

Sugar Mill Automation



YUTECH

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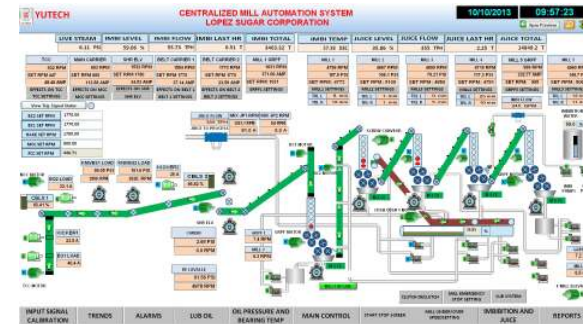
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Servicing the Sugar Industry since 1978

Agenda



- Need for Automation
- Automation Approach
- Mill 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.

The Purpose of Mill Automation



Basic Requirement:

- Safety of the Cane Feeding and Milling Equipment.
- Prevention of Overloading of Feeding and Milling Equipment.
- Prevention of Jams and Choking in Cane Feeding and Milling Equipment.
- Facilitate continuous operation.
- Reduction and Possible Elimination of Stoppages due to Human Error.
- Early indications of Faults.

Optimization:

- Maintaining optimum load on the Preparatory Devices and Mills.
- Maintaining Continuous Positive Feeding at all times.
- Maintaining Uniform Steam / Power Demand over the entire Mill House.

Automation Approach



Common Industrial Activities like Steam Generation or Process Plants share common engineering parameters like Pressure, Temperature, Flow and pH.

Milling is completely different from these activities. Therefore the Automation approach also differs greatly from other common processes. We would like to concentrate on this Approach.

Mill House Automation Systems

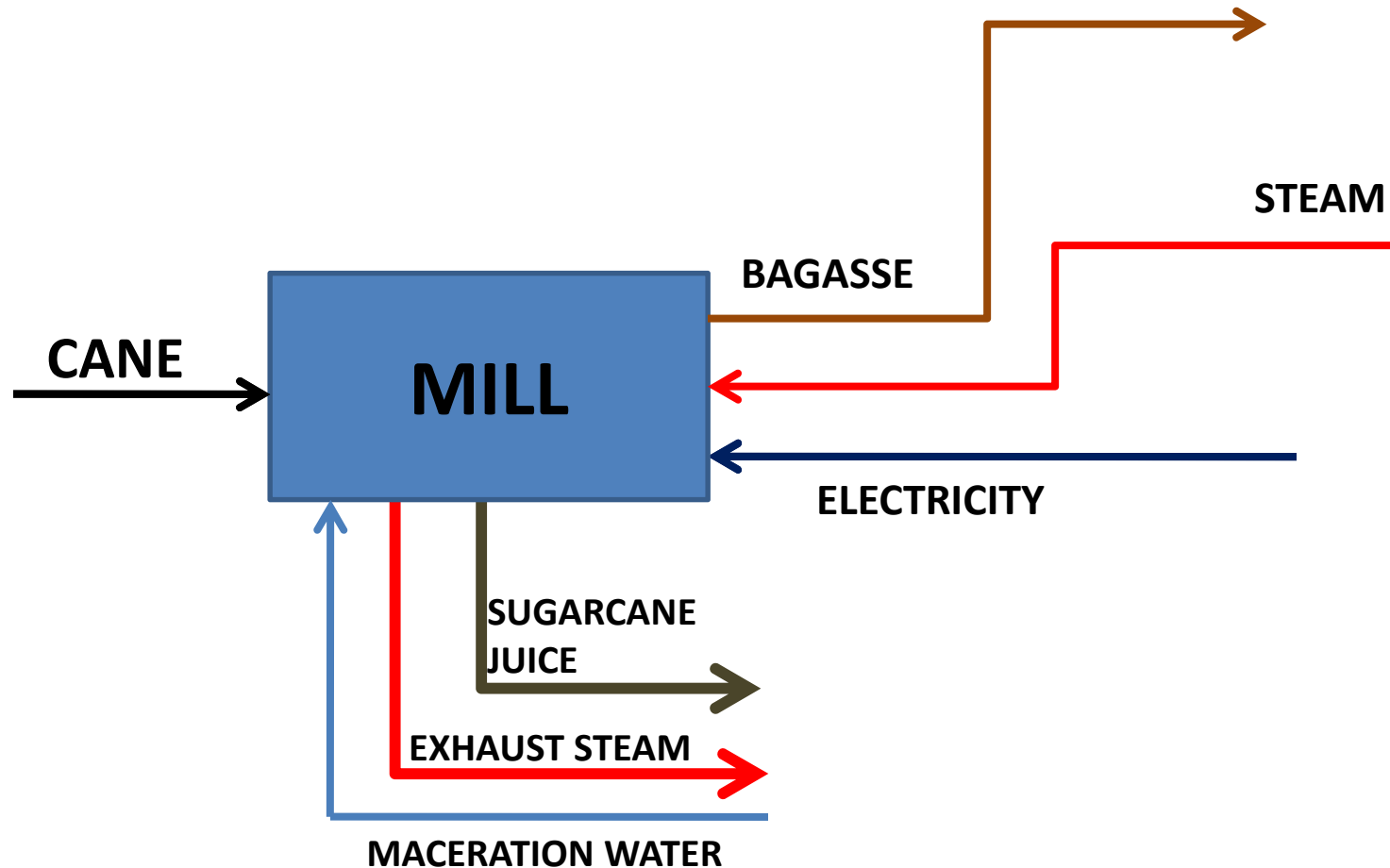


Interlocks, Protection and Alarming Systems:

- Automatic Interlocking System between Bagasse Carrier, Inter Carriers, Mills, Rake and Main Cane Carriers, Preparatory Devices, First or Auxiliary Cane Carrier meaning if any equipment stalls or trips then all preceding feeding equipment will stall.
- Bearing Temperatures Of all Mills, Cane Preparatory Devices, Cane Carriers are sensed and Alarms are generated if Temperature of any bearing rises above prescribed limit pin pointing the device.
- Any other Customized Factory Specific Application will be implemented.

