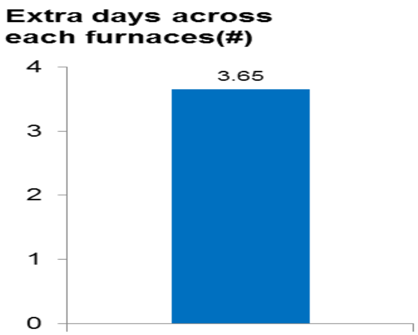
TATA STEEL

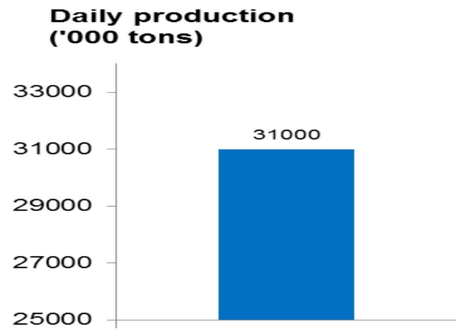
TATA

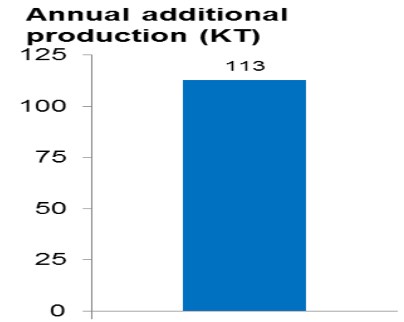
A maintenance approach towards Benchmark Effective Operating Hours at Blast Furnaces in Tata Steel, Jamshedpur

Benchmarking for Effective Operating Hours/Days

3.6 extra prod. days from 1% extra EOH of furnace	... at production rate of 31000 tpd	... to result in ~113 KT additional production
1% EOH. improv. = 3.65 days/furnace	Avg. daily production = 31,000 tons	3.65 X 31 KT = ~113 KT

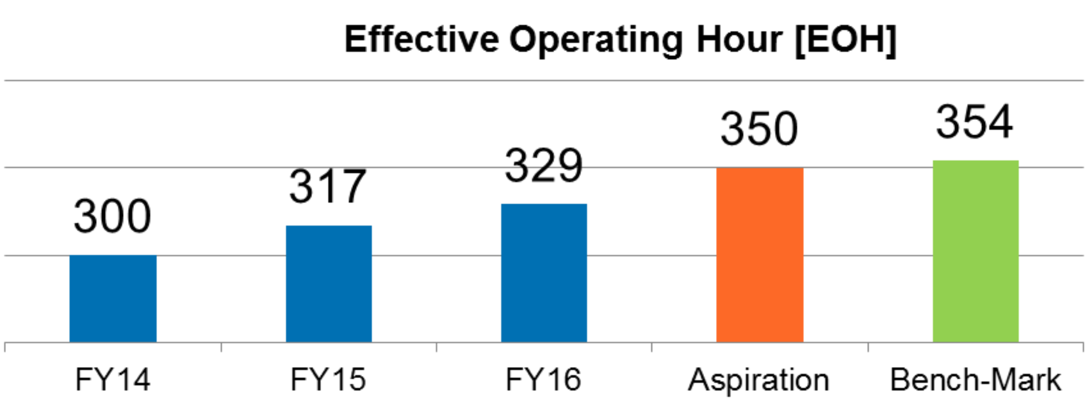






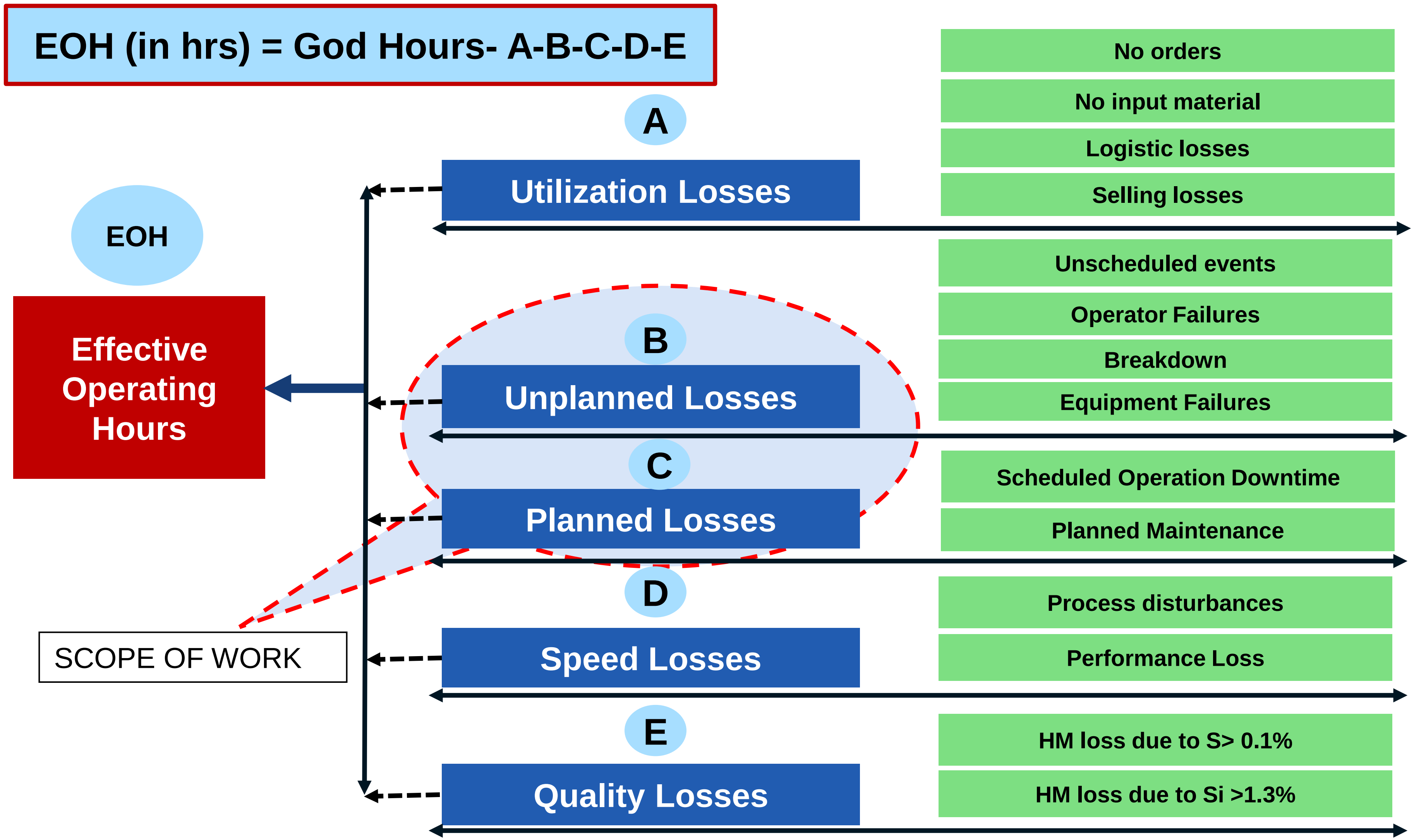
1% increase in EOH results in significant value creation

