

# Forbes Marshall

Energising Businesses and Communities Worldwide

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Varying Utility KPIs : Need to Improve, Optimize and Sustain Ongoingly

Digital Sustenance Service

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# Key Performance Indicators for Industry Today's Era :-

## A. Energy Intensity –

- Generation Efficiency & Safety
- Thermal Efficiency (Steam & Thermic)
- SSC (Specific Steam Consumption) – Kg of Steam / Kg of Production
- SFC (Specific Fuel Consumption) – Kg of Fuel / Kg of Production
- Condensate Recovery Factor & Feed Water Temp.

## A. Water Intensity –

- SWC (Specific Water Consumption) – Kg of Water / Kg of Production
- Ground / Fresh Water Footprint
- Recycle , Re-use & Reduce

## C. Environment & Emissions –

- Sox , Nox & Co2 Reduction
- Going Green : PNG & Biomass
- Optimized Effluent Discharges

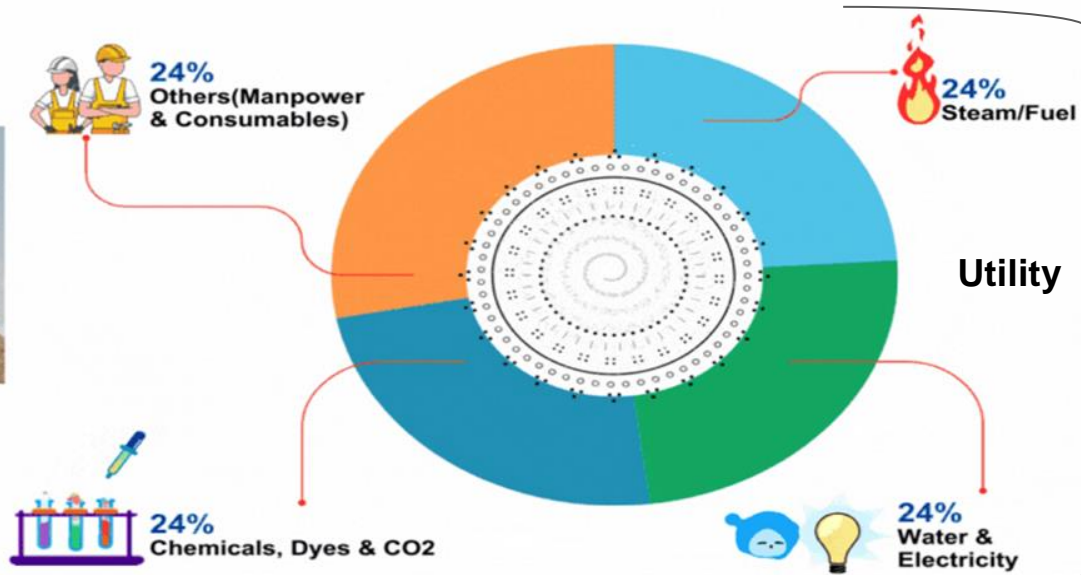
# Conversion Cost – Paper Industry

## Paper Industry

Raw Material



Conversion Cost



Finished Product



1x

+

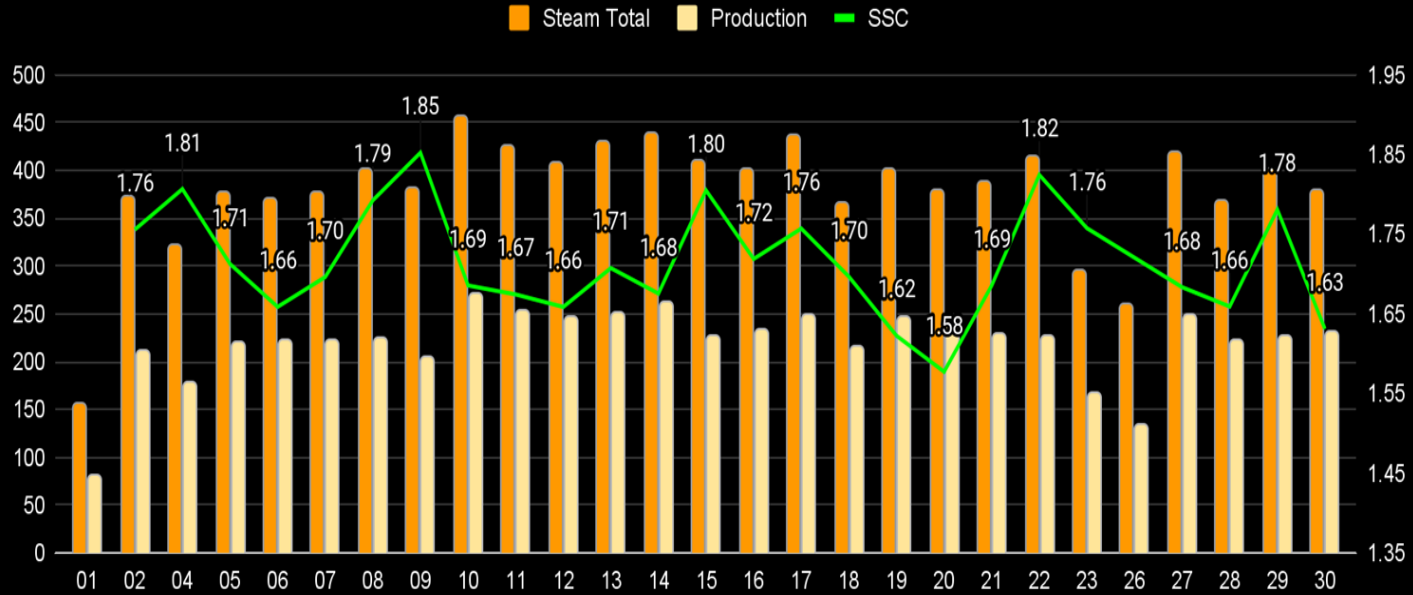
0.5x

=

1.5x

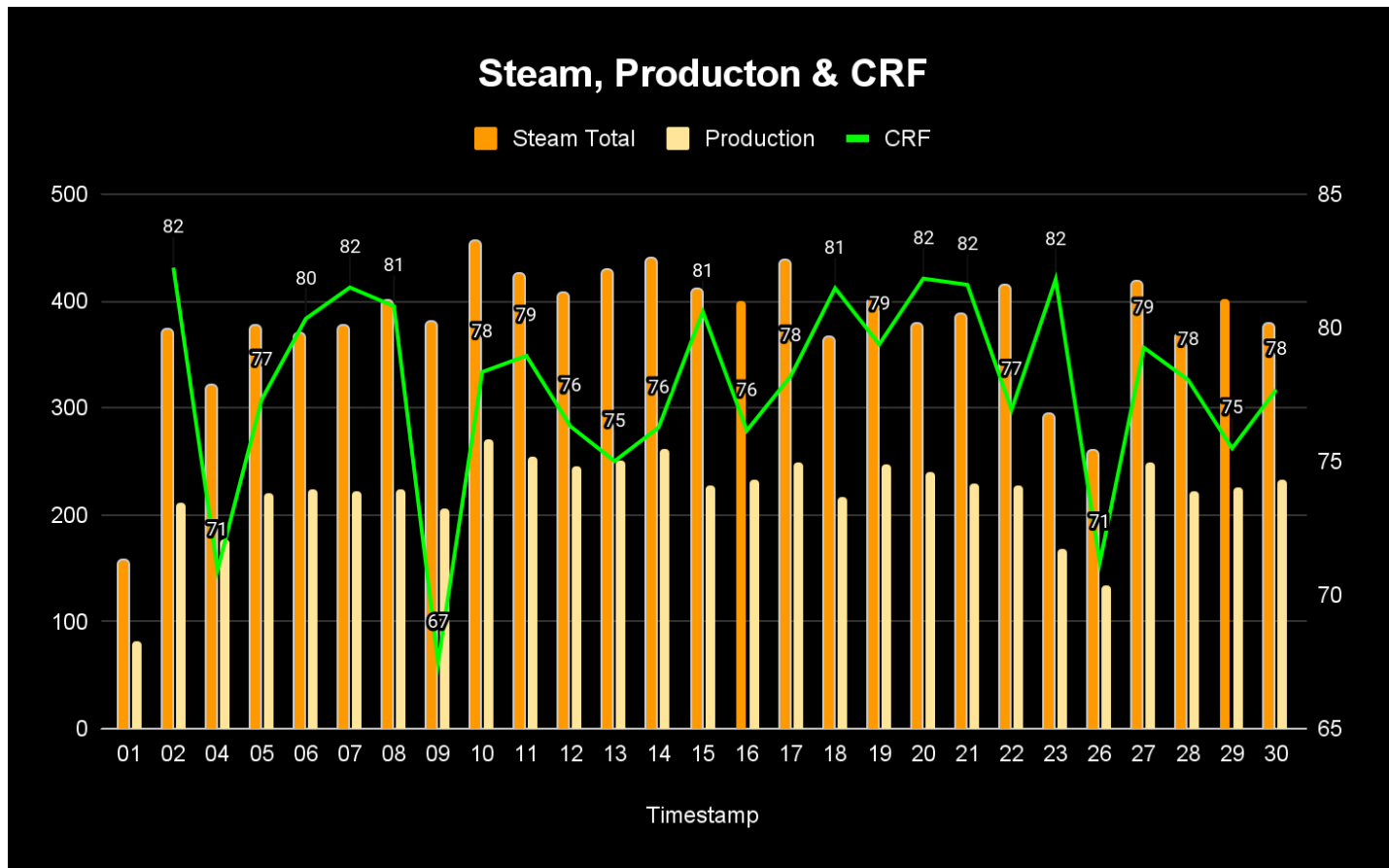
# Understanding Variation in KPIs

## Steam & Production TPD



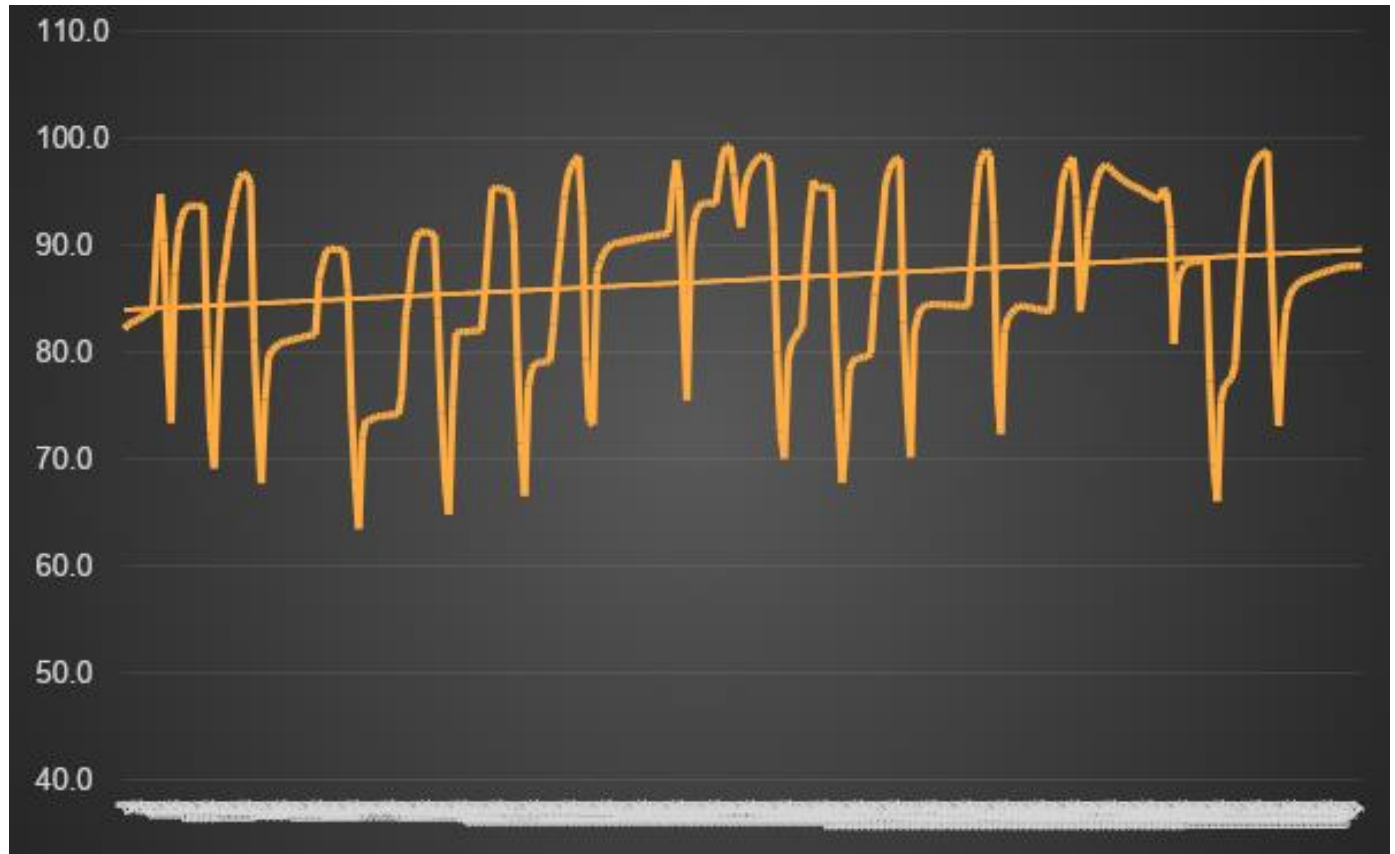
Production – 40% , Steam – 51% Variation

# Understanding Variation in KPIs



CRF – 28% Variation

Understanding  
Variation in  
KPIs – **Similar  
Plant  
FW Temp.**



>50% Variation in FWT

# Plant Parameters During Designing - Board Paper Mill

Description	Value					
Paper Type	BOARD					
Max Pope Reel Paper Production (TPD)	400					
GSM Range (grams)	180-450					
Paper Deckle (m)	4					
Machine Type	MF+SP+COATER					
TOTAL NO OF DRYER	41 + SP + 10					
Moisture % inlet to Pre Dryer (%)	50-51%					
Moisture % inlet to Size Press (%)	10					
Moisture % outlet Size Press (%)	28					
Moisture % at Pope Reel (%)	6.5					
DESIGNED SSC (SPECIFIC STEAM CONSUMPTION / TON OF PAPER) for Dryer Cylinder.	1.55					
<b>MOISTURE</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>
INLET TO DRYER (%)	45	46	47	48	49	50
INLET TO SIZE PRESS (%)	12	12	12	12	12	10
OUTLET TO SIZE PRESS (%)	27	27	27	27	27	28
AT POPEREEL (%)	6	6	6	6	6	6.5
SPECIFIC STEAM CONSUMPTION ( T/T)	1.38	1.43	1.48	1.53	1.58	1.55

