

PSST TECHNICAL WORKSHOP
JUNE 8, 2013 AT LAHORE

***PERFORMANCE ASSESSMENT OF
HYDRAULICALLY EQUIPPED
2 ROLLER MILL
AN EXPERIENCE AT FARAN SUGAR
MILLS***

by

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DGM (TECHNICAL)***

AIM OF PRESENTATION

To share the,

1. Objectives
2. Advantageous Features
3. Significant Aspects
4. Technical Characteristics
5. Operational difficulties, in-house corrective measures & Unit's out come with Reliability
6. Summarized achievements
7. Performance Evaluation
8. Power saving
9. Time efficiency
10. Discussion
11. Conclusion

INTRODUCTION

The objective of two - roller mill's induction in the sugar industry, primarily due to the considerations of Power and Energy saving which can be attainable up to 40%.

However, additionally, lower maintenance and overhauling cost can minimize up to 30% due to less components of equipment is an advantageous feature of newly designed unit.

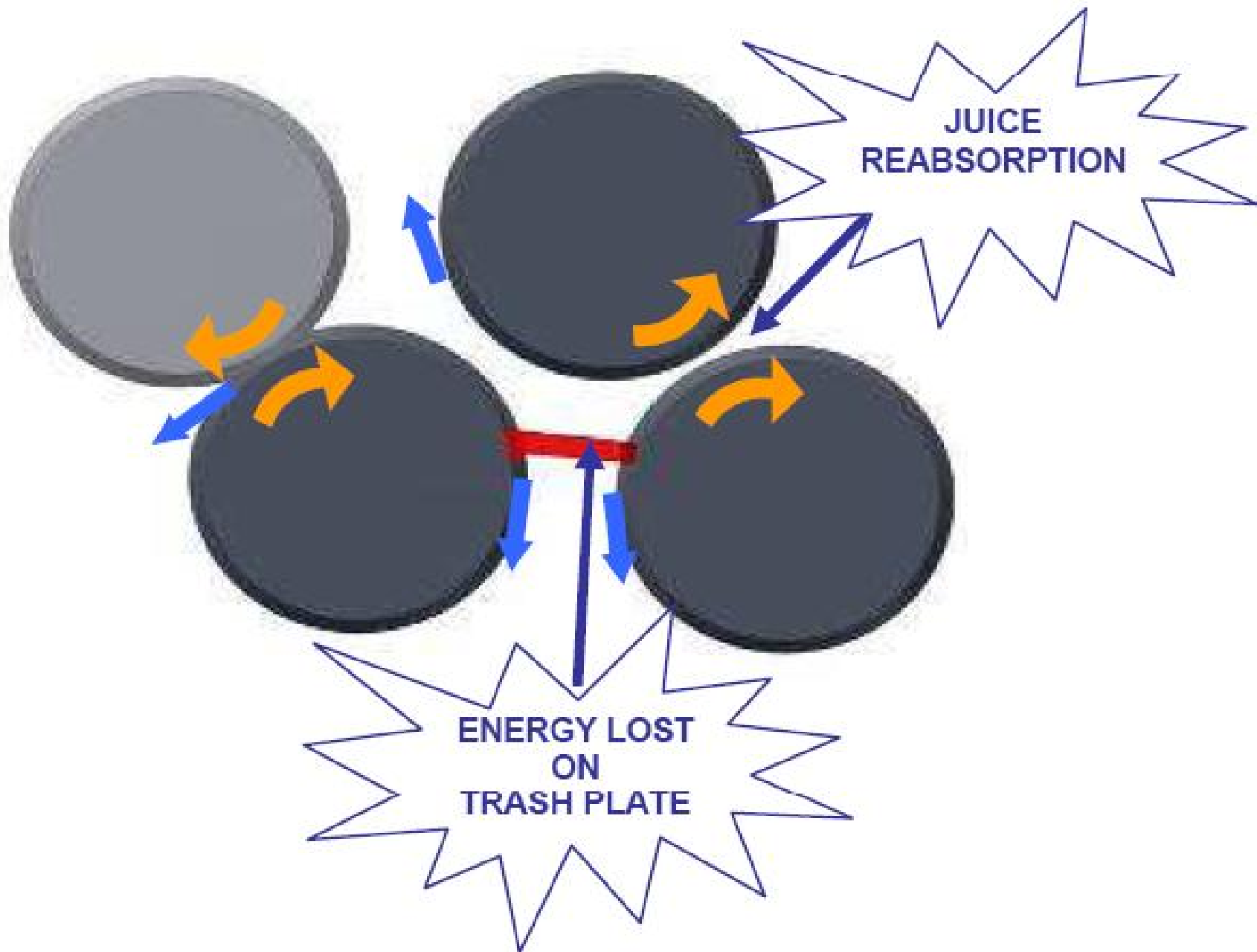
INTRODUCTION

Tremendous Power saving due to designed elimination of trash plate in a 2RM. However, Trash plate have significant share of specific mill power consumption in a conventional unit.

The orientation of Two Roller Mill in the country originates since 2008, while it is of different design and features without provision of hydraulic arrangement likely to treat fixed or rigid mill.

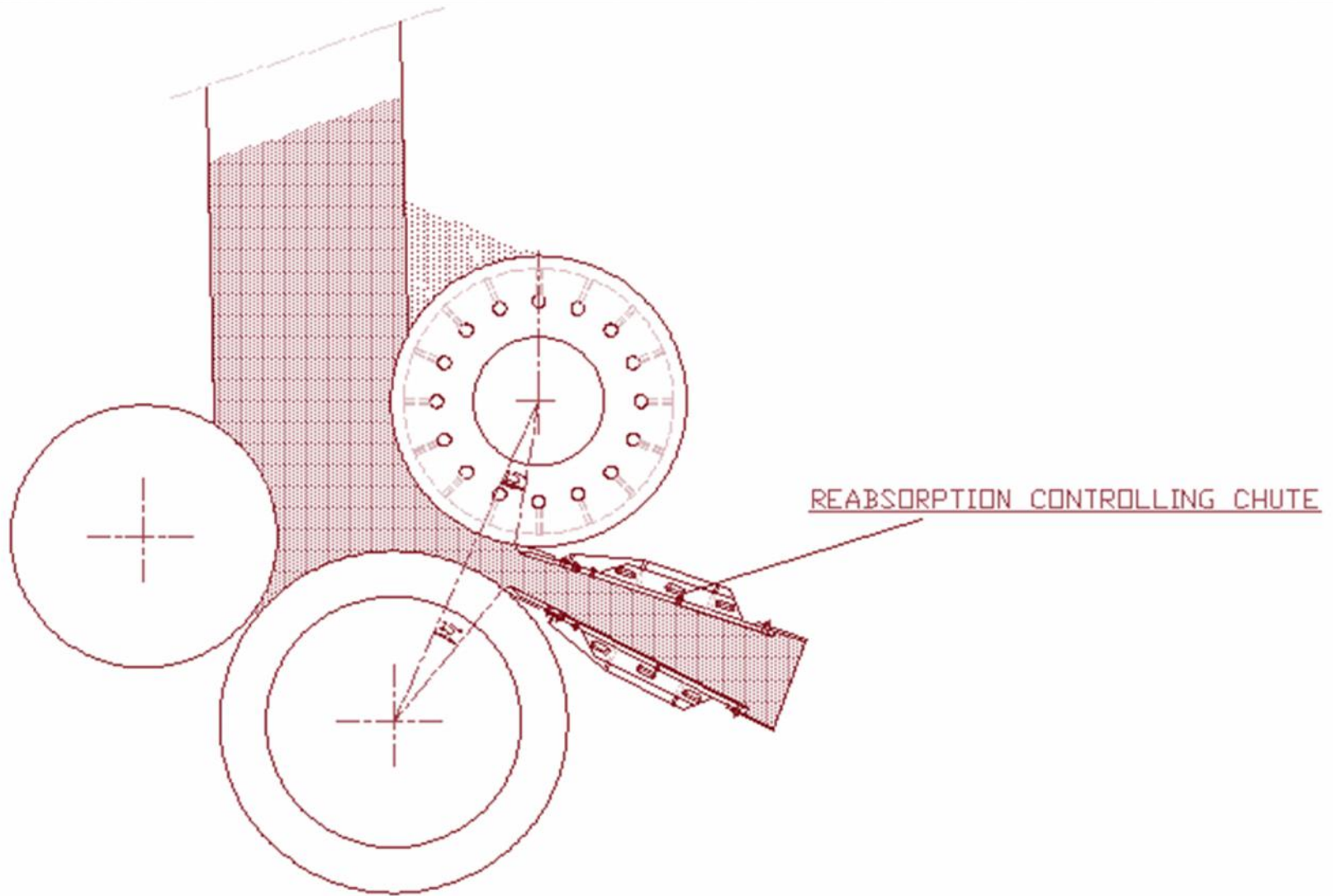
ADVANTAGEOUS FEATURES

- Top Roller is hydraulically loaded to maintain constant pressure on the cane blanket irrespective of cane flow to ensure milling performance & act as safe guard against rigidity.
- One of the main reason of re - absorption in the conventional unit (3 Roller Mill), huge pressure difference on the trash plate and delivery roller.
- Keeping in view that , significant aspect of bagasse, when it came out from mill in most compressed form. As soon as during expansion when it is emerges out, bagasse can absorbs water as much as **seven - times** the weight of fibre it contains.



ADVANTAGEOUS FEATURES

- Therefore, in order to overcome the intensity of re-absorption, 2RM is equipped with an arrangement named as decompression chute.