EOH – Effective Operating Hours



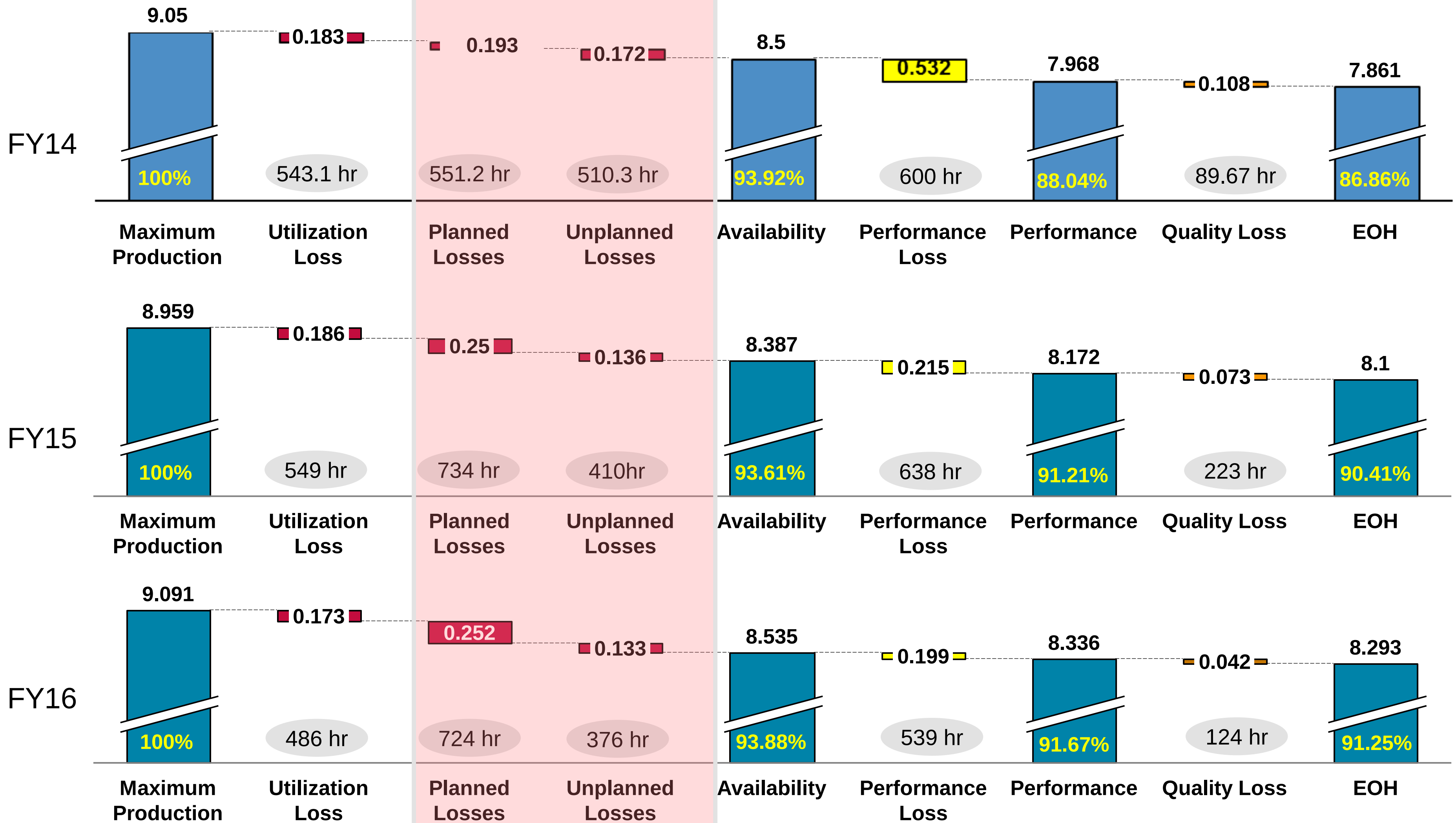
- ❖ **Aspiration to achieve 96% EOH (350 Days) in next 2 years**
- ❖ **An additional 0.5 MTPA (300+ Cr to Steel Business)**

Measuring Effective Operating Hours

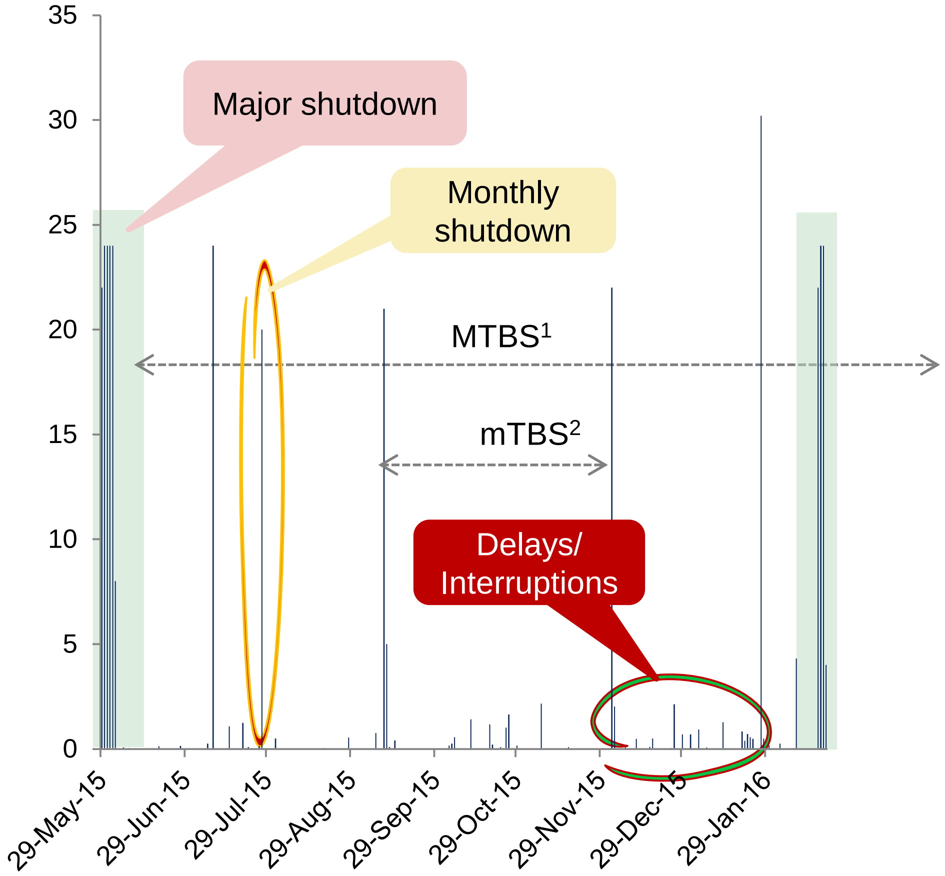


Blast furnace EOH basis best performance

EOH loss analysis (MTPA)



Maintenance strategy to increase EOH



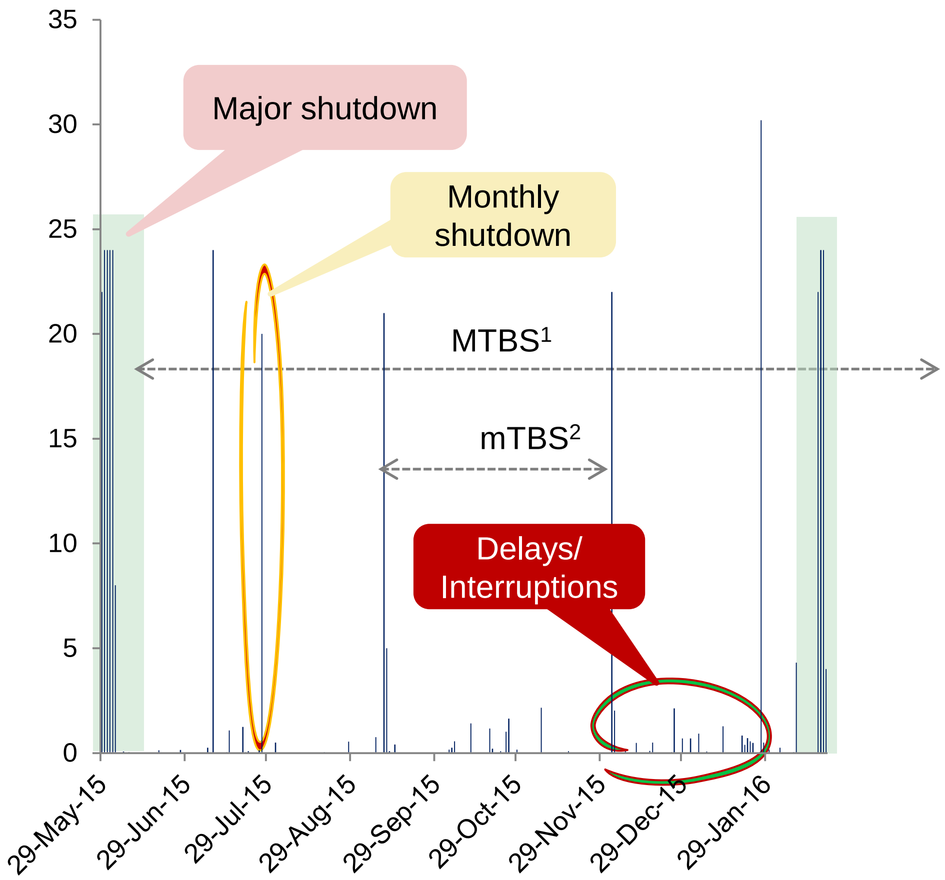
Two main value pools to target

1 Value pool 1: Zero delays
- Ideal maintenance planning
- Intelligent inputs, monitoring (digital)
- Smarter execution/ work processes