#BeyondConnectivity

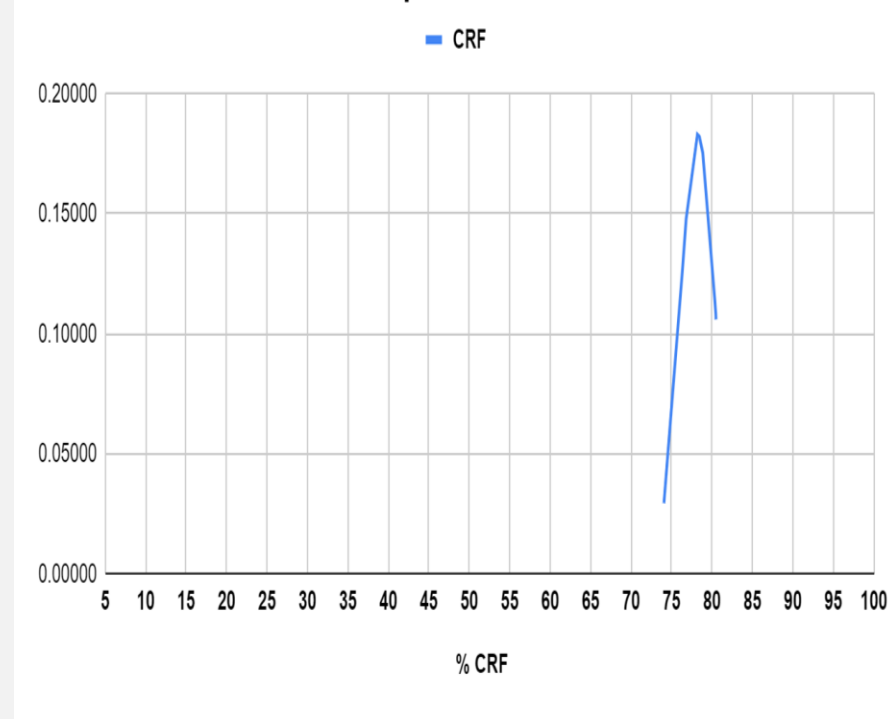
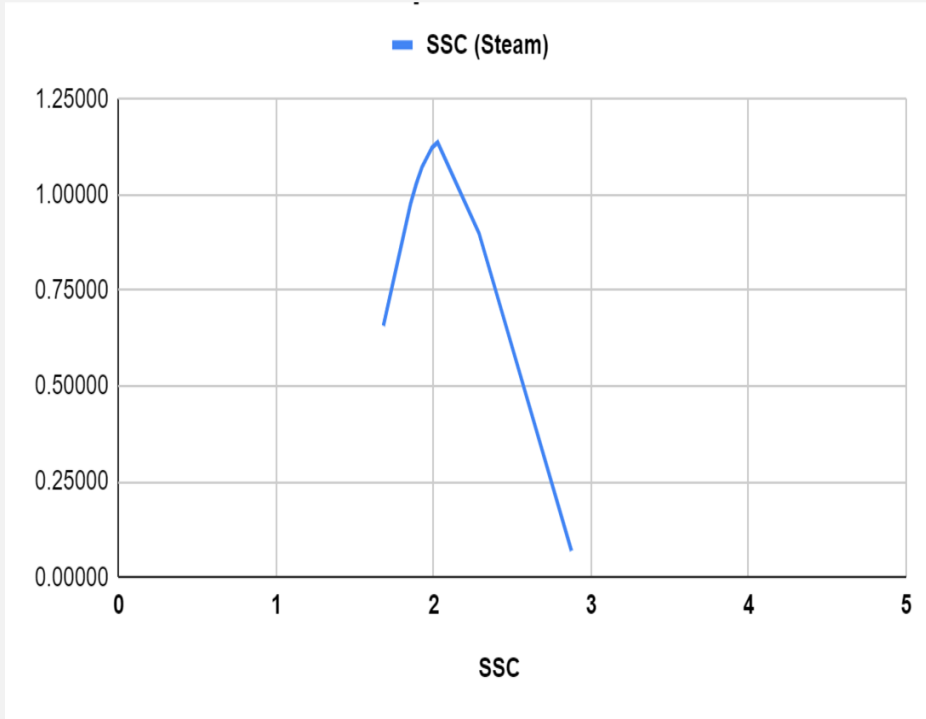
# Actual Running Plant : Daily Data

Date	Steam	Condensate	RO	Coal	Production	Electricity	SSC	SEC	SFC	CRF%
	TPD	TPD	TPD	TPD	TPD	kw/day	Steam	Electrical	Fuel	Condensate
09-10-2023	595	457	155	120	207	147300	2.87	712	0.58	77%
10-10-2023	757	578	149	123	393	133380	1.93	339	0.31	76%
11-10-2023	748	554	142	117	327	156420	2.29	478	0.36	74%
12-10-2023	754	607	143	140	379	159600	1.99	421	0.37	81%
13-10-2023	700	552	156	120	369	157200	1.90	426	0.33	79%
14-10-2023	769	618	86	136	407	146020	1.89	359	0.33	80%
15-10-2023	732	589	126	125	395	145680	1.85	369	0.32	80%
16-10-2023	729	570	113	130	360	142140	2.03	395	0.36	78%
19-10-2023	761	597	129	138	453	147900	1.68	326	0.30	78%
<b>Average Per Day</b>	<b>727</b>	<b>569</b>	<b>133</b>	<b>128</b>	<b>366</b>	<b>148404</b>	<b>2.05</b>	<b>425</b>	<b>0.362</b>	<b>78%</b>

- **Total Fuel Bill – 31.5 Cr / Anum ( 700 TPD x 1.5 Rs Steam cost x 300 days)**
- **Total Electricity – 35 Cr / Anum (1.48 L Units / day x 8 Rs. Unit cost x 300 days)**