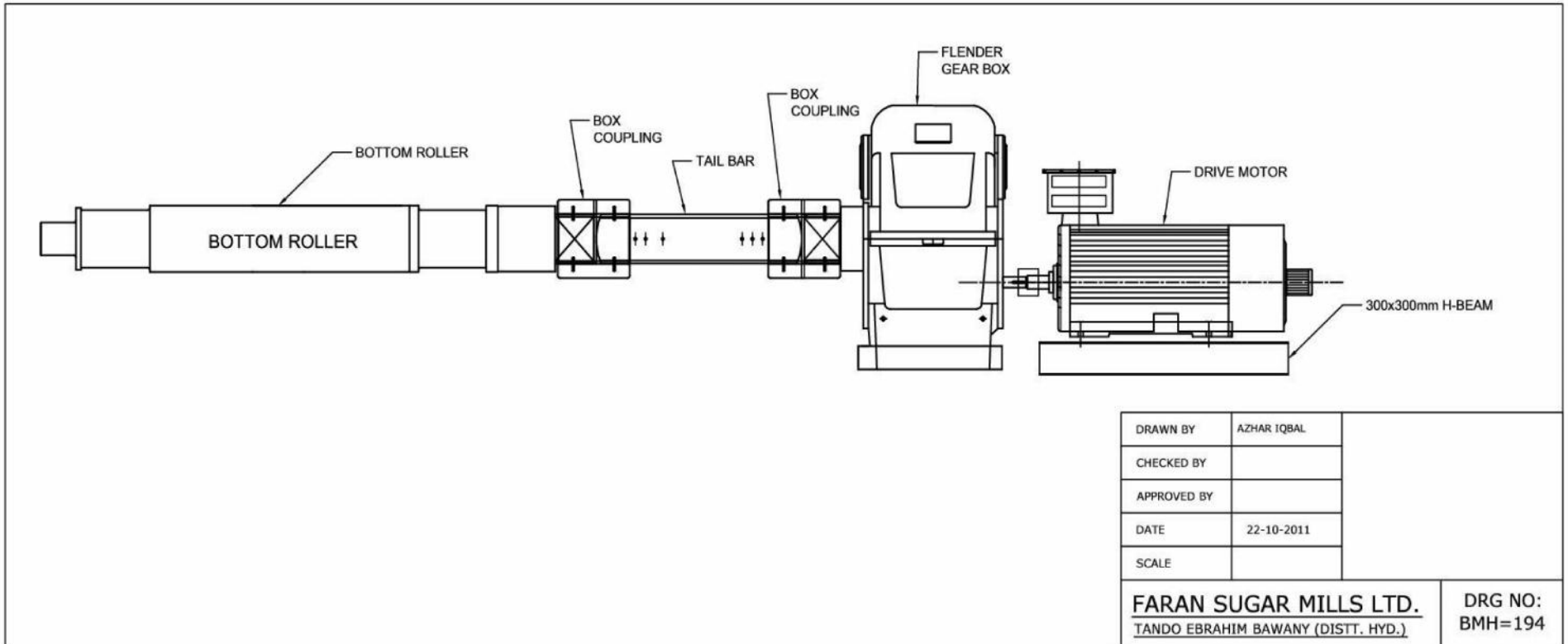


GRADUAL DECOMPRESSION/PRESSURE RELEASE

SIGNIFICANT ASPECTS

- Cost Effectiveness due to entirely local manufacturing having 30 - 40% less purchasing cost.
- Bottom Roller drive ensures **180 degree straight line** power - transmission from source to application.
- This mode of transmission ensured minimize possibility of jerks towards transmission end.
- If we compare this advantage with conventional Mill units where un-even lifts transmitted heavy jerks initiated from Top Roller towards transmission integrals (like Tail bar, square – couplings , Low/ high speed gearing & Prime mover) which consequently leads to major mishap as experienced.

**DRIVE ARRANGEMENT FROM FEED ROLLER
STRAIGHT –LINE POWER TRANSMISSION WITH MINIMUM
POSSIBILITY OF JERKS AS COMPARE TO TOP ROLLER DRIVEN
TRANSMISSION IN CONVENTIONAL MILL UNITS**



EFFECTIVENESS OF TOP LOTUS ROLLER
IN A HYDRAULICALLY EQUIPPED
2 ROLLER MILL

1. When juice over flow taken place on the surface of Top Roller, this situation seeks for optimum drainage area. Therefore, Lotus Roller design facilitated to make extraction of juice particularly from high compression zone to dual ends consequently improved extraction.
2. Provision of Lotus - Top roller in the unit is basically **value - added** aspect used to ensure additional extraction which can be realized up to 0.3 – 0.4 % as a first unit in a tandem.
3. Practical application of juice drainage through Lotus Roller can be realized as;





TECHNICAL ASPECTS

- **Unit Identification** HY-MECH 2R (46" / 50" X 90")
- **Position at Tandem** First Mill
- **Crushing capacity** **8000 – 10000 TCD (designed)**
- **Designed Extraction** **74 – 79 %**
- **Drive Power** 850 KW (Motor)
- **VFD** 1000 KW
- **Speed Reducer** 788 KW (Compact gearing)
- **Mill Speed** 4 – 6 RPM (However, Maximum operated at (2.88 RPM @ 6200 TCD in our case)
- **Top Roller Size** **46 x 90 inch**
(Lotus, equipped with Chevron, Speed of roller 6.25 % higher than the drive - one)
- **Feed Roller Size** **50 x 90 inch (30 Tons weight)**
(Equipped with Chevron & Messchaerts grooves)

TECHNICAL ASPECTS

- Under Feed Roller Size 41 x 90 inch
- (Cast Iron grooved) Speed 20% higher than the speed of Top Roller.
- Pitch of grooving **50 MM**
- Angle of grooving 45 degree (Relatively preferred angle for juice drainage & strength)
- Height of Donnelly chute **3.6 Meter**
- Status of Head Stocks Fabricated
- Scrapers Material M.S / Special material Hardox 500
- Angle of Mill **67 Degree**
- Pressure chute openings Inlet 200 MM, Outlet 310 MM Ratio (1.55)
- Let's proceeds to an assembled unit of capacity 8000 – 10000 TCD inducted during season 2011 – 12 in the next slides.

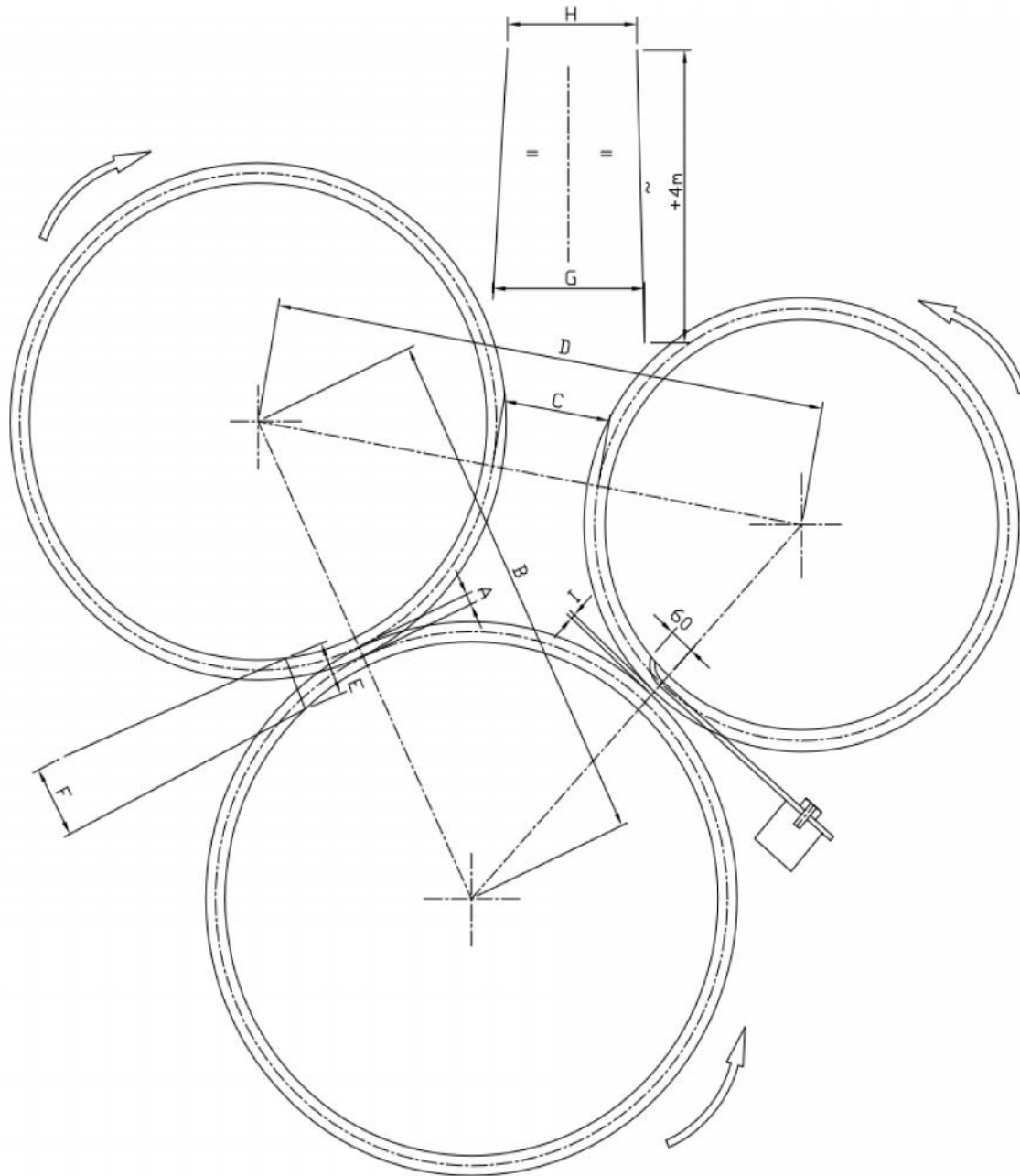


**Hydraulically equipped 2RM
assembled unit 8000-10000
TCD capacity installed at
Faran Sugar Mills during
season 2011 - 12**

CHOICES FOR MILL SETTINGS

- @ 8500 TCD
- @ 6000 TCD
- In our case we have attained our capacity requirement @ 6200 TCD

MILL SETTINGS FOR FARAN SUGAR MILLS, SEASON 2011-12



1) BASIC DATA:-

CAPACITY	-----	8500 TCD
FIBRE % CANE	-----	14-15
MILL SIZE	-----	46"/50"x90"
MILL TYPE	-----	2 ROLLER+U/FEEDER
NO OF ROLLERS	-----	03
POSITION OF MILL	-----	1st
MILL RPM	-----	4-5
U.FEEDER RPM	-----	4.2-5.25

2) ROLLER DETAIL:-

MILL NO.01	O.D	P.C.D	R.D
TOP ROLLER	1185	1139.13	1093.26
BOTTOM ROLLER	1270	1224.13	1178.26
U/FEEDER	1040	990	940
ROLLER LENGTH	2290		