2 Value pool 2: Efficient shutdowns
- Higher MTBS
- Lower planned shutdown time
- Higher execution compliance, effectiveness

MTBS – Mean Time Between Shutdowns

Maintenance strategy to increase EOH



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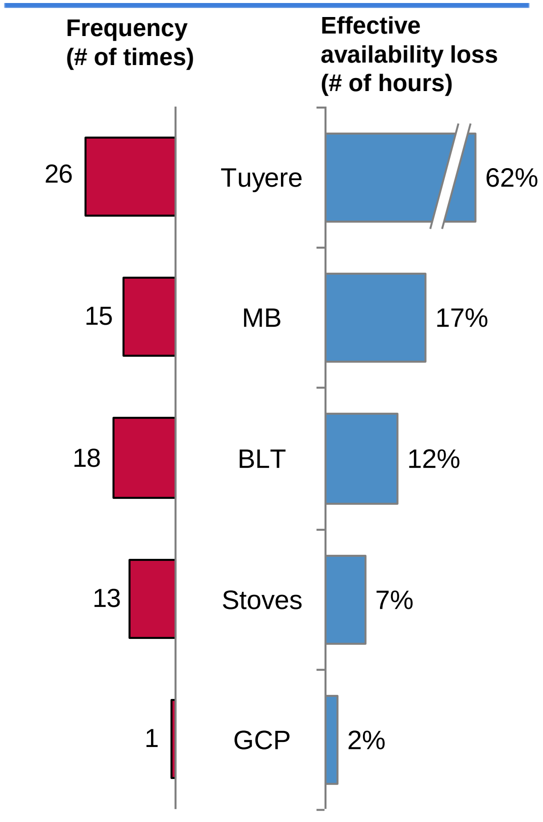
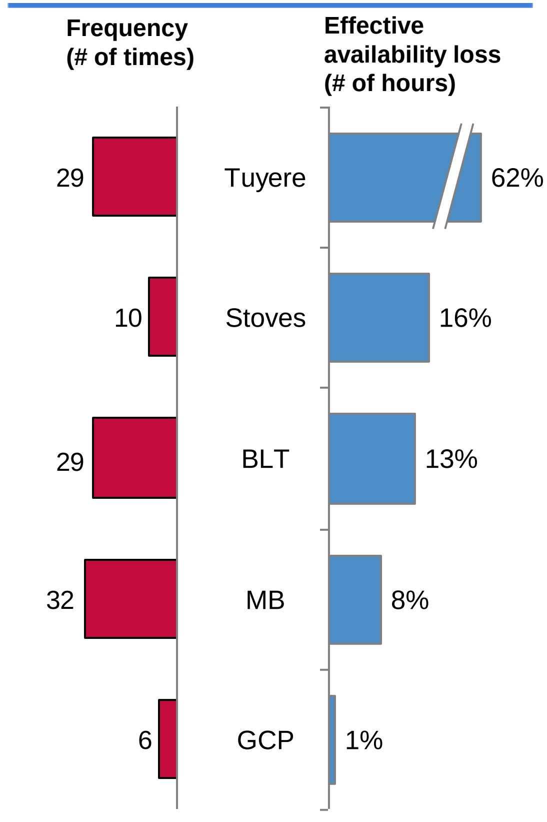
Blast furnace: Key Unplanned Losses – Chronic Soft Spots

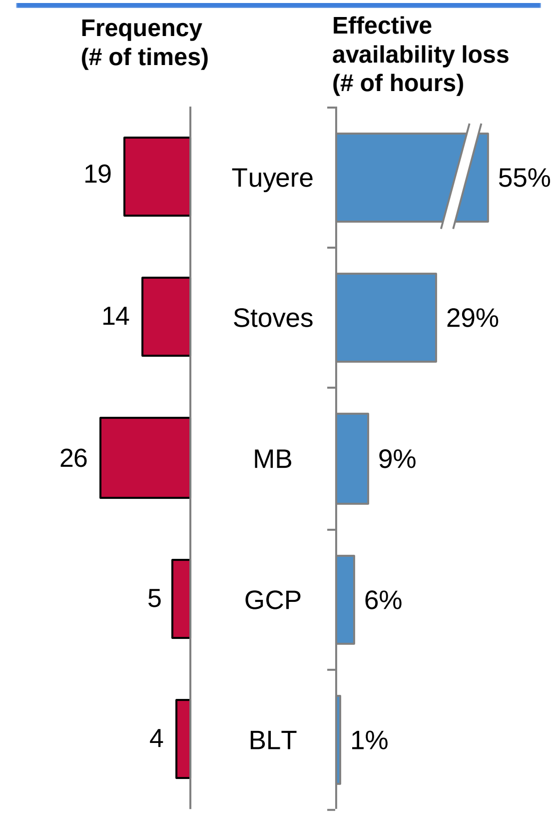
Key breakdown issues(FY14)



Key breakdown issues(FY15)



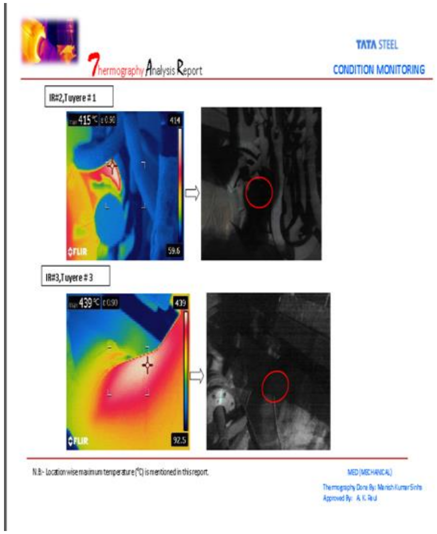
Key breakdown issues(FY16)

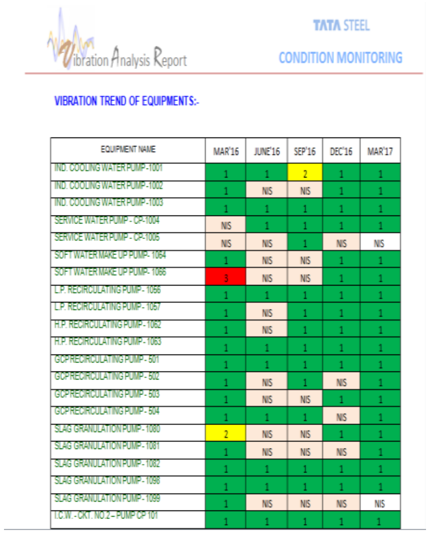


Strategy for Addressing Chronic Soft Spots

	Tuyeres	Conveyors	BLT Charging
EXTENSION OF CONDITION DIAGNOSTICS – SETTING UP OF AMDC (Asset Management & Diagnostics Centre)	●	●	●
STANDARDIZATION OF INSPECTION & MAINTENANCE PROCEDURES ACROSS BFs	●	●	●
RETURN TO BASIC OPERATING CONDITIONS – -- MODEL WORKPLACE CAMPAIGN -- MODEL CONVEYOR CAMPAIGN		●	●
FORUM FOR TECHNICAL EXCHANGE WITH OEM CREATED			●