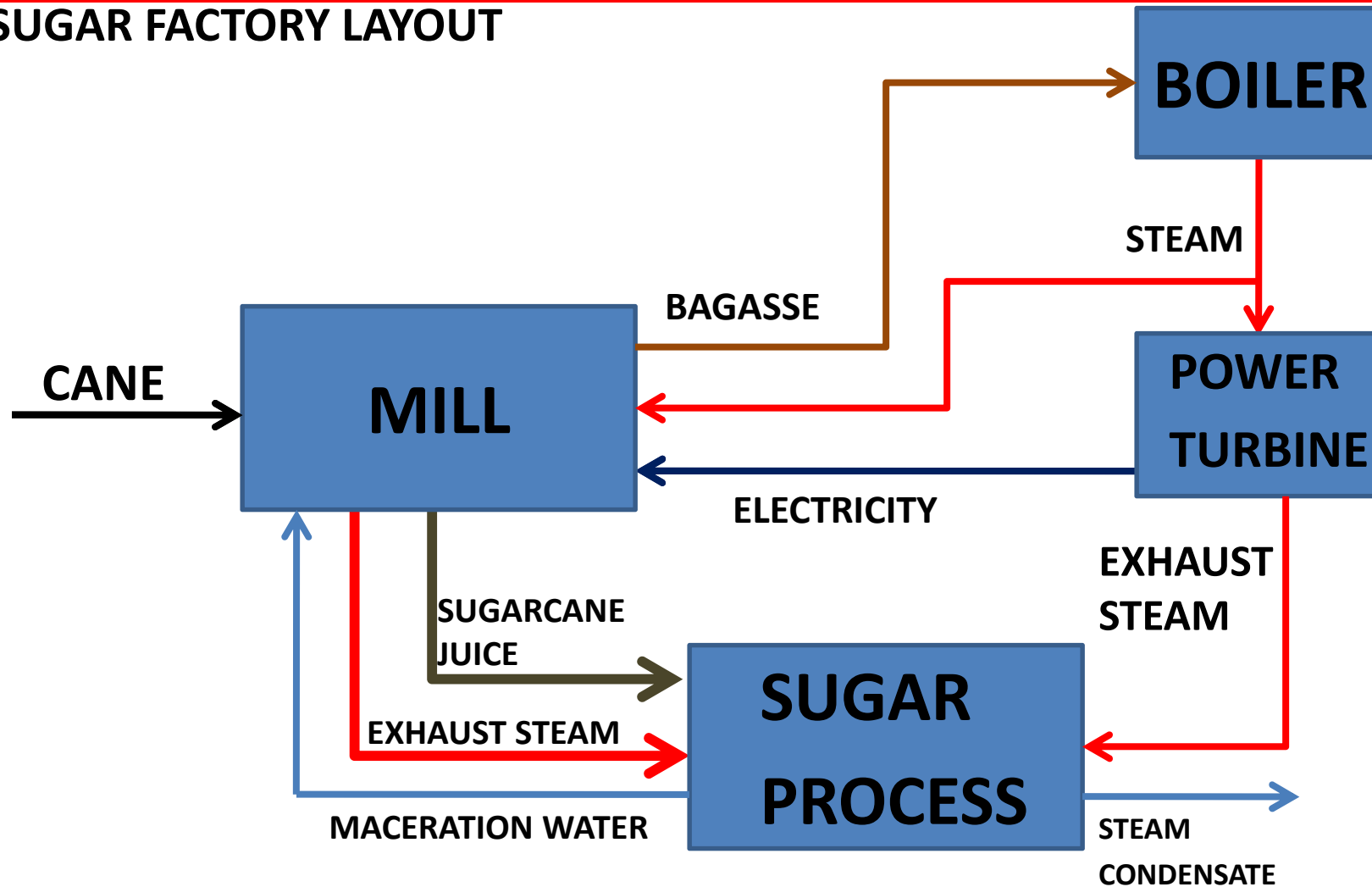
Understanding the Milling Process

SUGAR MILL INPUTS AND OUTPUTS



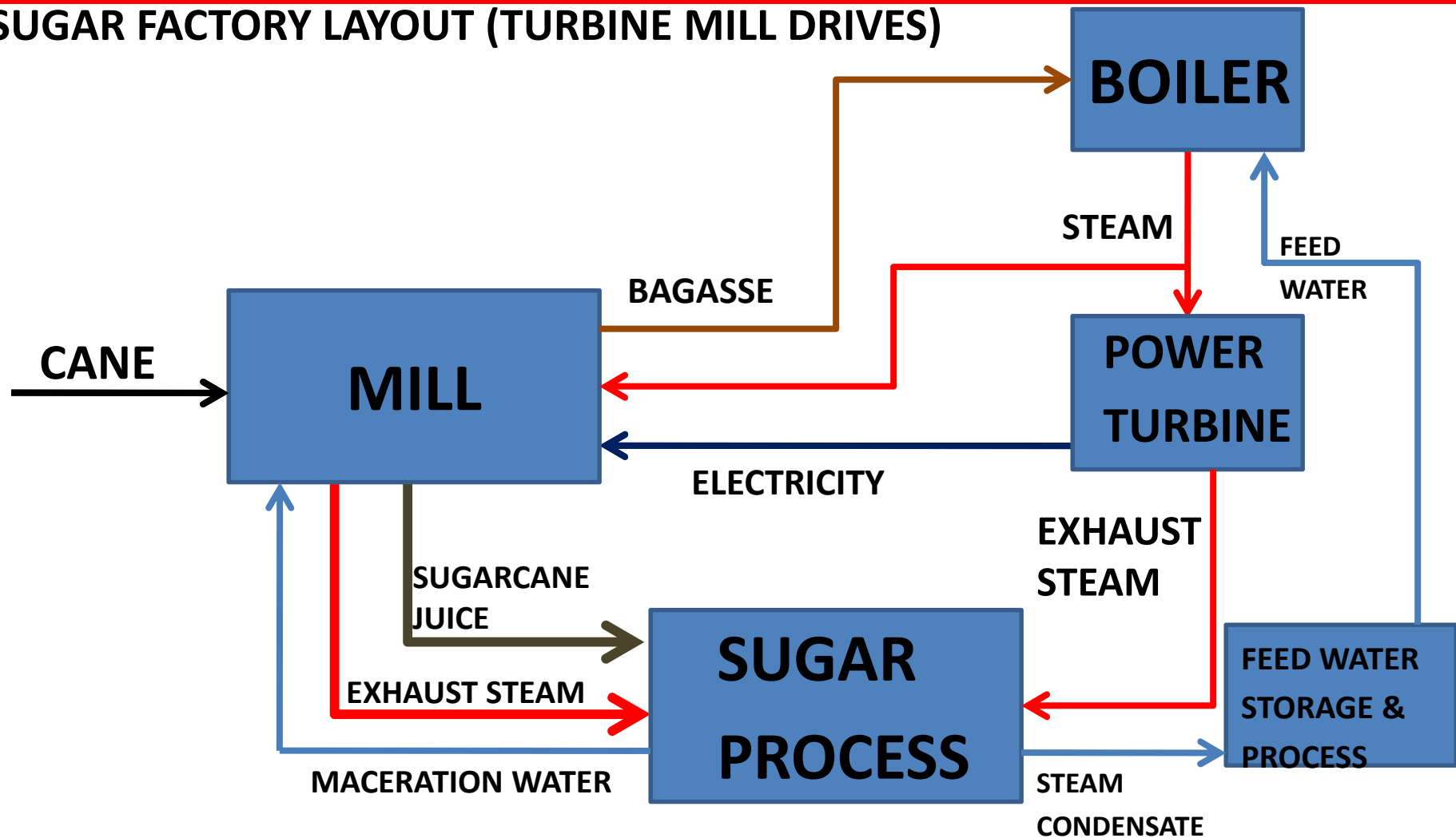
Understanding the Milling Process

SUGAR FACTORY LAYOUT



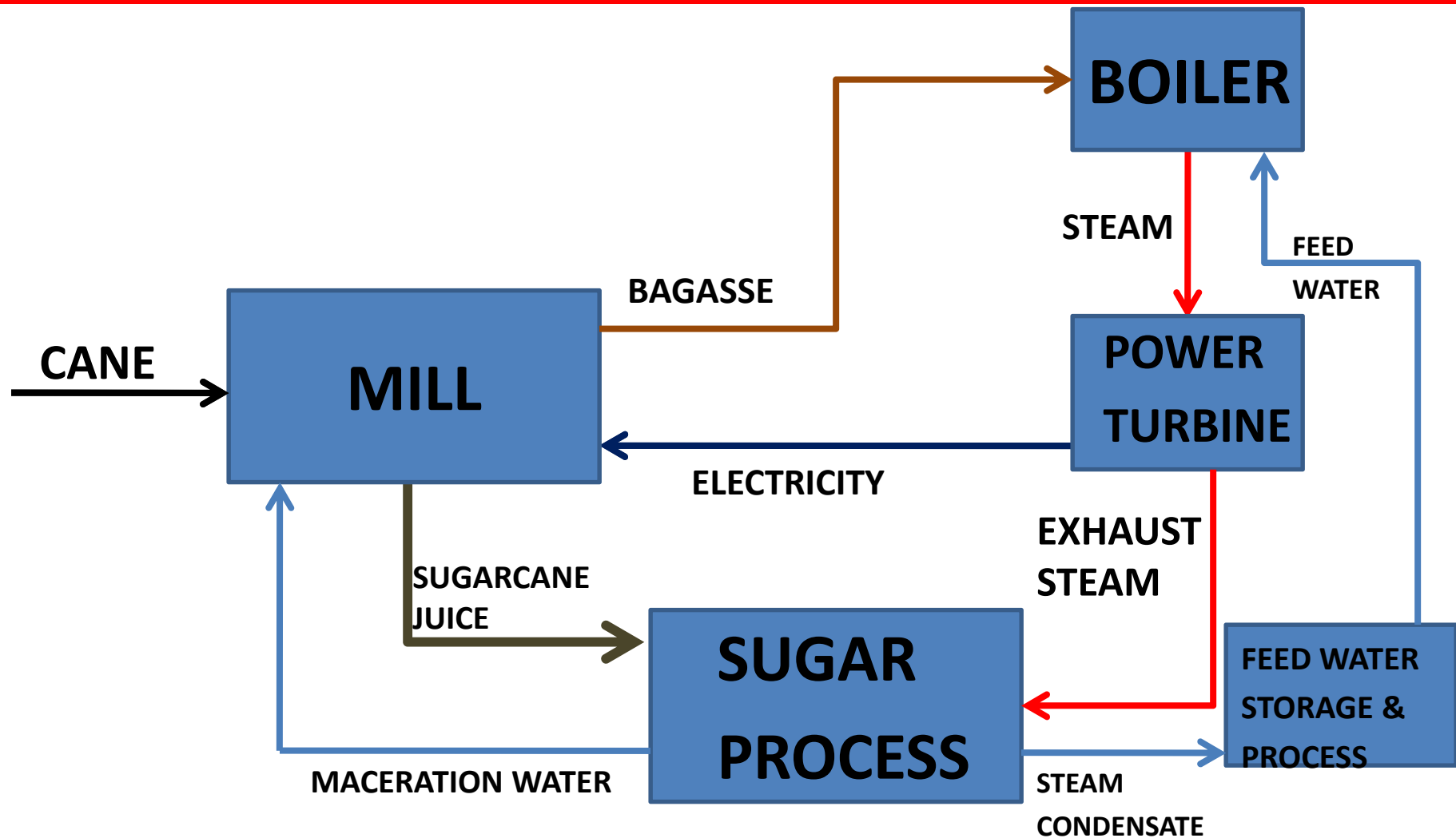
Understanding the Milling Process

SUGAR FACTORY LAYOUT (TURBINE MILL DRIVES)



Understanding the Milling Process

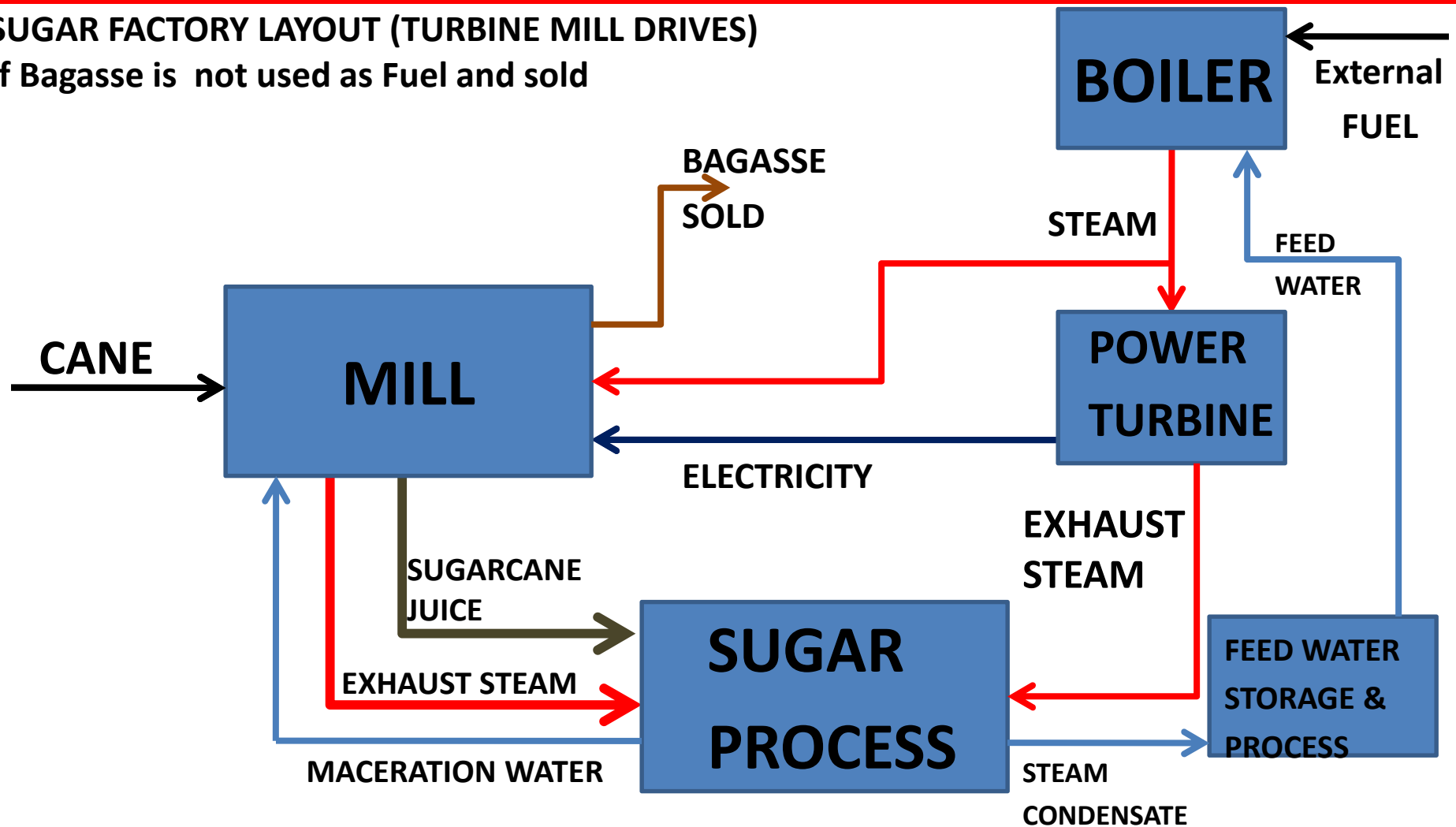
SUGAR FACTORY LAYOUT (ELECTRIC OR HYDRAULIC MILL DRIVES)



Mill House Automation Systems

SUGAR FACTORY LAYOUT (TURBINE MILL DRIVES)

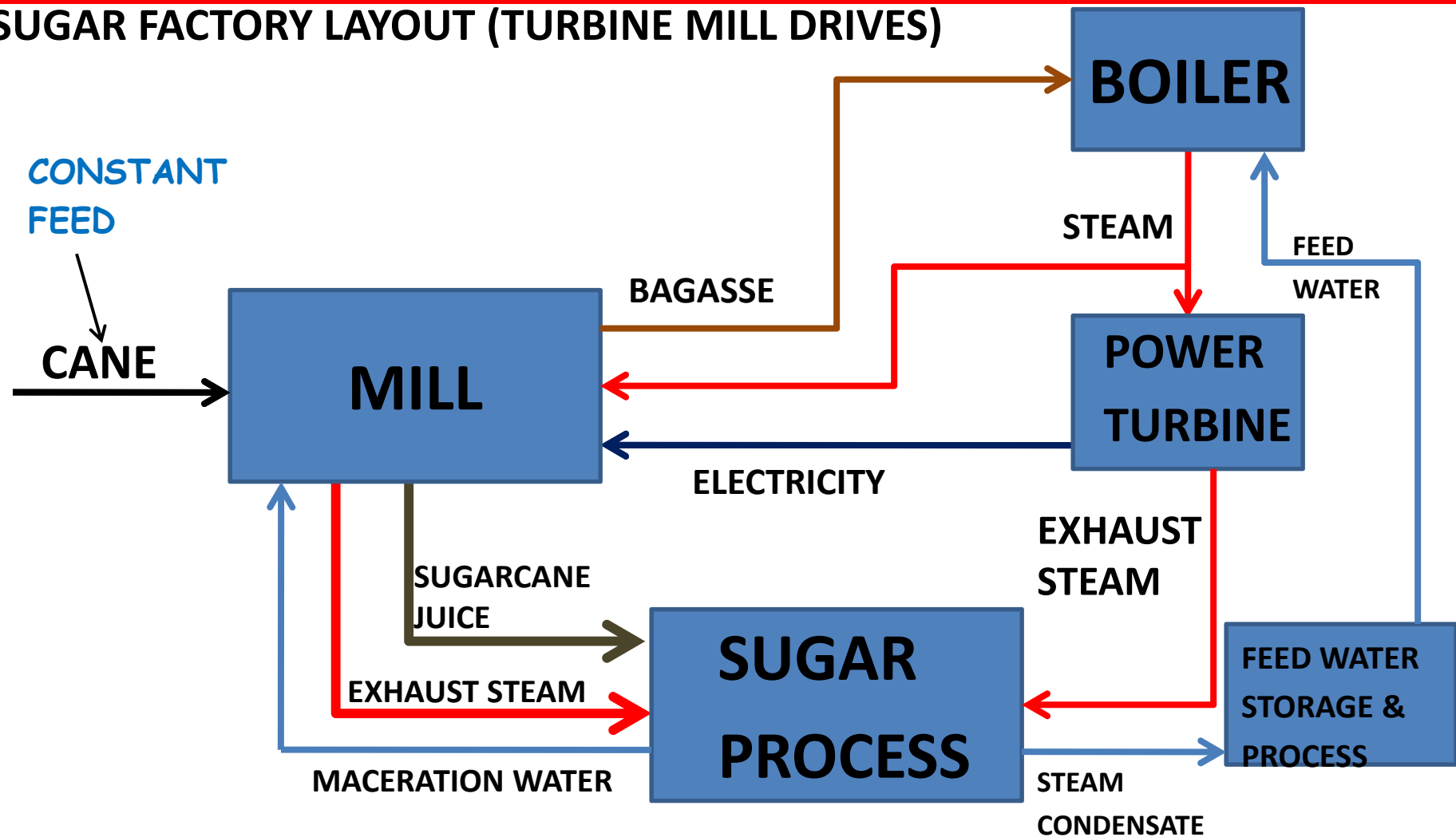
If Bagasse is not used as Fuel and sold



What will you achieve by installing YUTECH Mill House Automation Systems?