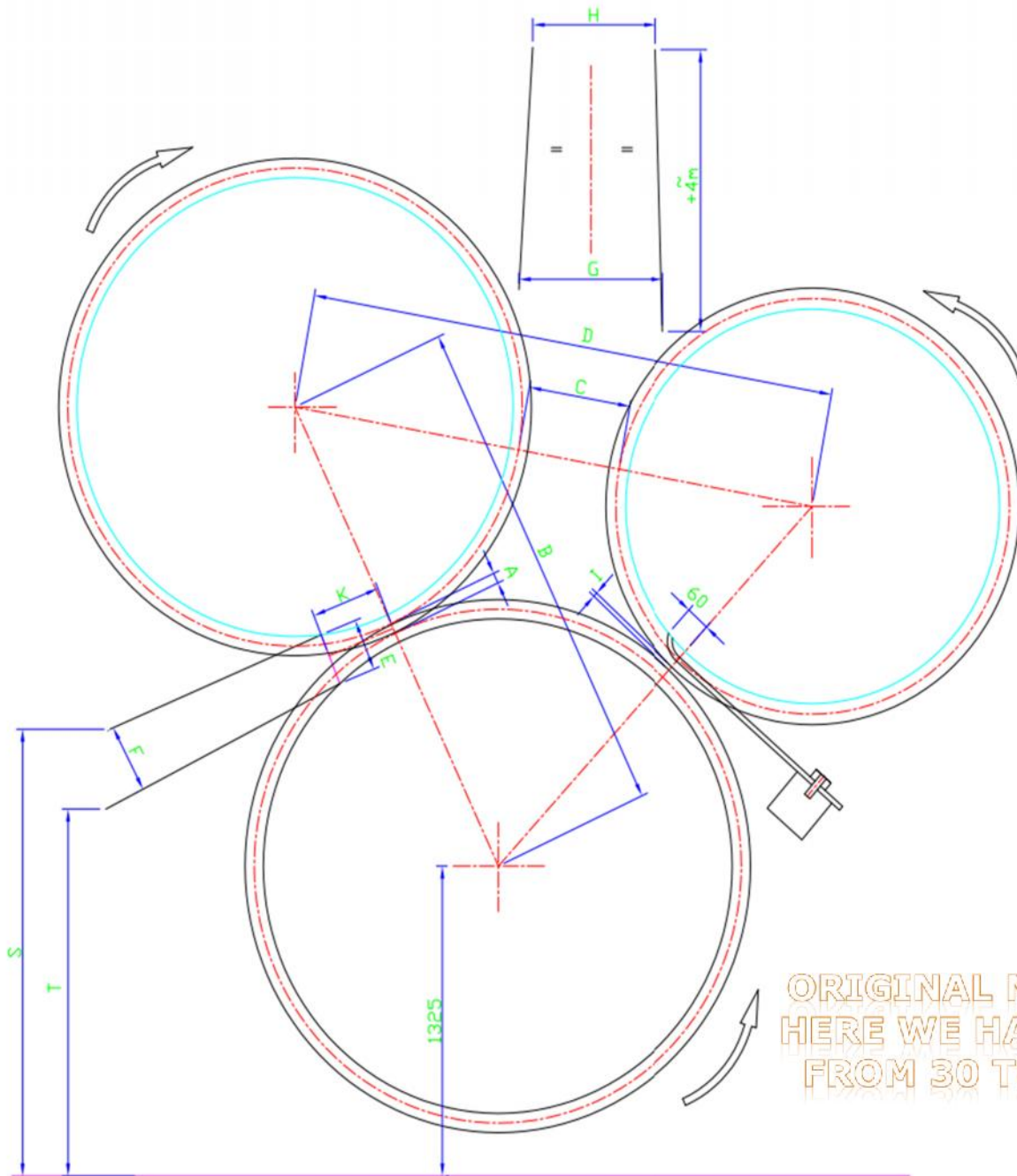
3) MILL SETTING:-

A	B	C	D	E	F	G	H	I	J
35	1216.6	260	1326.6	130	225	650	550	~10	60

NOTE:-

- 1- DIMENSIONS A & C FROM P.C.D TO P.C.D
- 2- DIMENSIONS E FROM R.D TO R.D
- 3- DIMENSIONS I FROM O.D TO O.D
- 4- MILL SETTING DIMENSIONS ARE SUBJECTED TO READJUSTMENT UNTILL DESIRED PERFORMANCE IS ACHIEVED.
- 5- ALL DIRECTIONS ARE LOOKING FROM MOTOR END

MILL SETTINGS FOR FARAN SUGAR MILLS, SEASON 2011-12



1) BASIC DATA:-

CAPACITY	-----	6000 TCD
FIBRE % CANE	-----	14
MILL SIZE	-----	46"/50"x90"
MILL TYPE	-----	2 ROLLER+U/FEEDER
NO OF ROLLERS	-----	03
POSITION OF MILL	-----	1st
MILL RPM	-----	4-5
U.FEEDER RPM	-----	4.8-6

2) ROLLER DETAIL:-

MILL NO.01	O.D	P.C.D	R.D
TOP ROLLER	1185	1139.13	1093.26
BOTTOM ROLLER	1270	1224.13	1178.26
U/FEEDER	1040	990	940
ROLLER LENGTH	2290		

3) MILL SETTING:-

A	B	C	D	E	F	G	H	I	J	
30	1211.6	265	1331.6	125	220	625	525	10	60	
								K	S	T
								165	1358	1098

NOTE:-

- 1- DIMENSIONS A & C FROM P.C.D TO P.C.D
- 2- DIMENSIONS E FROM R.D TO R.D
- 3- DIMENSIONS I FROM O.D TO O.D
- 4- MILL SETTING DIMENSIONS ARE SUBJECTED TO READJUSTMENT UNTILL DESIRED PERFORMANCE IS ACHIEVED.
- 5- ALL DIRECTIONS ARE LOOKING FROM MOTOR END

ORIGINAL MILL SETTING @ 6000 TCD,
HERE WE HAVE REVISED THE OPENING
FROM 30 TO 22 MM DURING SEASON
2012 -13

MAJOR IN-HOUSE ACTIVITIES AFTER TRIAL SEASON AND THEIR IMPACT ON PERFORMANCE

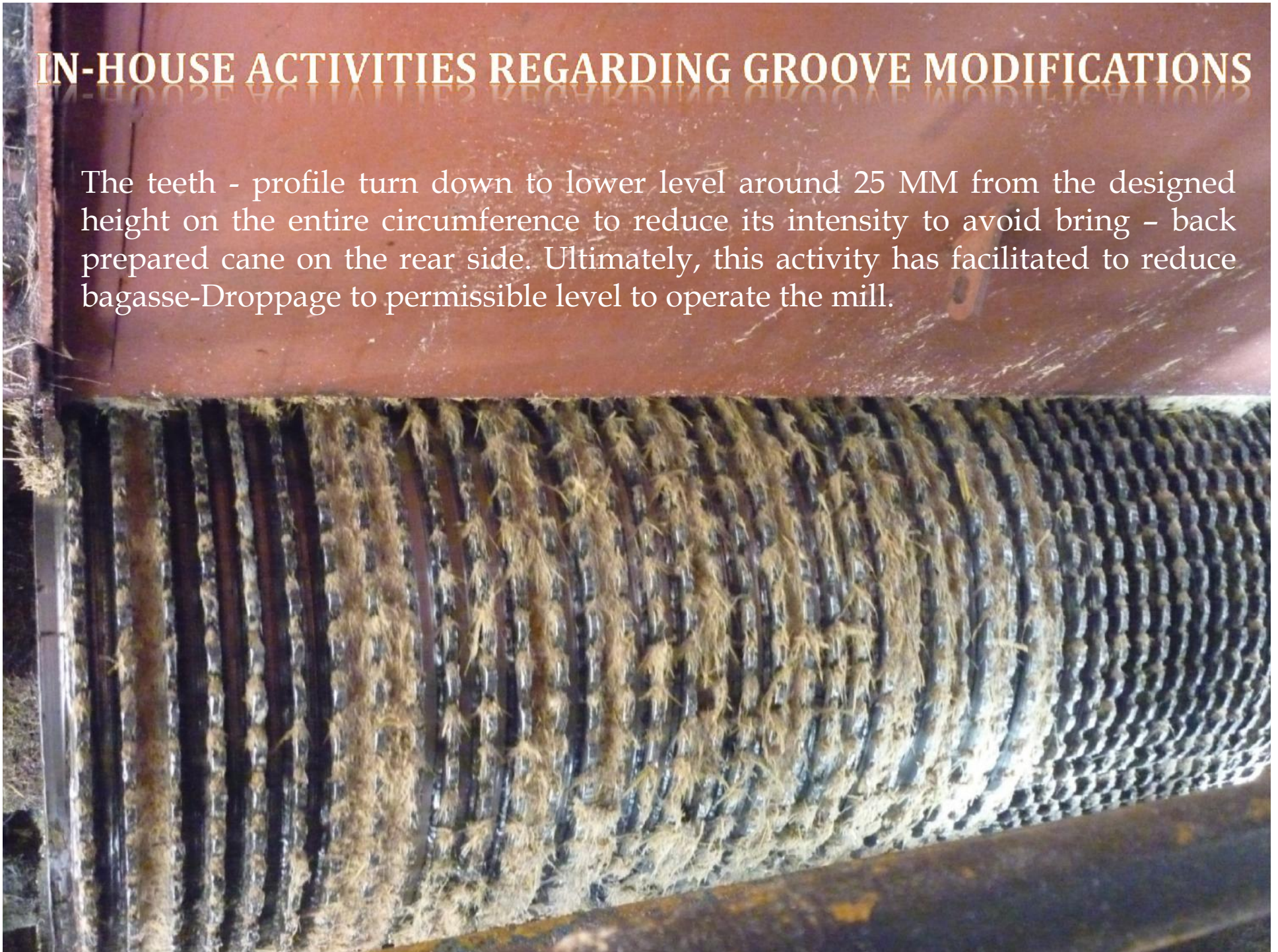
- Induction of cast Iron grooved Roller 41 x 90 inch after replacement of Fabricated Under Feed Roller had bagasse droppage severity during trial run 2011-12.
- Uniform feeding attained with improved drainage.



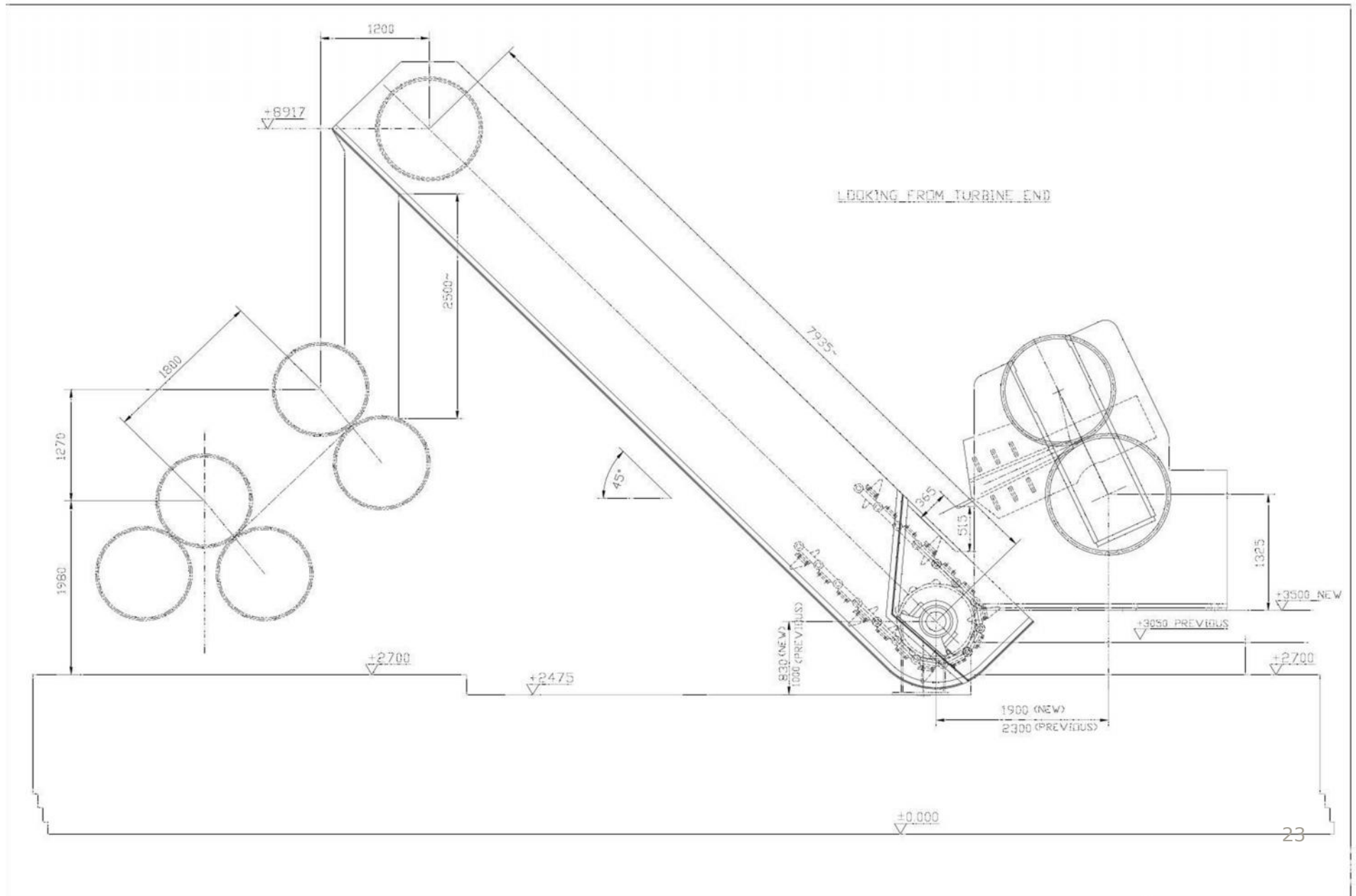
**ORIGINAL TEETH PROFILE OF
FABRICATED UNDER FEED ROLLER**

IN-HOUSE ACTIVITIES REGARDING GROOVE MODIFICATIONS

The teeth - profile turn down to lower level around 25 MM from the designed height on the entire circumference to reduce its intensity to avoid bring - back prepared cane on the rear side. Ultimately, this activity has facilitated to reduce bagasse-Droppage to permissible level to operate the mill.



