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Thondebhavi – Energy Excellence

ACC-Thondhebhavi / 10th & 11th September'2024

Presenter : Mr Karthikeyan M & Mr Abhishek Shukla
Team member – Mr Srikanth D , Manu Kumar, Rakesh Jain

1. Plant overview

Plant name	ACC- Thondebhavi
Plant type	Grinding Unit
Plant capacity	2 MTPA
Commissioning	Dec 2009
Dist	Chickballapur
State	Karnataka

Plant layout with site photo

Gantry

- 1* 15000 Tons Gypsum & CFA Storage capacity

New Gantry

- 1* 3000 Tons Slag / Gypsum Storage capacity

Clinker Silo

- 100000 Tons Clinker Fed clinker through Wagon tippler

Cement Mill

- 1 Mill (VRM) X 250 TPH (PPC), Loesche

HAG

- 1 HAG (HSD/LDO) – 5 M KCAL/Hr. Not in used

Packing House

- 2 X 240 TPH each EEL Make
- Bulk Loading Station of 150 TPH

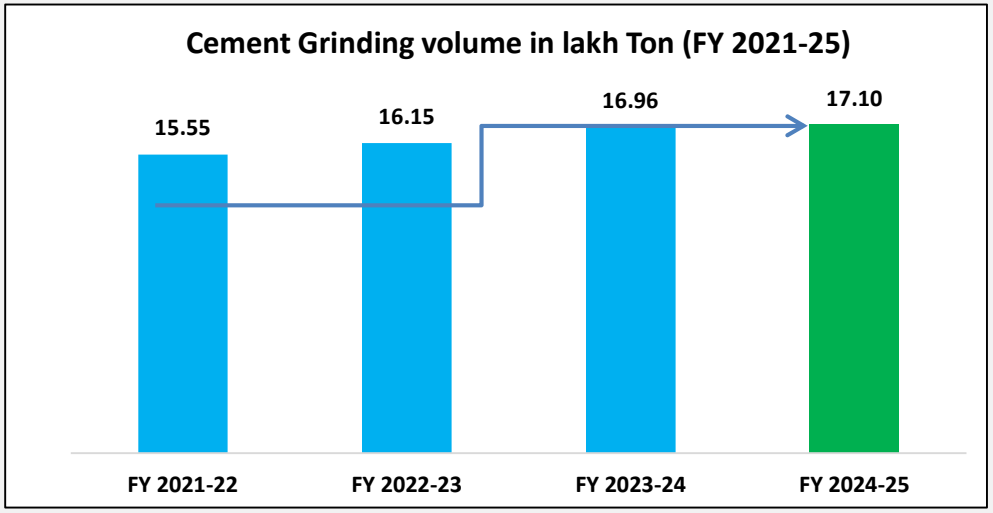
Dispatch

- 6 truck loading m/c.
- 120 TPH *6

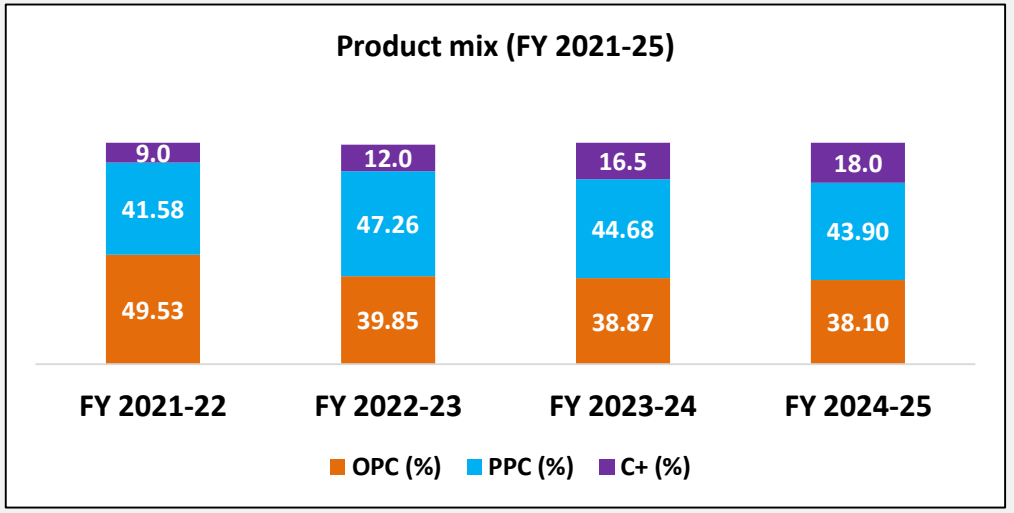
Cement Silo

- 2 X 10000 Tons each
- MS Silo 1X 1000 Tons
- Total Capacity = 21000 Tons

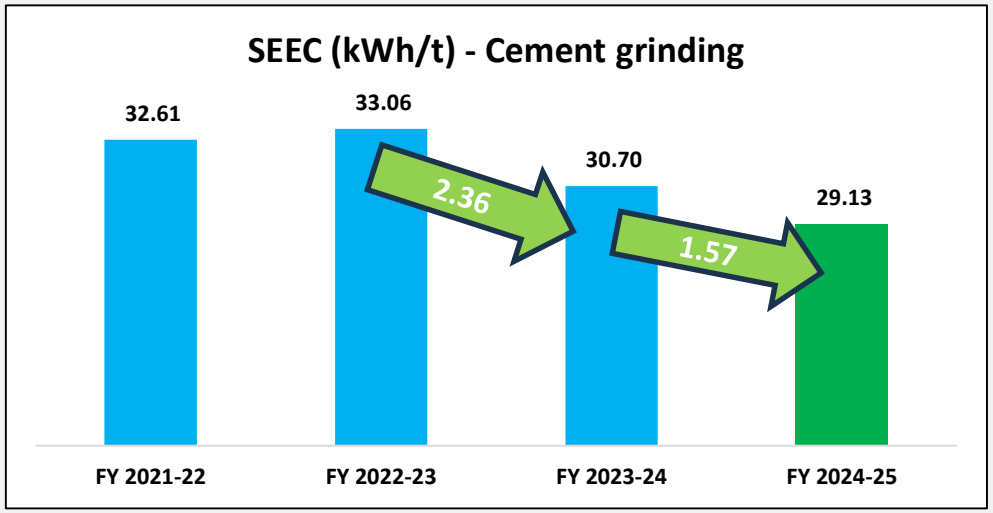
Cement product portfolio & SEEC



- Cement volume – increase over the years



- Cement product portfolio – Focus on reduction in OPC & increase in PPC & Premium product