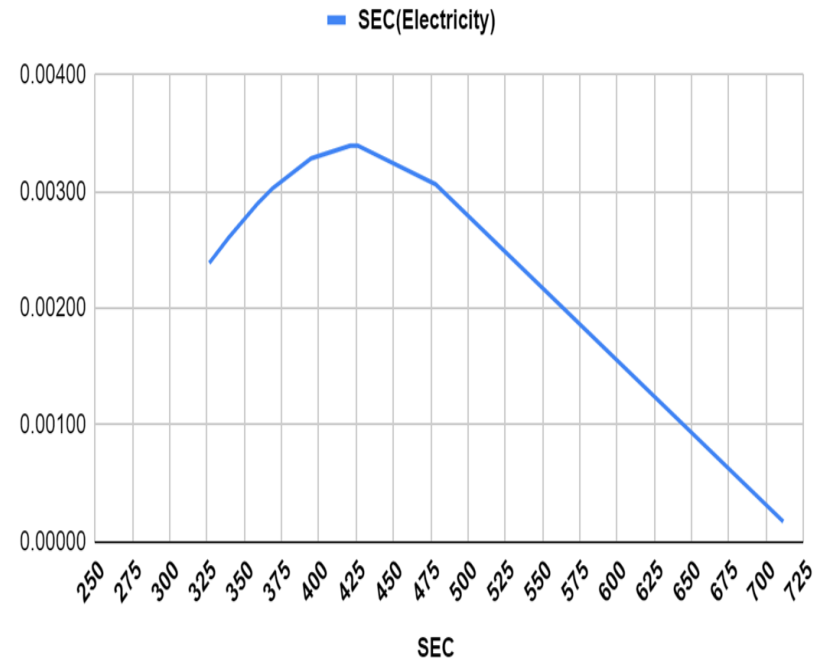
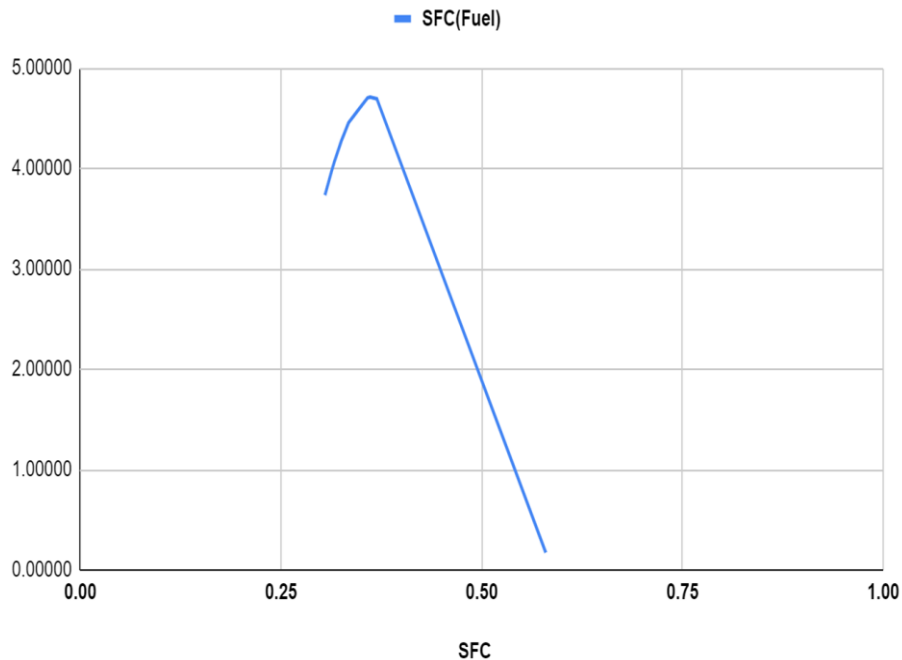
# Data - Steam and Condensate Recovery



Parameters	Max	Min	Mean
SSC (Steam)	2.87	1.68	2.0

Parameters	Max	Min	Mean
CRF	81	74	78

# Data - Fuel and Electricity



Parameters	Max	Min	Mean
SFC Fuel	0.58	0.30	0.36

Parameters	Max	Min	Mean
SEC (Electricity)	712	326	425.0

# Factor Impacting Steam Consumption in Paper Plant

- Production Capacity Utilization.
- Moisture Profile across Paper Machine.
- Steam-Condensate Control Loop Pressure – Level variation.
- Condensate evacuation from paper dryer.
- Uptime – Steam trap, Control valves, Condensate Pump, Meters.
- Proper utilization of Flash steam.
- Condensate Recovery Factor variation.

How / Why this variation  
happening??

**(1) Uncontrollable - Product Mix/Process  
Cycles – 10%**

**(2) Controllable – within our hand / which we  
can act & reduce increase/variation in KPIs  
-10%**

- *Operating Practices*
- *Competency/skill set*
- *Uptime of accessories*
- *Lack of Monitoring*