Mill Head Stocks height raised up to 450MM used to facilitated inter carrier racks to avoid striking from First Mill outcome bagasse as previously experienced during trial season 2011-12



MAJOR IN-HOUSE ACTIVITIES AFTER TRIAL SEASON AND THEIR IMPACT ON PERFORMANCE

Designed cladding (bearing covers) over bronze bearings (Top-side) has been provided which significantly eliminated the juice entrance inside bearings during season 2012-13 against experienced in the trial season 2011-12

VIDEO

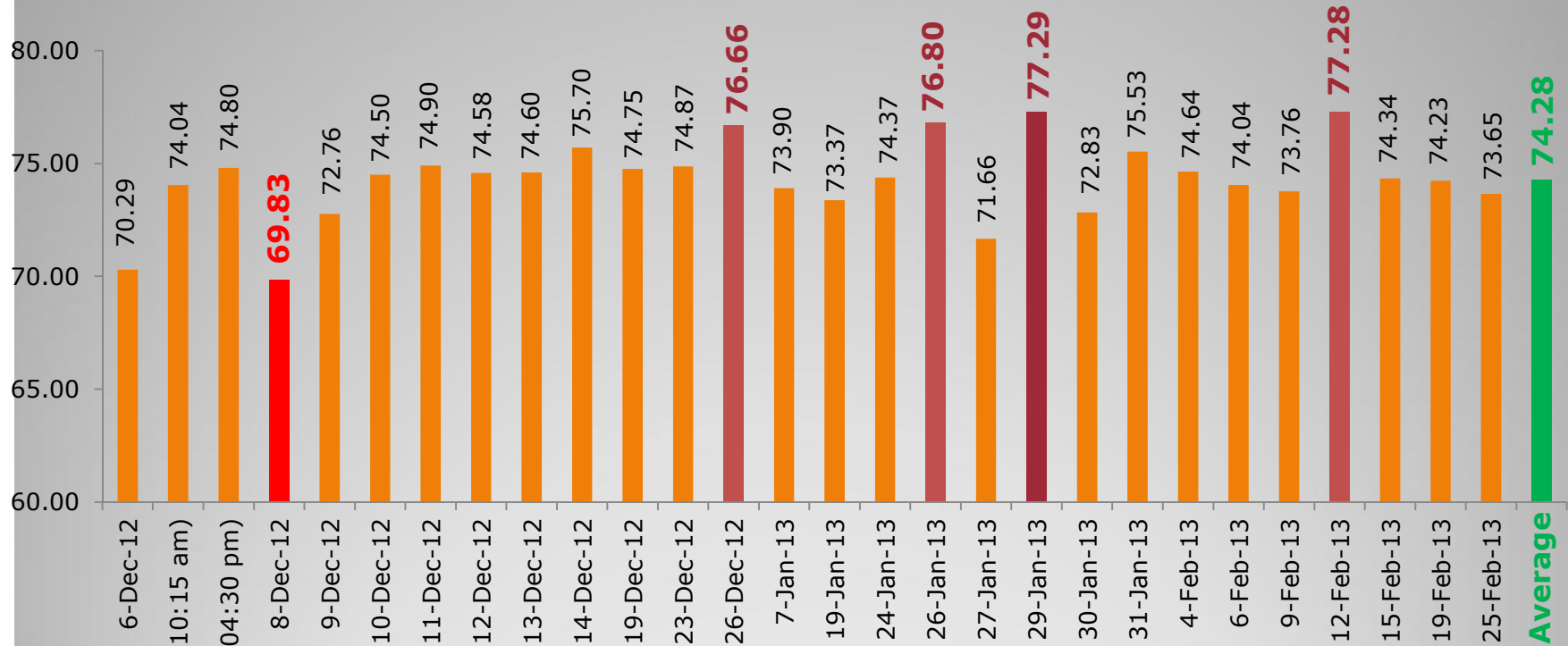
- Before going to proceeds performance segment it's interesting to make familiarity with the operation of hydraulically operated mill.
- I think this demonstration will present better understanding for the audience regarding 2RM operation.

SUMMARIZE PERFORMANCE

The achieved results for the season 2012 -13 is really encouraging, An out standing average reflection as follows based on mentioned results.

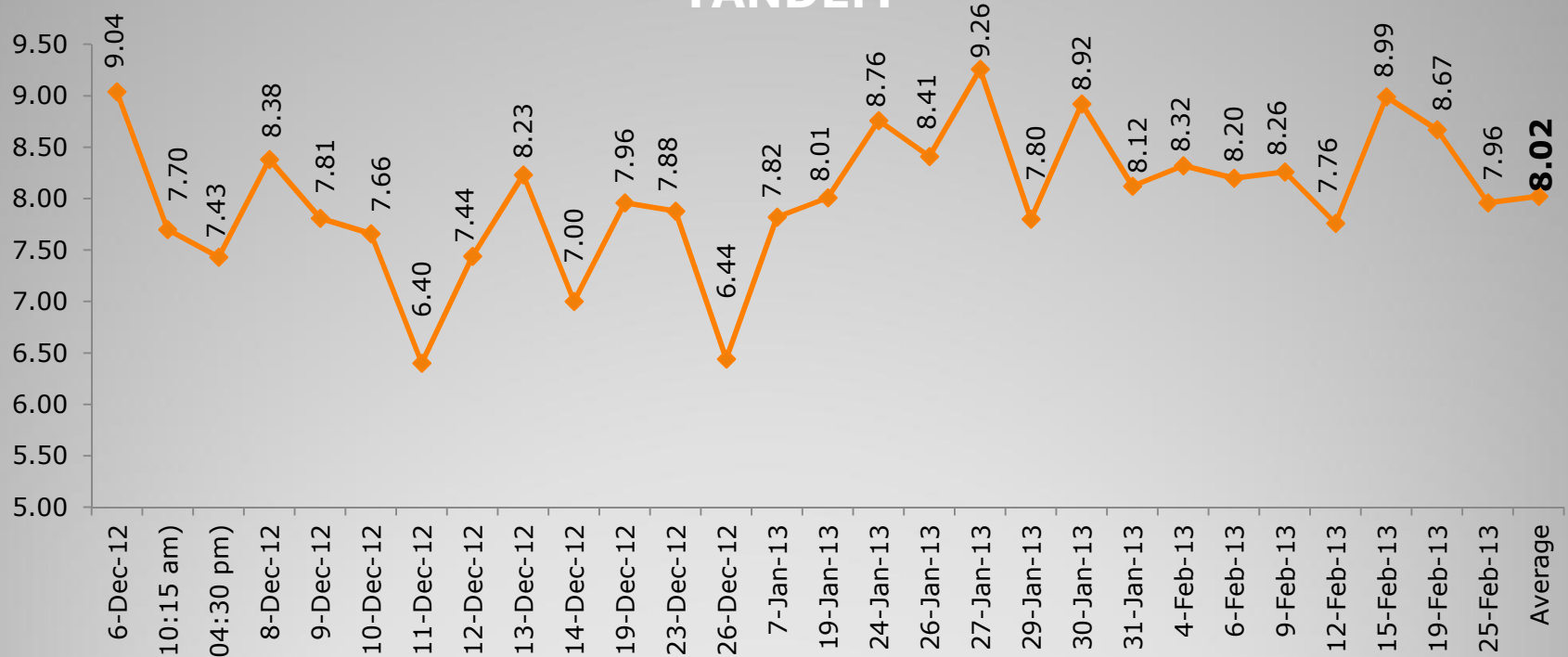
- **CPI** **89%**
- **First Mill Extraction** **74.28% @**
- **Power Consumption** **332 KWH**
- **Crush Rate** **233.52 TCH**
- **Over All Mill extraction** **96% (Plain)**
- **Reduce Extraction** **96.30% (Mittal)**
- **Reduce Extraction** **96.50% (Deer)**
- Let's proceeds to graphical representations based on season's 2011 - 12 & 2012 - 13 recorded results for evaluation and subsequent comparison.

2 ROLLER MILL EXTRACTION FOR THE SEASON 2012-13



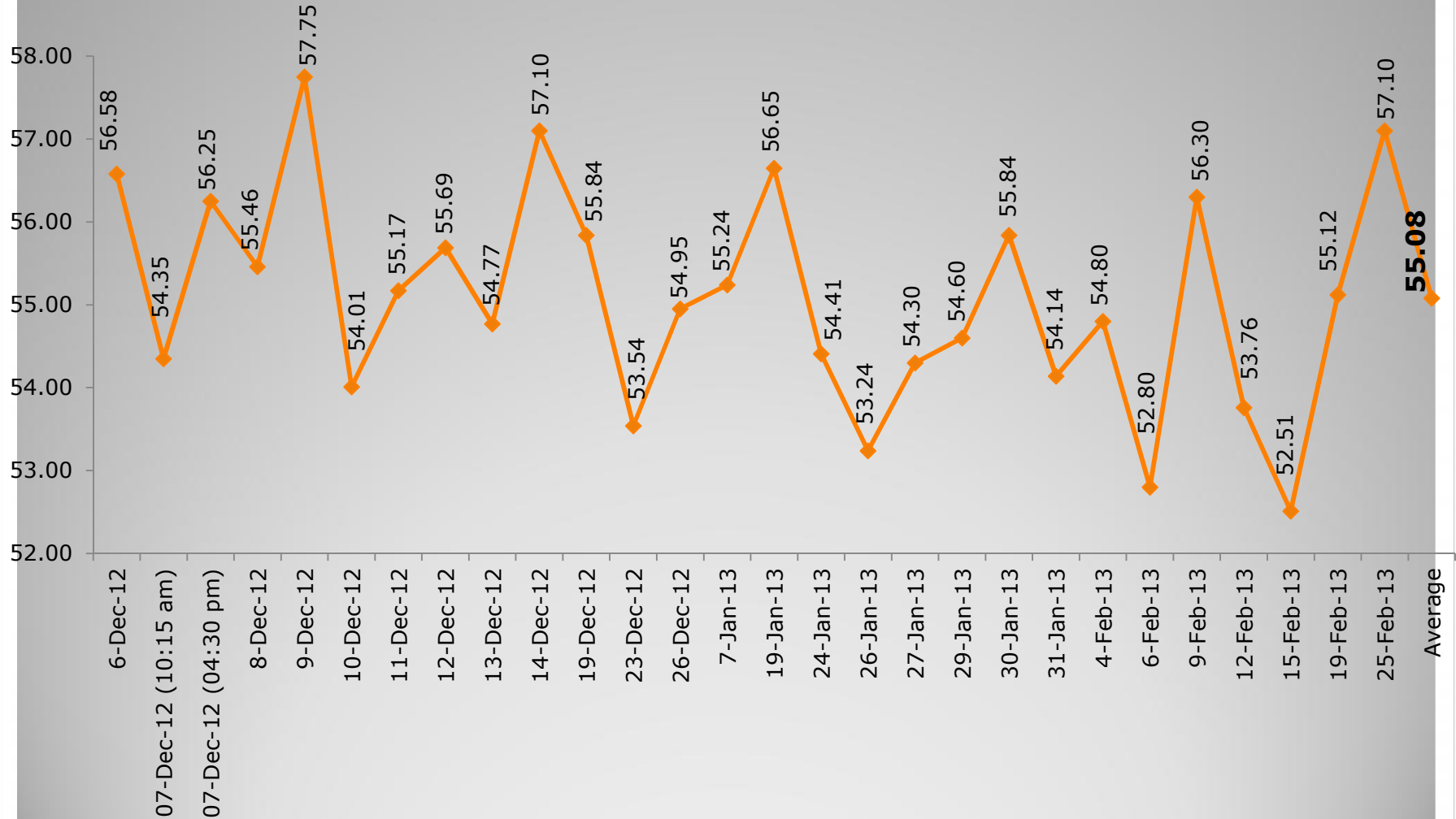
**Season 2012-13, First Mill Extraction at a glance, Lowest 69.83%, Highest 77.29%,
Average Extraction 74.28%**

