PSST TECHNICAL WORKSHOP 2022 KARACHI

Technological Development to improve profitability of Sugar industry

"An Engineering , Power Cogen & Compatibility Perspective"

Presented by

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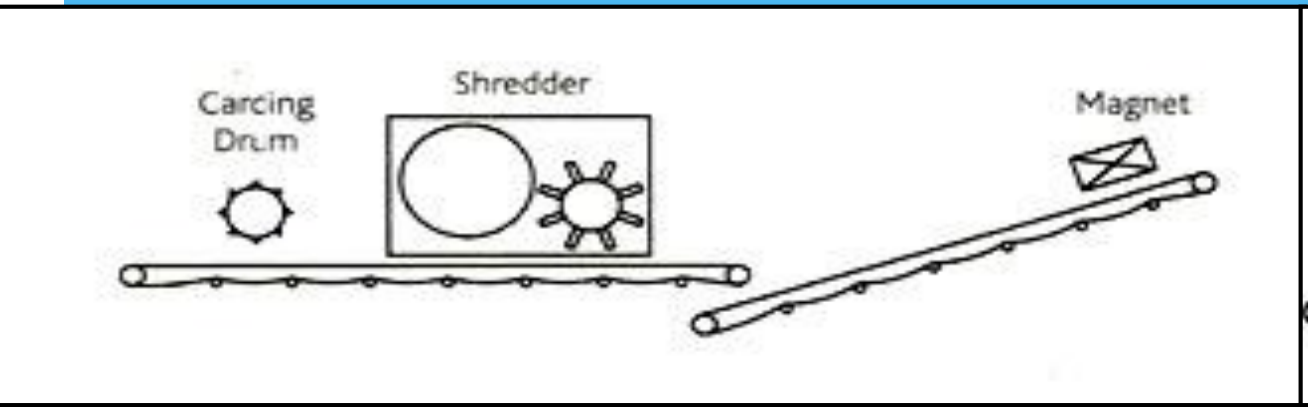
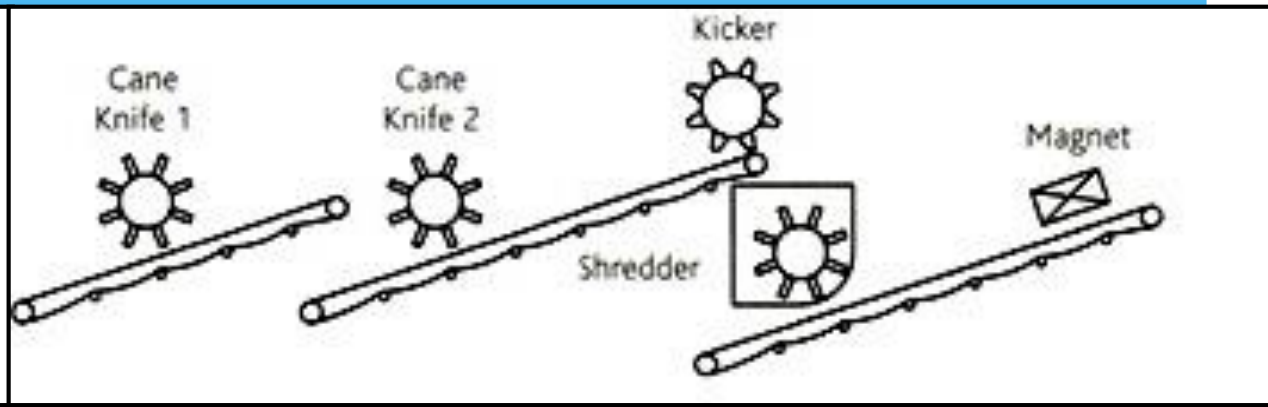
INTRODUCTION

By and large, Technological developments contribute a consistent share to manage profitability of sugar industry. However, prime variables like cane purchasing cost, sugar sales and relevant over heads always reflects a different scenario at the start of every new season. Therefore, technological - developed inductions termed as consistent contributor to increase the profitability of sugar industry or manage break – even in yearly financial regime.

CHOICE AVAILABLE FOR PRIMARY TASK (PREPARATION)

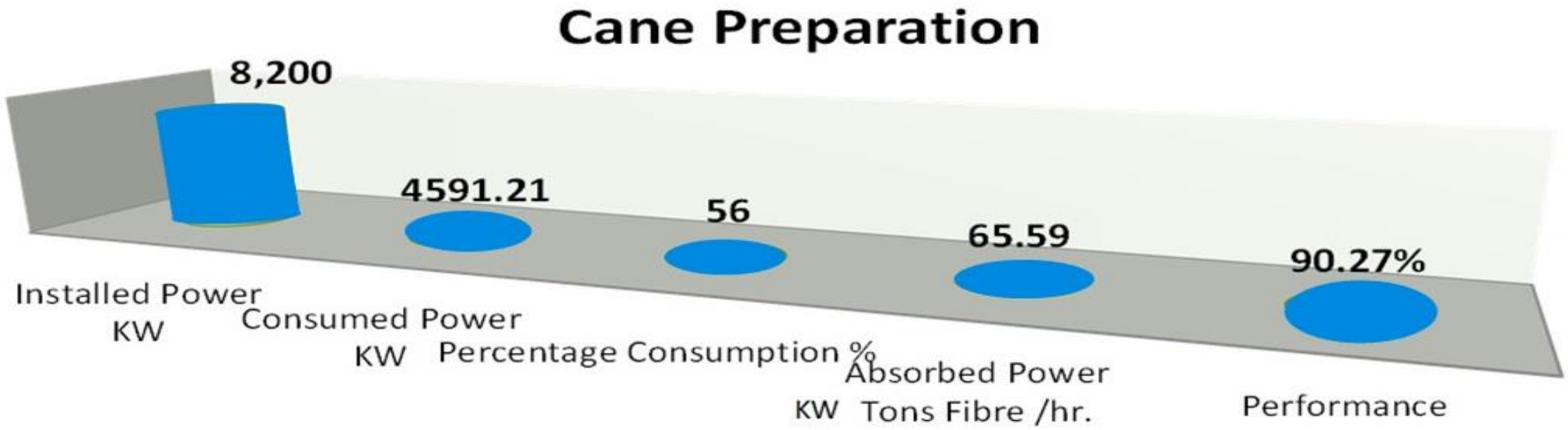




Features	Fibrizar			HD Shredder with dual Set of knives		
	Leveler	Pusher Drum	Shredder	Cane Cutter (Rough)	Cane Cutter (Fine)	Shredder
Power Installed	1.25 KW/Tons fibre	1.25 KW/Tons fiber	50 KW/Tons fiber	11 KW/Tons fiber	15 KW/Tons fiber	45 KW/Tons fiber
Consumable Status	Hard Facing	Hard facing	Hammers / Hard Facing	Knives / Hard facing	Knives/Hard facing	Hammers / Hard facing
Down Time / Maintenance	Minimum due to lesser integrated rotating devices. While, only hammer take up for planned stoppage against wearing during season 2 – 4 (hours)			Comparatively higher for intermittently planned stoppages for knives & hammer replacement against wearing during season 6 – 8 (hours)		
Limitations	Capacity limitations / Single unit dependency			Due to excess combination of cutting devices pith production on higher side, frequency of particles are flowing in system, Minute particles traveling with juice to process , Bagacillo loss		
Performance (P.I)	89 – 90 with long stringy fibre use to make advantageous roller grip-ability & better combustion efficiency as fuel.			90 figure consistency with additional provision of cutter set , Bypass can possible if any one device interrupted to manage crushing for short intervals		