Condition Diagnostics for Blast Furnaces





Vibration Analysis Report

TATA STEEL

CONDITION MONITORING

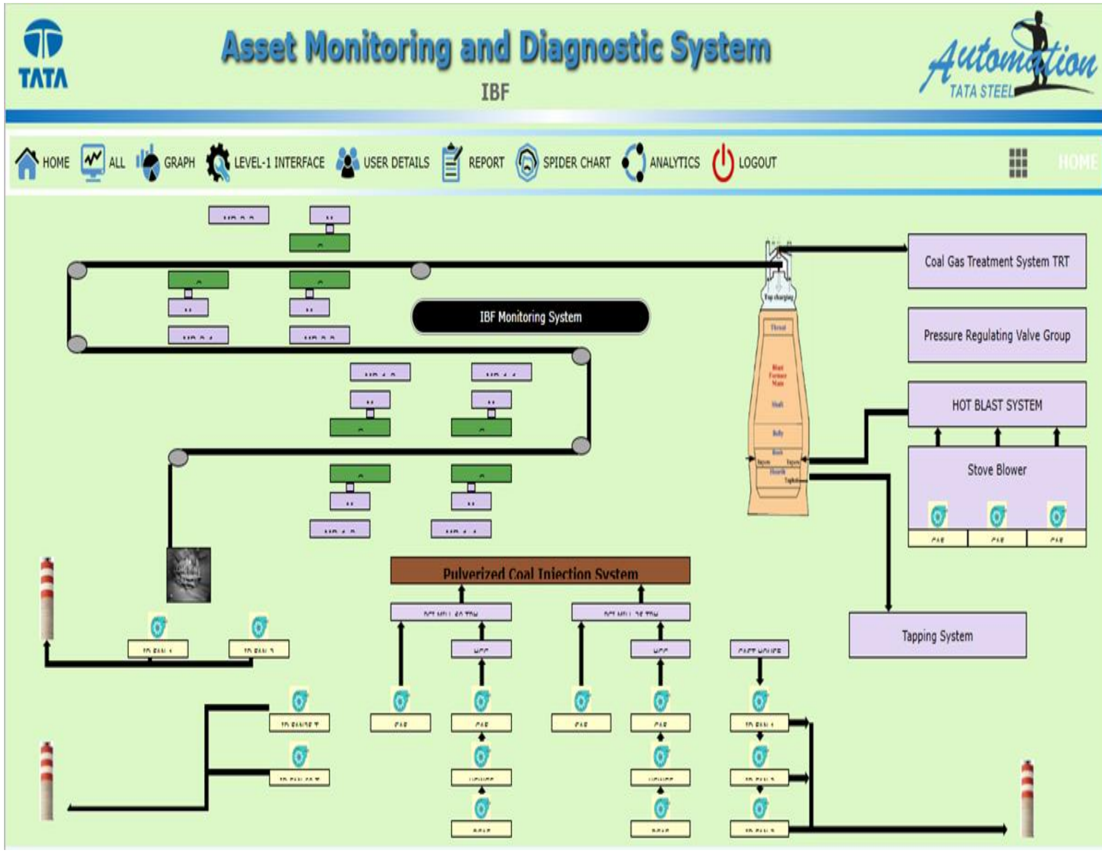
VIBRATION TREND OF EQUIPMENTS:-

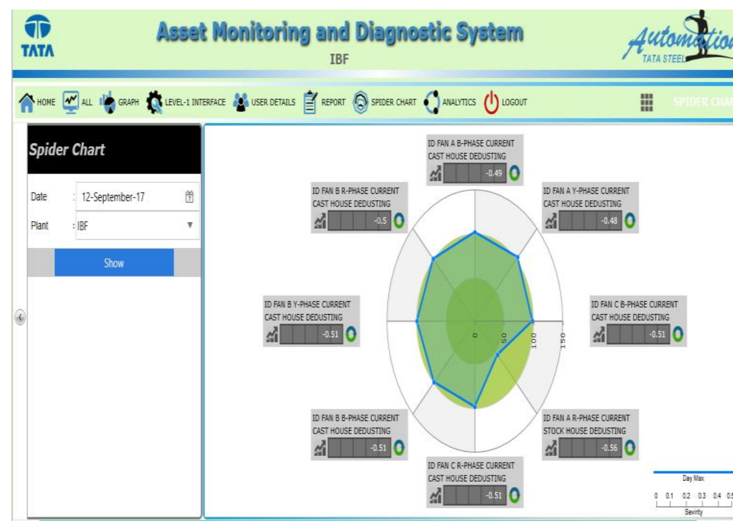
EQUIPMENT NAME	MAR'16	JUNE'16	SEP'16	DEC'16	MAR'17
IND. COOLING WATER PUMP - 1001	1	1	2	1	1
IND. COOLING WATER PUMP - 1002	1	NIS	NIS	1	1
IND. COOLING WATER PUMP - 1003	1	1	1	1	1
SERVICE WATER PUMP - CP-1004	NIS	1	1	1	1
SERVICE WATER PUMP - CP-1005	NIS	NIS	1	NIS	NIS
SOFT WATER MAKE UP PUMP- 1064	1	NIS	NIS	1	1
SOFT WATER MAKE UP PUMP- 1066	3	NIS	NIS	1	1
L.P. RECIRCULATING PUMP - 1056	1	1	1	1	1
L.P. RECIRCULATING PUMP - 1057	1	NIS	1	1	1
H.P. RECIRCULATING PUMP - 1062	1	NIS	1	1	1
H.P. RECIRCULATING PUMP - 1063	1	1	1	1	1
GCP RECIRCULATING PUMP - 501	1	1	1	1	1
GCP RECIRCULATING PUMP - 502	1	NIS	1	NIS	1
GCP RECIRCULATING PUMP - 503	1	NIS	NIS	1	1
GCP RECIRCULATING PUMP - 504	1	1	1	NIS	1
SLAG GRANULATION PUMP - 1080	2	NIS	NIS	1	1
SLAG GRANULATION PUMP - 1081	1	NIS	NIS	NIS	1
SLAG GRANULATION PUMP - 1082	1	1	1	1	1
SLAG GRANULATION PUMP - 1098	1	1	1	1	1
SLAG GRANULATION PUMP - 1099	1	NIS	NIS	NIS	NIS
I.C.W. - CKT. NO.2 – PUMP CP 101	1	1	1	1	1

- Temperature Trends
- Vibration Trends
- Thickness Checks
- Weld Joint Checks
- Replacement Strategies

Model Conveyors

Data Analytics for Blast Furnaces





Real Time Data Capturing & Monitoring

TATA STEEL

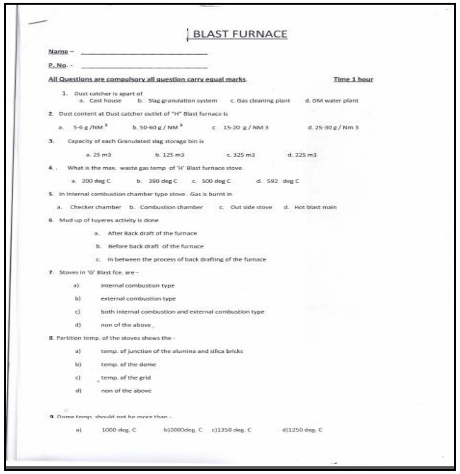
Standardization of Technical Specifications/Training

- **Drawing standardization of all conveyor pulleys to ensure higher reliability.**
- **Development of SMPs(Standard Maintenance Practices) for all critical equipment.**
- **Formulation of different CCTs(Core Competency Team) for quality assurance of spares**

Training Plan (General Mechanical and General Training)

Training Plan (General)														
Sr No.	Training Module		Period											
	Category	Sub-Category	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	Hydraulics	Training in hydraulic cell				6 Days	6 Days							
		Basic hydraulics in SNTI					4 Days		4 Days					
		Industrial Hydraulics SNTI												
2	Centrifugal Fans	Training at SNTI					1 Day							
3	Lubrication, levelling and alignment, Gear Box	Training at SNTI							6 Days					
4	Safety	AECT and JCC training					1 Day							
		First aid and fitness						2 Days						
		5s, VWM and safety						1 Day						
		Safety Awareness						2 Days						
		Gas Safety						2 Days						
5	Pneumatics	Industrial pneumatics at SNTI												
6	Conveyors													
7	TPM	Basic TPM concepts (Jishu Hozen)						2 Days						