2 ROLLER MILL EXTRACTED BAGASSE POL % FOR THE SEASON 2012-13 AS FIRST MILL IN THE TANDEM



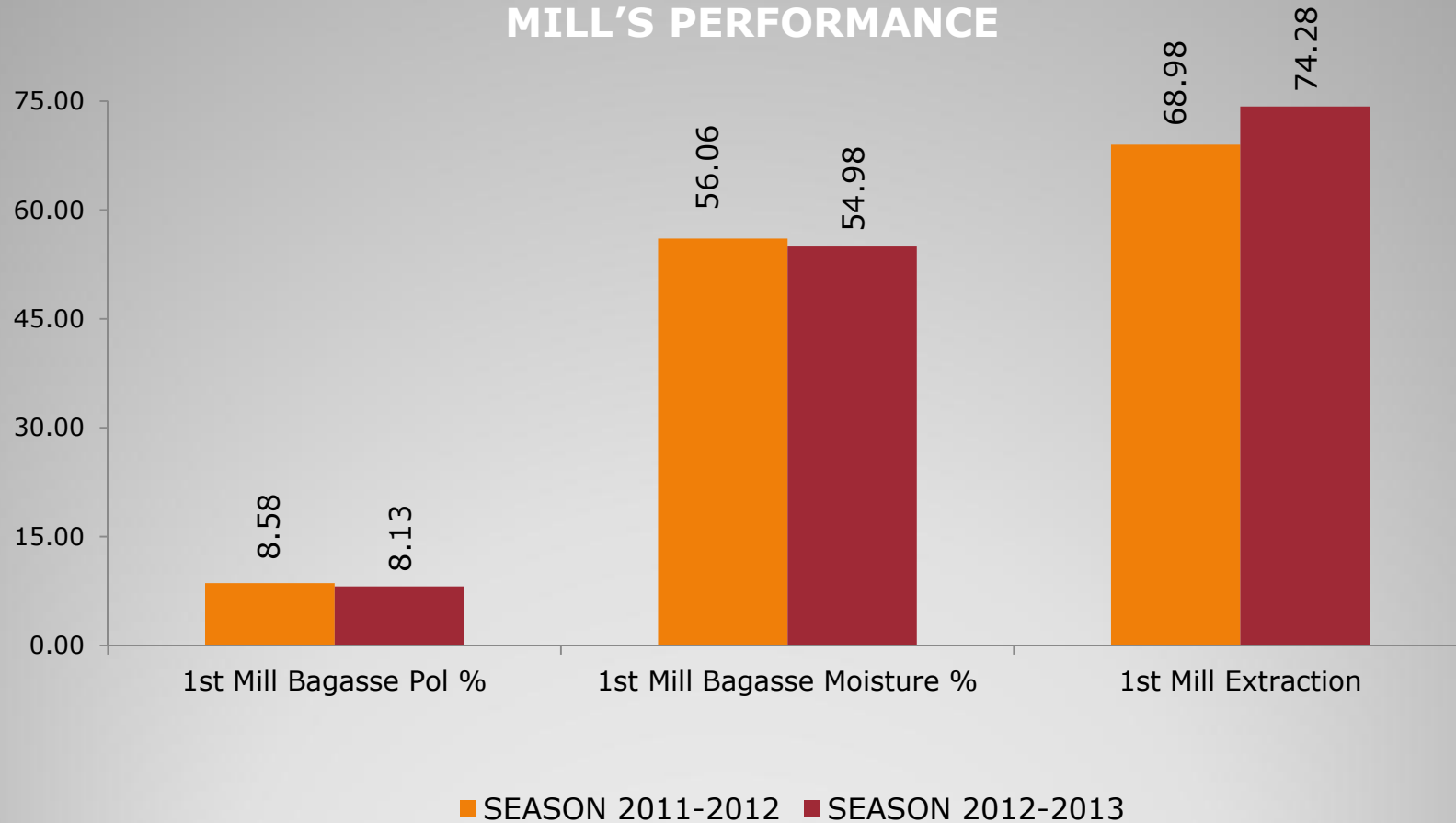
**First Mill bagasse Pol, Lowest recorded 6.40%, Highest 9.04%,
Average for the season 8.02 %**

2 ROLLER MILL EXTRACTED MOISTURE % BAGASSE FOR THE SEASON 2012-13



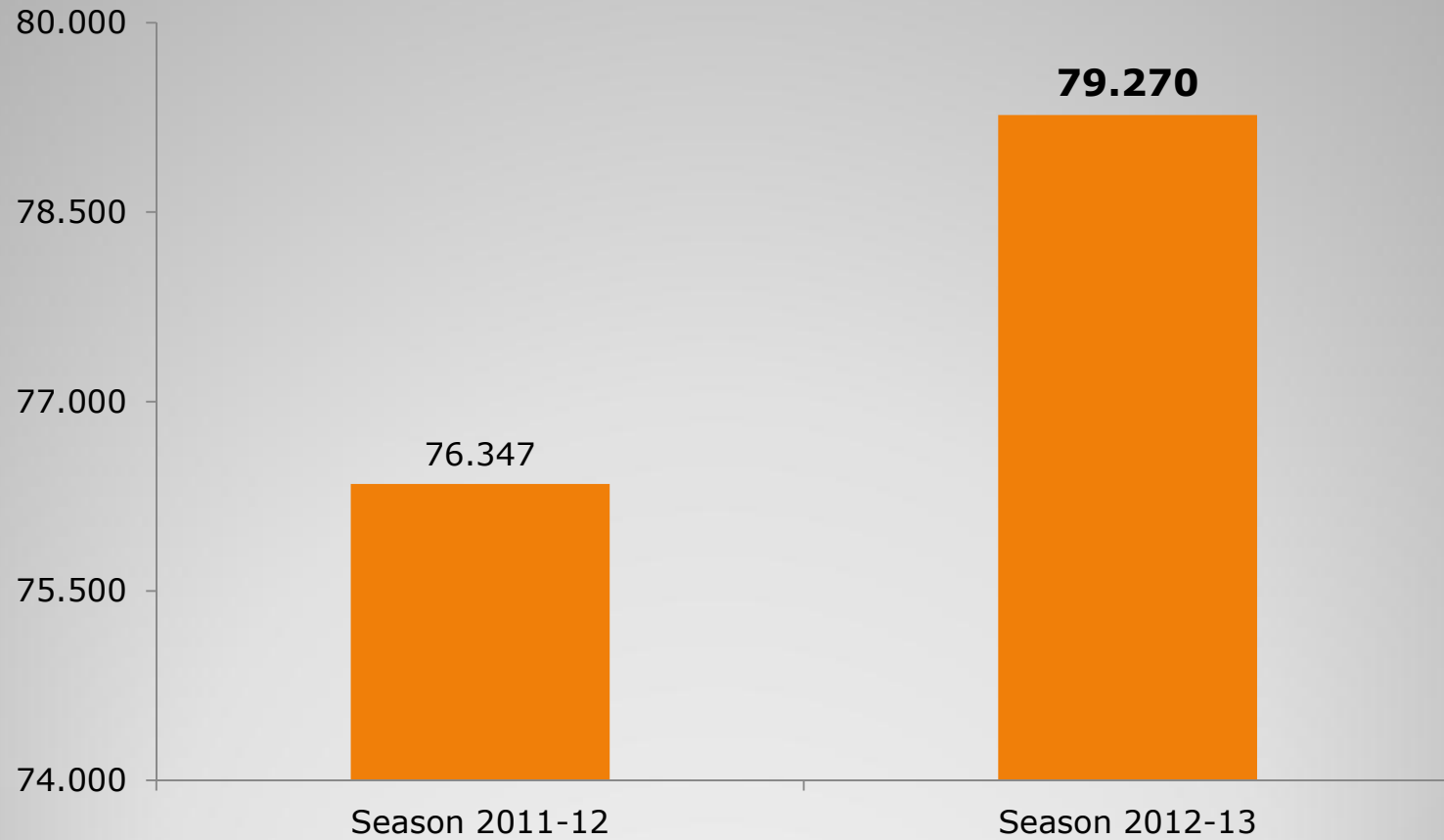
**First Mill bagasse moisture, Lowest recorded 52.51%,
Highest 57.75 % Average for the season 55.08 %**