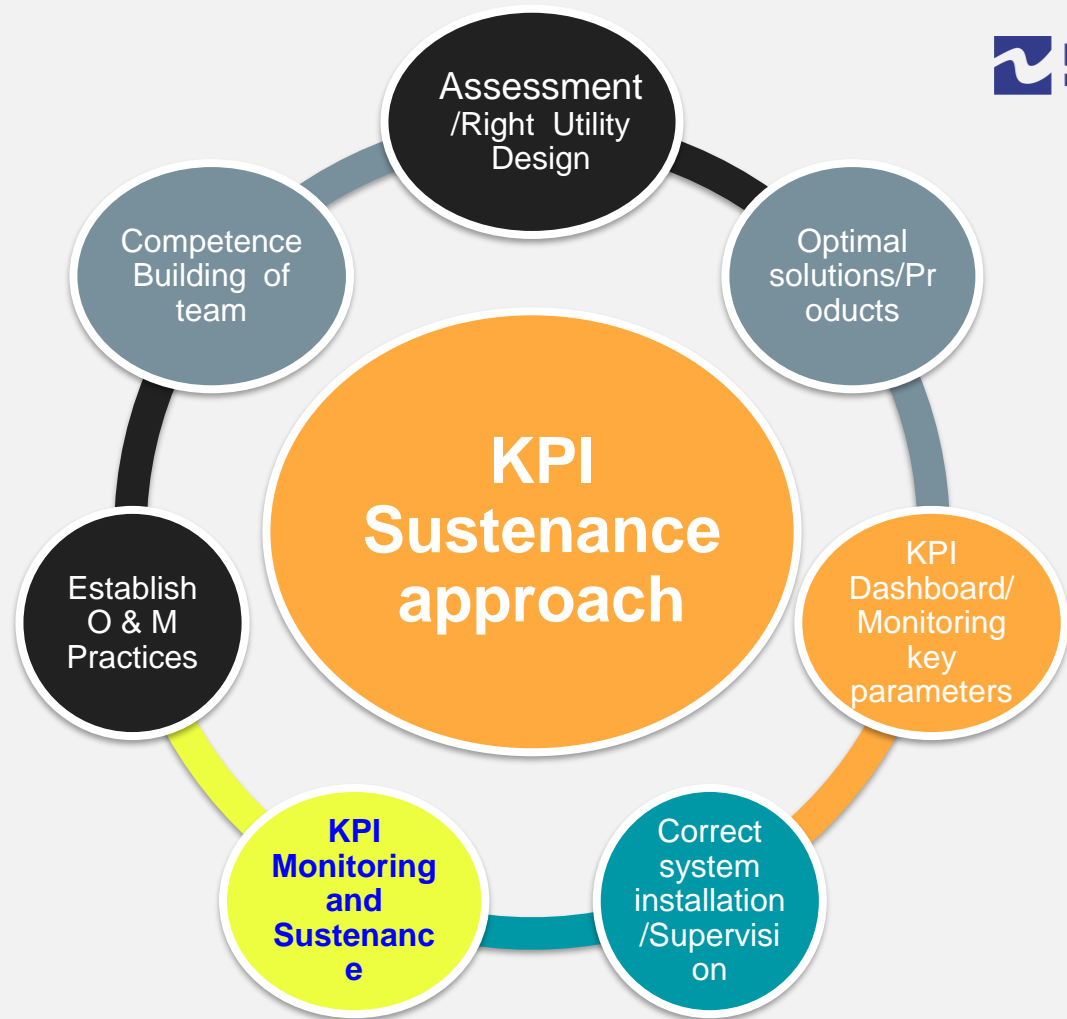
Why Variation  
in KPIs



# How I overcome controllable Variations?

## Sustenance Service

- Plant as per Design
- Monitor KPIs
- Sustain KPIs



# Deliverables : Digital Sustenance Partnership”

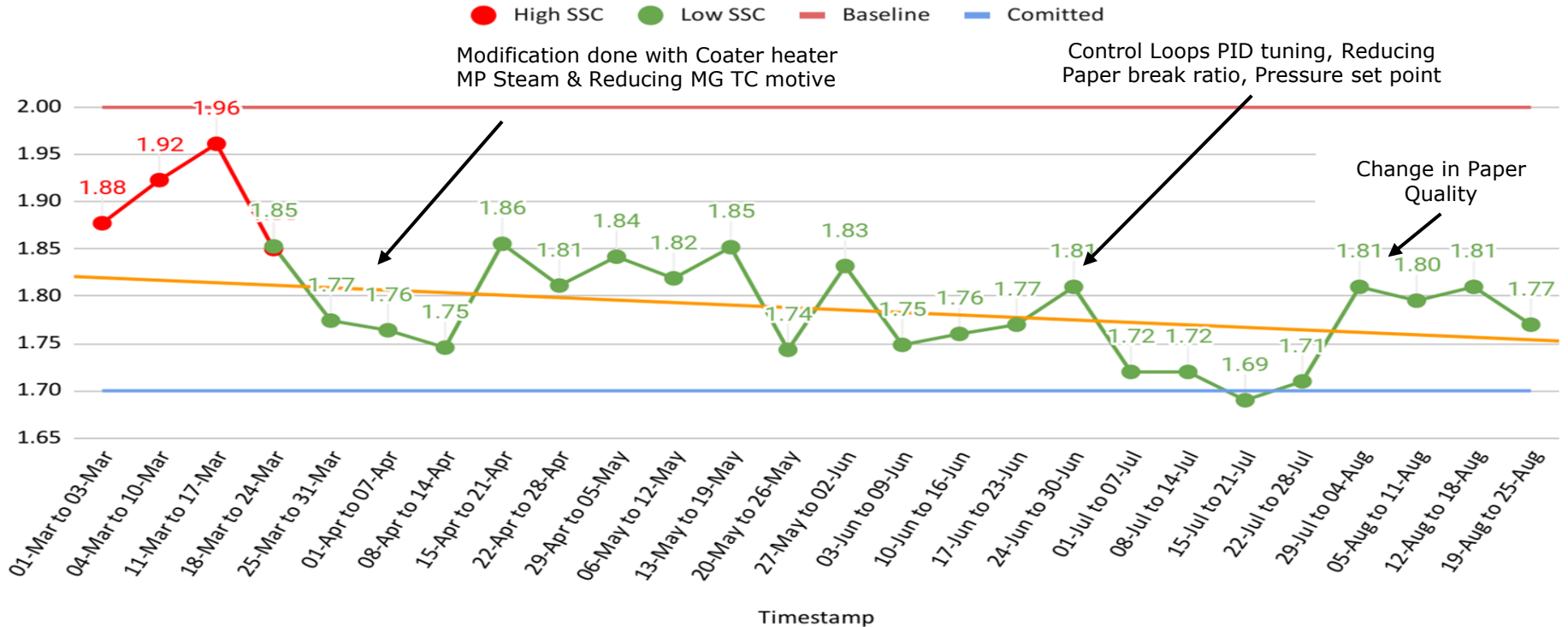
- Re- Establishment Benchmark value after detailed Heat-Mass Balance and Study.
- ✓ SSC (Specific Steam Consumption) Per Ton of Paper.
- ✓ Condensate Recovery Factor (CRF)
- Dashboard, Digitally Daily monitor the system, Understand the Variation and Provide solution GSM wise.
- Optimize the Steam and Condensate Control Loop.
- 24 x 7 Visibility of KPI with FM Digital presence.
- Expert Analysis report: Shift Wise, Daily, Weekly.
- Instant Alert: Things go beyond acceptable limits.
- Define SOP and Train the team periodically.
- Mapping the Scope card: Efficiency, O&M, Safety, and Environment.
- Define Roadmap and Continue Engagement for improvement to sustenance.