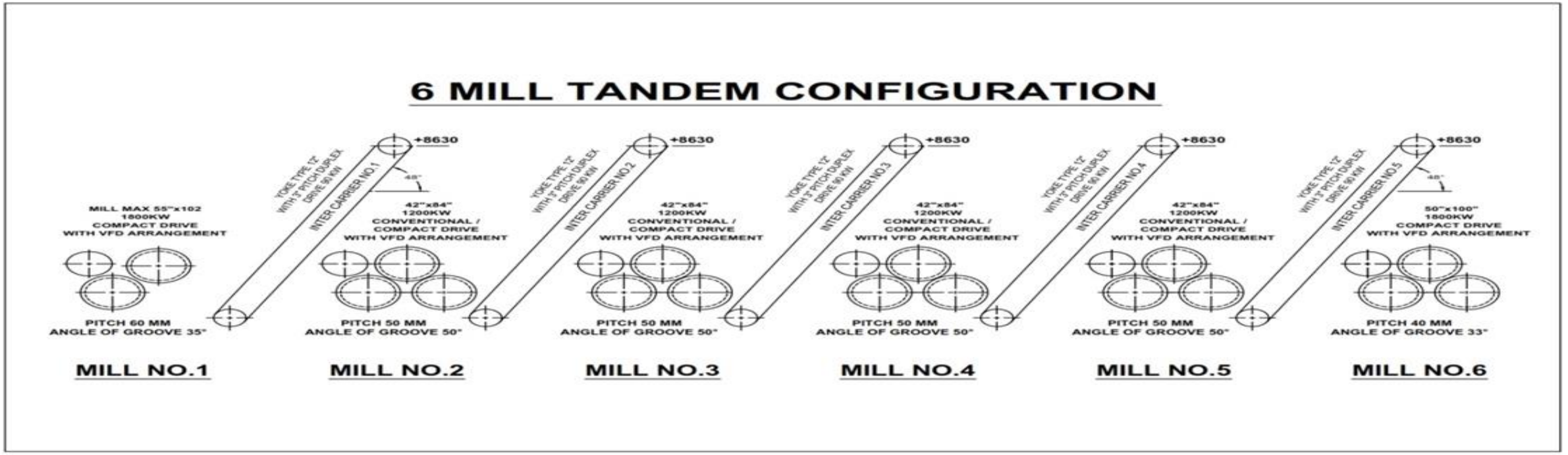
OPTIMUM PERFORMANCE @ POWER UTILIZATION

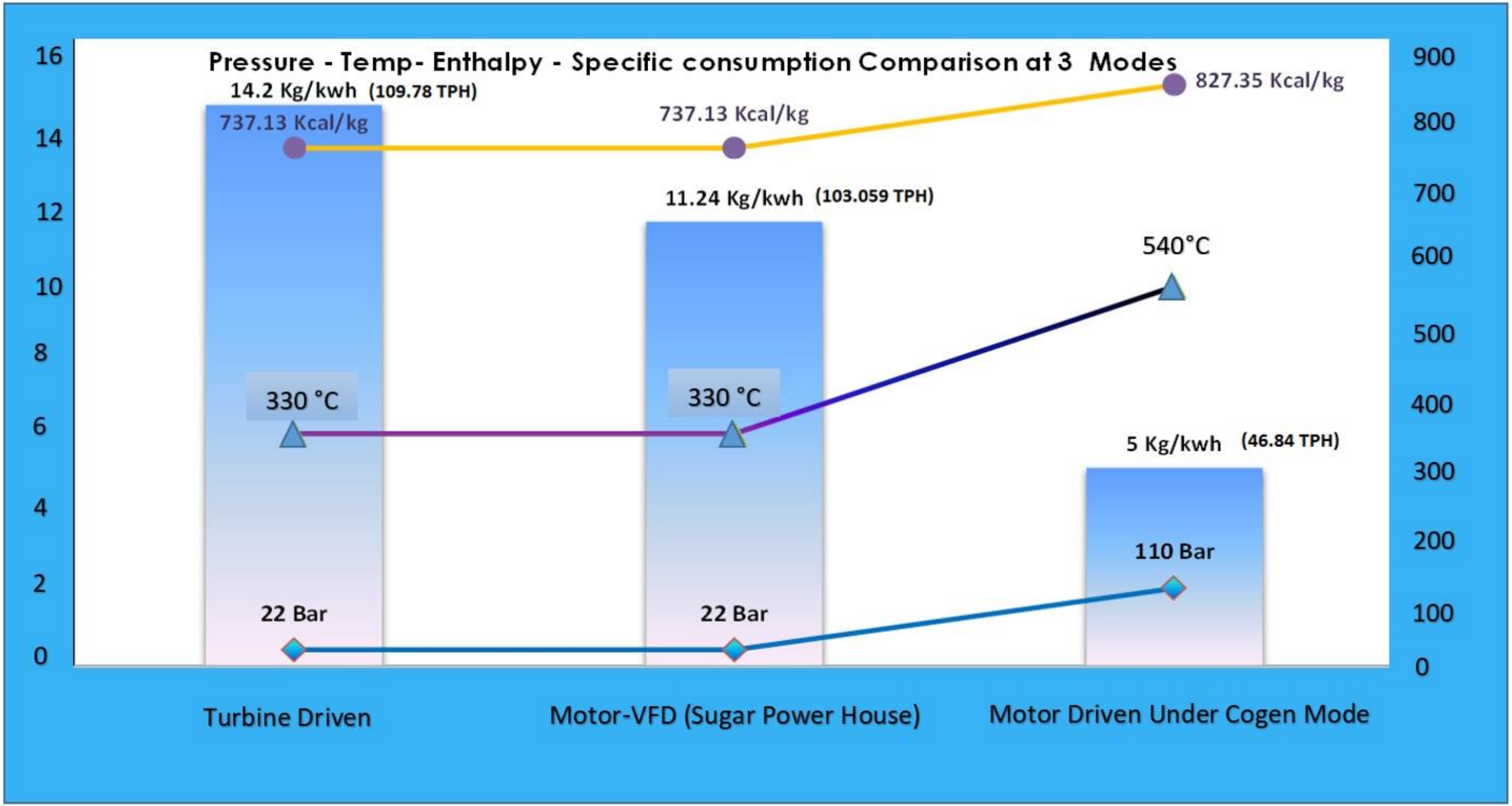
4 - Devices comprises on 3 HD cutters followed by HD Cane shredder drive through Motorized – VFD arrangement. Primary task @ higher power contributes capacity crushing. A summarized figure of 65.59 - 70 KW/Tons fibre/Hr is referred to be an optimized relation for targeted results.



WHAT WOULD BE THE TANDEM CONFIGURATION ?

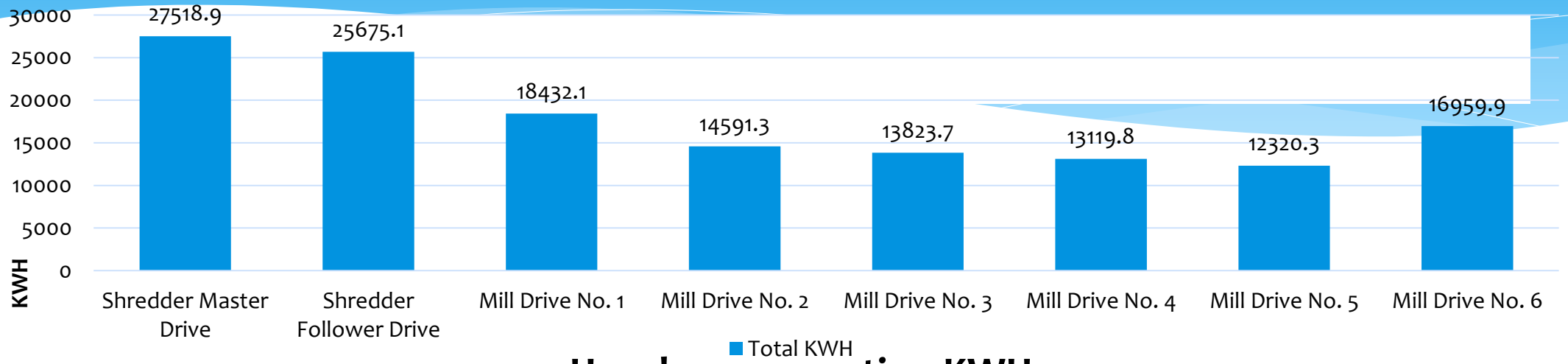
Ideally, milling configuration at rated power consumption having two different scenario are exists in country, one at specific conventional turbine driven mode while other completely electrified mode of drive with an efficient VFD arrangement. Here, bench – mark figures are 12 – 14 KWH/Ton of cane for Turbine - driven prime movers while for electric drives its 25 - 26 KWH/Ton of cane. While, in comparison its 15 - 16 KWH/Ton of cane & 27-28 KWH/Ton of cane in country have been experienced.



