORLD GREENER
AND YET, MAKE MONEY