DUAL - YEAR COMPARISON OF 2 ROLLER MILL'S PERFORMANCE

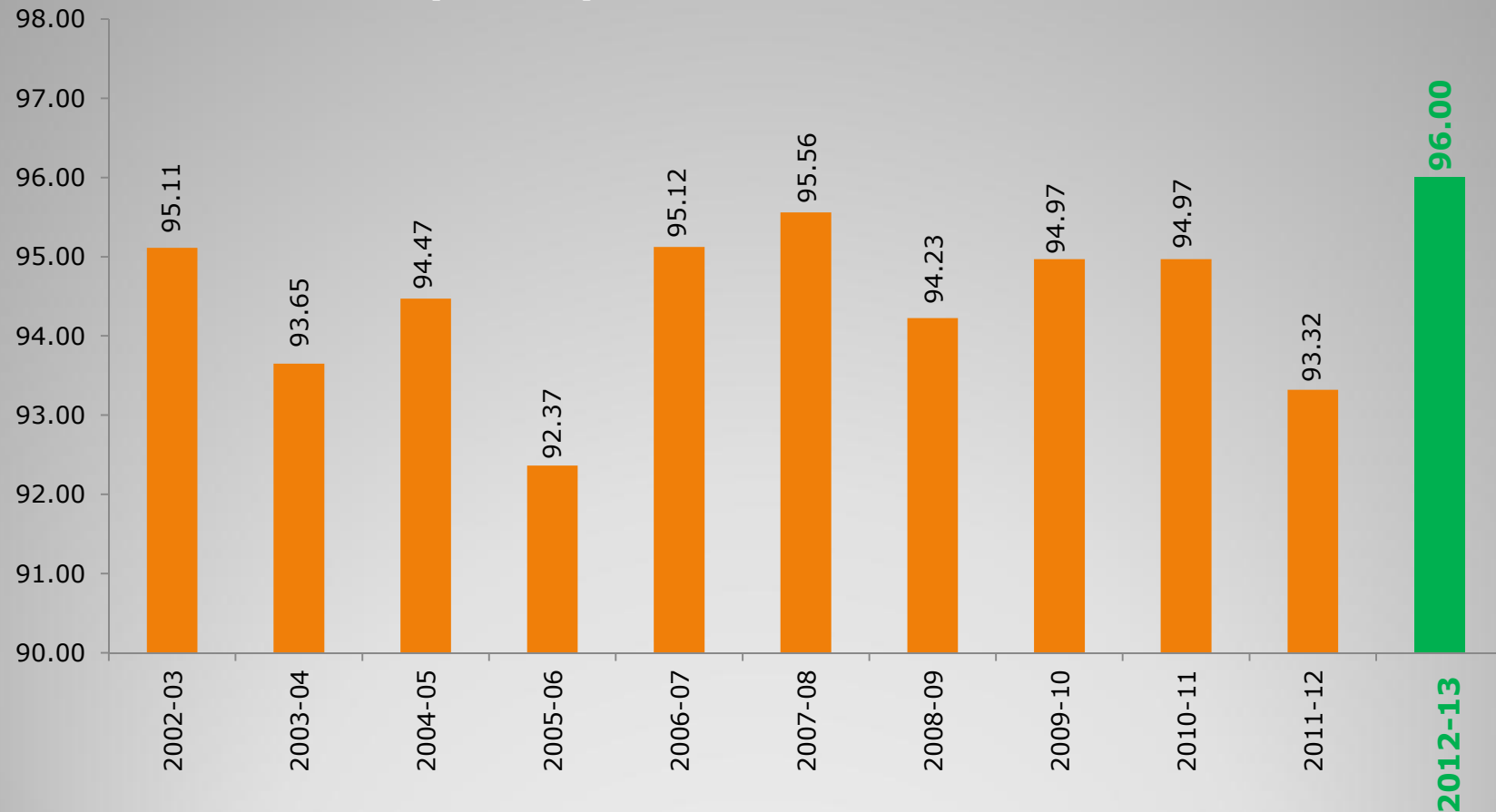


**First Mill bagasse Pol, Moisture & Extraction
(Season 2011-12 , 2012 – 13) after induction of 2RM**

UNDILUTED JUICE IN MIX JUICE % CANE FOR HMC TANDEM

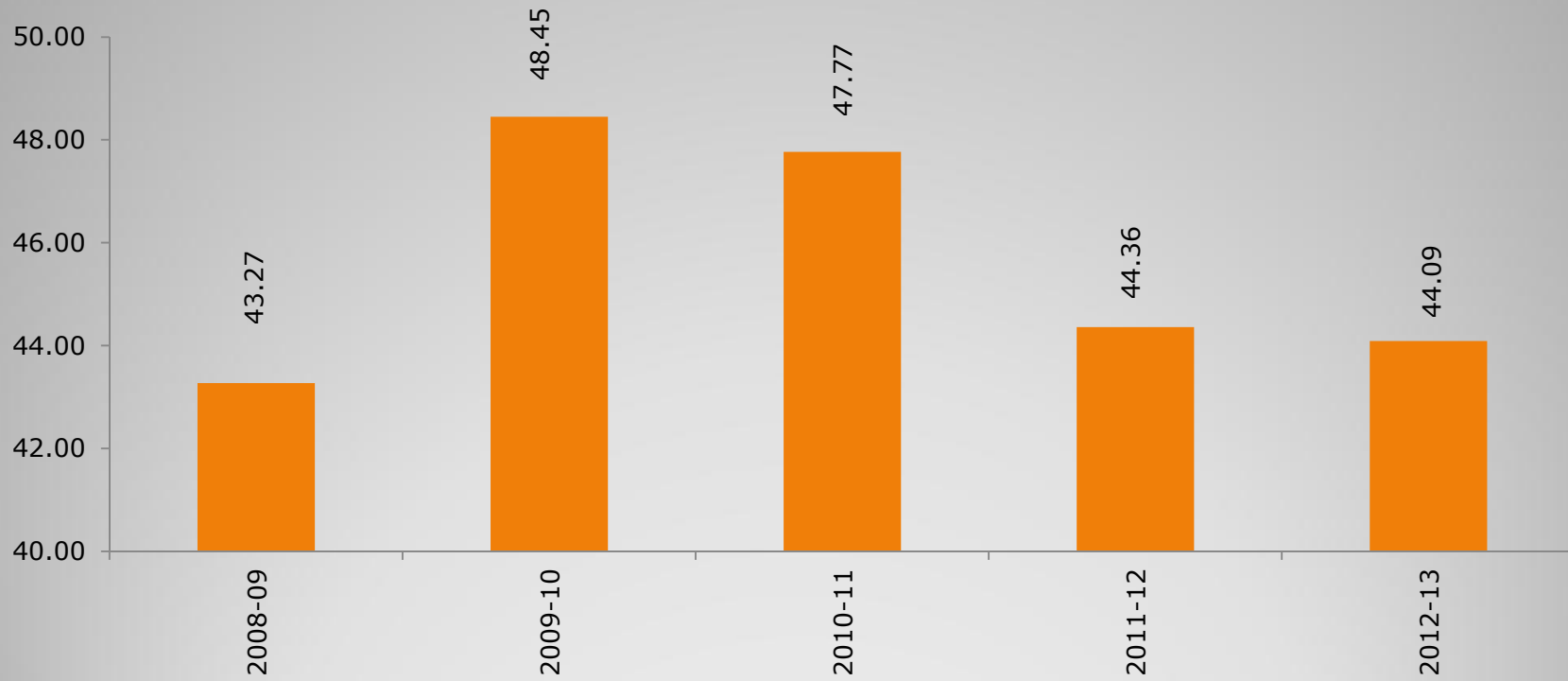


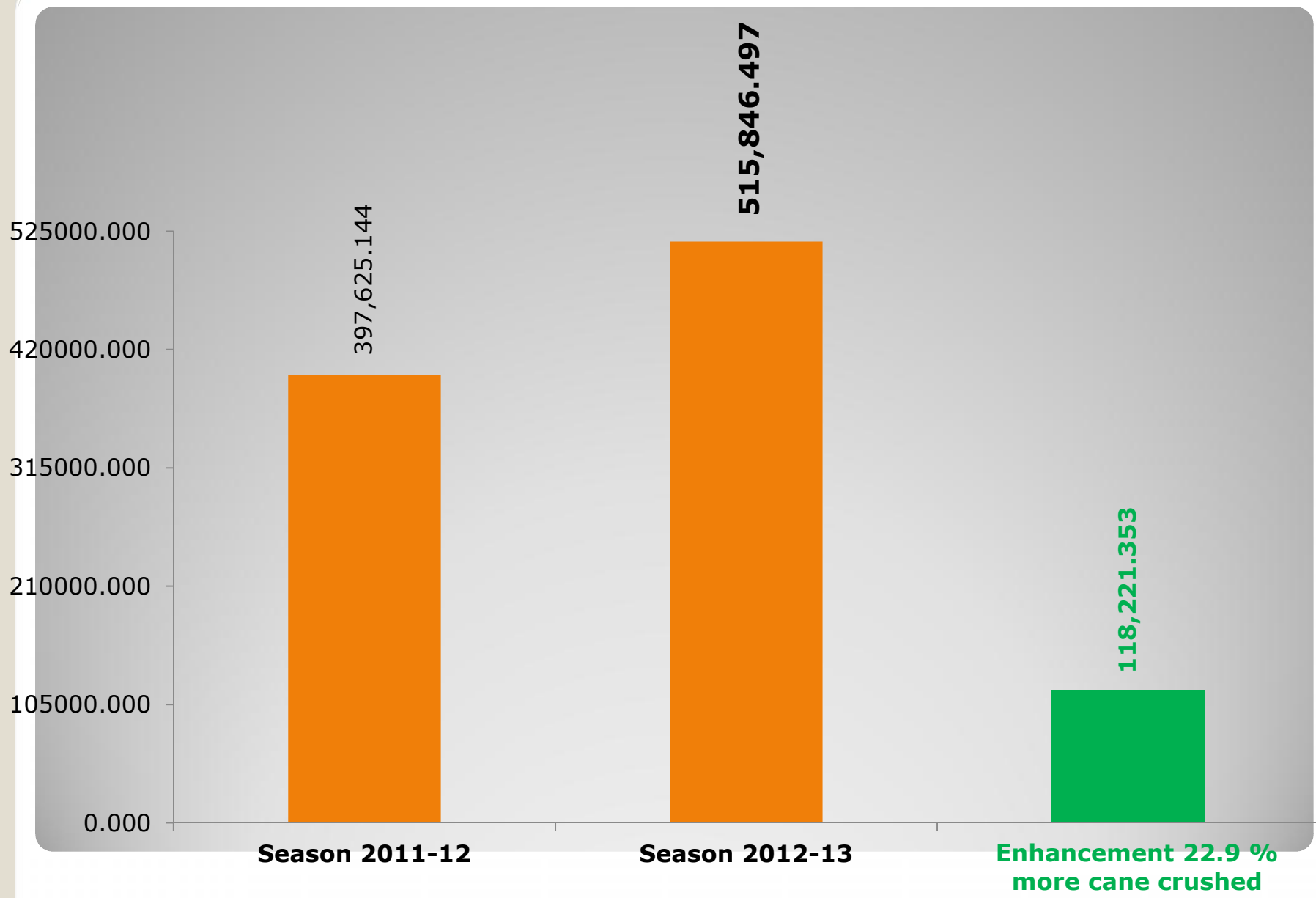
OVER ALL TANDEM ' S EXTRACTION SINCE (PLAIN) 2002 - 03 TO 2012 -13








Reduced Mill Extraction (Mittal)
Season 2011 -12 (95.26%) Season 2012-13 (96.30%)

IMBIBITION % CANE

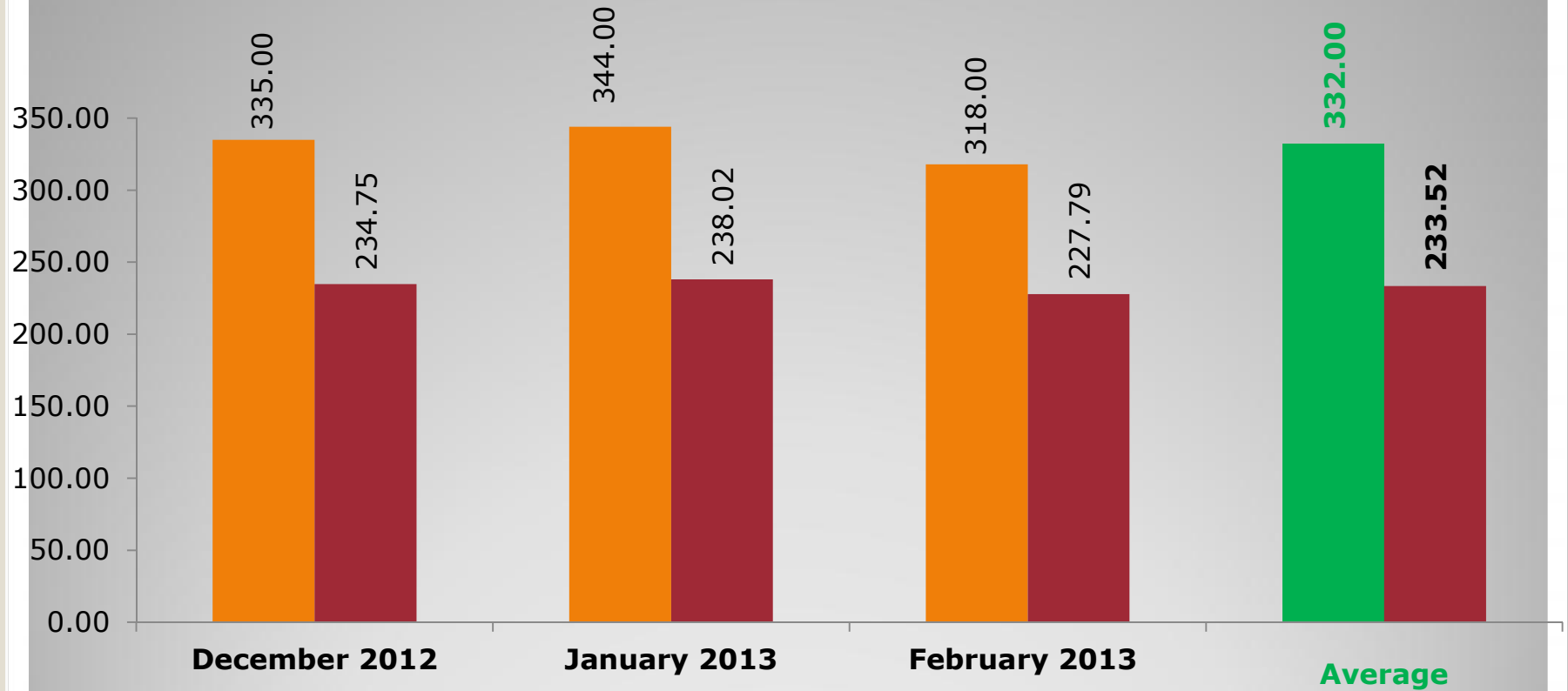




Comparison of Mill Units of various configuration on design, Power consumption, Cost analysis & Performance basis