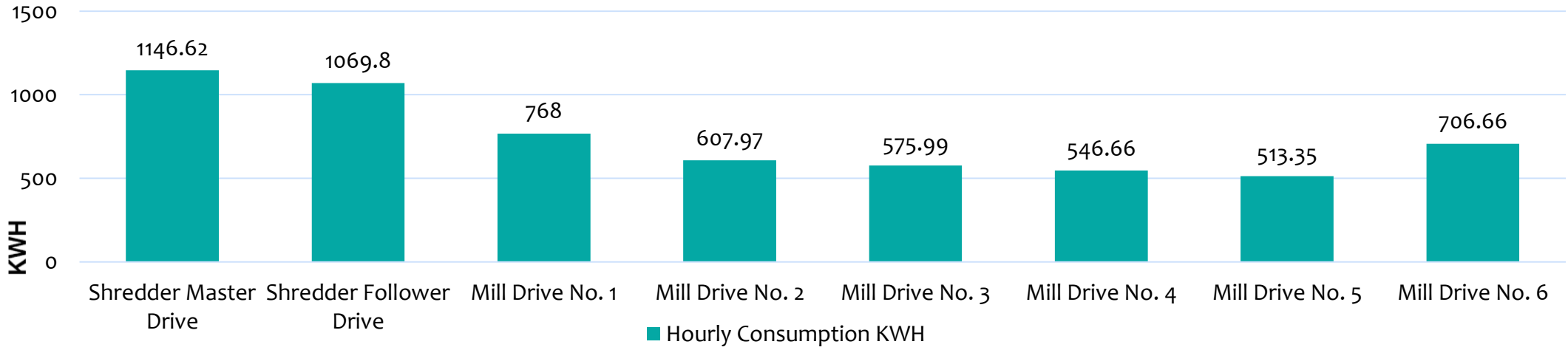

Pressure - Temp- Enthalpy - Specific consumption Comparison at 3 Modes
14.2 Kg/kwh (109.78 TPH)
737.13 Kcal/kg
737.13 Kcal/kg
827.35 Kcal/kg
11.24 Kg/kwh (103.059 TPH)
540°C
330 °C
330 °C
5 Kg/kwh (46.84 TPH)
110 Bar
22 Bar
22 Bar
0
2
4
6
8
10
12
14
16
0
100
200
300
400
500
600
700
800
900
Turbine Driven
Motor-VFD (Sugar Power House)
Motor Driven Under Cogen Mode

ELECTRIC - DRIVES ABSORBED POWER
FOR 12000 TCD SPECIFIC CONSUMPTION 25.84 KW/TON OF CANE

Total KWH (For 24 Hours)

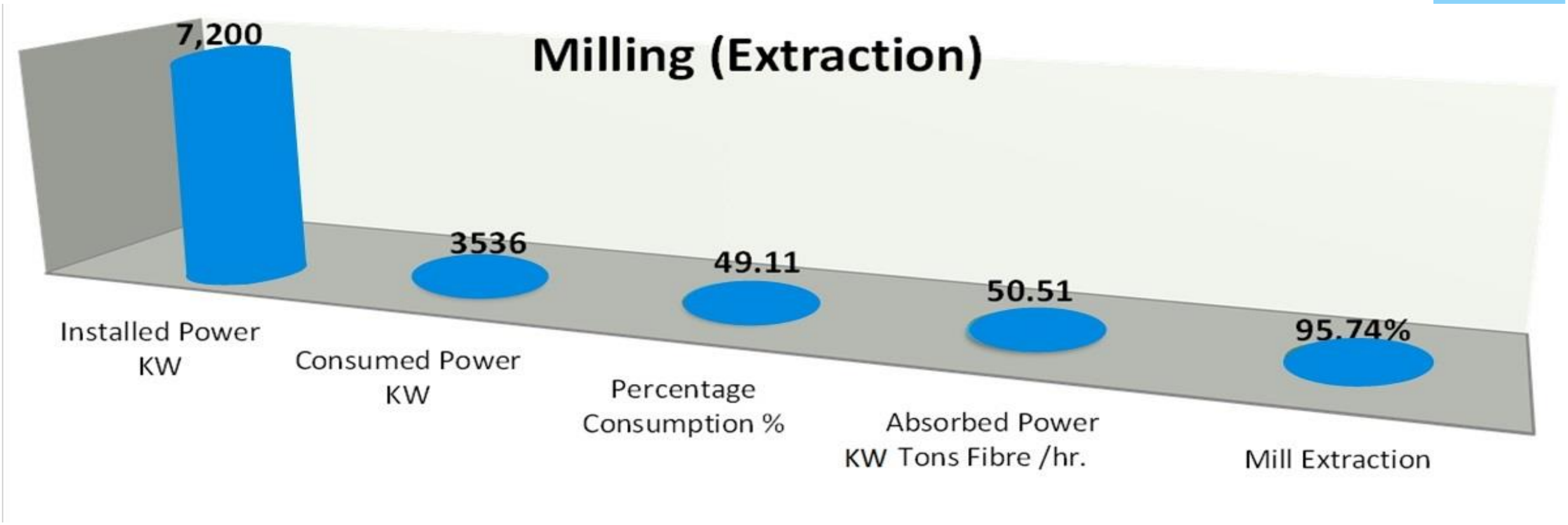


Hourly consumption KWH



MILLING OPERATIONS

Secondary task after preparation proceeds to milling operations which attains at lesser power @ 49.11 % of installed power. While, 50.51 KW/Tons fibre/hr to meets optimum figures. Its significant that 25% further crushing capacity can be realized with only 5 % additional power consumption on same series of equipment.



SPECIFIC DEVELOPMENTS TO MANAGE CONSISTING RESULTS

Advantage of larger Mills at first & last duties at Tandems

An application of Two Roller Mill at first duty ensures the capacity enhancement, first extraction 70 plus @ lesser power consumption while for last one as 4 roller configuration stands for control results @ reduce speed even at high imbibition rates

Compact Gearing with integrated MMC (Multi-misalignment / Rope - coupling)

Combination use to ensures 98% power transmission from source to an application with compact gearing. However, MMC a value added aspect to control the repeated action of lift phenomenon by replacing the conventional Tail-bar. However, compact gearing is being facilitating through absorbing advantage of design yokes of applied coupling & ultimately balance un even jerks in reliable mode of operation.

Mill Speeds & Automation

There are two schools of thoughts regarding operation is concerns, close - mill settings and Optimum speeds (RPM). Its rich - experienced that RPM always has the dominant role of milling control & subsequent results.

Ideally, for first and last Mill have same RPM (4 – 4.5) or vary within 0.5 RPM range on capacity crushing subject to rate of imbibition & applicable temperature. Such practice use to make an efficient control mechanism. Automation stabilize the operation and eliminates the momentary - stoppages and enhance capacity by 5%.