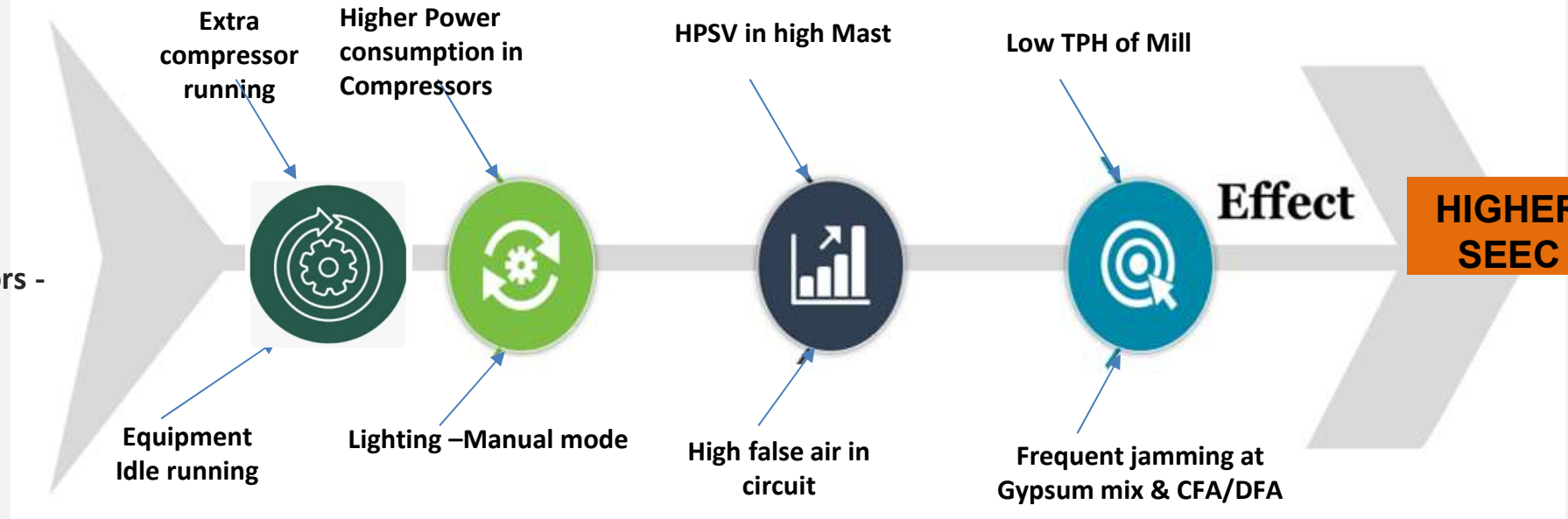
- **SEEC grinding – Reduction in power of Product portfolio**
  (Battery limit : Mill circuit + Wagon tippler circuit + Auxiliary)
- **FY 2022-23- Mill internal issue and CFA stabilization**