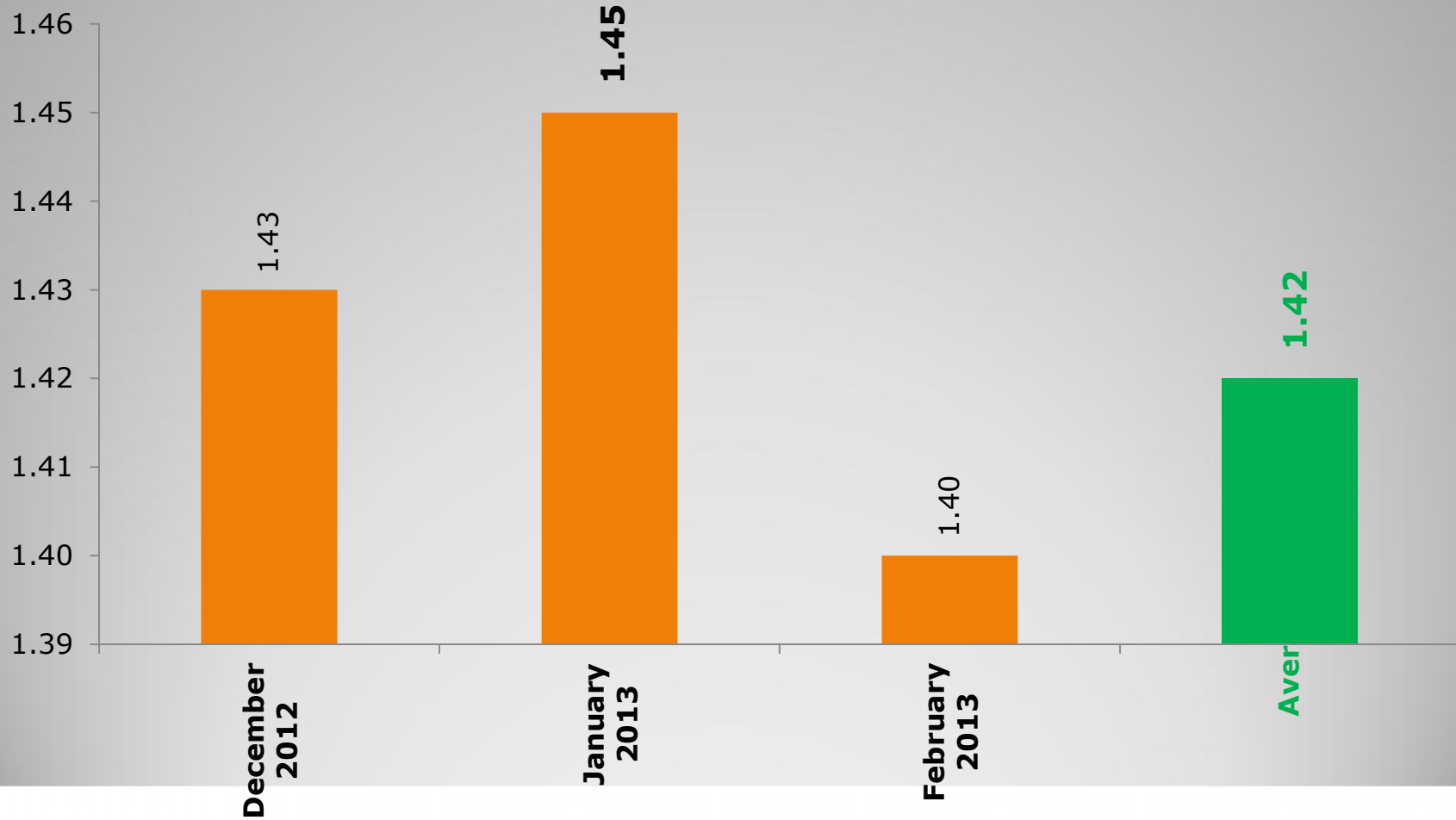
Mill Type	Conventional	Conventional	Conventional	Conventional	Hymech 2R
					
Pressure Rollers	3	3	3	3	2
Additional Roller (Pressure Feeder / Under Feed)	1	2	3	3	1
Unit Configuration	Three Roller with under feed	Three Roller with Pressure Feeders	Three Roller with P.F plus U. F	Three Roller with HD P.F plus U. F	2RM
Installed Power	18 KW/Ton fibre	20 KW/Ton fibre	22 KW/Ton fibre	23 KW/Ton fibre	14 KW/Ton fibre
Absorbed Power	14 KW/Ton fibre	15 KW/Ton fibre	16 KW/Ton fibre	17 KW/Ton fibre	10 KW/Ton fibre
Comparison variance with respect to 2RM on absorbed Power % based assessment	28.57	33.33	37.5	41.17	Lowest
Initial Cost	Moderate	High	High	High	Moderate
Maintenance Cost	Moderate	High	High	High	Lowest
Performance as first Mill % Extraction	65 - 69	70 - 72 (72.59)FSML T1	68 - 73	68 - 75	69 - 77 74.28 FSML T2

**2 ROLLER MILL POWER CONSUMPTION
AVERAGE KWH WITH RESPECT
TO CRUSHING RATE (TCH)**

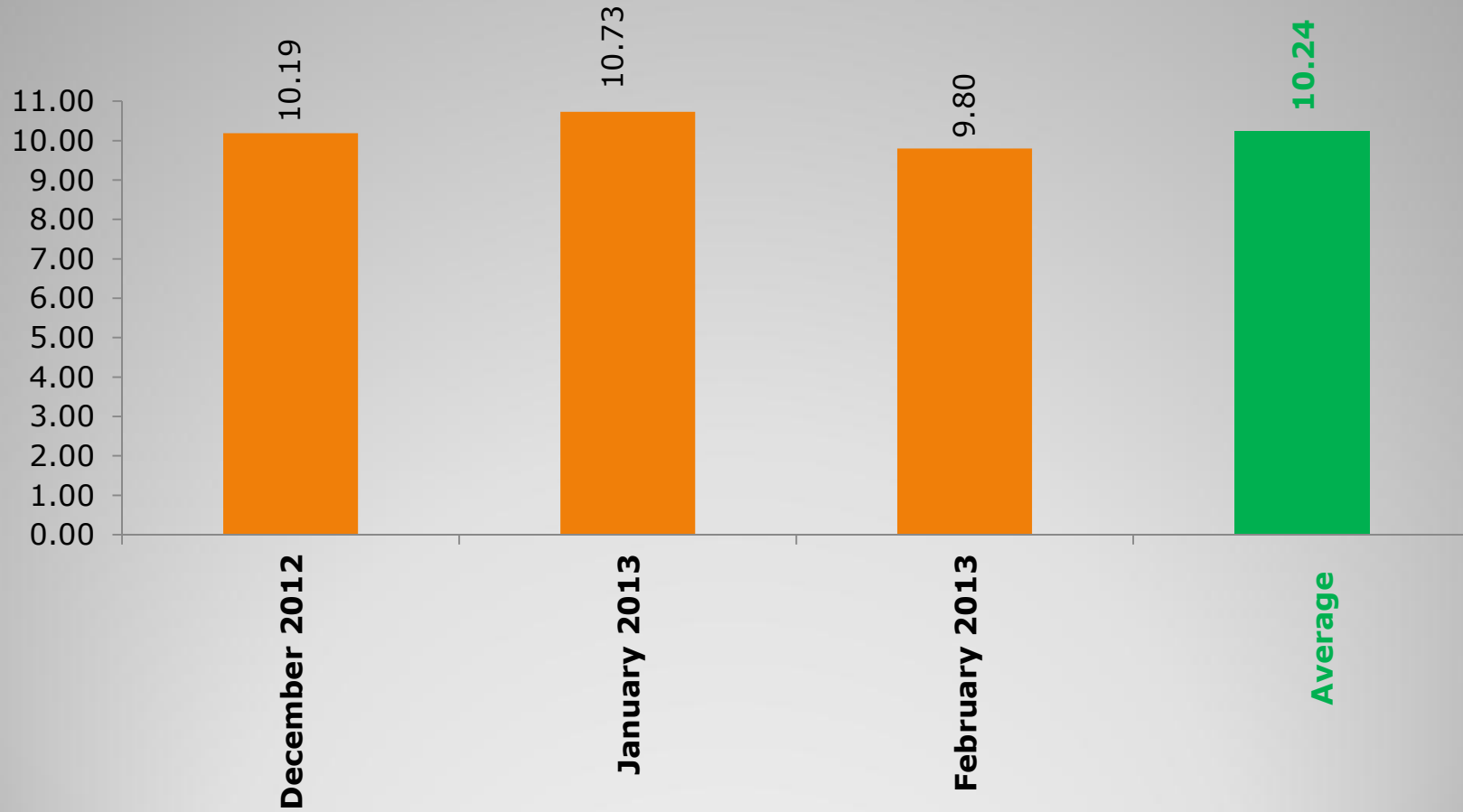


■ POWER CONSUMPTION AVERAGE KWH ■ CRUSHING RATE (TCH)

ANOTHER SPECIFIC COMPARISON OF 2RM UNIT'S POWER CONSUMPTION IN KW / TON OF CANE



POWER CONSUMPTION IN KWH / TON OF FIBRE



Average recorded 10.24 kw/ tons fibre SEASON 2012-13

COMPARISON OF POWER CONSUMPTION OF 2RM DRIVEN THROUGH MOTOR – VFD WITH CONVENTIONAL MILL SINGLE STAGE TURBINE @ 6200 TCD

<u>Motor-VFD</u>	<u>Conventional Turbine</u>	<u>Difference</u>
Power 335 KW	640 KW	305 KW
Translate @ 11.2kg/KWH	15kg/KWH	3.8 Kg/KWH
Steam Load 3.752 Tons	9.60 Tons	5.848 Tons

Calculations:

- Unit day saving $5.848 \times 24 = 140.352$ Tons
- For 100 Days $= 14035.2$ Tons
- If we generate electricity of above saved quantity of steam which will be $14035.2 \times 1000 / 11.2 = 1253.14$ MW for season.
- Further translation @ Rs.11.25/unit offer by HESCO for bagasse base generation will be $11.25 \times 1253.14 \times 1000 =$ **Rs.14.09 Millions**
can be realized as commercial advantage in terms of Power export.