Roller Grooving

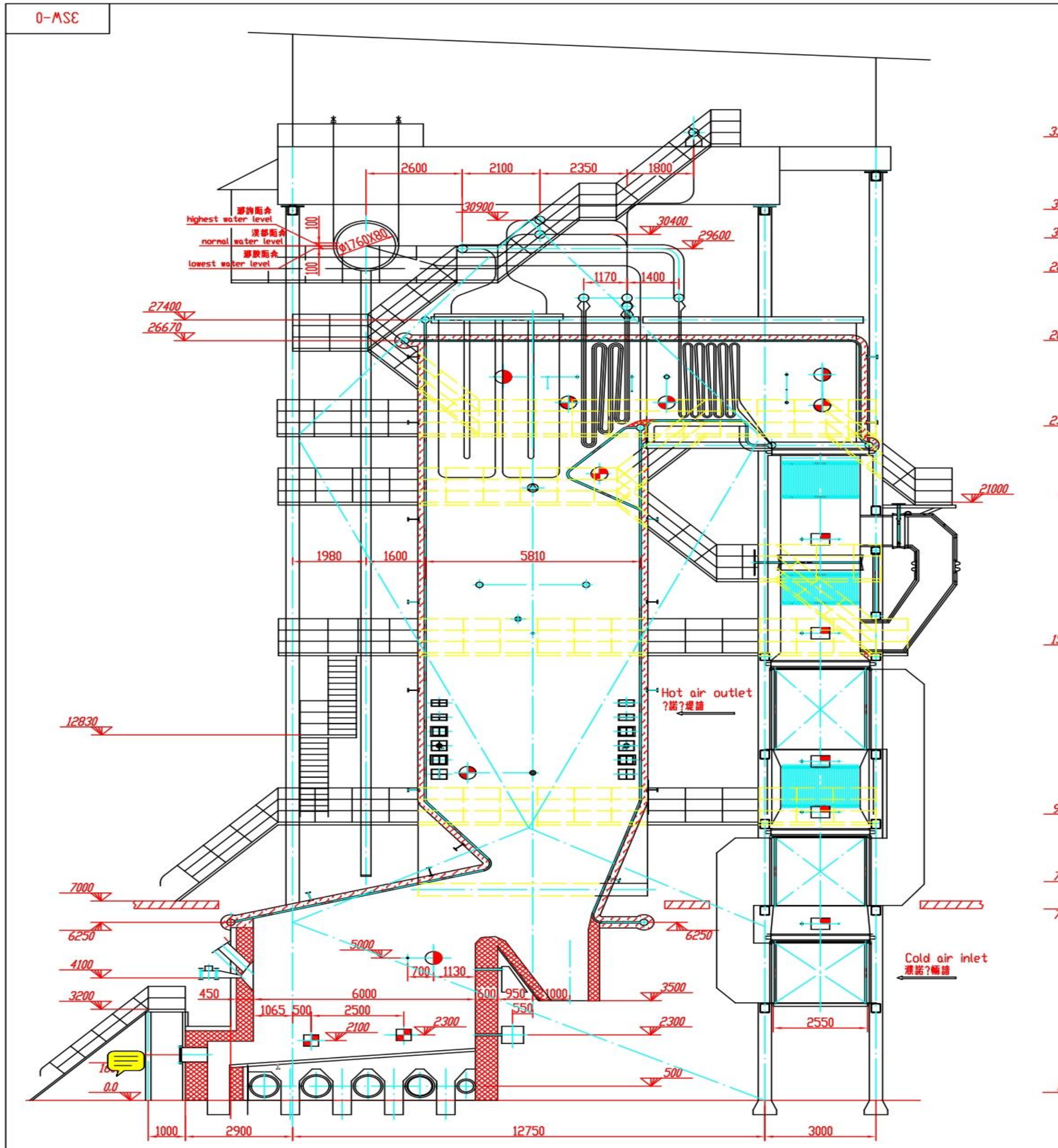
First & last mill equipped with 35^0 groove angle significantly improved drainage to maximize first extraction up to 70% plus while at last duty arrangement will make control of bagasse pol and moisture. While intermediate mills can equipped with $45\text{-}50^0$

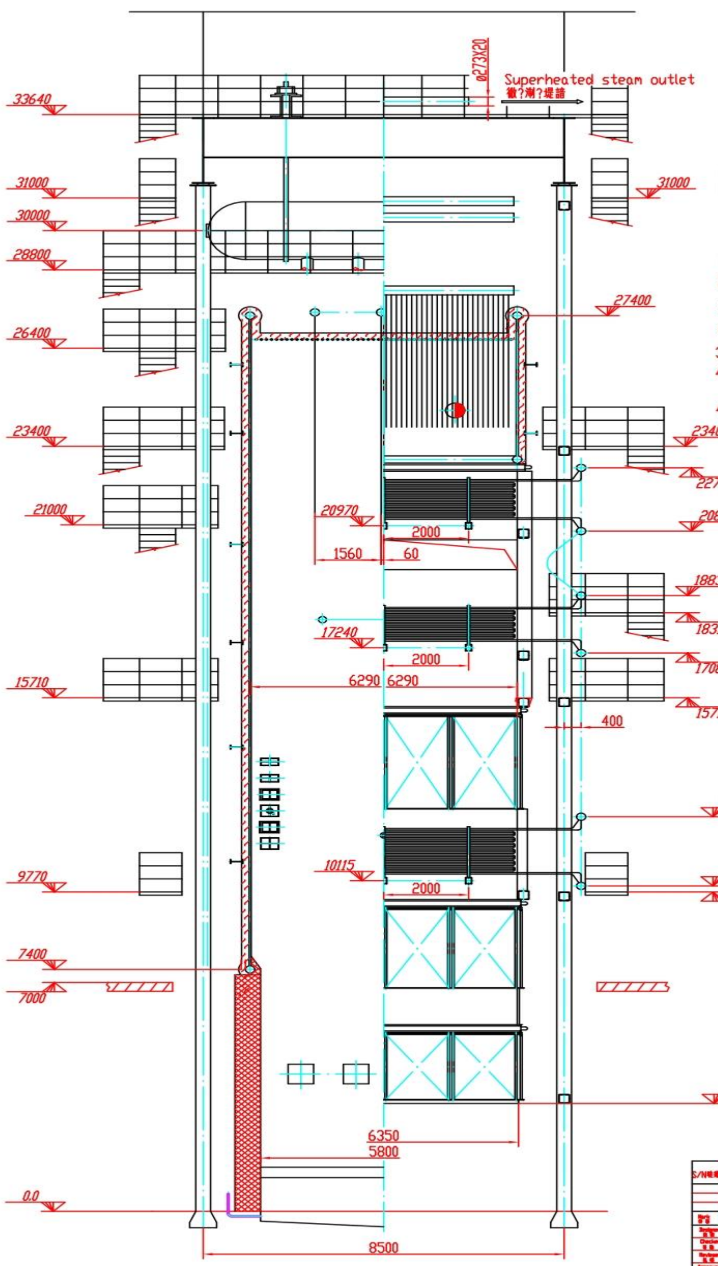
Application of Lotus Roller

An improved extraction has been experienced at Top & discharge equipped at specific mill.

HP Boiler

1. Principally, HP boiler uses intensive heat which enhance furnace temperature high enough, hence 70% of heat transmit to water by radiation , that's faster way of heat transfer.
2. High-pressure boilers have better firing methods, default based acute-monitoring automation, sealed furnace, Membrane equipped conditions, high velocity of water & gases, tendency of scale minimized.
3. Steam - Air Pre-heater is value added aspects to ensures combustion efficiency by enhancing ambient temperature air to 100 ^{O}C. This can finally ensures 961 ^{O}C temp at furnace.
4. For increasing the combustion rate and thus heat-release rate, pressurized air is used in the furnace. It gives a large amount of heat in a small space.
5. Significantly, Steam – bagasse ratio approached to 2.5 which is bench mark for bagasse fired boiler in country.





Technical Requirements 撮抖剃?

The following codes and standards shall be followed in boiler design, manufacture, installation and operation.

廓簪抡數,桼婖,假皴,堍倥剃睫磁眇狚寘最摯梓枸.

1.Steam Boiler Safety Technology Supervisory Regulations

1.<<涮?廓簪假?撮抖澭舷寘最>>;

2.DL/T5047-95 Code of Erection and Acceptance of Electric Power Construction Section of Steam Boiler Set

2.DL/T5047-95萇菪膘抡囫馱摯梳彶撮抖寘龲(廓簪儂鄙?) ;

3.GB/T12145-2008 Quality criterion of water and steam for for generating unit and steam power equipment

3.GB/T12145-2008鴌菪楷萇儂鄙摯涮?抡掘阨?窒請梓枸.

4.TSG G0002-2010 Supervision on Energy Conservation Technology for Boiler

4.TSG G0002-2010 廓簪誹夔撮抖澭飭摮熗寘最

Boiler Specifocations 廓簪寘龲		
Model: 倰燭U DHG100-9.0/540-A.G Fixed grate, single boiler drum and natural circulation boiler with water pipe		
Boiler Parameters 廓簪统杆		
Fuel ?蹋U	Bagasse 涫崎	Coal powder 撳爜
Rated steaming capacity:	100t/h	
Supersteam pressure:	9.0MPa	
Supersteam temperature:	540°C	
Feed water temperature:	150°C	
Exhaust gas temperature:	164°C	168°C
Boiler efficiency:	85.3%	87.9%
Lower heating value:	1850Kcal/kg	4500Kcal/kg
Fuel comsumption:	43207Kg/h	17280Kg/h