#BeyondConnectivity

# Result : Digital Sustenance Service - Board Paper Mill @ North India

## SSC - Machine Production - Weekly

**8.8% steam reduction,  
Monitory Saving of 146 LPA**



# KPIs Improvement

Parameter	Before (Jan 24 to Mar 24)	After ( July 24)	Actions Taken
Production TPD	205	215	
CRF %	81%	80-82%	
SSC (kg/kg)	<b>2-2.2</b>	<b>1.75-1.85</b>	MG Steam optimization, Coater MP steam reduction by replacing group trapping to individual trapping, Reducing steam during Paper breaks, Coater flash steam utilization into dryer
Steam Condensate Control Loop Controllability	PCV - 80% LCV -52% DPCV - 20%	PCV - 91% LCV -75% DPCV - 62%	Fine Tuning the PID values for each control loop to achieve the set point by taking the system online
Paper Break ratio (Nos / Day and Time)	<b>5.6 ton/hr</b> during paper break	<b>3.7 ton/hr</b> during paper break	Paper break ratio reduced from <b>0.5 to 0.2-0.3</b> to optimize the steam consumption during break
MP steam optimization in Coater <small>Proprietary content</small>	<b>95 Ton/day</b> MP steam used in Coater Heater	Reduced to <b>50-55 Ton Steam/day</b>	Individual Trapping of Heaters, MP condensate Flash steam utilization



**Overview**

Trends

Alarms •

Reports

Last updated on: **Thu, Sep 08 2024 (11:29 PM)**

### Specific Steam Consumption (SSC)

**1.78**



Baseline: 2 - 2.2 | Benchmark: 1.7 - 1.8

### Condensate Recovery Factor (CRF)

**86%**



Baseline: 70-80% | Benchmark: 85-90%

### Feedwater Temperature



Baseline: - | Benchmark: -

Previous Day

**Total  
Production**

**215** Ton

Previous Day

**Paper Break  
Number**

**4**

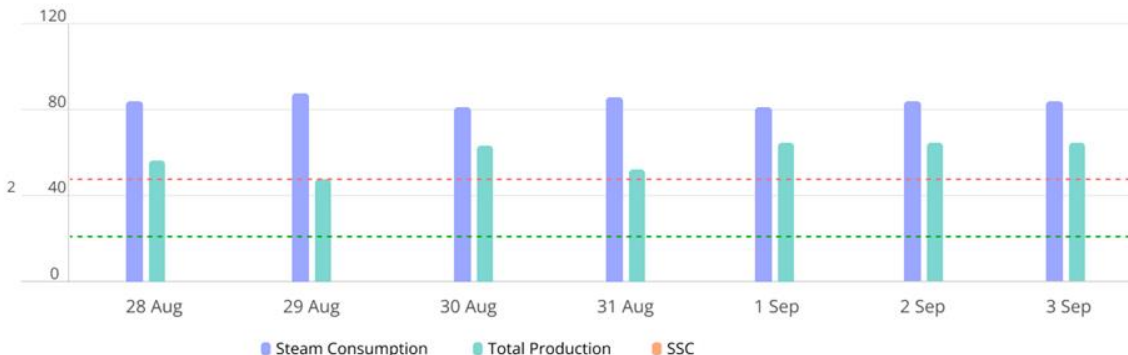
Previous Day

**Paper Break  
Time**

**320** min

### Steam Consumption, Total Production & SSC

Last 7 days ▼



Operation

Draw (TPH)	<b>0.0</b>
Production loss	<b>0.0</b>
Paper break time	<b>900.3</b>

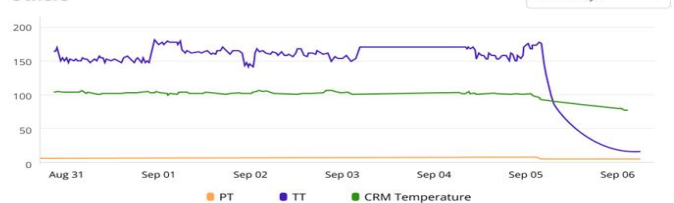
Production

Machine speed (MPM)	<b>12</b>
Basis weight (GSM)	<b>301</b>
Moisture (%)	<b>6.42</b>
Deckle (M)	<b>3.4</b>

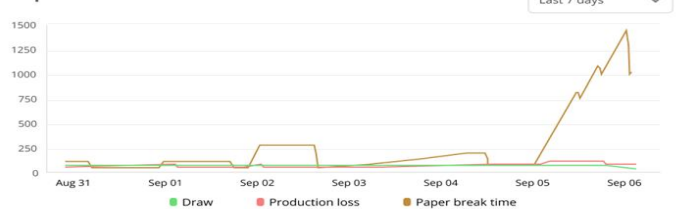
Others

PT (BAR)	<b>0.3</b>
TT (°C)	<b>26</b>
Condensate temperature (°C)	<b>58.3</b>
Common condensate tank level (%)	<b>47</b>