Analysis- SEEC reduction

Process Map -

1. High power consumption wrt other similar Plants circuit.
2. Mill output low

Potential Contributors -

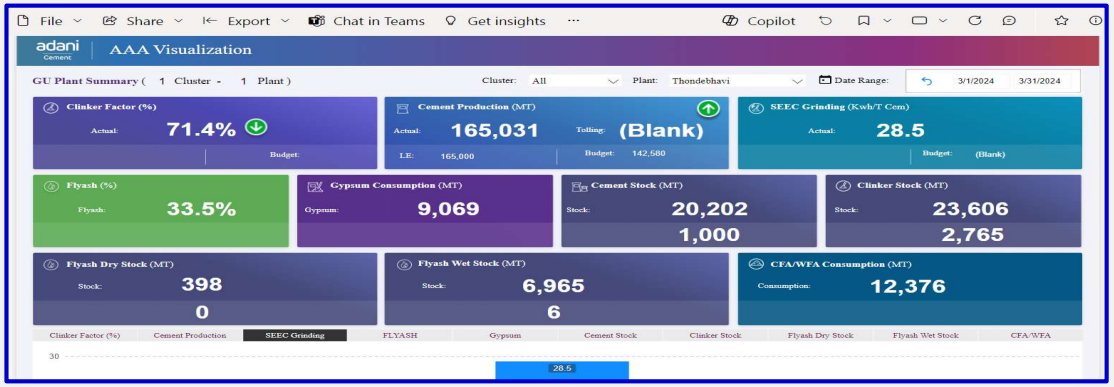


Data Collection Plan -

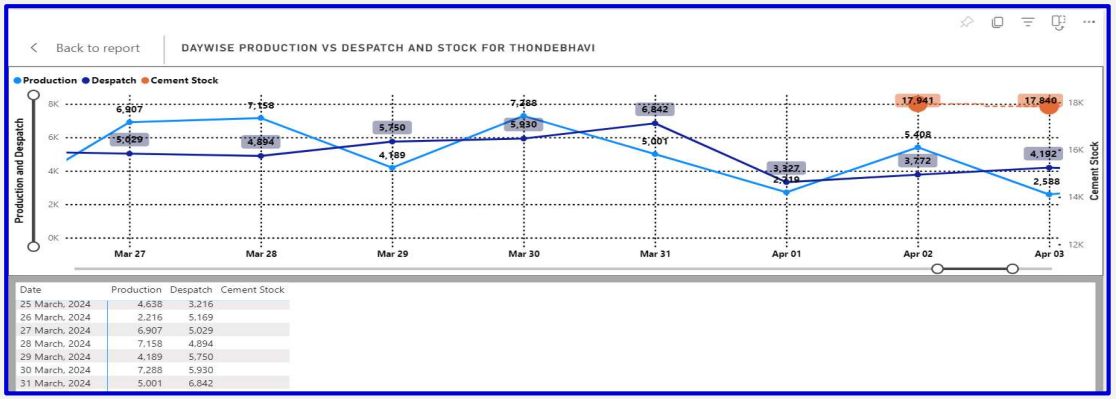
- AAA : CnC Manufacturing dashboard and Daily dashboard
- Bench marking of Mill with other similar Plants
- Electrical energy drive wise analysis
- Compressor circuit Study for the optimisation
- Fly Ash compressor frequent Load-unload
- Mill TPH of previous years

Analyze: Data collection, Analysis & Team engagement

- **AAA Corporate dash board with key KPI's -** for daily, monthly and Yearly data collection and analysis



Dashboard with key KPI's - for daily, monthly and Yearly data collection and sharing / discussion with team



Dashboard - for graphical analysis – Shift wise, Daily, Monthly and compare with Other Plant KPI's

Analyze: Mill Benchmarking within AAA

- **Benchmarking of Operational KPI's**

Plant	UOM	Kolar Thode	Dadri	Nalagrh	Tikaria	Marwar	Chanda
Mill number		VRM	VRM	VRM	VRM	VRM	VRM
VRM Model No	UOM	LM 56.3+3 Master / 3 Support Roller	LM 56 3+3 C/S	LM 56 3+3 C/S	Sinoma TRMK5631	Ok 42-4	LM 56 3+3 C/S
Product		PPC	PPC	PPC	PPC	PPC	PPC
Output	T/hr	270	278	280	230	312	232
Fineness Residue on 45 µm	%	11.5	15.1	11.5	9.5	9.5	11 to 13
Fineness Blaine	cm2/gm	3710.0	3840	3630	3350	383	3520
Main drive installed Power	KW	5400.0	5400	5400	5300	5600	5400
VRM Fan installed Power	kW	3300.0	3000	3000	2240	4250	3400
Main drive drawn Power	KW	4182.0	4868	4044		5113	3950
VRM Fan drawn Power	kW	2060.0	2130	2221		1756	2020
Main drive SEEC	kWh/t Cem	15.5	17.6	14.4	19.5	16.4	16.2
VRM fan SEEC	kWh/t Cem	7.6	7.7	7.9	9.5	5.6	9.4
Sep motor SEEC	kWh/t Cem	0.38	0.3	0.5	1.4	0.2	0.4
Aux	kWh/t Cem	3.6	4.3	4.19		1.5	4.9
Total SEEC	kWh/t Cem	27.02	29.88	27.0	35.4	23.7	30.8
Clinker factor	%	57.42	58.2	56.7	61.3	56.3	61.0

- **Input - Process – Output review**
- **Brainstorming** session.

❑ **Comparison with Best Plant –**

Gap of 1.88 unit with DFA+CFA operation

Gap of 0.32 unit with 100 % DFA consumption

Mill KPI's benchmarking - PPC grinding					
S.No	**Marwar**	**Dadri**	**Nalagrah**	**Thondebhavi**	Unit Diff.
Cement product	**PPC**	**PPC**	**PPC**	**PPC**	kWh/t
Make	FLS OK42	Loesche	Loesche	Loesche	
Mill- operating (TPH)	**310**	**293**	**285**	**274**	
SEEC (kWh/t)	24.59	27.36	27.5	26.47	1.88
Main Drive	16.4	15.63	15	15.67	-0.73
Bag house	5.6	6.56	7	7.58	1.98
Separator	0.21	0.36	0.5	0.35	0.14
Compressor	0.26			0.4	0.14
Auxiliary	2.12	4.81	5	2.47	0.35

PPC Products	DFA- 35 % + CFA 65 %	DFA- 100 %
Mill tph	**274**	**300**
SEEC (kWh/t)	**26.5**	**24.91**
Main Drive	15.67	14.96
Bag house	7.58	6.81
Separator	0.35	0.33
Compressor	0.4	0.4
Auxiliary	2.47	2.41
Mill outlet temp, Deg C	68	81
Mill – DP (mbar)	70	64.7

Thondebhavi – Energy Benchmark

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Table 25: Benchmarking of Cement Mill Section VRM-PPC

Sr. No.	Parameter	Unit	Plant 1	Plant 2	Plant 3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Plant 10
	Overall SEC	kWh/MT Cement	18.80	19.70	21.18	22.28	22.30	22.33	22.55	24.95	25.85	26.8
1	Product variety		PPC									
2	Make	-	Loesche	FLS	Loesche	Peiffer	Pfeiffer	Pfeiffer	Pfeiffer	Loesche	Pfeiffer	Loesche
3	Type / Model	No	LM 53.3+3S	OK 39.4	LM 56.3+3	MPS 5600 BC	MBR 6000 C6	MPS 5600 BC	MPS 5600 BC	LM 46.2+2	MVR 5000C4	LM 56.3 + 3 CS
4	Design output	TPH	280	265	305(OPC)	180 (PSC)	412	300	230	115(OPC)	200	305 (PPC) @ 3400 Blaine
5	Operating output	TPH	320	300	286 - OPC, 342 - PPC	330 (PPC)	412	400	324	147.4 - OPC, 163-PPC	195	290 @ OPC, 373 @ PPC, 270 @ CC
6	Final Product Blaine	m^2/kg	330	350	350/ 300	360	360	350	335	350/ 300/ 300/ 380	350	310/ 360/ 380
7	Final Product residue (% residue on 45 mics)	%	14	14	18-20	-	10	16	12	18-20	34	<15
8	Fly ash Addition	%	32.0	34.5	31.8	32	35.0	35.0	34.9	31.4	0	PPC 34.5%, CC 25.8%
9	Clinker factor		0.66	0.63	-	0.62	0.6	0.63	0.58	-	-	-