DWG. No.	Name	Qty.	Material	Unit Weight	Total Weight	Remarks

Boiler General Plan 廓簪軞芞

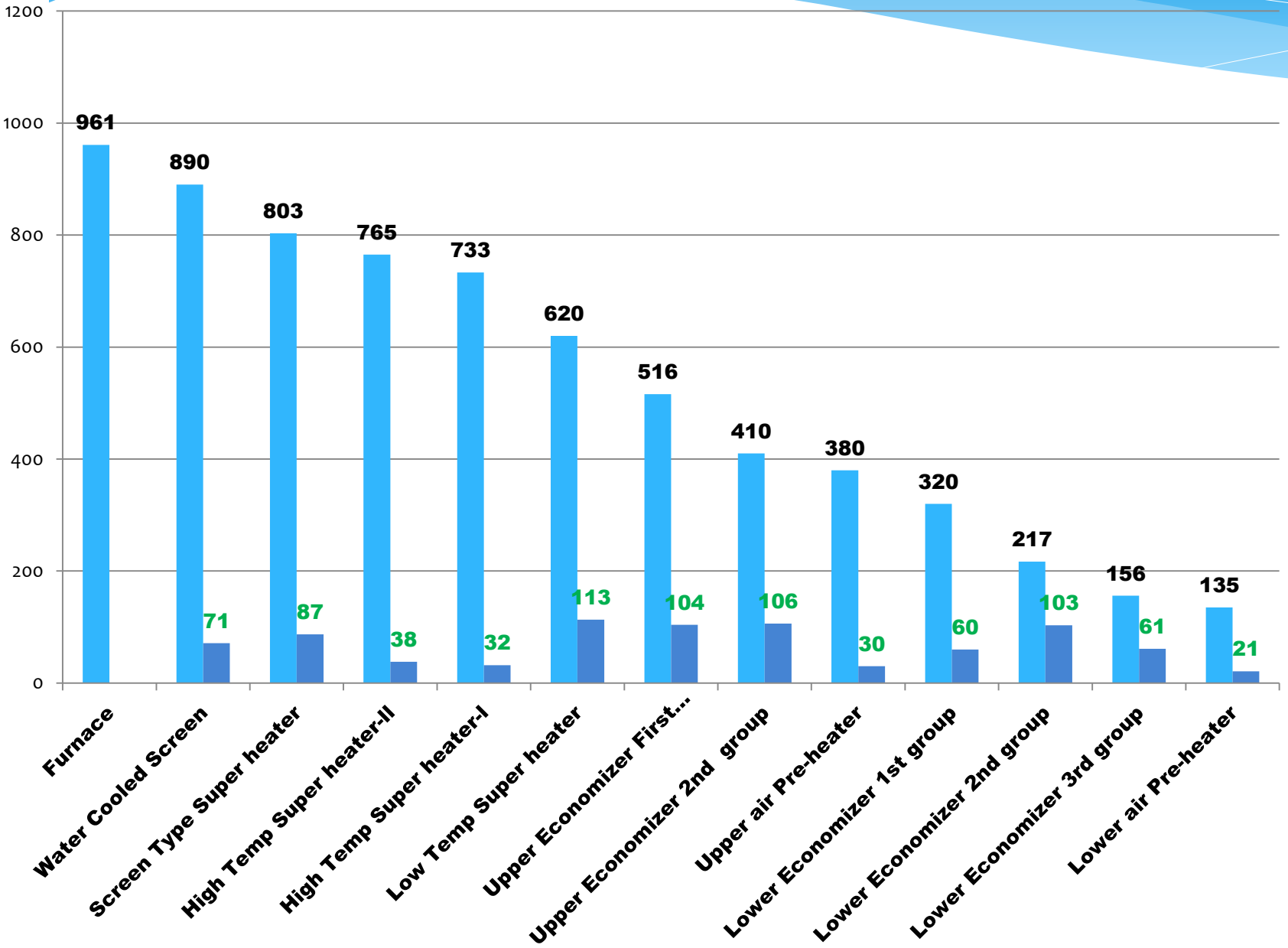
3SW-0

A

1 : 70

DHG100-9.0/540-A.G

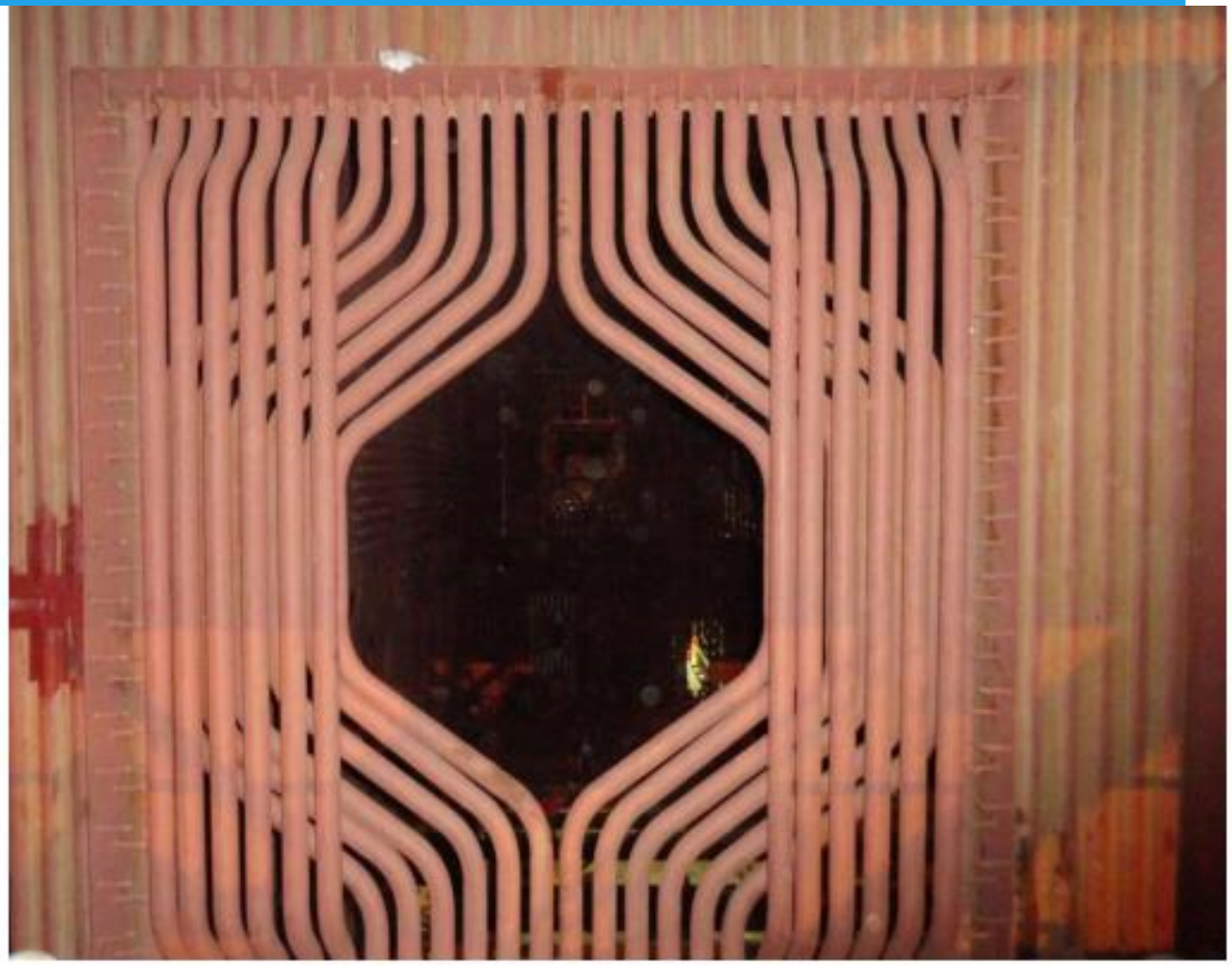
Thermodynamic aspect of combustion gases in HP Boiler from furnace to atmospheric discharge(control measures) Feed water temp 240^{O}C (3 set of Economizer) Drum Steam temp 323^{O}C, Steam temp 540^{O}C with 4 set of super heaters @ 85.91% efficiency



Thermodynamic aspect of Flue – gases in HP Boiler for control measures Temp (oC)