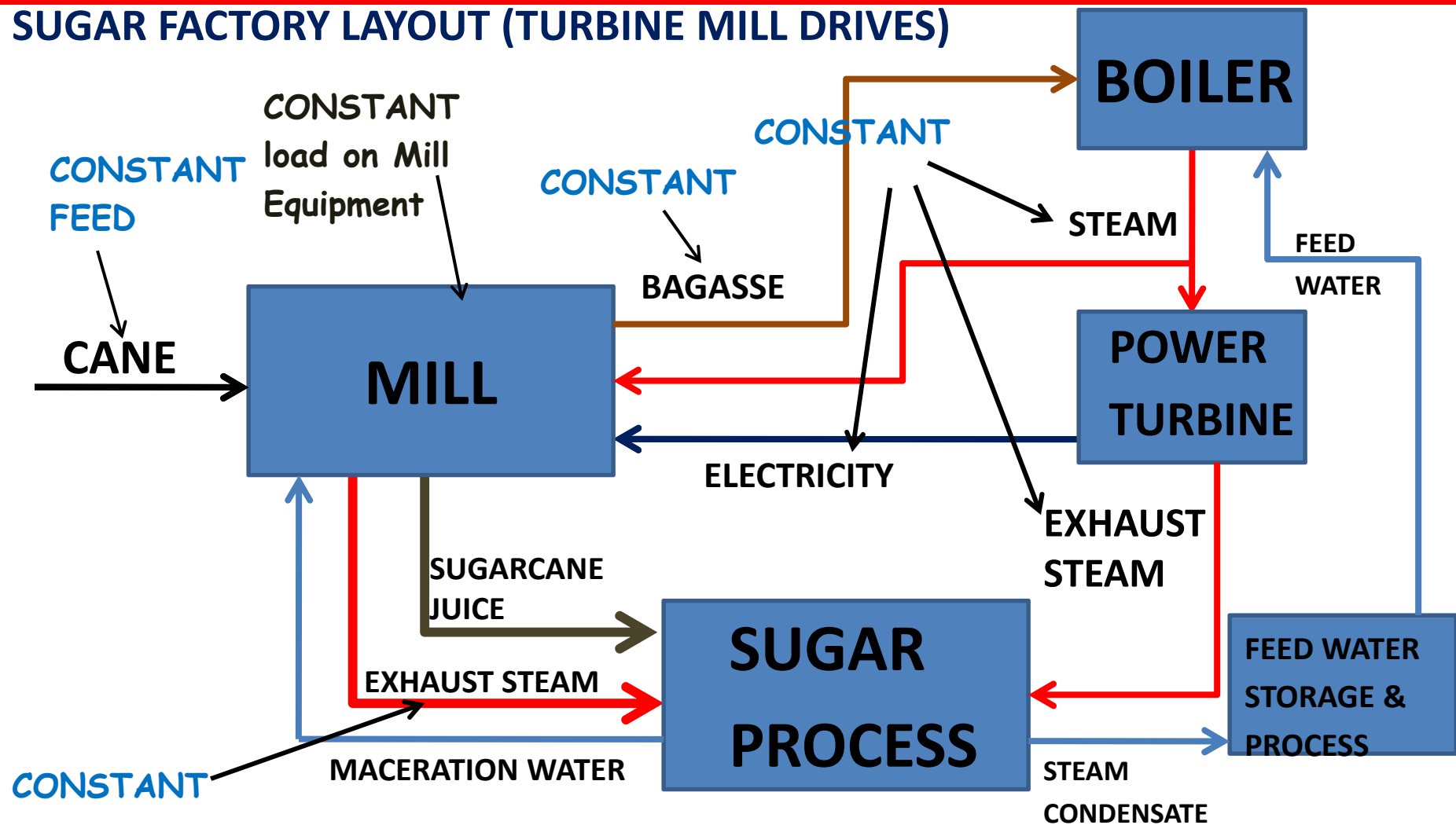
Mill House Automation Systems

SUGAR FACTORY LAYOUT (TURBINE MILL DRIVES)



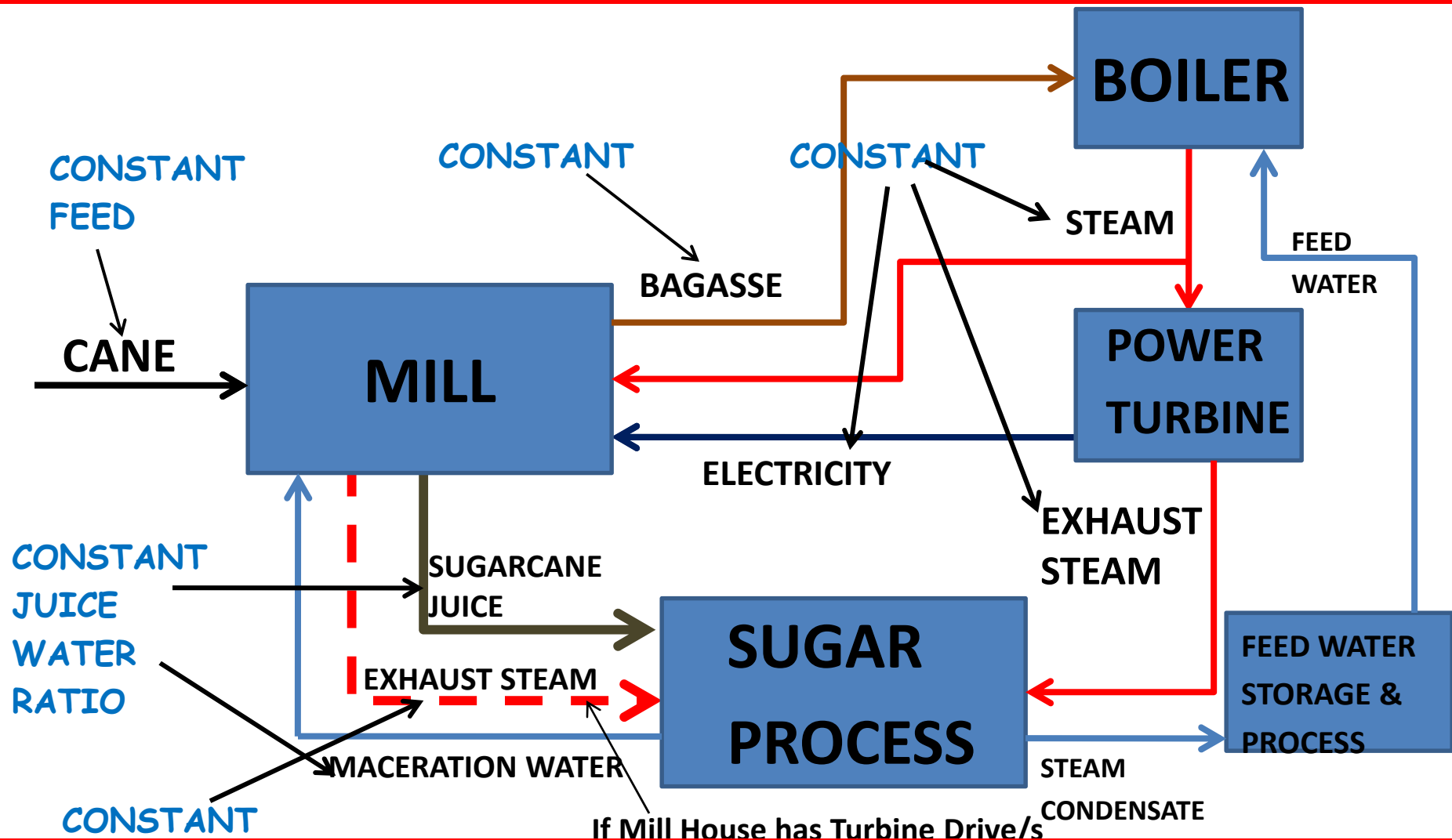
Mill House Automation Systems

SUGAR FACTORY LAYOUT (TURBINE MILL DRIVES)



Mill House Automation Systems

SUGAR FACTORY LAYOUT (TURBINE MILL DRIVES)



Constant Cane Feeding at all times and Automatic Optimization of Mill Speeds



Constant

- Steam and Power Demand in the Mill House
- Dry Bagasse to the Boilers
- Juice to Water Ratio
- Juice Flow to Process
- Levels in Donnelly Chutes hence ensured positive feeding at all times

Therefore Mill Automation



Improves



- **Primary Mill Extraction**
- **Reduced Mill Extraction**
- **Bagasse Pol**
- **Bagasse Moisture**
- **Overall Efficiency**
- **Throughput**

Mill Automation



Reduces or Completely Eliminates



- Human Errors
- Choking and Jamming at Preparatory Devices
- Choking and Jamming at Donnelly Chutes
- Overloading of Drives
- Under feeding
- Wear and Tear of Equipment

Constant Cane Feeding at all times and Automatic Optimization of Mill Speeds



Saves



- Power by reducing Consumption
- Steam by reducing Consumption



Therefore reducing Bagasse Fuel for Boiler

- Water
- Lubricants
- Steam for Process

Mill House Automation Systems



Mill Automation thus



Facilitates Constant



- **Boiler Operation**
- **Process or Boiling or Raw House Operation**
- **And Overall Production**

Mill House Automation Systems



Mill Automation Advantage



MORE

Crushing with the same Mechanical Equipment
Production with minimized losses
Efficiency with lesser stoppages

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Mill House Automation Systems



Milling Process Control Systems:

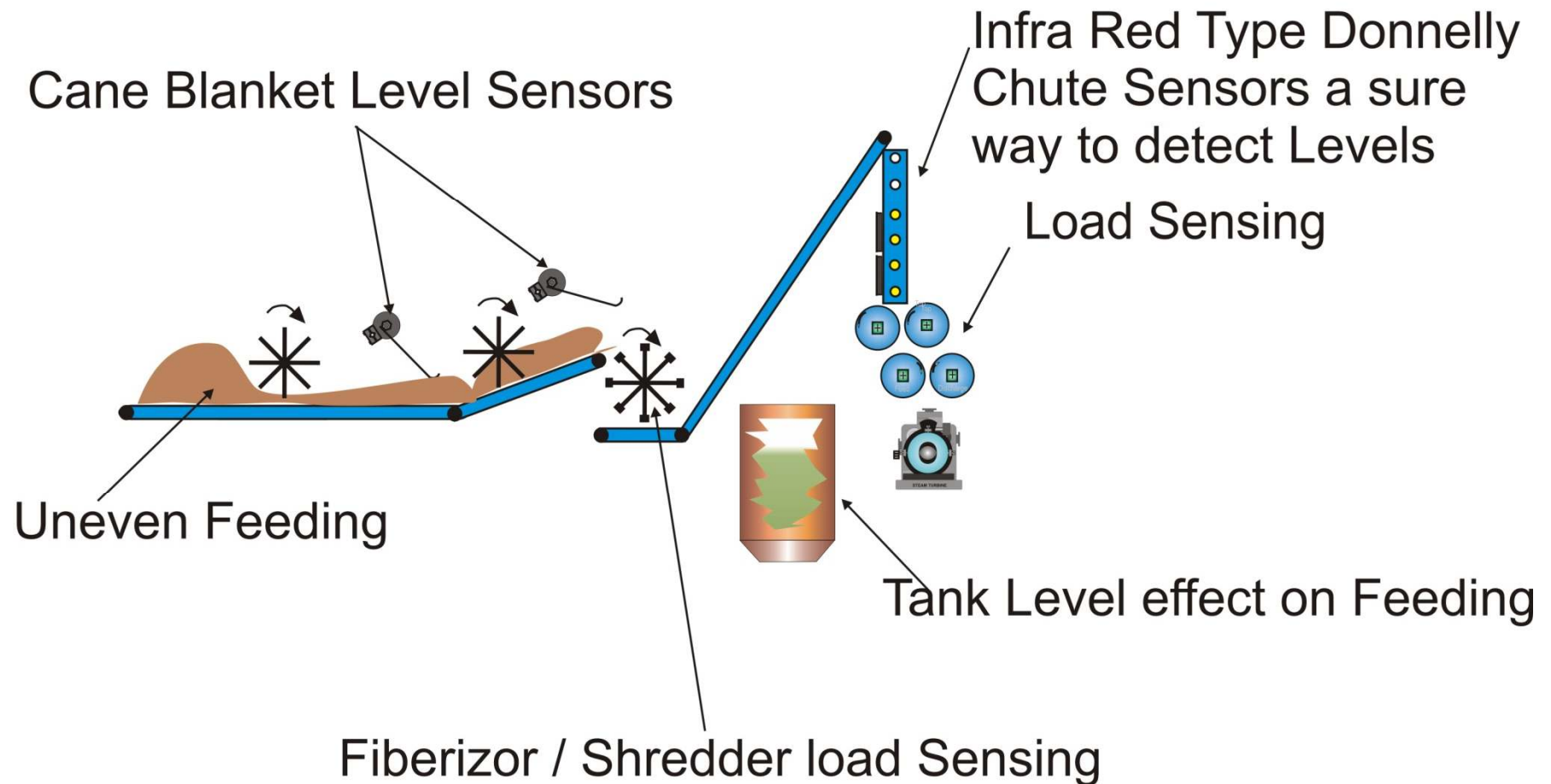
- **Automatic Cane Feeding Control System**
- **Automatic Mill Speed Control System**
- **Automatic Maceration Water Control**
- **Automatic Juice Flow Control System**

Mill Protection System:

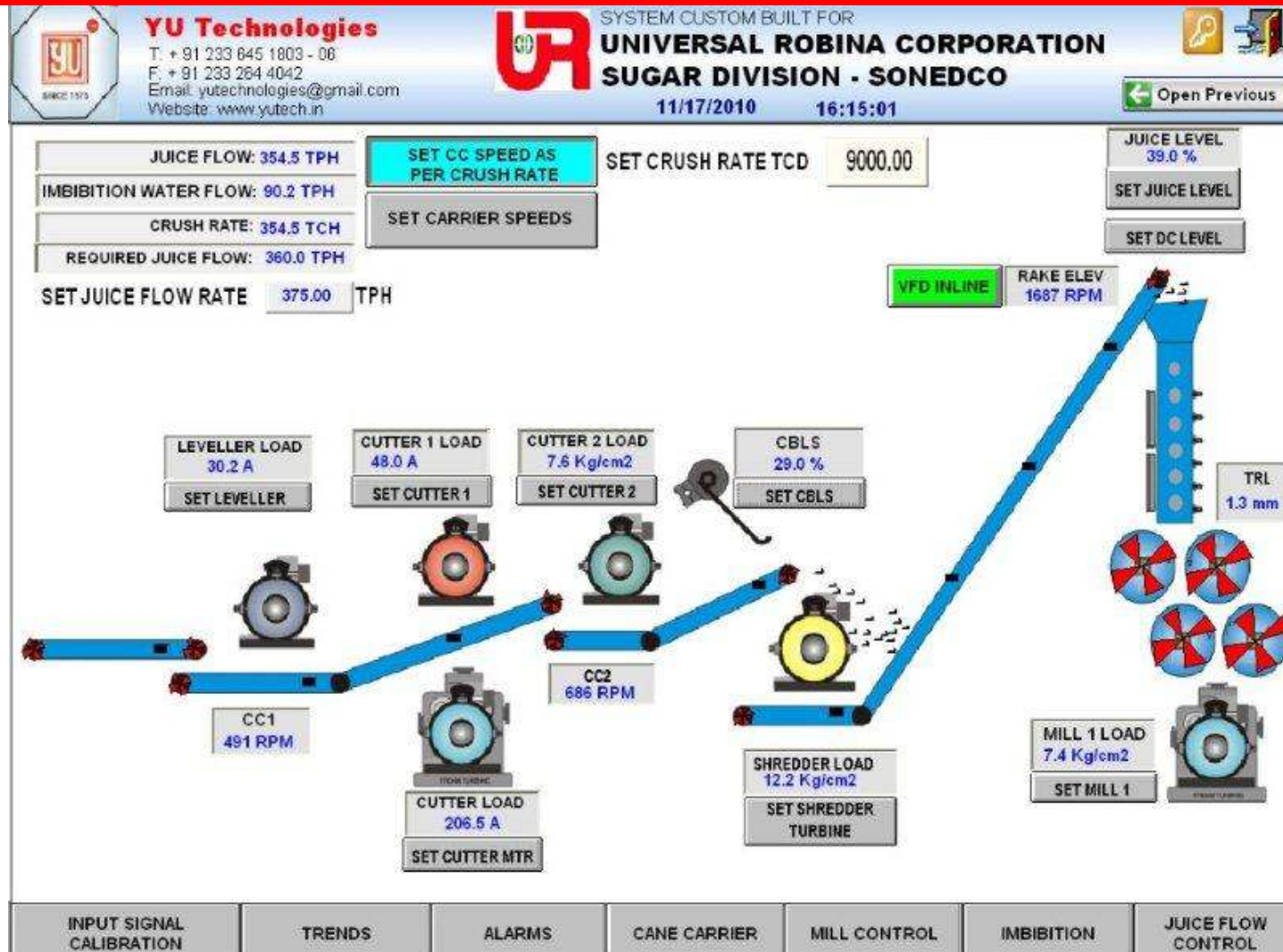
- **Automatic Interlocks**
- **Alarms and Emergency Trip / Stop**