Others













Operations



Production



Created Time	Description	Type	Severity	Status			
2024-09-05 12:05:04	Paper Break	Critical	High	Active Unknowledged			
2024-09-04 13:54:02	Moisture	Warning	Medium	In Progress Acknowledged			
2024-09-02 17:04:22	CRF	Critical	High	Active Unknowledged			

# Steam System Performance Rating of a Plant

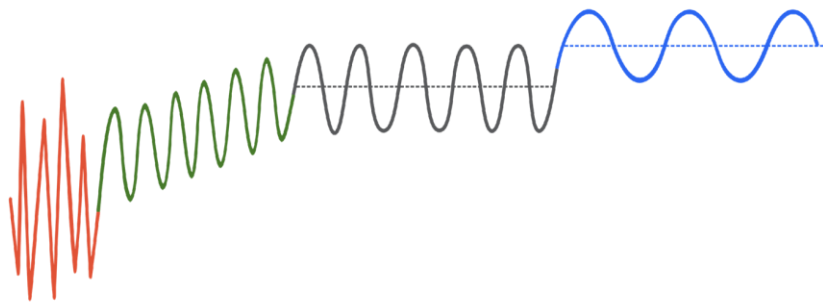
## FORBES MARSHALL STEAM SYSTEM SCORECARD



# Forbes Marshall DIGITAL – Service For Sustainability



“Total Ownership with 78 Years Knowledge, Product-Solutions and Service to Improve and Sustain Plant KPIs”



Unattended KPI	Right Products	Operations Over Time	Beyond Connectivity
High variability, significant opportunity to optimise	An efficient plant built for your needs, aimed at being a benchmark plant in your industry	Plant performance impacted by operating practices, production loads, and other variables over time	Reduced variance, 24x7 detection of any failure, quicker resolution, actionable insights, prediction for maintenance or failure

## Partnership Deliverables :

- **Establishment** Benchmark value for each KPI within plant.
- **Real time** Dashboard.
- **24 x 7** Visibility of KPI with FM Digital presence.
- **Expert Analysis** Update : ShiftWise, Daily, Weekly.
- **Instant Alert** : Things go beyond acceptable limits.
- Define **SOP** and **Train the team** periodically.
- Measure Analyze Perform : **Efficiency, O&M, Safety, Environment.**
- Define Roadmap, Go to Points and Continue Engagement for **Improvement to Sustenance.**
- **CDS** : Commit, Deliver and Sustain

## KPIs

### Generation

S:F, Boiler Efficiency

### Distribution to Recovery

Condensate Recovery Factor

### Plant Level KPI

Specific Steam / Specific Water  
Per unit of Product

### MAP

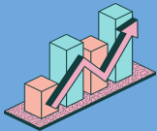
Safety, Efficiency,  
O & M, Environment

# Cultural Shift through Sustenance Service



**Forbes Marshall Digital**  
Partnership For Delivering Value Ongoingly

Data



Data Informed

Domain  
Knowledge



Innovative

Field Experts



Customer Centric

Customer  
Collaboration



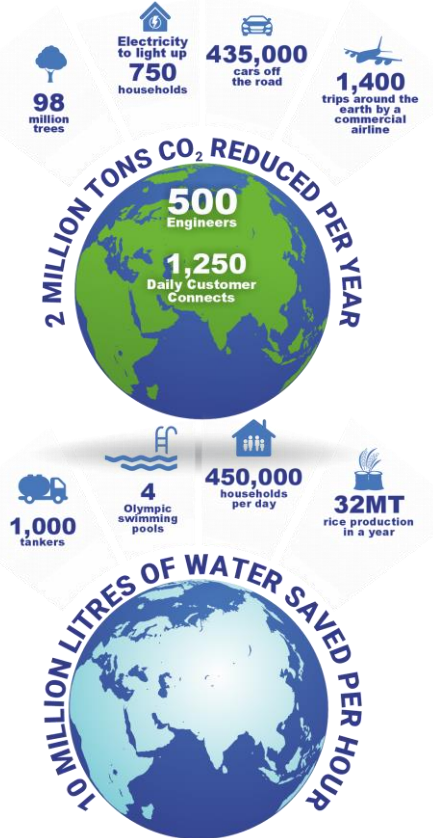
Collaborative

Energy

Environment

Effluent

# Enabling Results – 15 to 25% Improved Profitability



## - Energy conservation

- Reduction in energy footprint - Improved Productivity , CRF, SSC, SFC. Benchmark & Sustenance.

## - Process improvement & efficiency

- Quality & efficiency KPI's - Reduction in Wastage, Batch time reduction, Quality improvement.

## - Environment

- Co2 reduction, Dust/ Nox, Water sustenance, Effluent handling.

# Digital Sustenance Service

“FM - Knowledge Driven Partnership for KPI Improvement to Sustenance”

## Across

Food & Beverage  
 Textiles  
 Power Plants  
 Paper & Corrugation  
 Water  
 Tyre & Rubber  
 Rice  
 Metal & Mines  
 Plywood & Laminates  
 Pharma & Chem  
 Oil & Gas  
 Hospitality  
 Fertilisers  
 Sugar & Distilleries

& many more

### Designing of a benchmark plant

Best designed plant with lowest energy, emission, water & best efficiency

### Setting & running the benchmark plant

World class Innovative products giving customer benefits

### Sustaining the benchmark performance

Plant improvements & sustaining benchmark performance

### Consultancy Plant Knowledge + Services

### Products Technical + Application knowledge

### Digital + Physical

Process Knowledge  
 Digital ecosystem  
 Knowledge of plant dynamics

Thank you

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