Training	
	Planned
	Actual


BLAST FURNACE

Name –

P. No. -

All Questions are compulsory all question carry equal marks. Time 1 hour

1. Dust catcher is apart of
   a. Cast house b. Slag granulation system c. Gas cleaning plant d. DM water plant
2. Dust content at Dust catcher outlet of "H" Blast furnace is
   a. 5-6 g /NM³ b. 50-60 g / NM³ c 15-20 g / NM 3 d. 25-30 g / Nm 3
3. Capacity of each Granulated slag storage bin is
   a. 25 m3 b. 125 m3 c. 325 m3 d. 225 m3
4. What is the max. waste gas temp of 'H' Blast furnace stove
   a. 200 deg C b. 390 deg C c. 500 deg C d. 592 deg C
5. In Internal combustion chamber type stove . Gas is burnt in
   a. Checker chamber b. Combustion chamber c. Out side stove d. Hot blast main
6. Mud up of tuyeres activity is done
   a. After Back draft of the furnace
   b. Before back draft of the furnace
   c. In between the process of back drafting of the furnace
7. Stoves in 'G' Blast fce. are -
   a) internal combustion type
   b) external combustion type
   c) both internal combustion and external combustion type
   d) non of the above
8. Partition temp. of the stoves shows the -
   a) temp. of junction of the alumina and silica bricks
   b) temp. of the dome
   c) temp. of the grid
   d) non of the above
9. Dome temp. should not be more than -
   a) 1000 deg. C b)2000deg. C c)1350 deg. C d)1250 deg. C

Competency Building programmes

The Bottom-Up Approach

Shop-floor driven Campaigns for Blast Furnaces

Project Milestone Plan of Action

Quality circle name – A-F blast furnace hydraulics	Dept.- A-F BF; Coordinator – Neha	Facilitator: Pawan Dubey Leader Name – John Thomas Members Name – P Ram krishna; Dilip kr Jha; Mahavir Prasad; R C Patel; Sandip Mani; K Alam;
Project – Reliability Improvement of Blast furnace Dustcatcher	Reason for selection – Reliability Improvement of Blast furnace Dustcatcher	
Major Project No. – 97	Beginning Date – 7/10/14; Completion date – 17/02/15	
Meeting Day-Tuesday ,Time – 8:15AM	No. of project completed – 97 Till date	

No.	ACTIVITY WEEK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Target Days	Actual Days
1	Defining the problem																					7days	
2	Analyzing the problem																					7days	
3	Identifying the causes																					7 days	
4	Finding out the root cause																					14 days	
5	Data analysis																					7 days	
6	Developing solution																					28 days	
7	Foreseeing possible resistance																					7 days	
8	Trail implementation and checking performance																					42 days	
9	Regular implementation																					14 days	
10	Follow-up / Review																					7 days	24

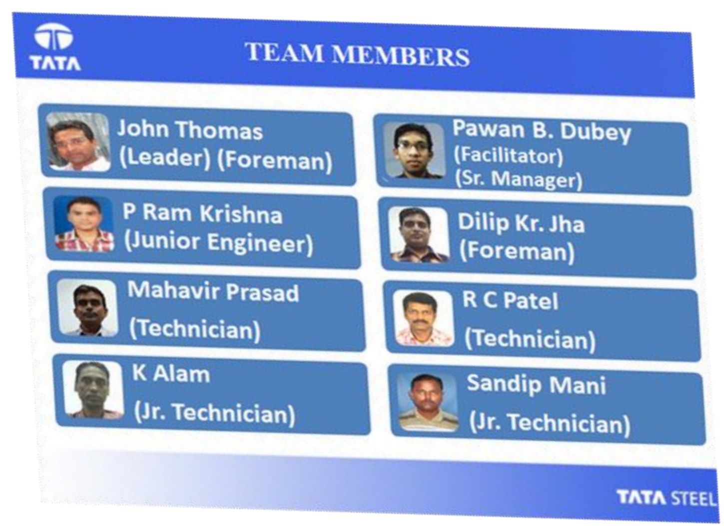
CIRCLE DETAILS

NAME	:	A-F BLAST FURNACES HYDRAULICS
CIRCLE CODE	:	SG00006712
DEPARTMENT	:	A-F BLAST FURNACES
SECTION	:	MECHANICAL AND OPERATION
CUSTOMER	:	LD1, LD2 & LD3
FORMATION	:	2009
MEETING	:	EVERY TUESDAY AT 8:15 AM TO 9:00AM
MEETING PLACE	:	MECHANICAL MEETING ROOM
ATTENDANCE	:	95.32 %

NO. OF KAIZEN IN FY'14 -15 : 14

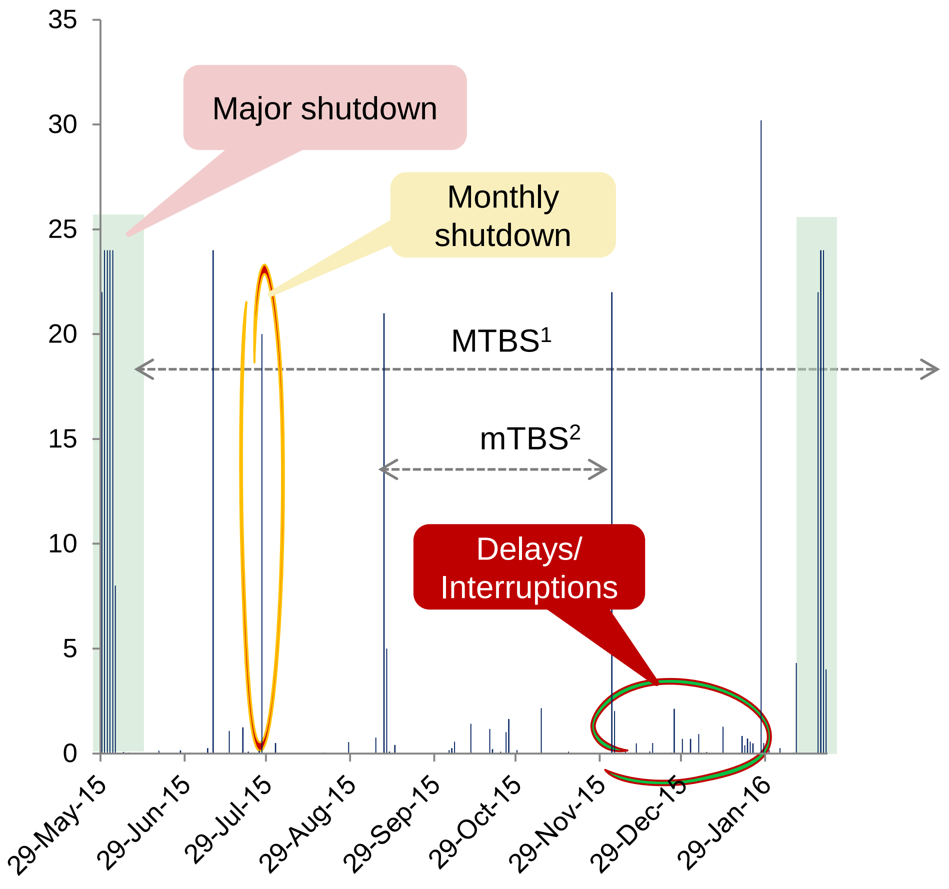
OUR TEAM IS A CROSS FUNCTIONAL TEAM

TATA STEEL



- **MASS**
- **SGA Circles**

Maintenance strategy to increase EOH



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Shutdown Optimization: Analysis of Planned Losses