Automation Approach for Cane Feeding:

Cane Feeding Arrangement and Automation Approach



Example of Automatic Cane Feeding system



YUTECH Infra Red Type Donnelly Chute Level Sensors or IR Sensor Features



- Infra Red Sensing
- 100% True Level Detection
- IR Sensors Sense Level Through Dirt, Juice Films, Bagasse Powder and also Juice and Water Mist in the Donnelly Chute
- IR Sensors have Built-in Raining Bagasse Compensation and easily Sense Level through it
- No False Level Detections
- IR Light is Known for Deep Penetration and used in Medical Applications like Deep Fomentation hence the choice of IR for this Critical Application
- Water Ingress and Dirt Proof
- YUTECH invented this Technique in 1986
- More than 400 Sugar Mills use YUTECH IR Sensors in India, Asia Pacific and African Regions

Automatic Cane Feeding Control System

Features:

- Infra Red Type Donnelly Chute Level Sensing
- Hall's Effect Type Cane Blanket Level Sensing
- High Precision Non-Invasive CT Protectors and Isolating Converters
- Pressure Transmitters for Sensing Chest Pressure of Turbine, Hydraulic Drives and Live Steam
- Juice Tank Level Feedback
- Smooth and Jerk-less Carrier Speed Variation with respect to above sensing

Infra Red Type Donelly Chute Level Sensors



Infra Red Sensor Installation.

100% True DC Level Detection
No False Indications
No Problems due to Bagasse
Particles or Juice



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YUTECH Hall's Effect Type Cane Blanket Level Sensor Features



- Hall's Effect Type Electromagnetic Sensor
- Pendulum Type Primary Level Sensor Floats on Cane Blanket
- Extremely Rugged Heavy Duty Enclosure to suit the Physical abuse of Flying Cane from Leveller / Cutter / Knives
- 100% True Level Detection through all the Shocks, Vibration, Moisture and Dirt
- No False Level Detections
- Water Ingress and Dirt Proof
- YUTECH invented this Technique in 1986
- More than 400 Sugar Mills use YUTECH CBLS Sensors in India, Asia Pacific and African Regions

YUTECH Hall's Effect Type Top Roller Lift Sensors and Indicating Transmitters



- Hall's Effect Type Electromagnetic Sensor
- Telescopic Primary Level Sensor rests on Mill Pressure Plate
- Extremely Rugged Heavy Duty Enclosure to suit the Physical abuse of Cleaning, Moisture, Sugar Cane Juice and Juice Mist, Bagasse and Steam
- 100% True Top Roller Lift or Float Detection through all the Shocks, Vibration, Moisture and Dirt
- Water Ingress and Dirt Proof
- YUTECH invented this Technique in 1992
- More than 300 Sugar Mills use YUTECH TRL Sensors in India, Asia Pacific and African Regions

YUTECH Mill Instruments: Hall's Effect Type Cane Blanket Level and Top Roller Lift Sensors

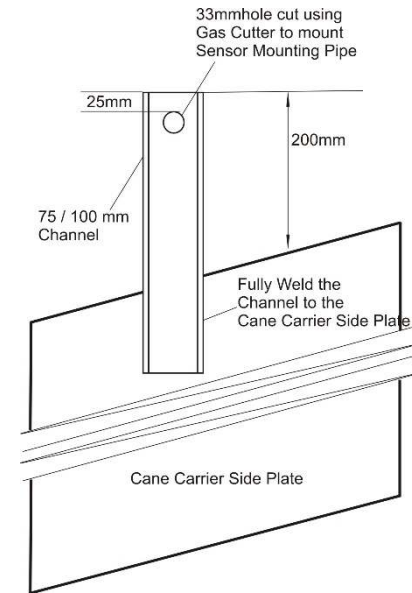
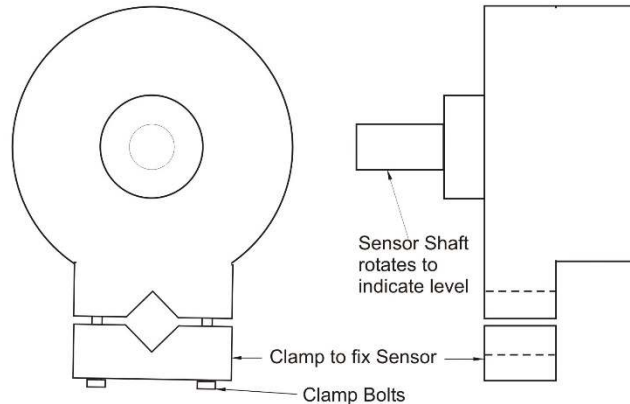
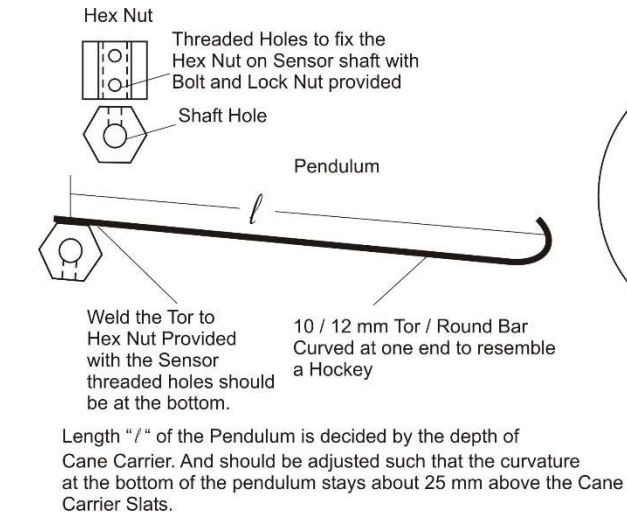


Hall's Effect Type Cane Blanket Level Sensors:
100% True Cane Blanket Level Detection
No False Indications
No Problems due to Bagasse
Particles or Juice which are associated with
Conductivity Type Level Sensors.

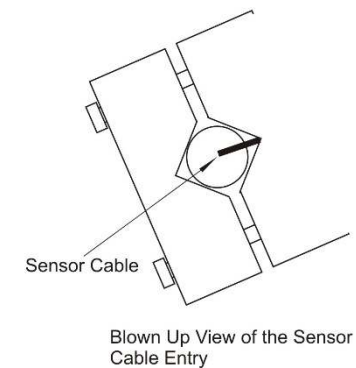
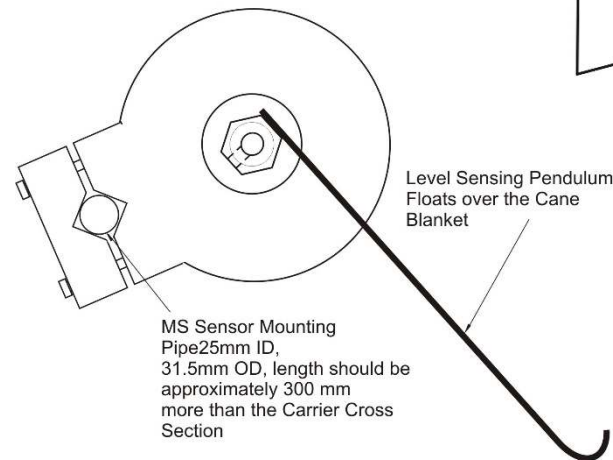
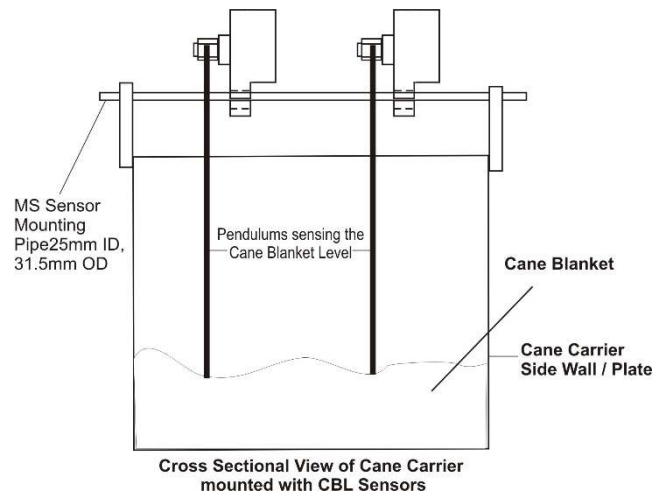


Hall's Effect Type Top Roller Lift Sensors:
100% Linear and Non Contact type
Sensing

Hall's Effect Type Cane Blanket Level Sensor Assembly Diagram



Sensor Mounting Welding Diagram



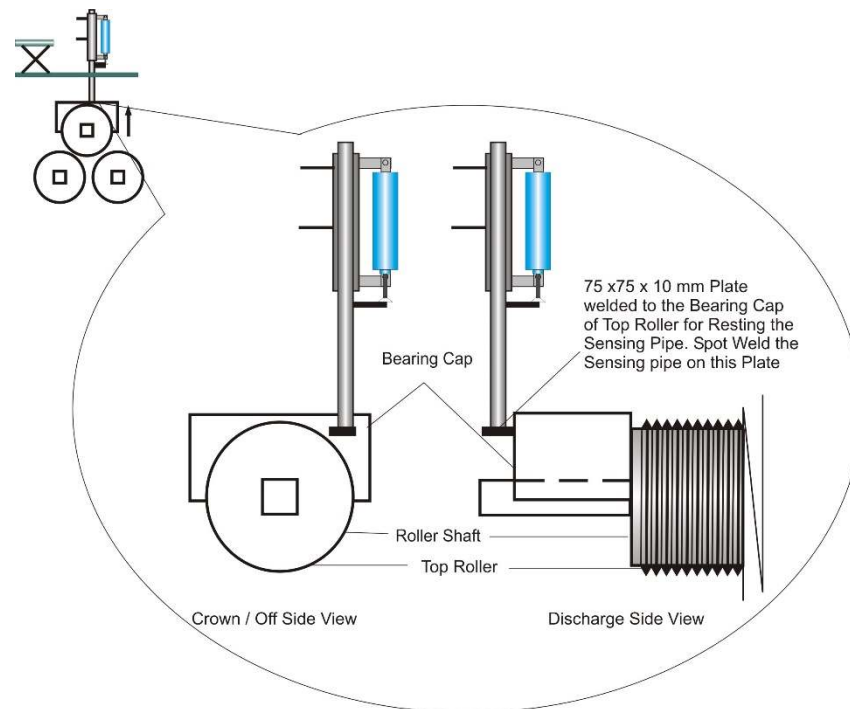
Hall's Effect Type Top Roller Lift Sensor Assembly Diagram



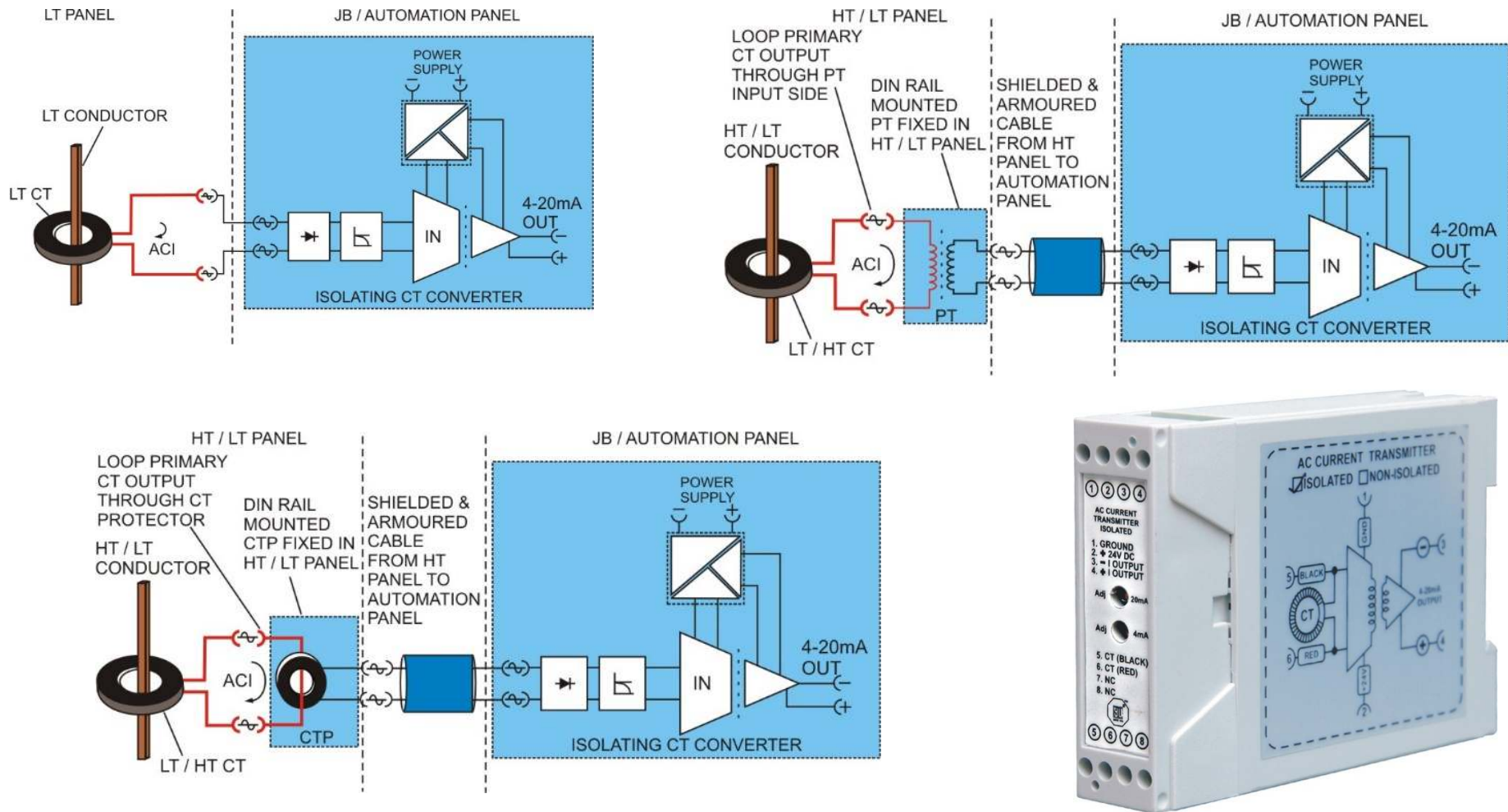
Hall's Effect Type Top Roller Lift Sensor