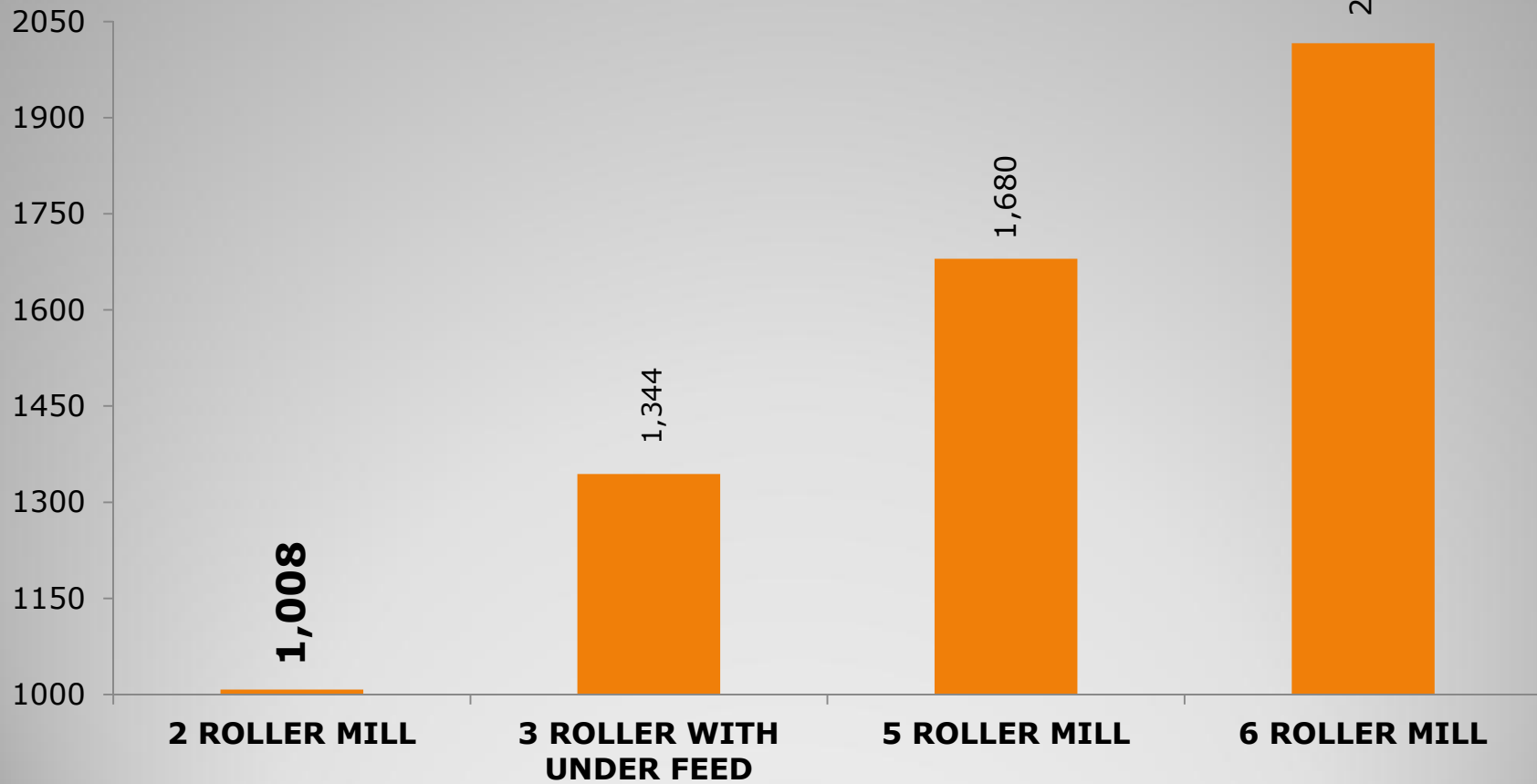
IMPACT ON LUBRICATION CONSUMPTION

1. For 5 Roller Mill Connections	10 Numbers
2. For each point consumption	0.07 liters/hr
3. For 5 Roller Mill	0.7 Liters/hr
4. For 5 Roller Mill	16.8 Liters/day
5. For season based on 100 days	1680 Liters
6. For 2RM (6 connections)	0.42 Liters/hr
7. For 24 hrs.	10.08/day
8. For season based on 100 days	1008 Liters
9. Difference in consumption	672 liters
10. Saving	40 %

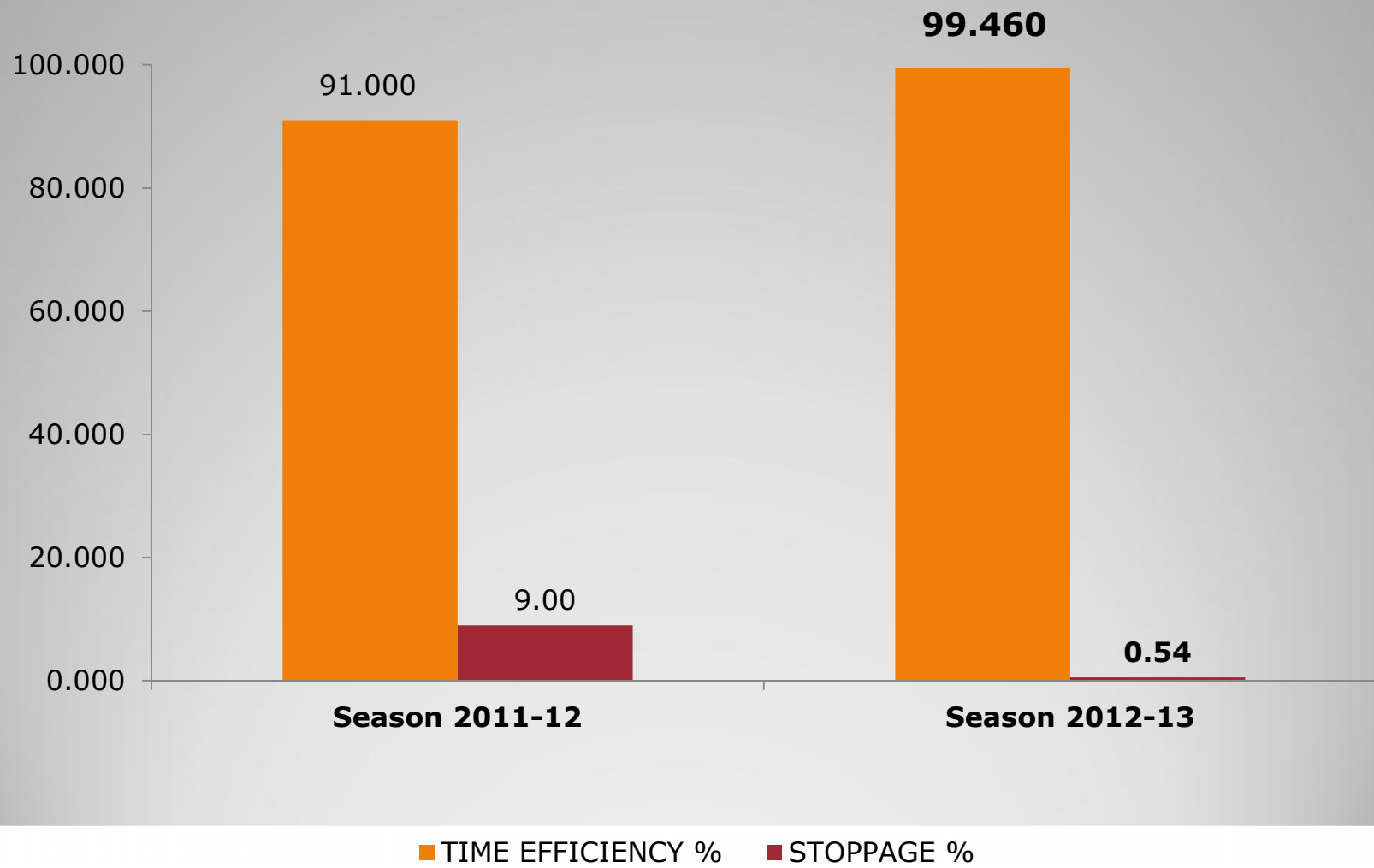
Comparison reduction of lubrication with other units

1. 25% with 3 Roller with under feed
2. 40 % with 5 Roller Mill
3. 50 % with 6 Roller Mill

**COMPARISON OF LUBRICATION - CONSUMPTION
(LTR.) BETWEEN 2ROLLER MILL AND CONVENTIONAL
MILL UNITS**



2RM OPERATIONAL RELIABILITY %



OVER ALL HMC TANDEM'S PERFORMANCE EVALUATION (TIME EFFICIENCY)

1. Tandem's Integrity

Total Working Hours - Down time due to Technical reasons
(Mechanical + Electrical) / Total working hours

$$2433.00 - 67.49 / 2433.00 = \underline{\mathbf{97.22\%}}$$

2. Tandem's Reliability

Total Working Hours - Down time due to General Cleaning
/ Total working hours

$$2433.00 - 2.58 / 2433.00 = \underline{\mathbf{99.89\%}}$$

Tandem's Availability

Total Working Hours - Down time due Internal causes (No-Cane plus
others) / Total working hours

$$2433.00 - 147.24 / 2433.00 = \underline{\mathbf{93.94\%}}$$

4. Tandem's Utilization

Total Working Hours - Down time due to Entire causes / Total working
hours

$$2433.00 - 253.58 / 2433.00 = \underline{\mathbf{89.57\%}}$$

DISCUSSION

- The performance as reflected from the results is self-explanatory. However, its operational consistency achieved after two years patience team efforts. Unit proved itself with improved extraction @ reduce power consumption.
- Still 2RM unit have potential to perform even better due to reflected highest figures for onward improvement as recorded (%) in our case as first Mill unit in a tandem.

<u>Mill Ext:</u>	<u>Bagasse Pol</u>	<u>Bagasse Moisture</u>
77.28	7.76	53.76
77.29	7.80	54.60

CONCLUSION

- Induction of Two – Roller mill is basically the start of new era for the replacement of conventional mill units. However, it will take time but intermittent possibilities at start of Milling tandems have an advantageous feature where up to 77% extraction can be realized.
- If we compare this with conventional mill having the less extraction even for 5 or 6 Roller Mill on relatively **almost dual** power consumption , components & maintenance expenditure too.
- Consequently, comparison reflected mirror-like evaluation to make the difference between the conventional units & 2RM for the fellow technologists regarding performance @ **power saving in terms of future perspective.**

ACKNOWLEDGEMENT

1. First of all I am thankful to Grate Almighty Allah who help us to overcome the difficulties and achievement of targeted extraction range.
2. I am also grateful to management of Faran Sugar Mills & specially Mr. R.J. Suleri (General Manager) for their support, encouragement and confidence on our team to get such results after a massive BMRE activities during season 2011-12.
3. We are also acknowledging the contribution as made by Mr. Abdul Rahim Mallah GM(Operations) & our team during the activities to achieve encouraging results during season 2012 - 13

*THANKS FOR
PATIENCE HEARING*