Parameter	Thondebhavi
SEEC of Mill	26.5
Product Variety	PPC
Make	Loesche
Type/Model	LM 56.3+3CS
Design Output	250
Operating output	274
Final Product Blain	380
Final Product residue	10
Fly ash addition ~DFA+ CFA	34
Clinker factor	0.60

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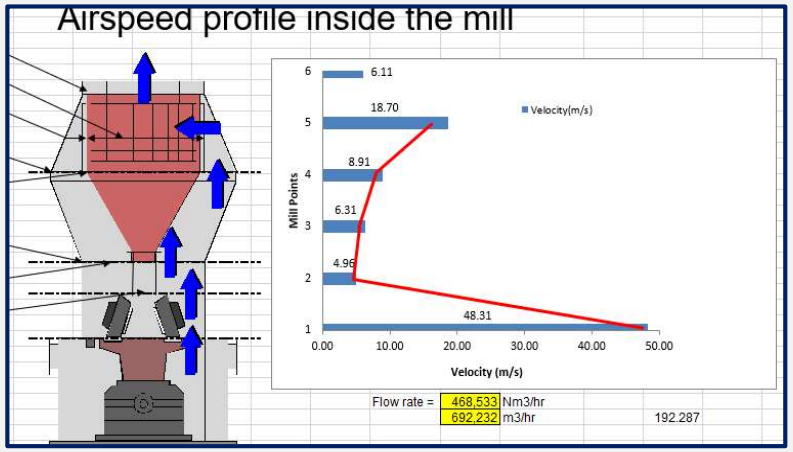
Analyze: Equipment drive wise analysis

Equipment drive wise analysis is carried out

					9.10.2023 (OCT 2023)				Jan-23			
S.NO	HAC CODE	APPLICATION	TYPE OF MOTOR	KW	Running Load-KW	Running R	Running Y	Running B	Running Load-KW	Running R	Running Y	Running B
Main Drive 5400KW												
1	561-RM1.M1	Drive for cement mill	SLIP RING	5400	4960	530	526	518	4187	405	409	494
2	561-RM1.M2	cement mill motor cooling fan drive	SQUIRREL CAGE	7.5/9.3	6.3	9.5	9.2	9.4	6.2749494	9.7	9.2	9.2
3		Forced Oil lubrication system (FOLS) Mill main Motor	SQUIRREL CAGE	1.1	0.6	1	1.1	1	0.5822118	0.9	0.9	1
Bag House Fan Drive 3300KW												
1	561-FN1.M1	Drive for cement mill Bag House Fan	SLIP RING	3300	2150	190	189	185	2088	184	182	178.2
2	561-FN1.M2	Baghousefan motor cooling fan drive	SQUIRREL CAGE	3.7	3.3	6	5.9	6.1	4.0107924	6.2	6	6.1
3		Bag House Fan Drive Aux supply, Drive cooling fan		18	16.5	25	26.5	25.3	17.466354	27	26	27
Mill section												
1	531-FN4	Drive for bagfilter fan weigh feeder area	SQUIRREL CAGE	37	10.5	15.2	15.1	15.5	9.380079	14.5	14.8	15
2	531 FN 5	Drive for bag filter fan Mill Buiding	SQUIRREL CAGE	55	50.26	70	71.1	70.2	42.3073908	65.4	66.8	68.2
3	531-FA2	Air slide fan - DFA	SQUIRREL CAGE	5.5	5.3	8.4	8.4	8.4	5.498667	8.5	8.4	8.5
4	531-FA3	Air slide fan - DFA	SQUIRREL CAGE	5.5	5.2	8.2	8.3	8.1	2.264157	3.5	3.5	3.4
5	531-RF1	Drive for RAL , Mill feeding RAL	SQUIRREL CAGE(GEARED MOTOR)	11	5.83	8.12	8.3	8.3	4.3989336	6.8	6.1	6.9
6	531-RF2	Drive for RAL 531-RF2-DFA	SQUIRREL CAGE(GEARED MOTOR)	3.7	5.75	8.8	8.9	8.8	5.498667	8.5	8.4	8.5
7	531-RF3	Drive for RAL 531-RF3-DFA	SQUIRREL CAGE(GEARED MOTOR)	3.7	2.6	3.6	3.6	3.5	2.264157	3.5	3.5	3.4

Action implementation– Process improvement



- Nozzle velocity is increased.

Before	
Open area (m2)	4.27
Flow rate (m3/h)	192
Velocity (m/s)	**45**

After	
Open area (m2)	3.98
Flow rate (m3/h)	192
Velocity (m/s)	**48.3**

Key levers identified -

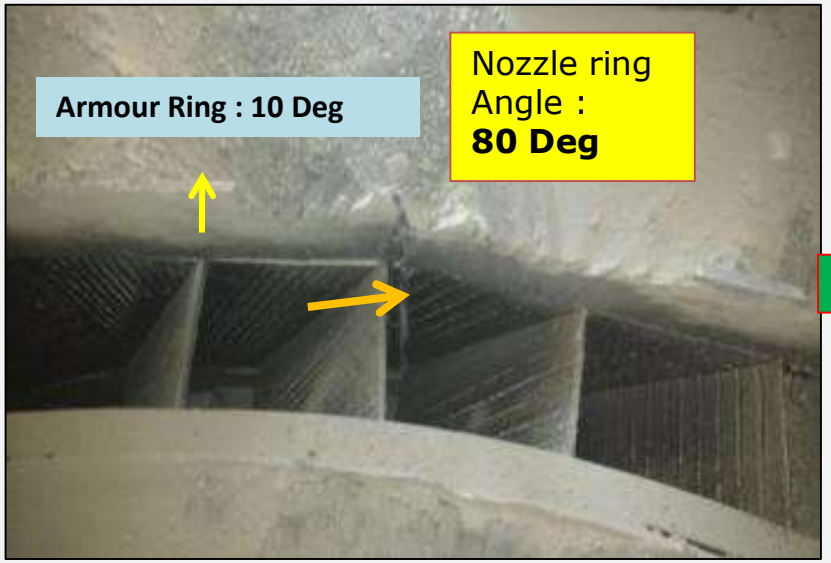
- False air is reduced from 16.69 % to 13.25 % and continuously measuring and identified the false air points