Sensor Mounting Assembly

Extension to rest on Mill Pressure Plate

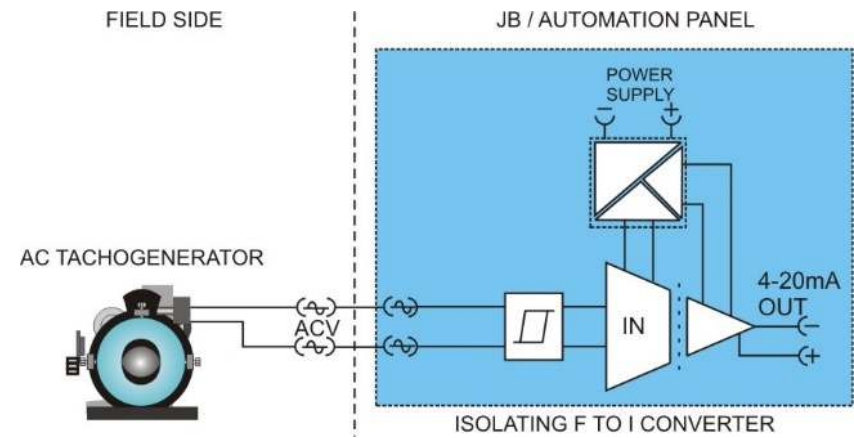
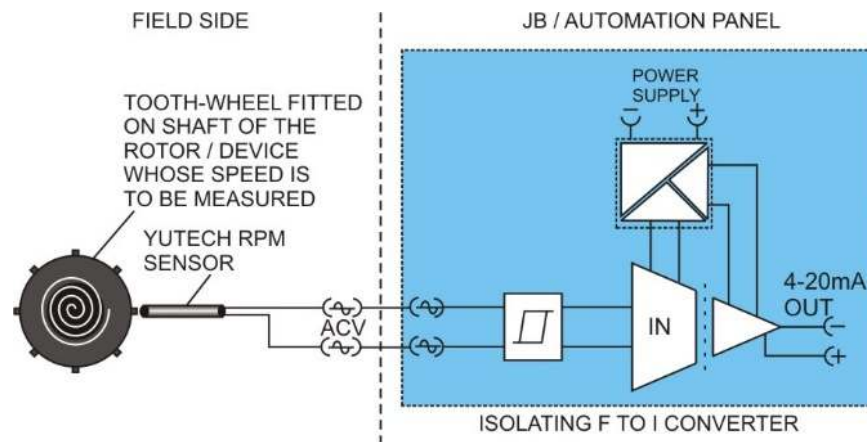


Precision HT and LT Current Sensing



Isolating CT Converter

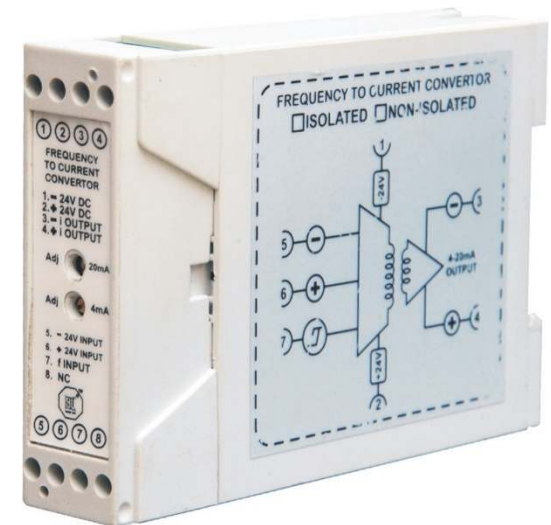
Precision Drive Speed Sensing



RPM Sensor



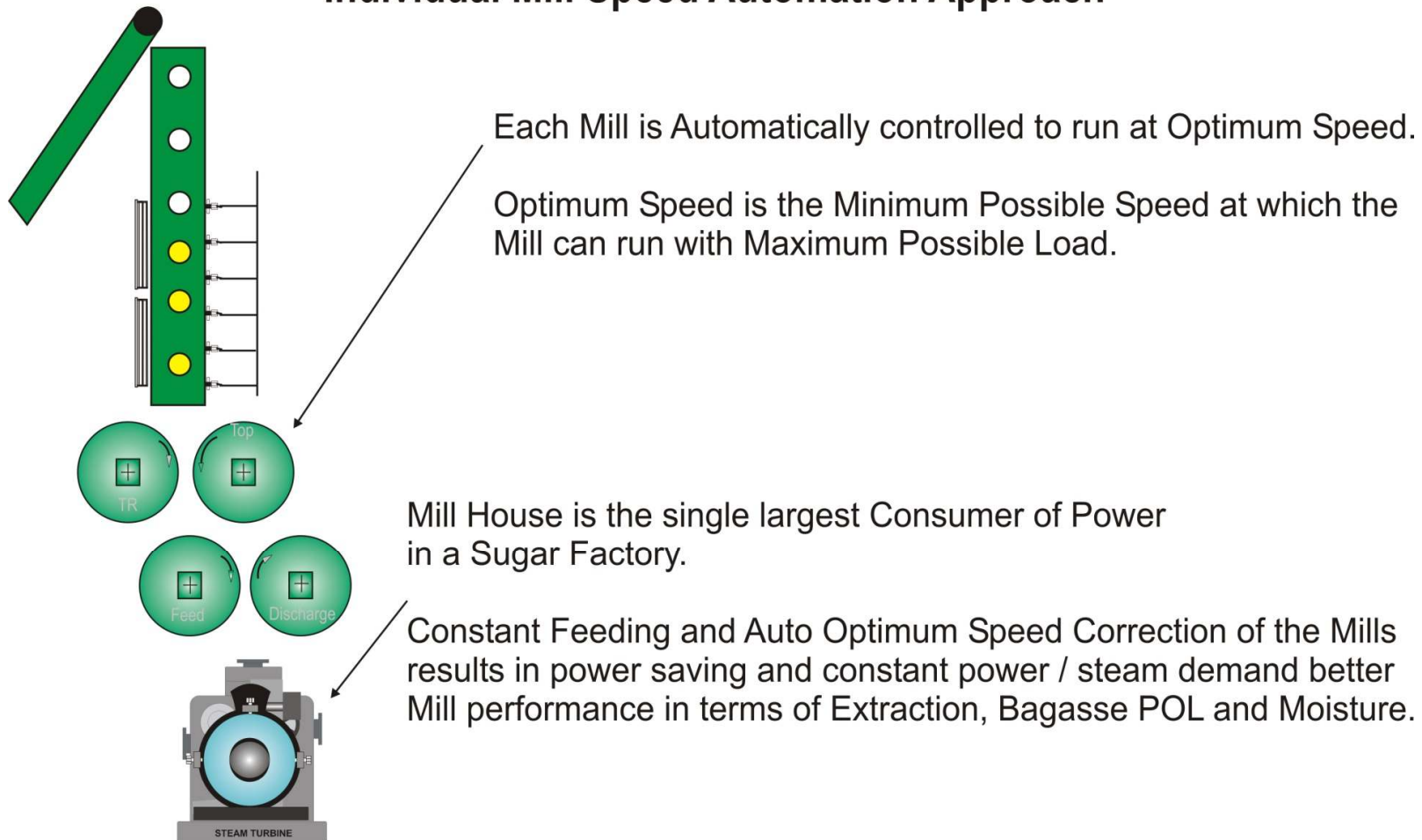
**Isolating RPM Indicator
cum Transmitter**



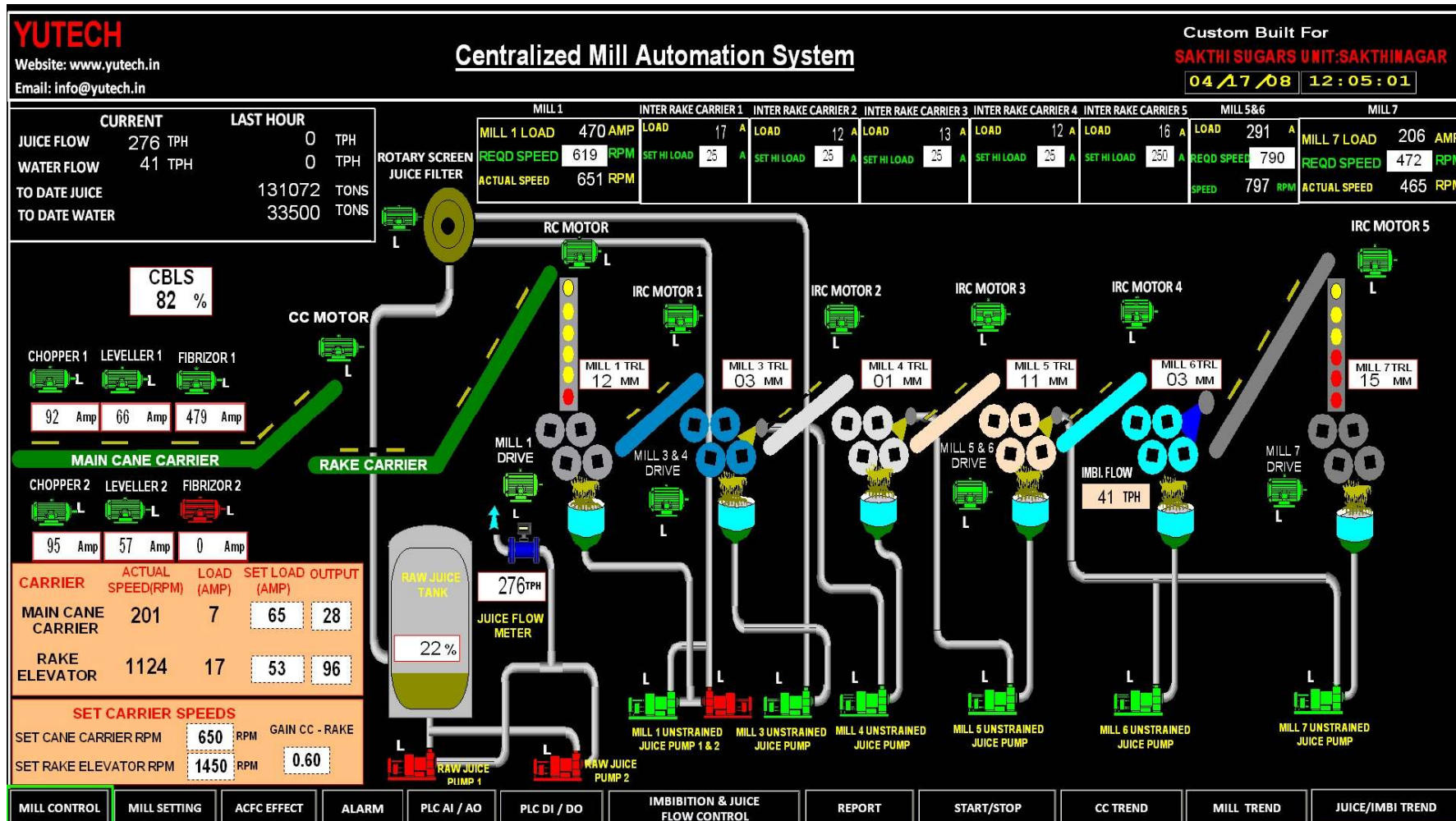
Isolating RPM Transmitter

Mill Speed Control Automation Approach:

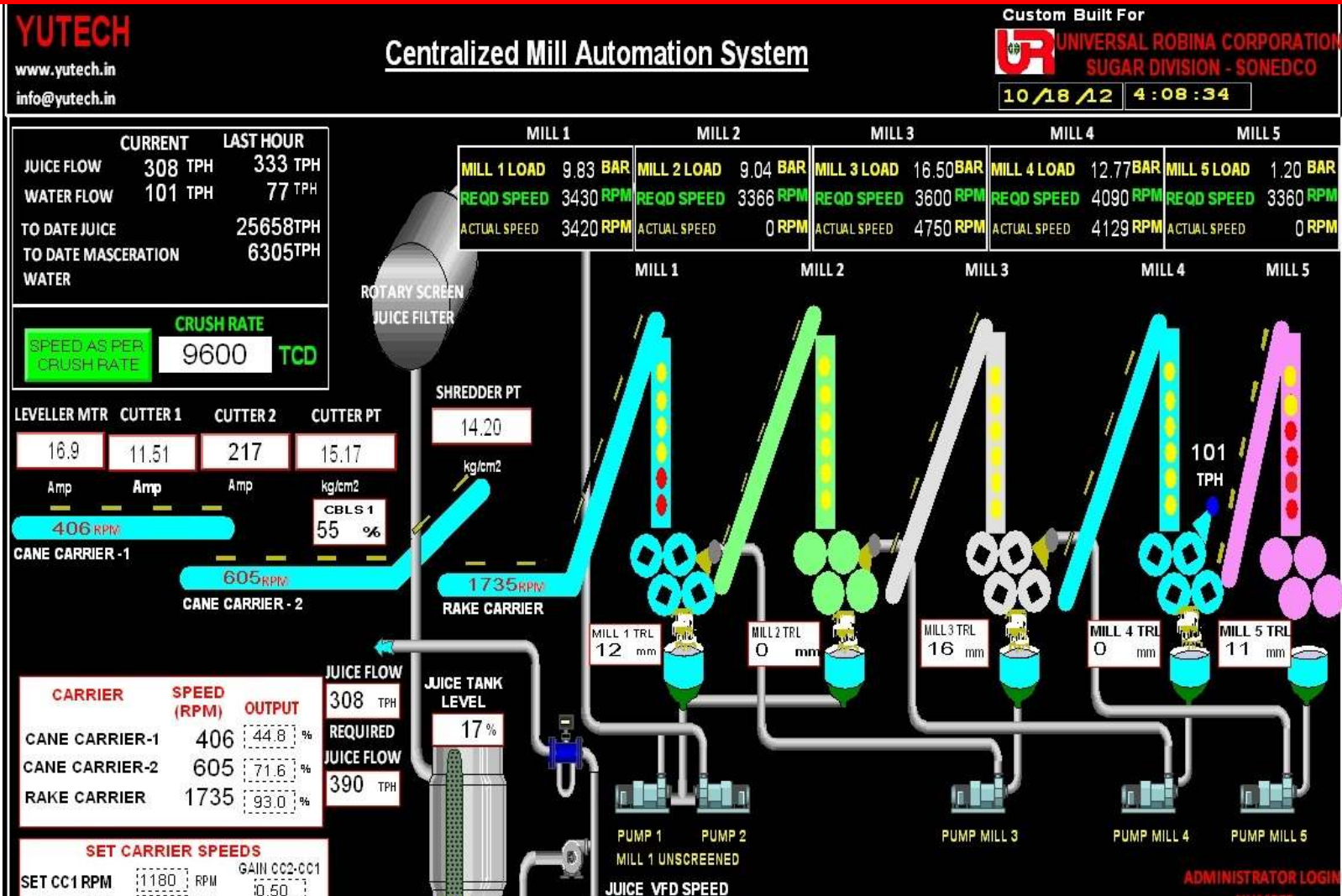
Individual Mill Speed Automation Approach



Screen Shot of Mill Automation at Sakthi Sugars, Sakthinagar



Screen Shot of Mill Automation at URC - SONEDCO



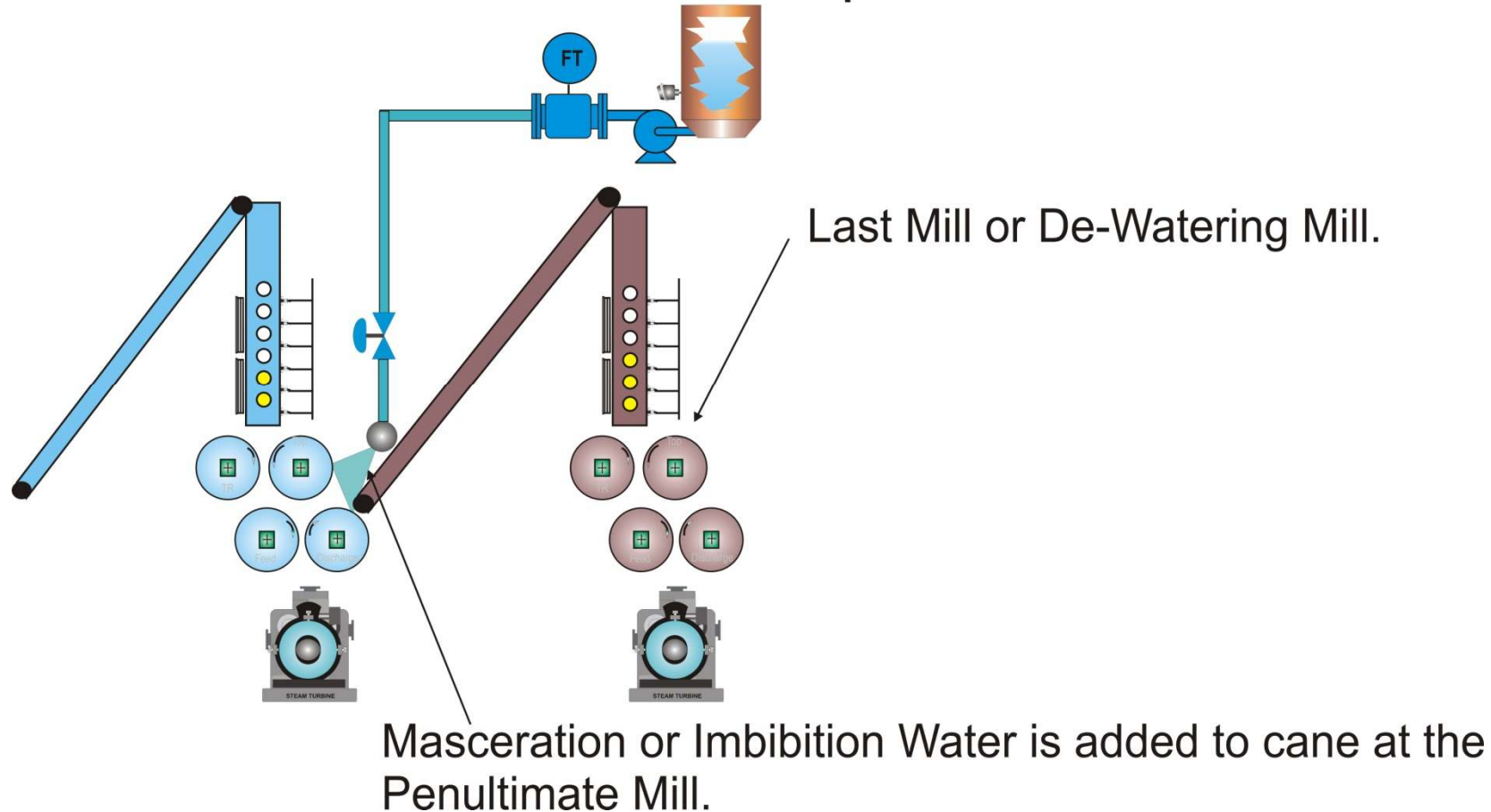
Automatic Mill Speed Control System

Features:

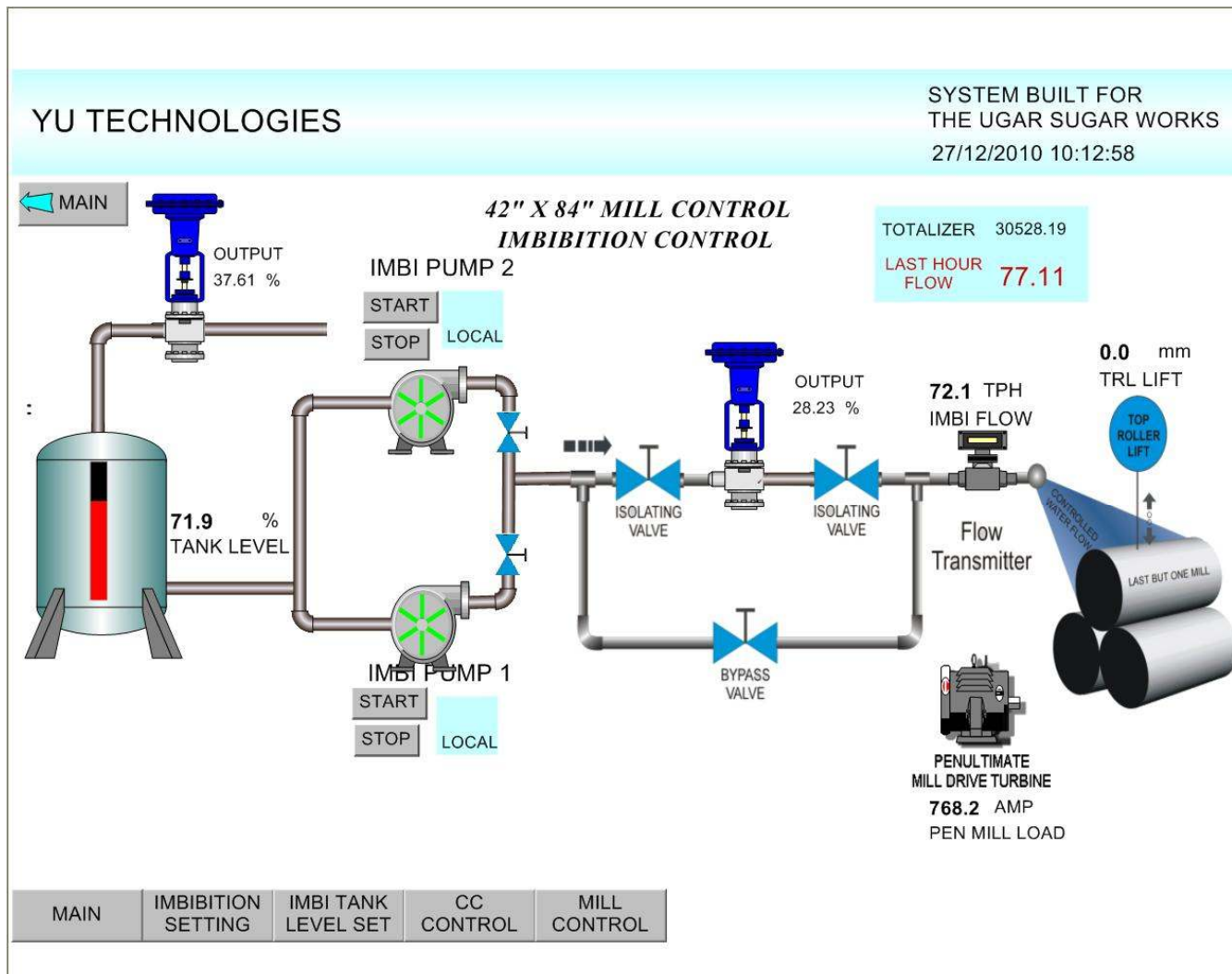
- **Infra Red Type Donnelly Chute Level Sensing**
- **Hall's Effect Type Top Roller Lift Sensing**
- **High Precision Non-Invasive CT Protectors and Isolating Converters**
- **Pressure Transmitters for Sensing Chest Pressure of Turbine, Hydraulic Drives and Live Steam**
- **Mill Speed Variation with respect to individual Mill Load and Donnelly Chute Level**
- **Next Mill Donnelly Chute Level and Speed Feedback**
- **Maintained Mill Speed Safe Operating Band**

Maceration or Imbibition Control Approach:

Imbibition and Last Mill Speed Automation



Masceration or Imbibition Control Screen Shot:



Mill House Automation Systems



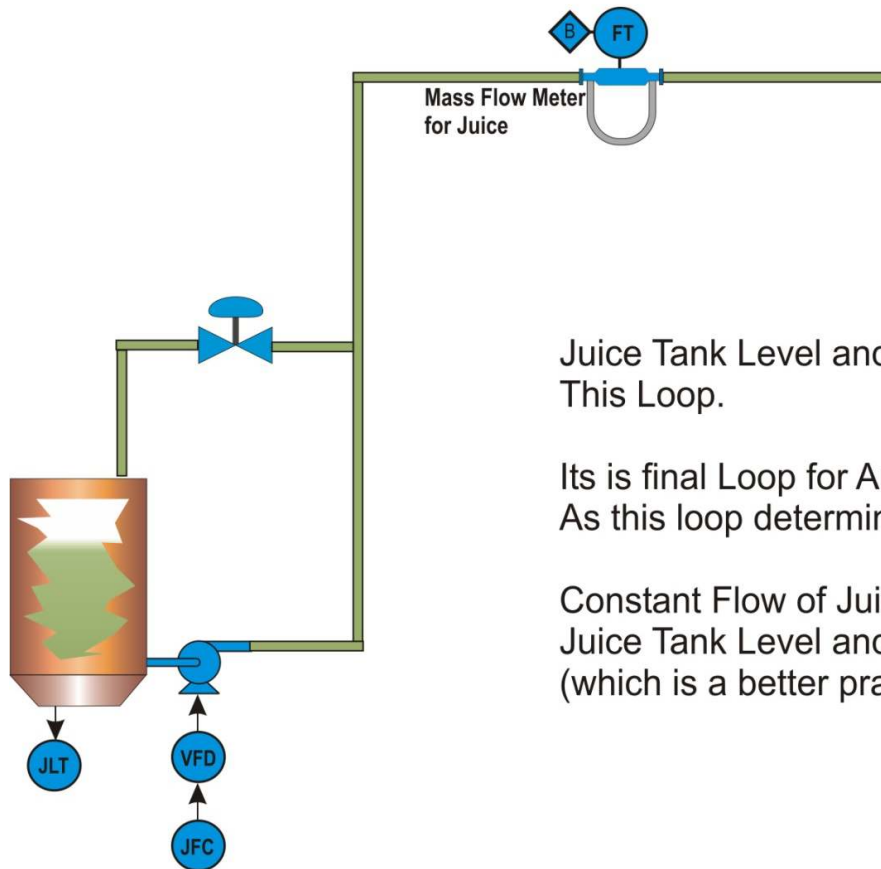
• Automatic Maceration Control System

Features:

- Hall's Effect Type Top Roller Lift Sensing
- High Precision Non-Invasive CT Protectors and Isolating Converters
- Pressure Transmitters for Sensing Chest Pressure of Turbine, Hydraulic Drives and Live Steam
- Water Flow Variation with respect to Pen-Ultimate Mill Load and Top Roller Lift
- Juice Flow Feedback to adjust Crush Rate Variations
- Built-in Maceration Calculation
- Water Cut-Off when: No Cane in Mills
- Maceration Tank Level and Temperature Control

Juice Flow Control and Stabilization:

Juice Flow Automation

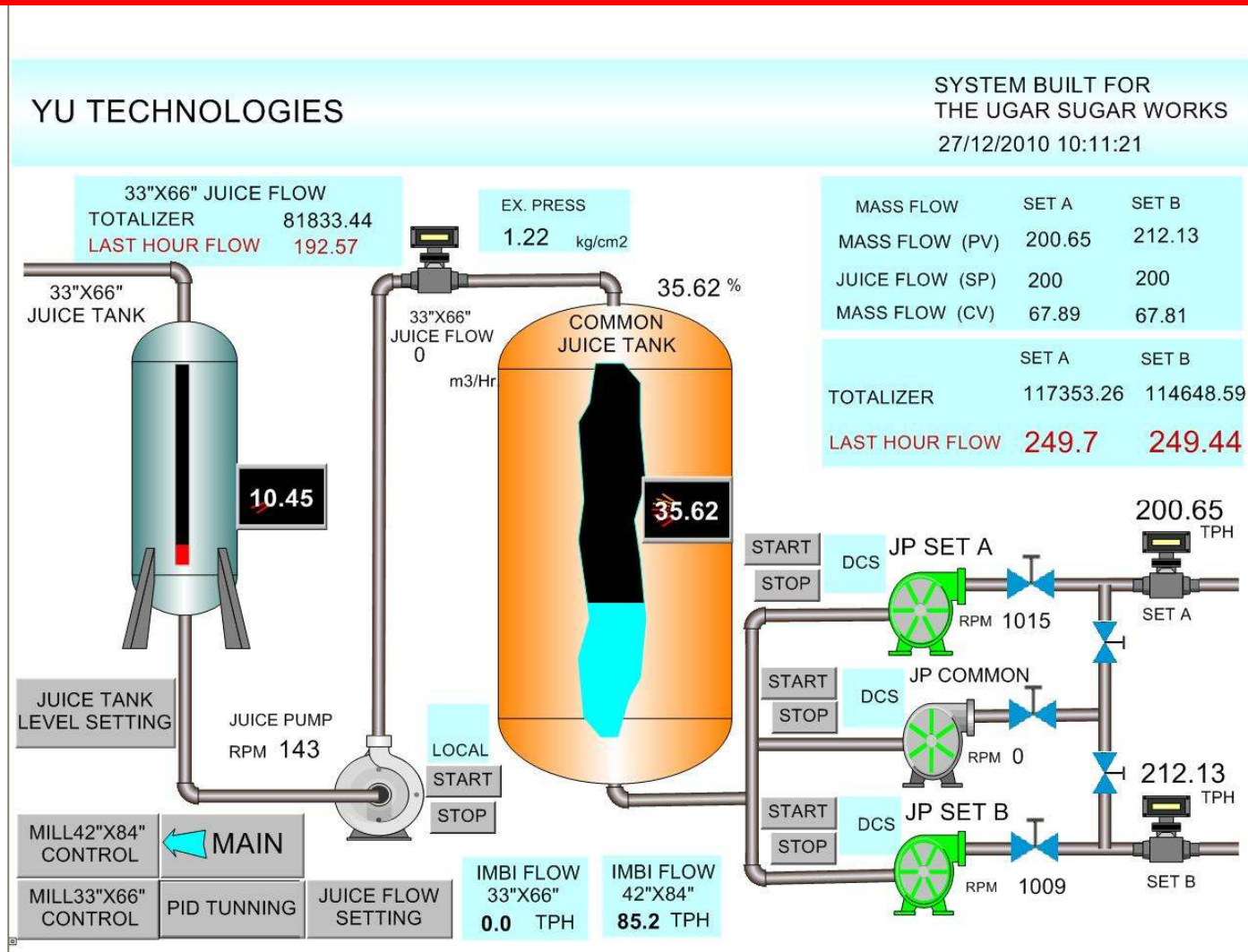


Juice Tank Level and Juice Flow Sensing is the means of Automating This Loop.

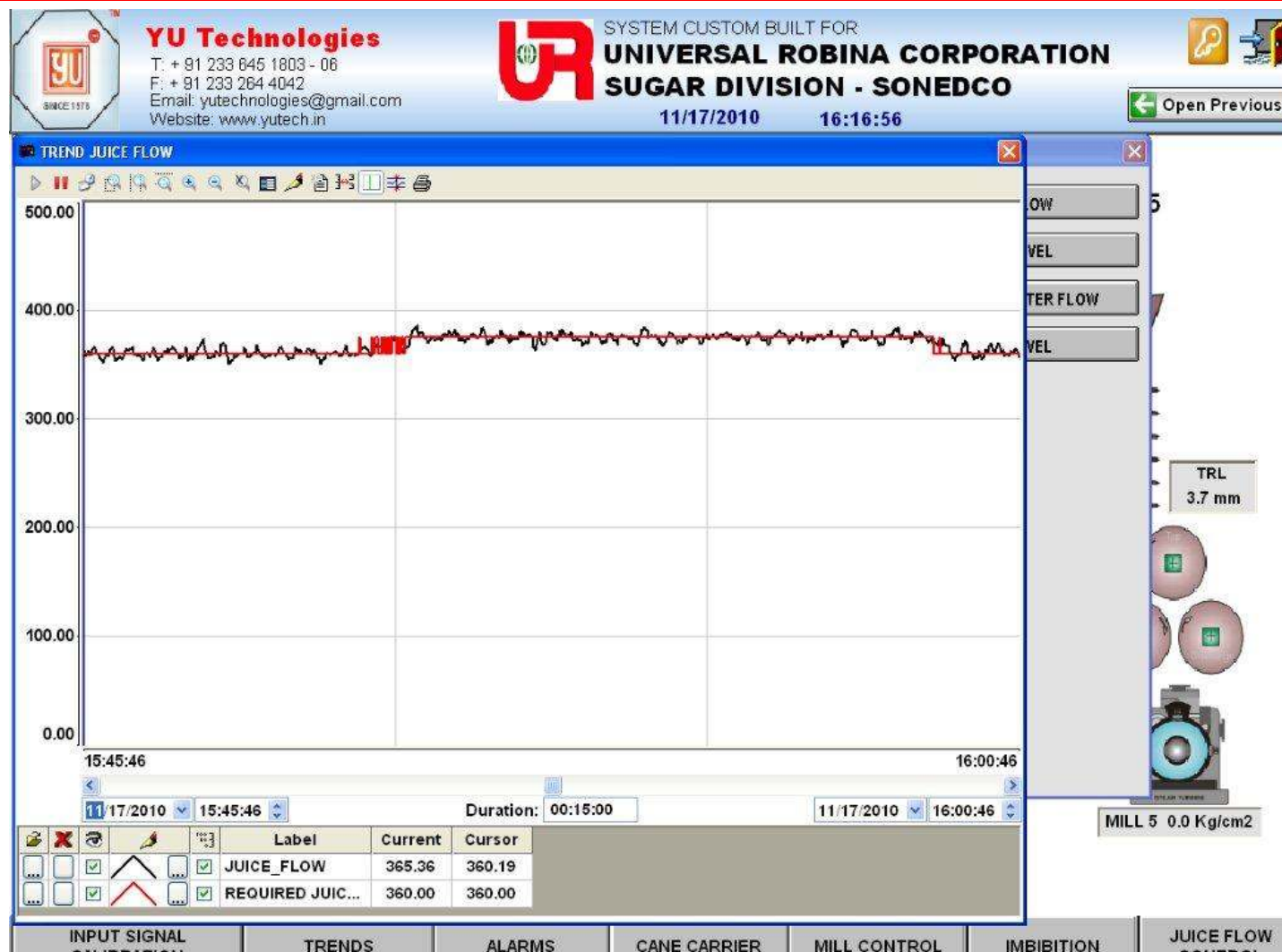
It is the final Loop for Automation of the Mill. The essence of Mill Automation. As this loop determines the Mill Tandem's Output.

Constant Flow of Juice is maintained by this Automation with respect to Juice Tank Level and Flow Rate. By Controlling either the Juice Pump VFD (which is a better practice) or by regulating the Juice Bypass Valve.

Juice Flow Control Screen Shot:



Juice Flow Control Actual Trend Screenshot:



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Mill House Automation Systems

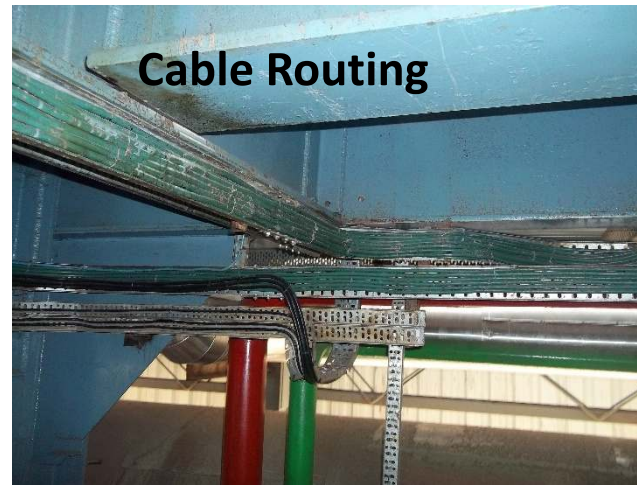


• Automatic Juice Flow Control System

Features:

- Level Transmitters for Sensing Juice Tank Level
- Maintain Constant Juice Flow to Process
- Juice Tank Level Sensing to avoid Juice Overflow and Pump Dry Run

Field Instrument Installation



Screen Shot of Centralized Mill Automation at Shree Renuka Sugars Gokak, India



YU Technologies

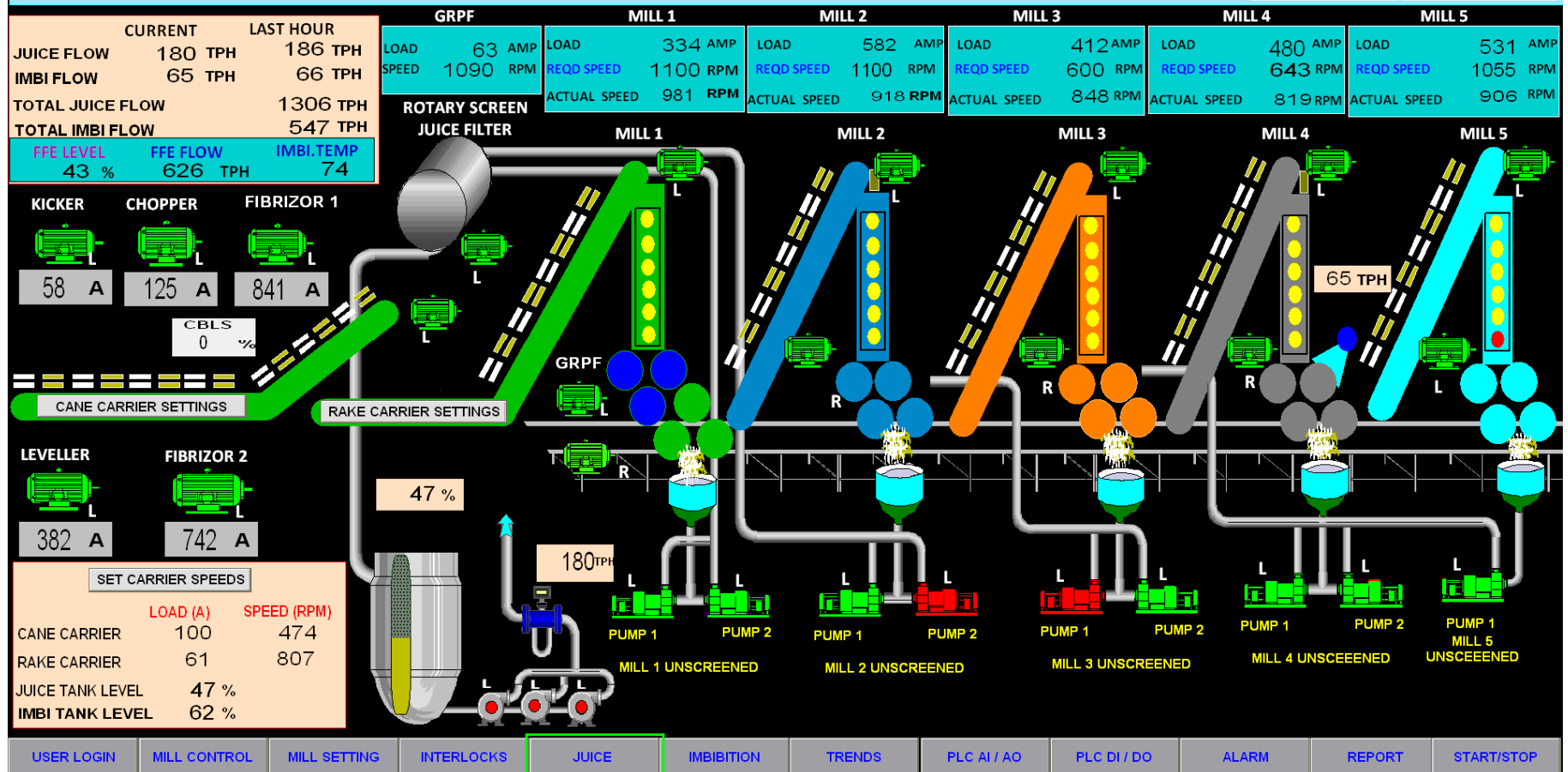
Website: www.yutech.in

Email: info@yutech.in

Centralized Mill Automation System

Custom Built For
Shree Renuka Sugars Ltd.
Factory: Gokak Sugars Ltd.