Temp reduce (oC) from furnace to atmosphere

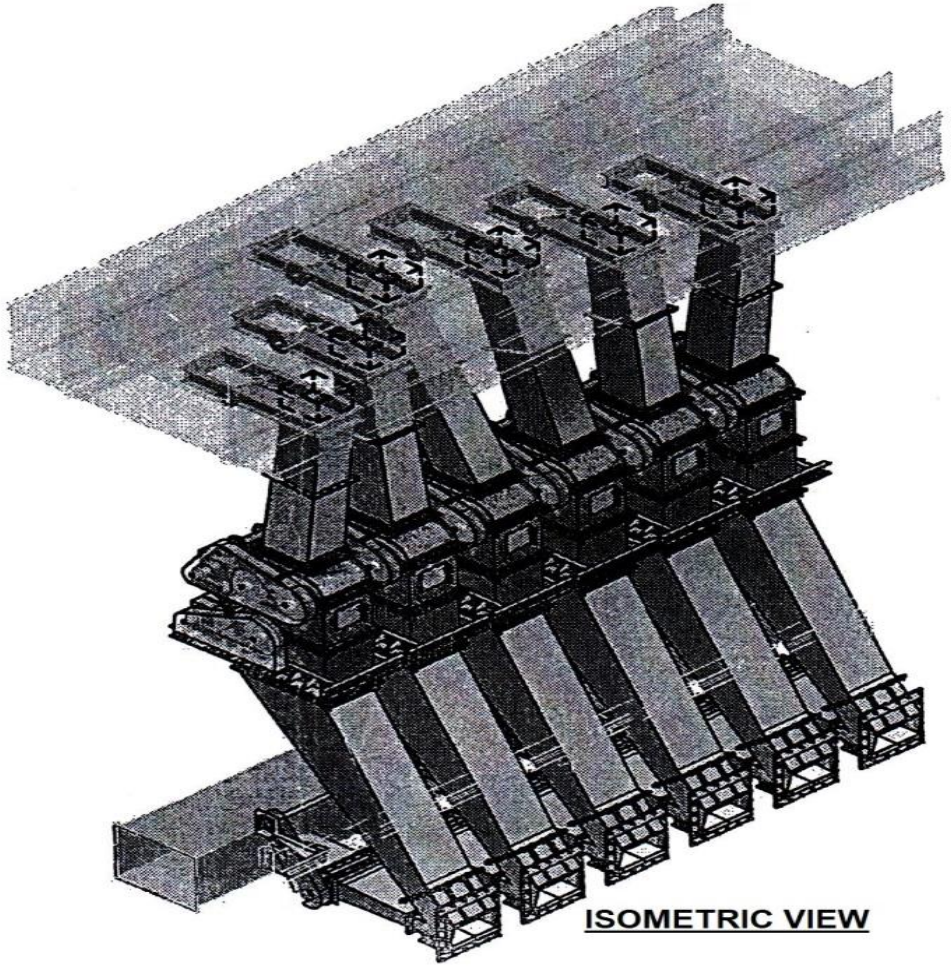
Membrane wall contributes in HP boilers @ 80 KW/M^2 heat release rate averagely. While heat load bearing 128 KW/M^2 max. Its contributes air-tight construction, evenly poised distribution of heat in furnace.



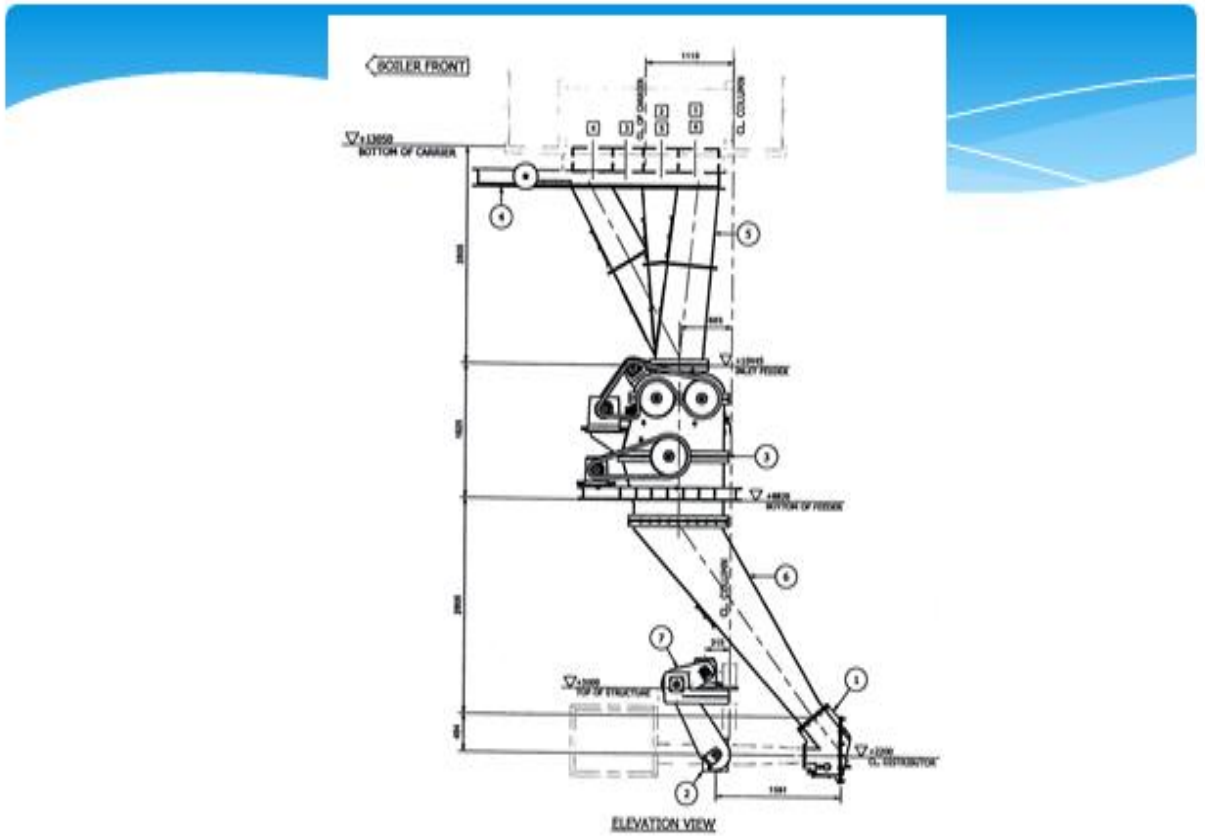
MEMBRANE WALL

TWIN – ROLLERS BAGASSE FEEDERS

Special feature of HP Boilers facilitates uniform Lumps free bagasse feeding across the furnace to improve combustion efficiency. An addition of spreader fan also do the even distribution to improve combustion. However, this arrangement also can incorporated in LP boiler to improve furnace efficiency.