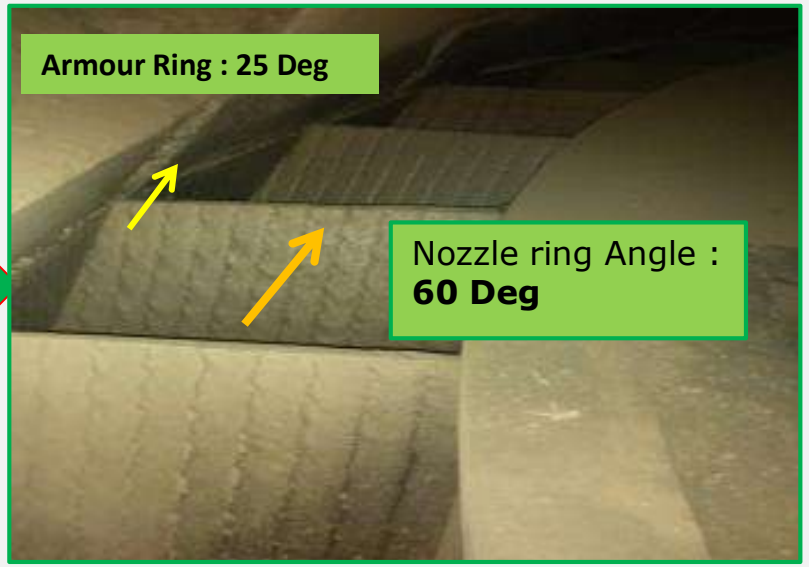
- Reduction in Electrical energy by 67 kw ~0.26 kwh/t

Mill - False air in circuit				
% Fasle air in Circuit	16.69	14.87	13.25	%

Action implementation– Process improvement

Mill internal process improvement - Installation of nozzle @ 60 deg and Armour ring @ 25deg



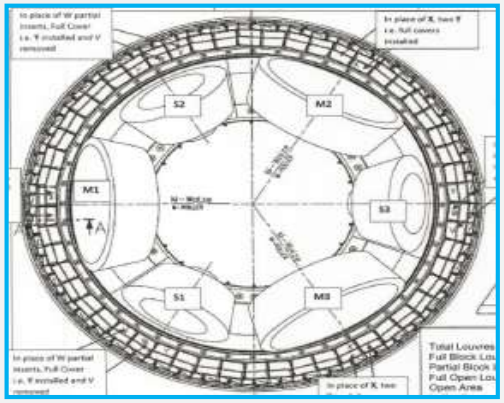


Action implemented:

- Re-installation of **Louver ring** with the angle **of 60 deg** and **armour ring angle to 25 deg**
- Reduced opening area by blocking 15 louvers

Benefits :

- Reduction of mill fan power consumption by ~87 KW
- Impact **~ 0.38 kWh/t Cem**



Action implementation– Process improvement

Actions implemented– Raw material hopper improvement job

Before – Raw material hopper

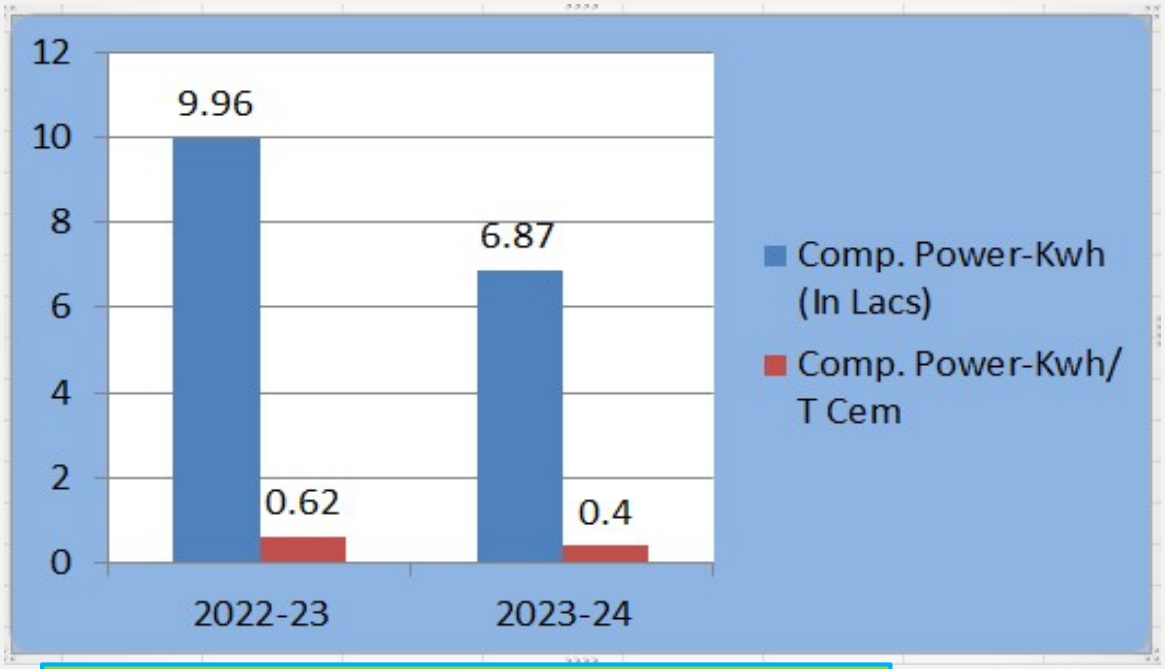
After Raw material hopper – Installation of Polymer liner and Air blaster to avoid jamming and to have a continuous flow of material