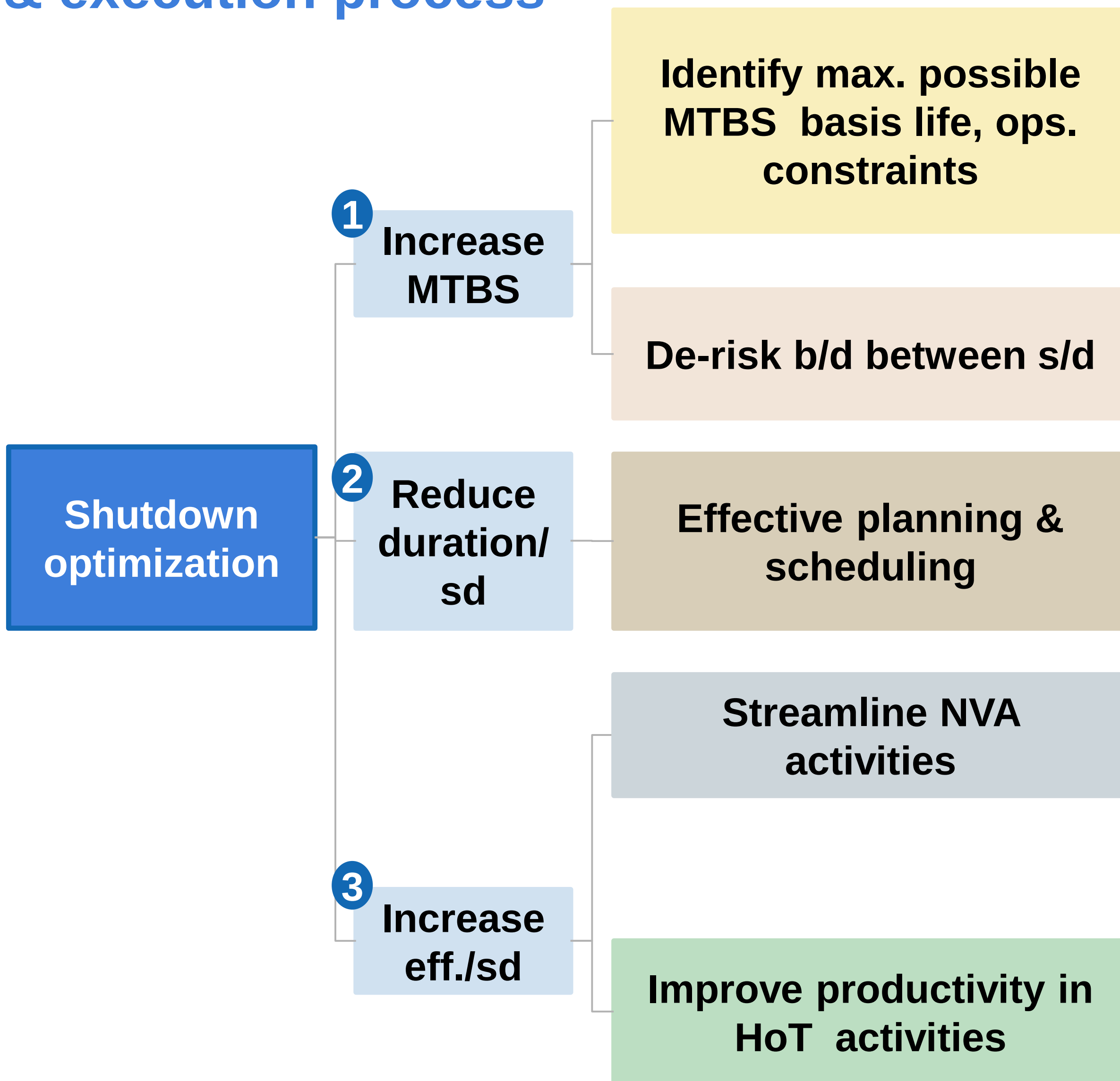
A Planned Outage i.e. Furnace Shutdown affects production under following buckets

1. Ramp-Up & Ramp-Down Time – Fixed in nature
2. Isolation Time - Fixed in nature
3. Net Maintenance Time - Varies according to the Shutdown Plan
4. Isolation Removal & Trials - Fixed in Nature

Shutdown Optimization: Reduction in Number of Planned Outages will result in :

- **Net Gain in total Maintenance time keeping Planned Outage hour as constant in a year**
- **Net Gain in EOH**
- **An advantage in the planning of resources & subsequently, cost**

Following levers identified for optimizing shutdown planning & execution process



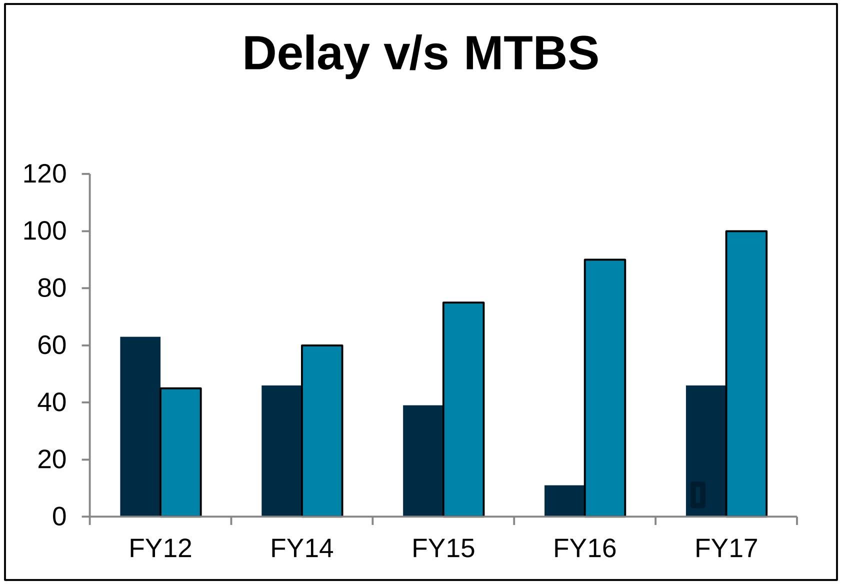
Increase in MTBS - Risks & Challenges

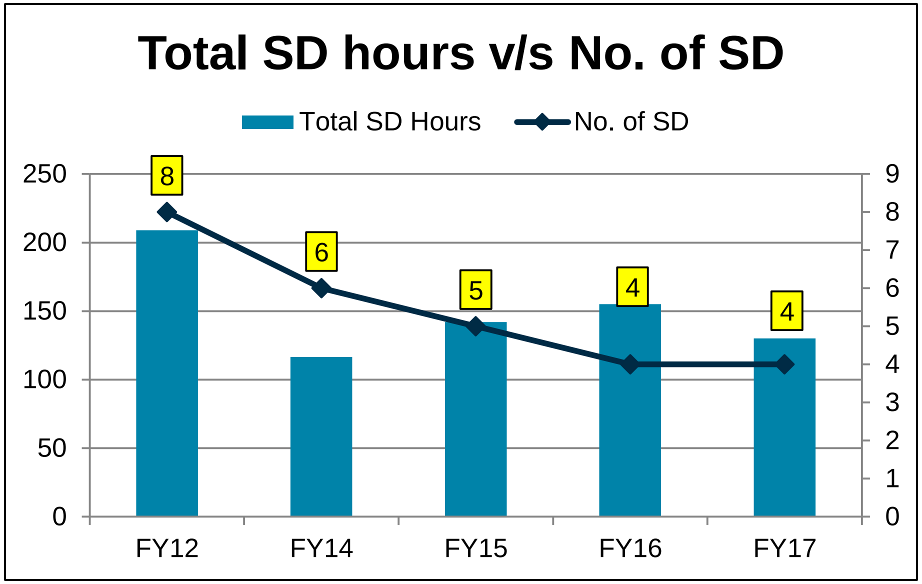
.If strategies are not implemented rigorously,

- **Chances of an increase in Unplanned Outages**
- **De-Bottlenecking of one equipment shifts the constraint to another equipment**
- **Chances of bigger failures**

Approach for Deployment - The increase in MTBS was first implemented in a smaller furnace

An Experiment in a Small Furnace





Trend1: MTBS has steadily increased from 45 days to 75 days while delay is also in decreasing trend.