ISOMETRIC VIEW



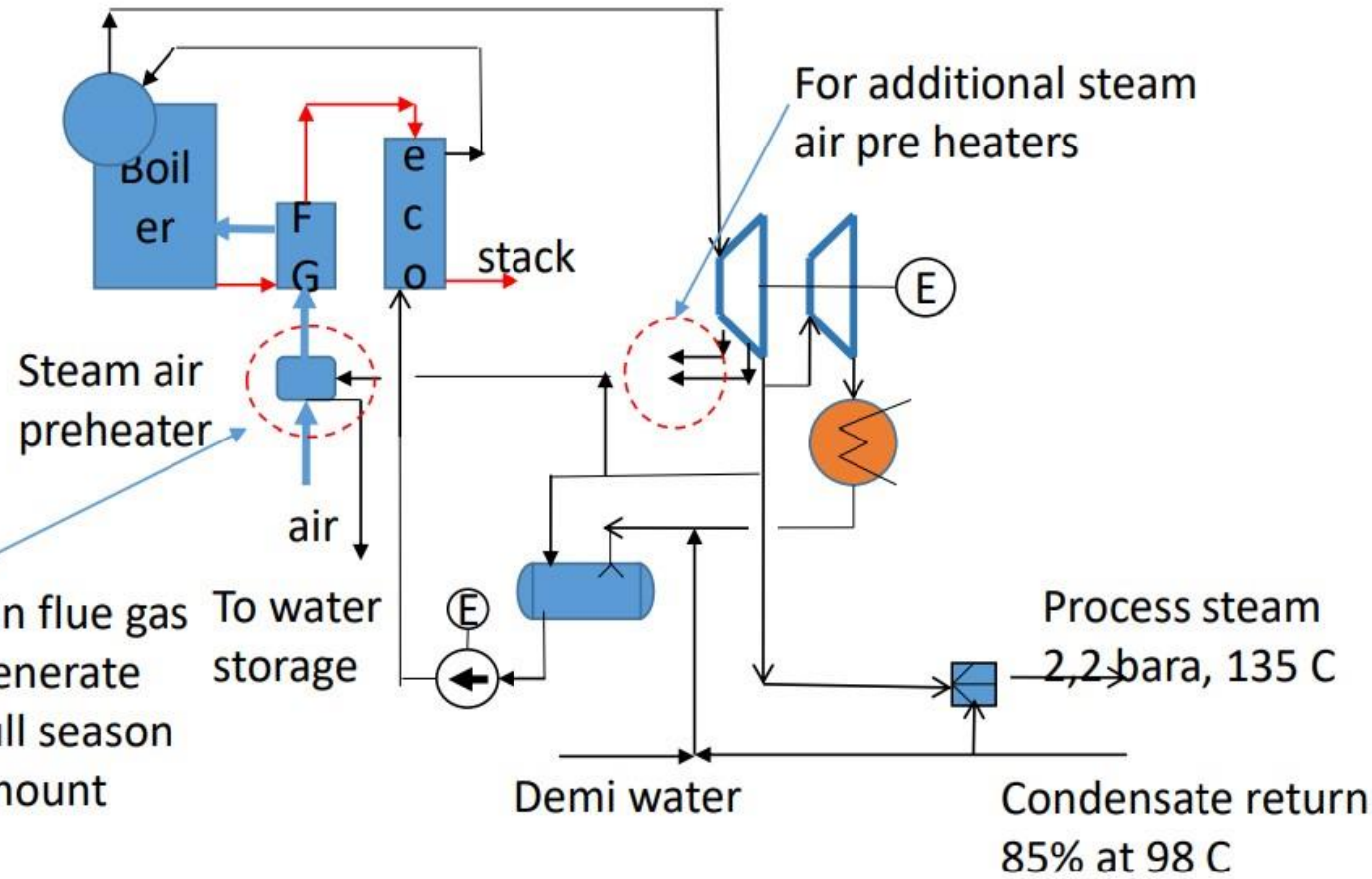
ELEVATION VIEW

STATUS OF BAGASSE AS FUEL ONCE SUBJECTED TO COMBUSTION AT VARIOUS SCENARIO

Scenario	Bagasse Pol %	Bagasse Moisture %	Heat available After combustion Kcal/kg	Useful heat for generation Kcal/kg*	Steam/bagasse Ratio
1	1.6	51.50	1733.05	1355.24	2.10
2	1.6	51.00	1757.3	1374.20	2.13
3	1.6	50.50	1781.55	1393.17	2.15
4	1.6	50.00	1805.80	1412.13	2.18
5	1.6	49.50	1830.05	1431.09	2.21
6	1.6	49.00	1854.30	1450.06	2.24
7	1.6	48.00	1902.80	1487.98	2.30

Note:* Useful heat subjected to deduction of sensible heat loss through flue gases, un-burnt solid, radiation, convection and imperfect combustion. However, excess air take up @ 36 % with 78 % boiler efficiency, 180 - 190^{O}C flue gas temperature for 24 bar operation. **While in comparison through HP regime this efficiency can enhance up to 85.91 @ 135^{O}C flue gas temperature to atmosphere with steam bagasse ratio 2.47 – 2.50**

System with one boiler and one condensing /extraction steam turbine and air steam preheater



Prevents corrosion in flue gas air preheater and generate more power over full season for fixed bagasse amount

Approx. 5 % more power

COMPATIBILITY OF PRODUCING QUALITY SUGAR

Quality sugar sale has an advantage of Rs. 4 – 10 per kg over commercial sugar. However, corporate sector have certain queries to manage their SOP. While R-1 sugar ≤ to 25 ICUMSA, Turbidity ranges 20 - 25 IU are acceptable figures.

Here, critical requirements to meets foreign matter (Sediments) compliance at ≤ 10 mg/kg. Initially, investment integrated as advance filtration like DBF, EATON, SS integration are the core requirements.

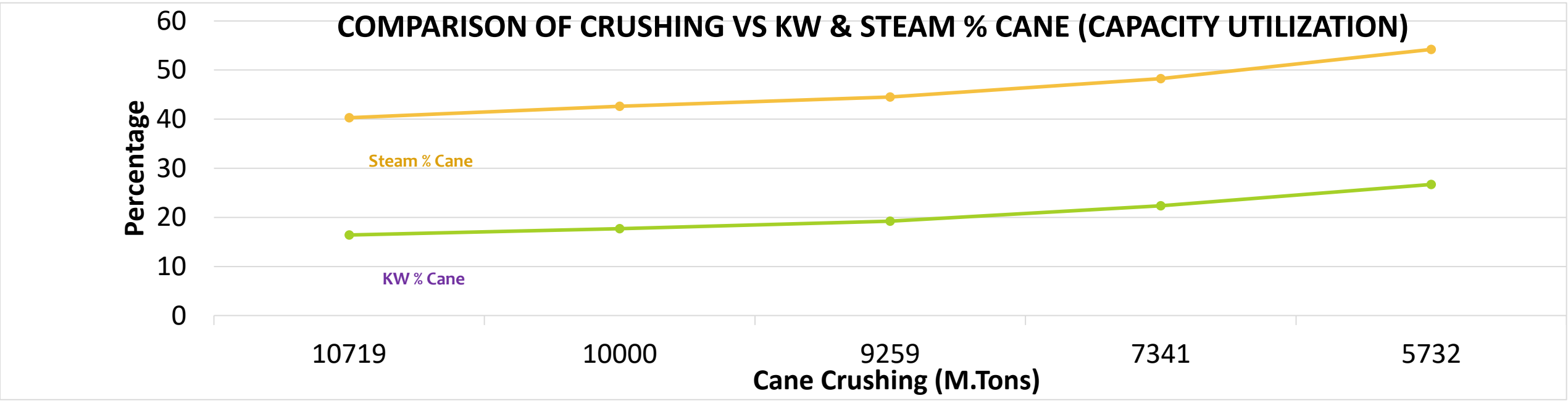
One of other aspect in food industry CASTER based sugar of 30 Mesh passed product also an incentive aspects to increase sale price Vs commercial sugar cost. However, it can be realized up to ≥ Rs. 20/ Kg which ultimately manage the average price.

BY PRODUCT OVERVIEW (COMPATIBILITY MODE)

1. **Bagasse** @ 30% more or less produce on given quantum of crushed cane. Typical analysis experienced since April 2022 around 10 - 12 % moisture reduction due to climate change impact 6 - 7 ^{O}C high in comparison to 2021 for same duration . Consequently, weight reduction effects over final sale. Moreover, Timely sale can avoid its LCV reduction @ 4.6% per month and moisture reduction too.

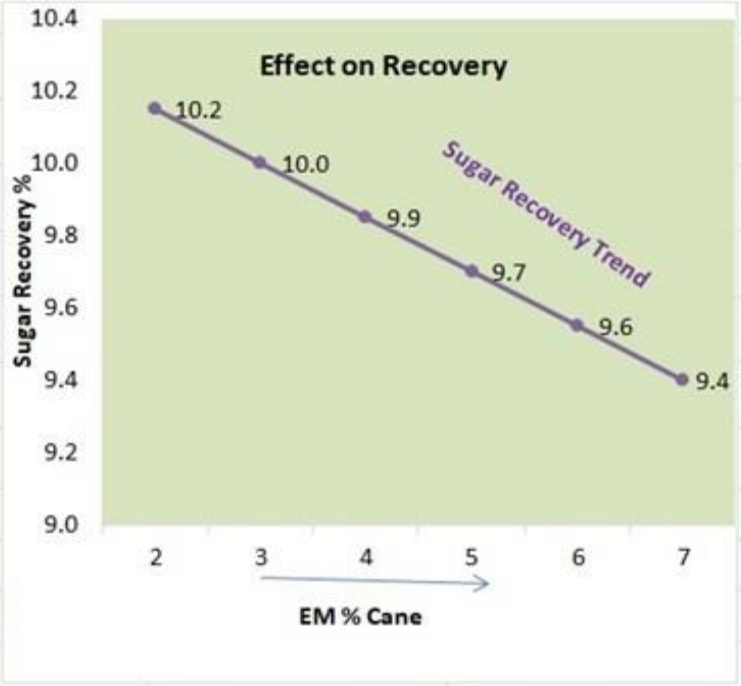
2. **Molasses** Recommended storage 30-35 ^{O}C. However, it lose its ferment sugar @ 2-3% per annum. While temp increased by 40 ^{O}C or more this impact would leads to quadruple. Nowadays, 7 ^{O}C excess has been recorded in comparison to last year which is alarming. Fortunately, averagely Rs. 21000 - 22000 per ton of molasses sales realized by sugar mills in current season.