Action implementation- Mill compressor Kwh

Actions implemented –

- Compressed air line-Survey and repair done, All leakages plugged
- Line Size modification done as per requirement

After Modification- One Compressor running



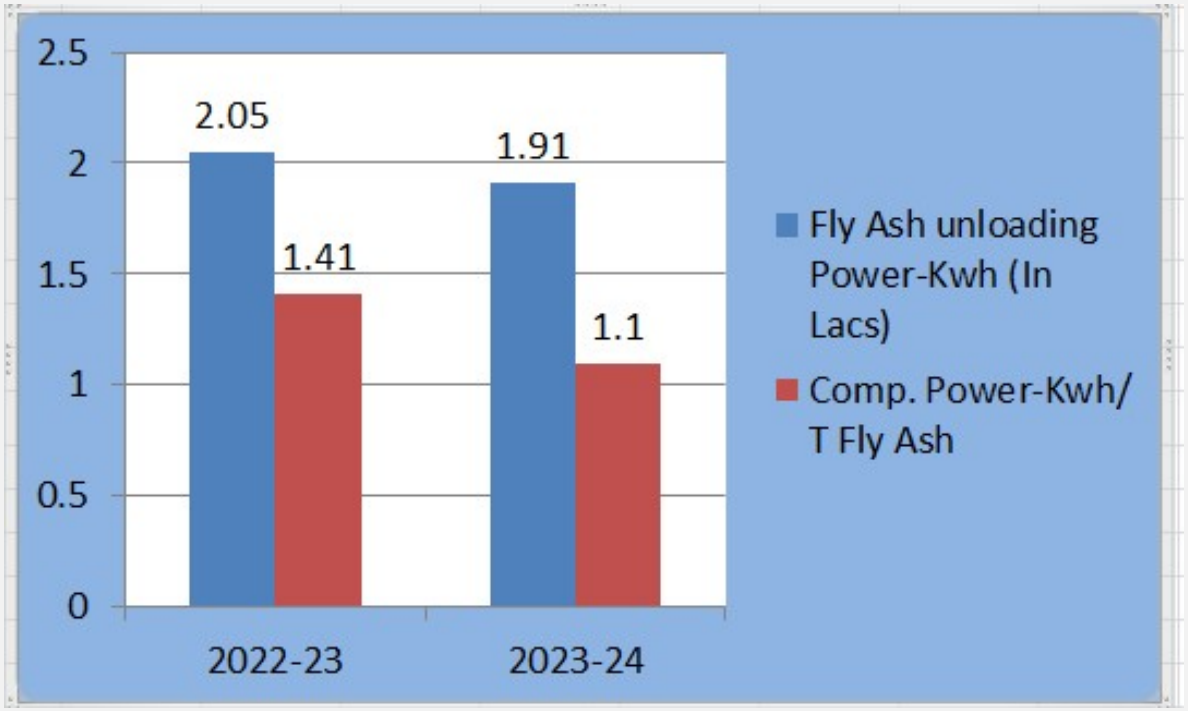
Saving Achieved – 0.22 Kwh/T Cem

Action implementation- Mill compressor Kwh

Actions implemented –

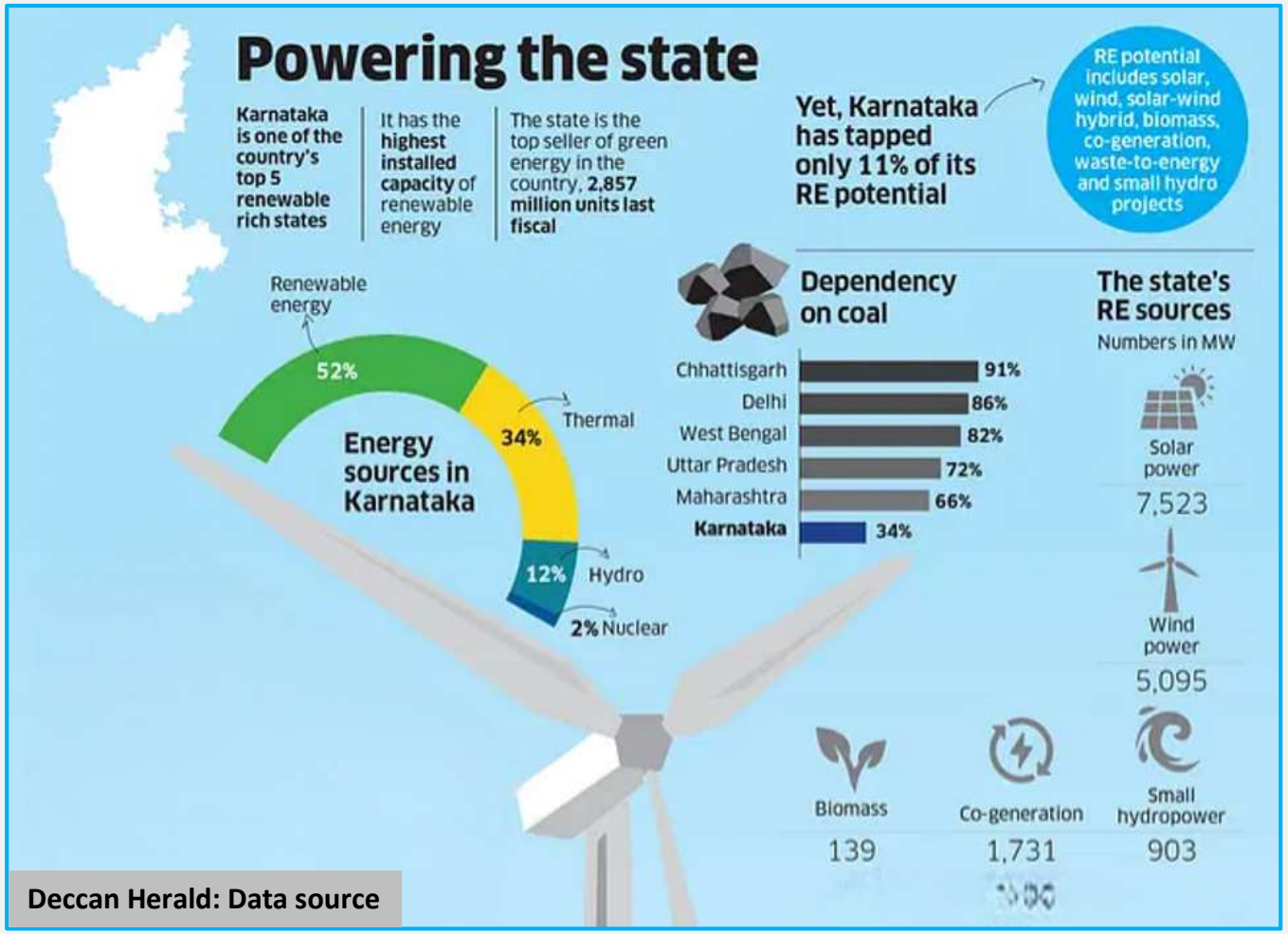
- VFD Installed in Fly ash unloading Compressor
- VFD set point taken in PID mode for optimum speed