Trend2: Total shutdown hours has decreased from 200 hours to 150 hours range & in last 3 years shutdown hours more or less are same. While no. of Shutdowns goes down from 8 to 4.

Deployment of Learning in the Larger Furnaces

BF MTBS Journey

41 DAYS

- MAJOR REPAIR OF GBF
- SPEED INCREASE OF MAIN BELT
- SEAL VALVE DESIGN MODIFICATION
- BIG BLASTER IN HOPPER
- GB GREASE CARRYING CAPACITY INCREASE
- DOWNCOMER CHANGE
- AXIAL CYCLONE

54 DAYS

- UT / DP OF WELD JOINTS ON BLT VALVES
- STRENGTHING OF MB#1 & MB#2 DRIVE BASE
- IDLER DAMAGE IN MAIN BELT.

59 DAYS

- IMPROVED QUALITY OF SOFT SEALS
- INJECTION LANCE QUALITY IMPROVED
- SOI INSPECTION OF MAIN BELT BEARINGS
- PRE-FORMED SPLICING KIT IN MAIN BELT
- TURBO DESIGNED PULLEY INSALLED IN MAIN BELT
- Zirconium Coated Tuyeres

76 DAYS

- RELIEF LINE CERAMIC BEND INSTALLED
- MB CHUTE MODIFICATION
- MAIN BELT IDLER DESIGN IMPROVED
- STRAINER IN GCP
- TUYERE CAMERA INSTALLATION

90 DAYS

- USE OF PLAZMA COATED AND SPIRAL TUYERE
- HIGHER STOVE VALVE RELIABILITY
- GCP WATER SYSTEM RELIABILTY.

MEAN TIME BETWEEN S/D

Increasing Planning & Resourcing capabilities

FY 14 | FY 15 | FY 16 | FY 17 | FY 18

Entire value chain of shutdown management being optimized & digitized

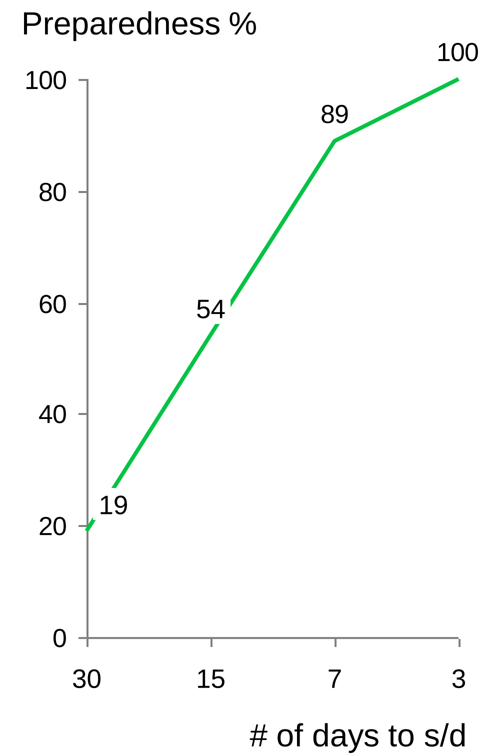
Shut down strategy	Scope definition & planning	Resource planning	Scheduling, execution & governance
☑ Production planning to minimize losses	☑ Reliability/ risk assessment	☑ Contractor mgmt./ coordination	☑ Clear decision roles & responsibilities
☑ Sequencing and clustering	☑ Scope challenging process	☑ Contractor skills	☑ Efficient handover/ start-up procedures
	☑ Target benchmarks (cost/duration)	☑ Resource mgmt./ coordination	☑ Optimized duration of critical path
	☑ First time right execution KPI	☑ Contractor bidding/ strategy	☑ Detailed pre-shutdown walkthroughs
	☑ NVA activity identification		☑ Efficient permitting process
	☑ Equipment, job clustering		☑ Tight execution monitoring
	☑ Distributed maintenance		☑ Look-backs
			☑ Safety monitoring

Shutdown preparedness index being developed as a lead indicator for checking readiness

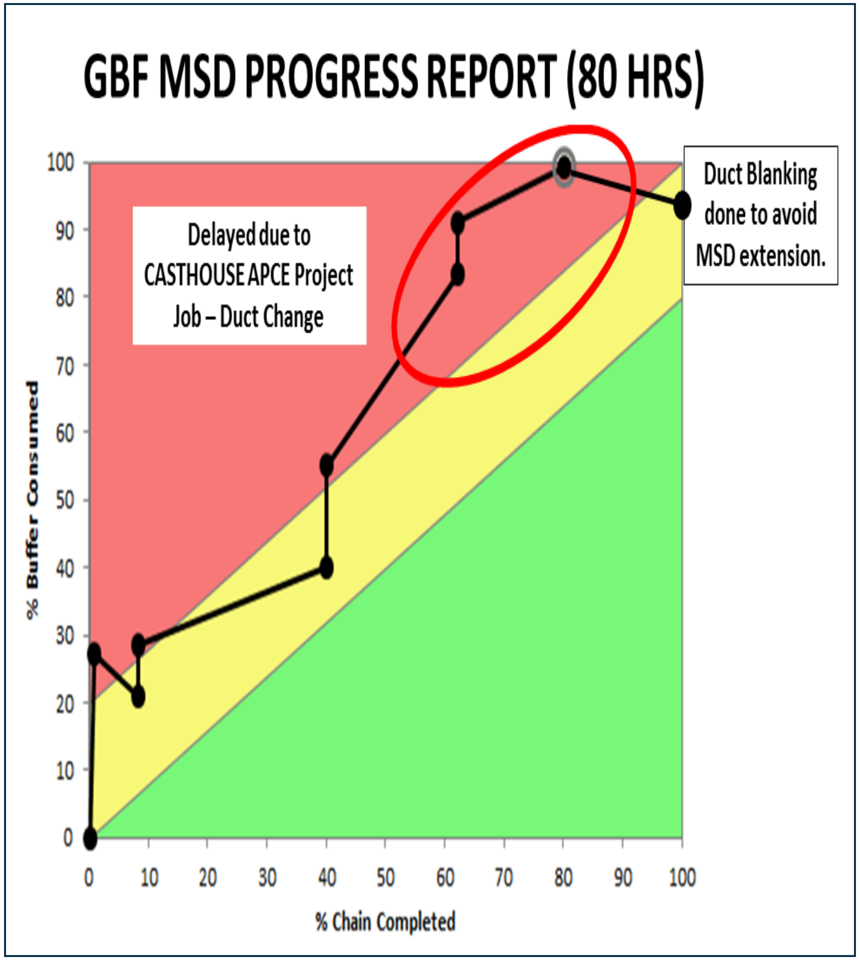
9 parameters to define S/D readiness

- Planning
- Spare mgmt.
- Document.
- Contractor mgmt.
- Prework
- Facility maint.
- Resource mgmt.
- Scheduling
- Coordination

Desirable readiness at each point of time



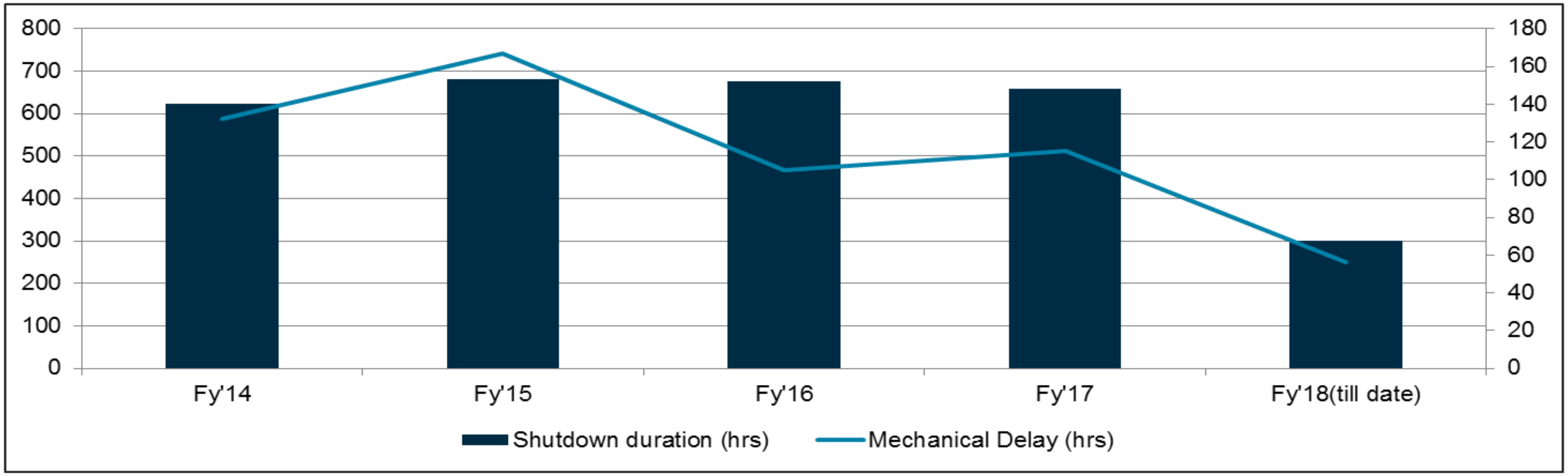
Shutdown Execution Control & Measurement of Shutdown Performance