8:33:55 01/04/12



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Screen Shot of Mill Automation: Settings



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info@yutech.in

MILL SETTINGS

Custom Built For
SAKTHI SUGARS UNIT:SAKTHINAGAR

04/17/08 12:06:19

MILL - 1 SETTING

MAX MILL SPEED 700 RPM
MIN MILL SPEED 505 RPM
MAX MILL LOAD 500 AMP
MIN MILL LOAD 300 AMP
DCL 1 EFFECT 10 RPM
DCL 2 EFFECT 30 RPM
DCL 3 EFFECT 40 RPM
DCL 4 EFFECT 200 RPM
DCL 5 EFFECT 900 RPM
DCL 6 EFFECT 1000 RPM
LOOP UPDATE 5 Sec

MILL - 5&6 SETTING

MAX MILL SPEED 900 RPM
MIN MILL SPEED 600 RPM
MAX MILL LOAD 400 AMP
MIN MILL LOAD 200 AMP
DCL 1 EFFECT 0 RPM
DCL 2 EFFECT 0 RPM
DCL 3 EFFECT 0 RPM
DCL 4 EFFECT 0 RPM
DCL 5 EFFECT 0 RPM
DCL 6 EFFECT 0 RPM
LOOP UPDATE 5 Sec

MILL - 7 SETTING

MAX MILL SPEED 700 RPM
MIN MILL SPEED 350 RPM
MAX MILL LOAD 500 AMP
MIN MILL LOAD 200 AMP
DCL 1 EFFECT 50 RPM
DCL 2 EFFECT 75 RPM
DCL 3 EFFECT 100 RPM
DCL 4 EFFECT 300 RPM
DCL 5 EFFECT 350 RPM
DCL 6 EFFECT 375 RPM
LOOP UPDATE 5 Sec

PID SETTING

SET POINT 519. RPM
PV 512. RPM
P 0.50
I 0.05
D 0.00
AUTO
CONT OUT 46 %
MANUAL OUT 55.0 %
OUT MIN 45.0 %
OUT MAX 75.0 %

PID SETTING

SET POINT 870. RPM
PV 798. RPM
P 1.00
I 0.05
D 0.00
AUTO
CONT OUT 60 %
MANUAL OUT 0.00 %
OUT MIN 60.0 %
OUT MAX 90.0 %

PID SETTING

SET POINT 450. RPM
PV 453. RPM
P 0.50
I 0.05
D 0.00
AUTO
CONT OUT 44 %
MANUAL OUT 45.0 %
OUT MIN 40.0 %
OUT MAX 80.0 %

MILL CONTROL

MILL SETTING

ACFC EFFECT

ALARM

PLC AI / AO

PLC DI / DO

IMBIBITION & JUICE
FLOW CONTROL

REPORT

START/STOP

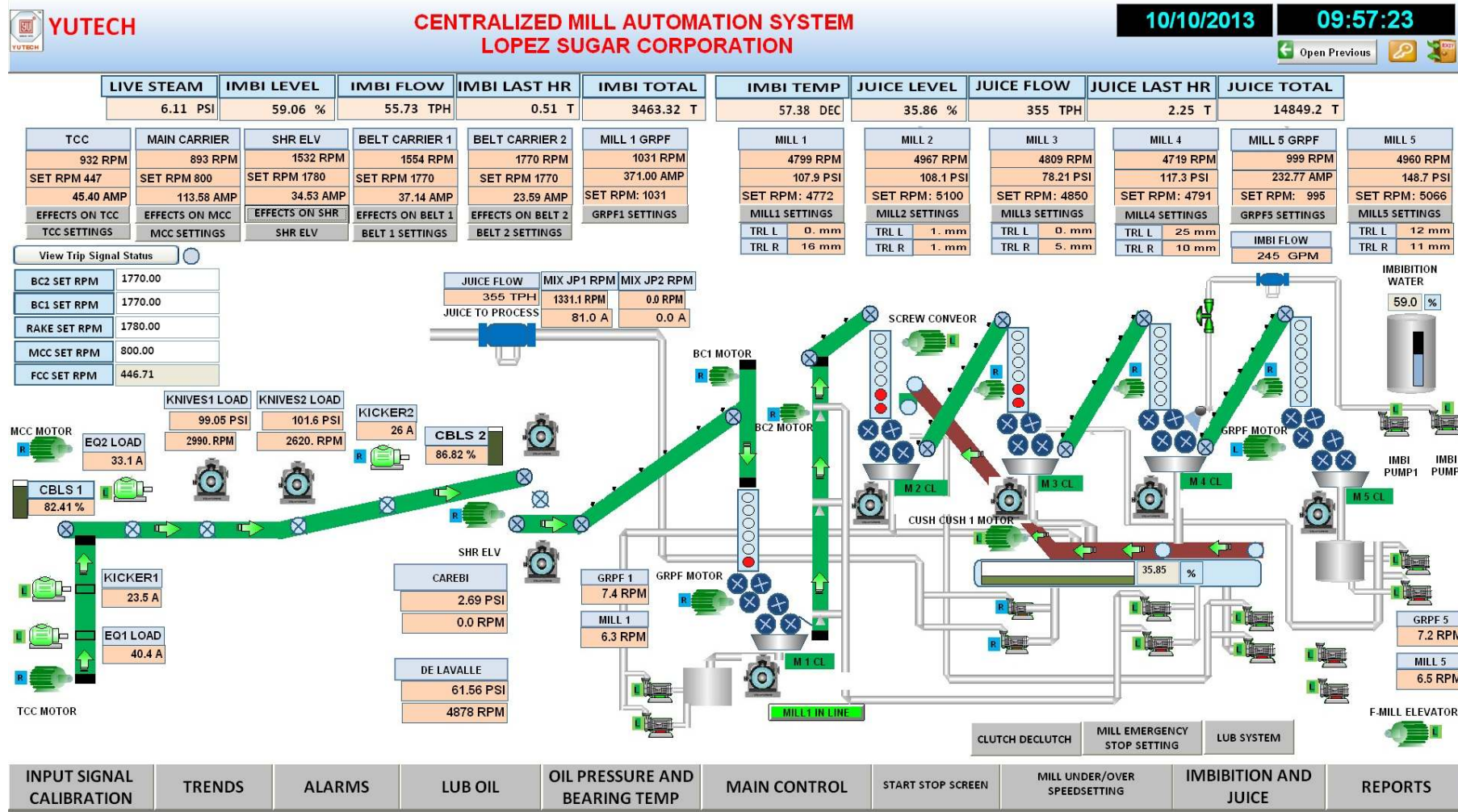
CC TREND

MILL TREND

JUICE/IMBI TREND

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Screen Shot of Mill Automation at Lopez Sugar, Negros, Occidental



Centralized Sugar Plant Automation Control Rooms:



Centralized Sugar Plant Automation Pictures:



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**

Advantages of Mill Automation:



Operational Advantages:

Increased Milling with the Same Equipment due to:

- ✓ Continuous and Un-interrupted Feeding reduces Downtime and Increase Throughput
- ✓ Elimination of Choking at Preparatory Devices, Mills, Chutes or Carriers
- Maintained Juice to Imbibition Water Ratio increases Evaporation Efficiency
- Optimum Mill Speeds with respect to Loads and Levels ensure good Milling Results at all times
- Effective water saving and cutting off water flow when crushing is stopped.
- Constant Juice Flow for Process ensures even loading in the Boiling House and Stabilizes and Reduces the Steam Consumption which means higher Boiling House efficiency and Bagasse Saving

Advantages of Mill Automation:



- Stable Juice Flow also helps in better Juice pH Control which in turn ensures better Juice and Sugar Colour which means better Sugar Price
- Constant Process Flow ensures better Boiling House Efficiency

Improved Milling Performance

- ✓ Constant Load on Preparatory Devices ensures Better Cane Preparation resulting in better extraction, RME, Reduced Bagasse Pol and Moisture
- ✓ Constant Load on Mills and Level in all Donnelly Chutes results in Power and Steam Savings
- ✓ Constant Load on Mills also results in Lesser Mechanical Wear & Tear

Why invest in YUTECH Products



- 1. Experience of over 30 years with Expertise of a very highly qualified Engineering Team.**
- 2. Superior Technical Support with Remote Access Facility.**
- 3. Excellent Quality Workmanship.**
- 4. Extensive Warranty Coverage.**
- 5. Highly accurate calibration facilities with traceability certifications.**
- 6. Feature Rich State of the Art Technology developed and matured in the Sugar Environment.**

YUTECH Technical Advantage:



- Highly Qualified Experienced and Strong Engineering Team.
- In-house System Engineering.
- In-house Design and Development of Systems and Controls.
- In-house Design, Development and Manufacturing of Industrial Electronics, Instrumentation and Automation Equipments.
- In-house Software Development from Micro Controller Programming to SCADA, PLC, DCS Programming to Visual Basic etc.

YUTECH Mill Automation Case Study:



**A Case Study of Performance of the Mills with
and Without Automation in:**

The Ugar Sugar Works Ltd.,

**Ugar Khurd, Tal: Athani, Dist. Belgaum,
Karnataka, India.**

www.ugarsugar.com

helpdesk@ugarsugar.com

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Milling Performance with and without Automation: Ugar Sugar Works – Value Analysis



Sr	PARTICULARS	SEASON 2009-2010 AutoCane	SEASON 2010-2011 Partial Automation	SEASON 2011-2012 Full Automation
1	CROP DAYS	160	177	132
2	CANE CRUSHED	1427046	1599327	1322904
3	AVERAGE CRUSHING PER DAY	8919	9036	10022
4	POL % CANE	13.58	13.21	13.86
5	RECOVERY % CANE	11.54	11.26	11.86
6	MILL EXTRACTION	95.03	95.09	95.38
7	REDUCED MILL EXTRACTION (RME)	95.66	95.72	95.93
8	POL % BAGASSE (LAST MILL)	2.26	2.17	2.16
9	MOISTURE % BAGASSE (LAST MILL)	50.10%	50.02%	49.66%
10	POL LOSS IN BAGASSE % CANE	0.68	0.65	0.64
11	BAGASSE SAVE % CANE	1.93	2.24	2.84

Power Savings due to Mill Automation: Ugar Sugar Works



Sr	PARTICULARS	SEASON 2009-2010 AutoCane	SEASON 2010-2011 Partial Automation	SEASON 2011-2012 Full Automation
1	CROP DAYS	160	177	132
2	CANE CRUSHED	1427046	1599327	1322909
3	AVERAGE CRUSHING PER DAY	8919	9036	10022
4	POWER CONSUMPTION ON 33x66 MILL KWH	13.84	14.31	12.56
5	POWER CONSUMPTION ON 42x84 MILL KWH	11.91	11.41	12.13
6	TOTAL POWER CONSUMPTION ON BOTH MILLS KWH	25.75	25.72	24.69

Tangible Economic Benefits at Ugar Sugar Works

By Power Saving:



1	Power Saving 1 KWH per ton of cane	KWH	1
2	Cane Crushed in Season 2011-2012	M.T.	1322909
3	Energy Saved during Season 2011-2012	KWH	1322909
3	Power Rate per KWH	Rs.	4
4	Savings	Rs.	5291636.00
5	Savings in US Dollars	USD	101762.00

Tangible Economic Benefits at Ugar Sugar Works

By Bagasse and Sugar Savings:



Total Bagasse Saving (0.6% increase)	Tons	2391
Monetary Benefit by this saving (Price 1400/- per Ton)	Rs.	3,347400.00
Bagasse Price per Ton	Rs.	1400.00
Sugar in Bagasse % Cane	Tons	36
Sugar Price per Kg	Rs.	30.00
Total extra earning by sale of this sugar	Rs.	1,080000.00

Total Saving: Rs. 9,719036.00

Total Saving: USD 186904.00

YUTECH Mill Automation Case Study:

Benefits of Mill Automation:



Sahakari Khand Udyog Mandal Ltd., Gandevi, Gujarat, India

Year	Average Crushing (TPD)	Total Cane Crushed (Tons)	Total Steam Consumed (Tons)	Steam consumed as % of Cane	Saving wrt last year
2011-12	6049	9,73,357	1,38,479	14.23%	
2012-13	6378	11,09,610	1,38,180	12.45%	1.77%
2013-14 (till 31st Dec 13)	6462	3,58,178	42,367	11.83%	0.62%

Sahakari Khand Udyog Mandal Ltd., Gandevi

Benefits of Mill Automation



Bagasse Pol	Mill Extraction	Recovery %	Mix Juice %	Bagasse Water %	Avg Added Water to %Cane	Stoppages Mechanical Total Plant
1.826	96.30	11.68	106.40%	49.38%	33.7160	21 Hrs
1.785	96.45	11.74	105.22%	49.34%	32.0200	18 Hrs
1.810	96.62	12.71	104.51%	49.44%	31.2330	12 Hrs

Benefits of Mill Automation



Gandevi Benefits Observed:

- Reduced Maintenance and Breakdown
- Increased Throughput due to constant Crushing
- Reduced Steam Consumption of upto 2% hence Bagasse Saving

Ugar Intangible Benefits Observed:

- Reduced Overall Maintenance
- Reduced Mill DC Drives Maintenance
- Reduced Breakdown
- Increased Throughput
- More Cane Crushed in Lesser Days

Concluding Remarks



Tailor-made automation solutions within Sugar Industry are the need of time to gain

- **Efficiency**
- **Energy savings in electricity, fuel and other natural resources.**
- **Improving Quality while achieving Cost Reduction**

THANK YOU!
For your time and Presence

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