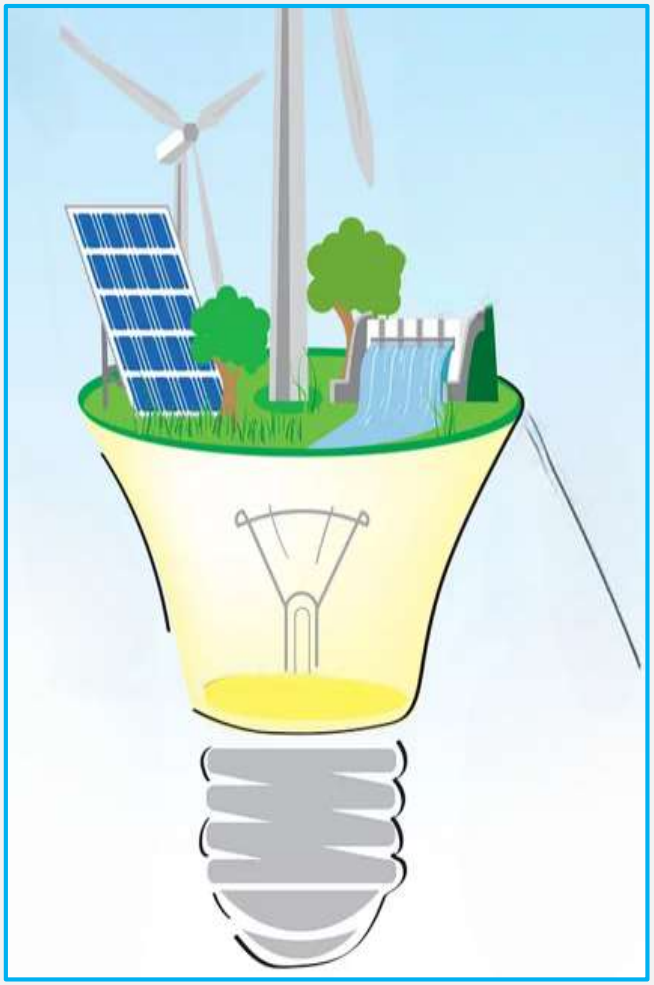
After Modification- Fly Ash unloading Compressor in VFD Mode



Saving Achieved – 0.31Kwh/T Fly Ash

Energy source : From BESCOM





Plant is committed to utilize maximum Renewal Energy

Energy : Offsite & Onsite energy consumption details

Offsite RE consumption details

		Offsite			
Year	Source, Solar, Wind,	Total offsite Installed capacity (MW)	Capacity Addition(MW)	Total Generation (million kWh)	Share % W.R.t overall consumption
FY 21-22	Solar	NA	NA	32.39	61 %
FY 22-23	Solar	NA	NA	54.56	75 %
FY 23-24	Solar	NA	NA	7.23	13 %
FY 24-25	Solar			0	0 %

Onsite RE consumption details

Year	Source, Solar, Wind,	Total offsite Installed capacity (MW)	Capacity Addition(MW)	Total Generation (million kWh)	Share % W.R.t overall consumption
FY 21-22	Solar	0	0	0	0
FY 22-23	Solar	0	0	0	0
FY 23-24	Solar	0	0	0	0

FY 24-25(October'24 onwards) , TCW plant is plan to utilise 35 % Solar Power from ADANI GREEN ENERGY LIMITED, KHAVDA,

Energy : Power mix & consumption

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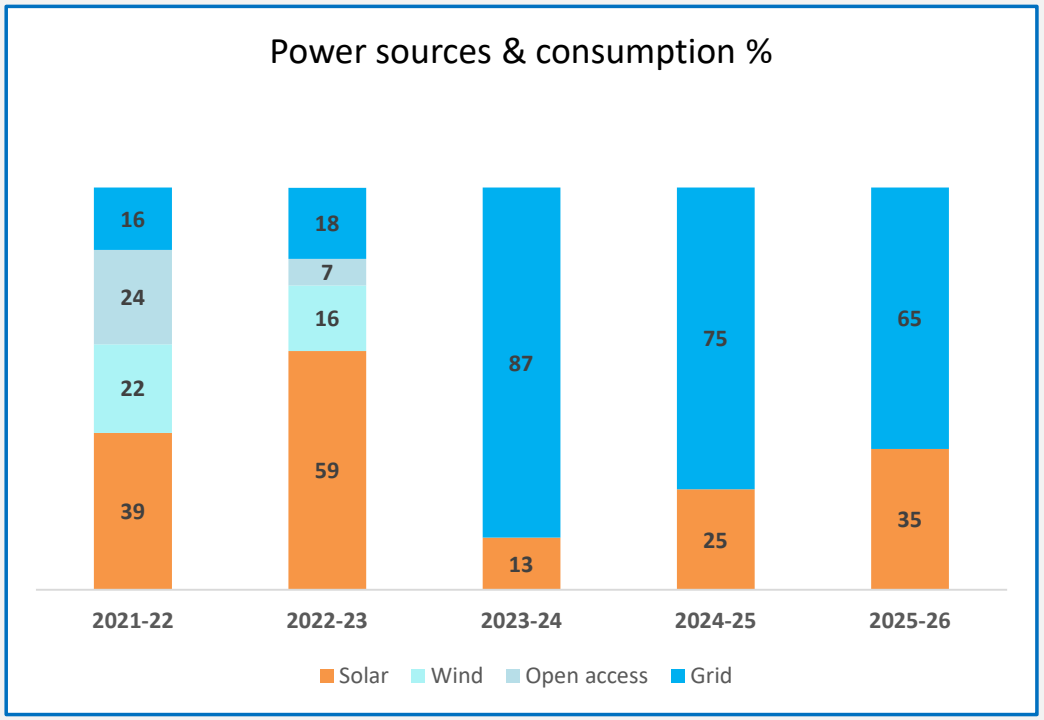