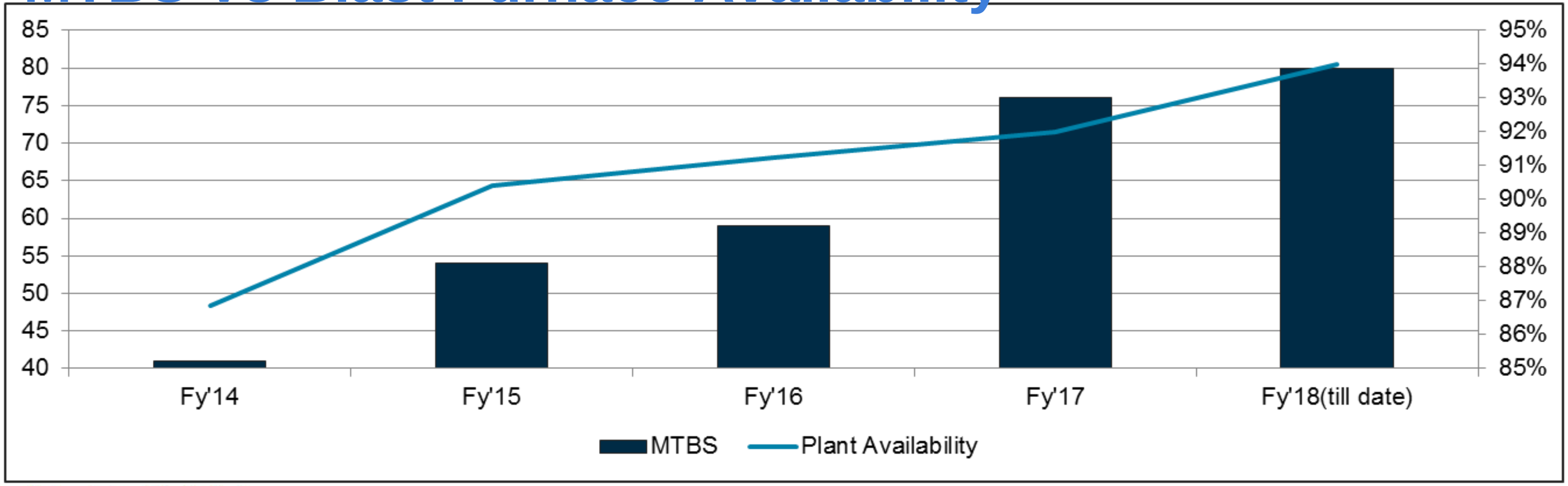
Improvement in Shutdown Effectiveness

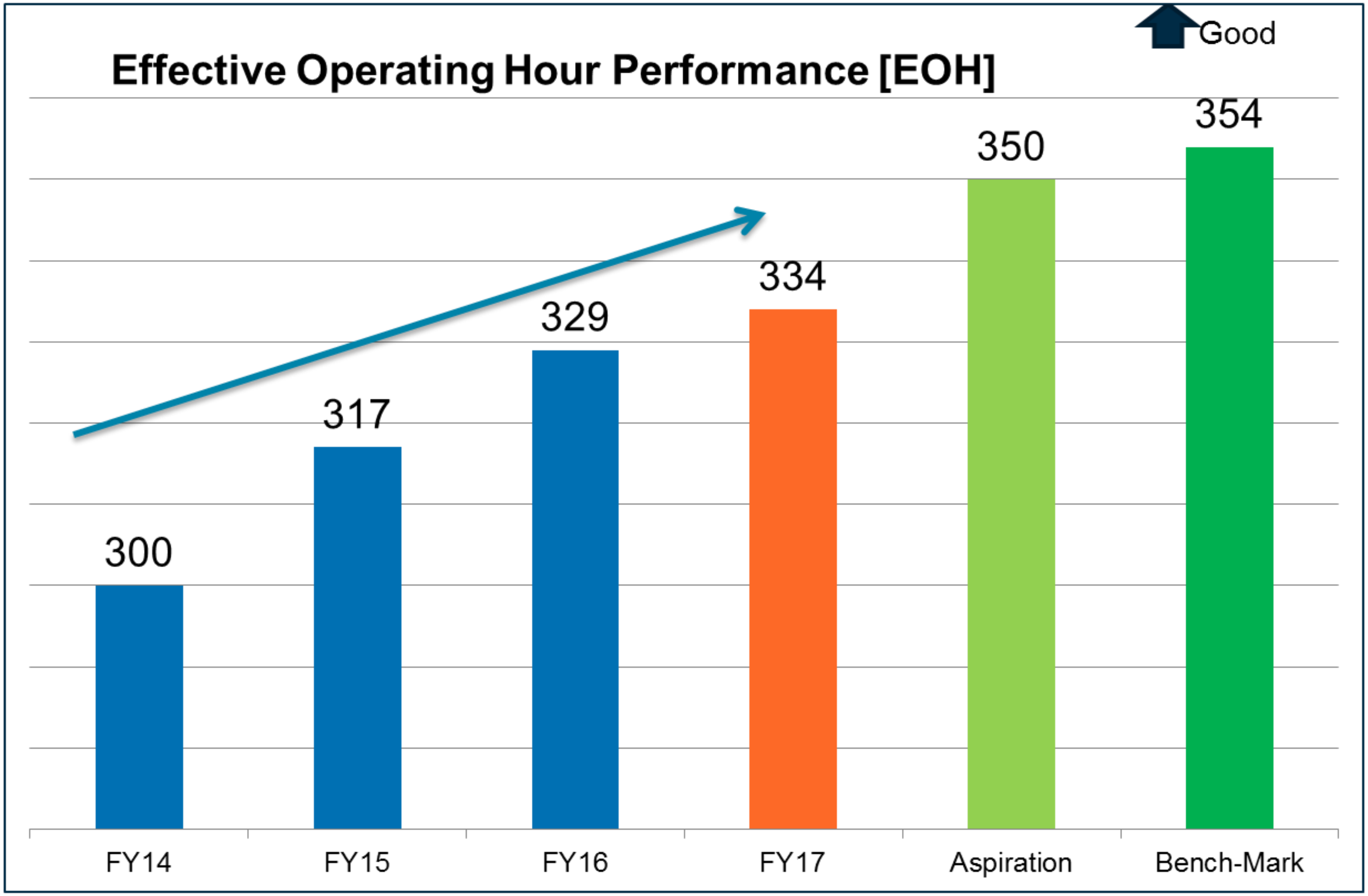
- Zero Rework
- No breakdowns after SD
- Time Compliance to Plan
- Job Compliance to Plan
- Unanticipated Jobs
- Jobs that took longer than plan

Shutdown Duration Vs Delay



MTBS Vs Blast Furnace Availability




Good
Effective Operating Hour Performance [EOH]
300
317
329
334
350
354
FY14
FY15
FY16
FY17
Aspiration
Bench-Mark

Questions