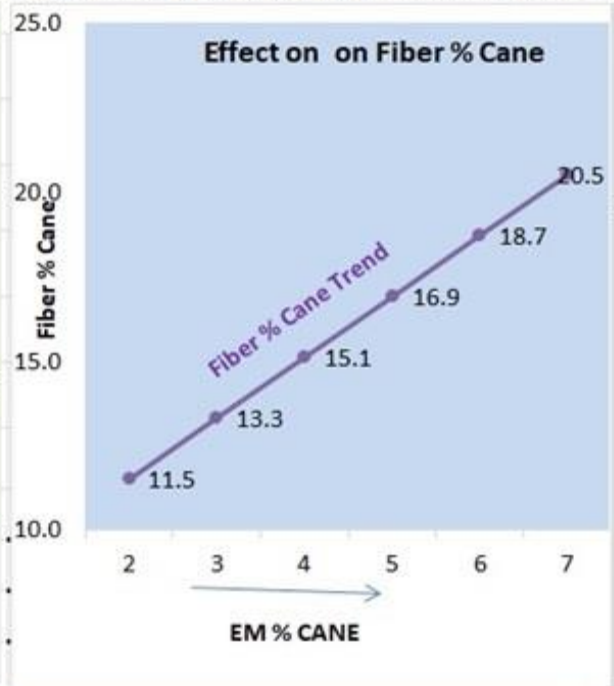
3. **Mud** Nowadays its too commercial commodity rather than orthodox by product due to increase rate of sale around Rs. 1400/Ton especially in south. Here, one of significant features is that currently its sales is on actual weight rather than conventional estimation of 3% on cane. Its weightage can reach up to 4.5 to 4.9% to attain extra revenue since couple of years.
4. Over all quantum of all three by products can be sum up to **19 - 21%** cost contribution in relation to season cane purchasing cost.

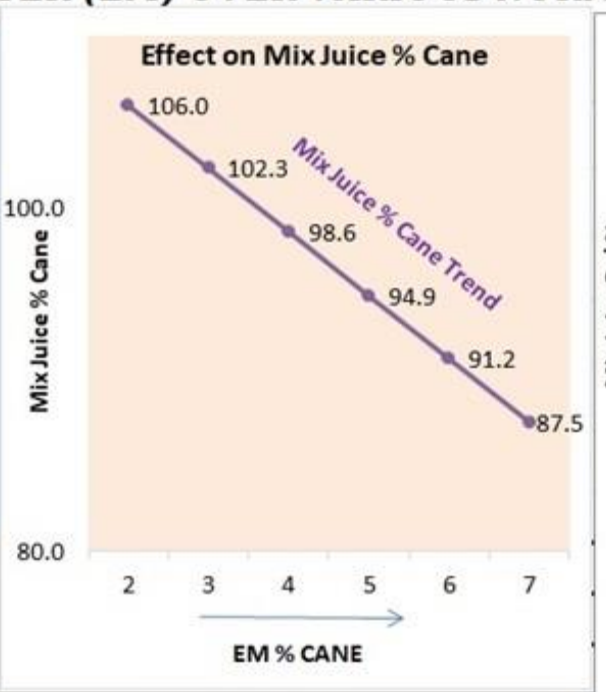


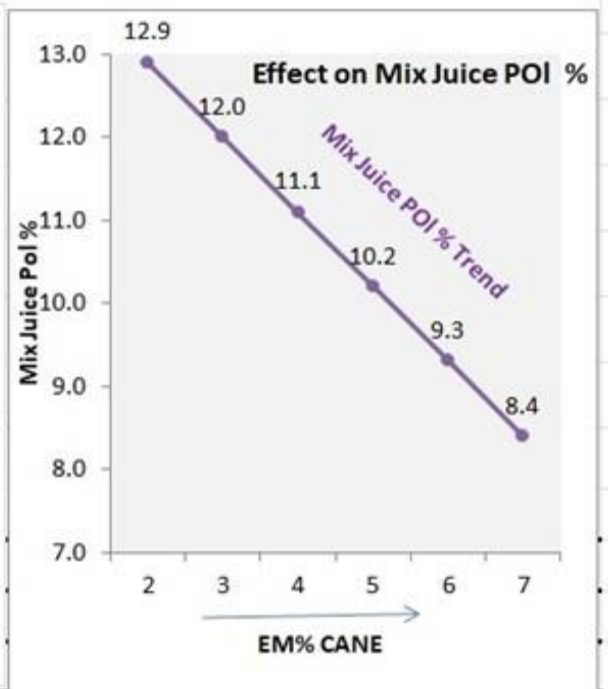
Cane Crushing	Bagasse (Tons)	Power Consumption (KW % Cane)	Steam (%) Cane
10,719	3104	16.42	40.30
10,000	2926	17.69	42.60
9,259	2709	19.22	44.50
7,341	2148	22.34	48.25
5,732	1677	26.69	54.20

IMPACT OF EXTRANEOUS MATTER (EM) OVER VARIOUS NORMS





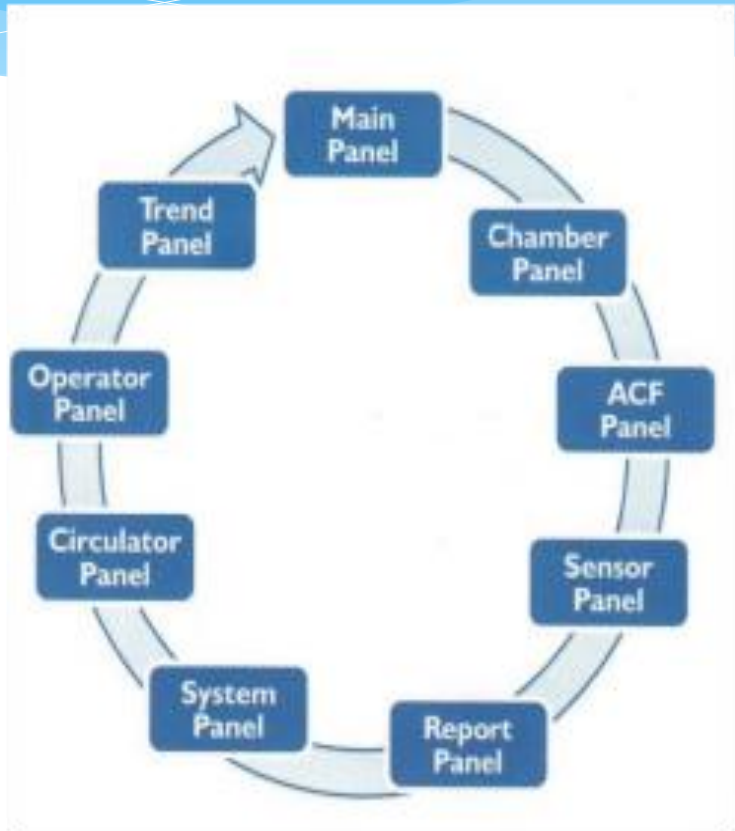




Cane Crushing (TCD)	EM Vs Recovery		EM Vs Fiber % Cane		EM Vs Mix Juice %		EM Vs Mix Juice Pol %	
	Extraneous Matters	Recovery % Cane	Extraneous Matters	Fiber % Cane	Extraneous Matters	Mix Juice % Cane	Extraneous Matters	Mix Juice Pol %
10,000	2	10.15	2	11.5	2	106.0	2	12.9
10,000	3	10.00	3	13.3	3	102.3	3	12.0
10,000	4	9.85	4	15.1	4	98.6	4	11.1
10,000	5	9.70	5	16.9	5	94.9	5	10.2
10,000	6	9.55	6	18.7	6	91.2	6	9.3
10,000	7	9.40	7	20.5	7	87.5	7	8.4
For every 1 % Increase in EM contributes 0.15% Recovery Drop @ 10000 M.T			For every 1 % Increase in EM contributes 1.8 % rise in Fiber % Cane		For every 1 % Increase in EM contributes reduction 3.7 % Mix Juice		For every 1 % Increase in EM contributes reduction 0.9% of Pol in Mix Juice	

VERTICAL CONTINUES PAN

An innovative technology currently introduced at country sugar industry
specially design to operates at low temperature vapors to ensures steam economy
For all massecuite applications
Fully automation - control system with significant controlled results ≤ 30 final purity
Currently installed at couple of sugar mills at Sindh



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