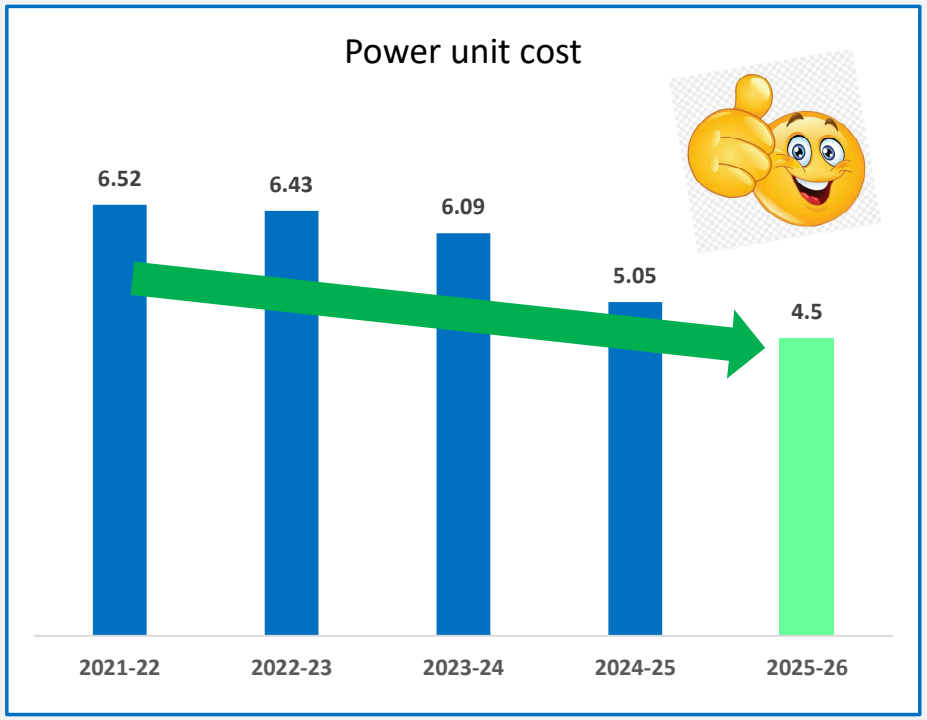

1) **FY 2024-25 and FY 2025-26 : Projection value**

2) **Plant is committed to utilize maximum Renewal Energy by adopting and optimization different available energy sources with low power cost (Adani – Khavda Project)**

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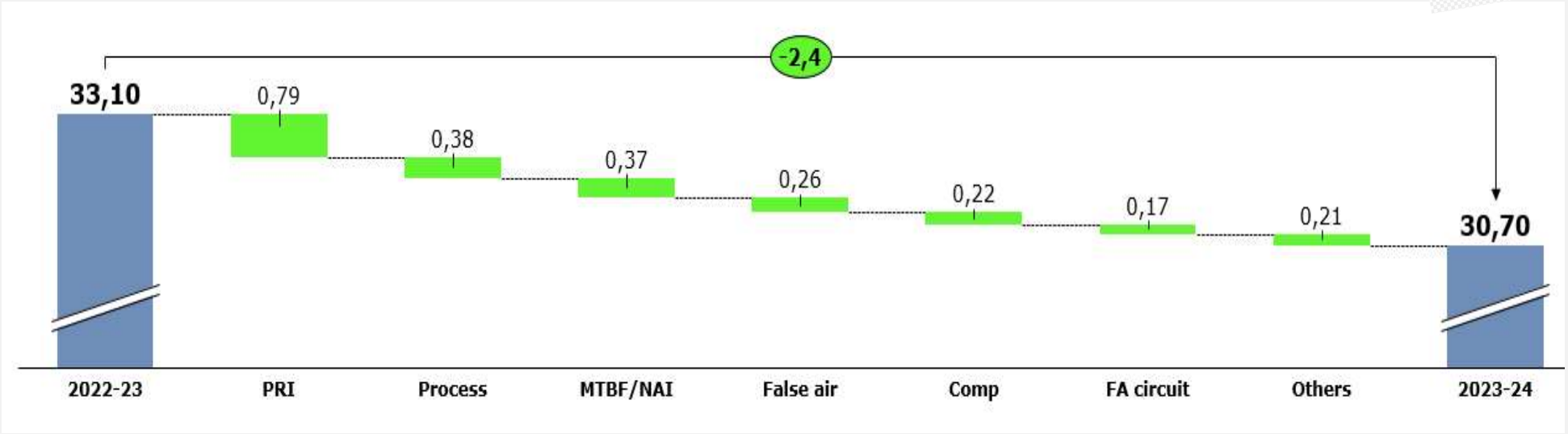
Encon Projects: FY 2023-24 - implemented

S.No	Title of Project	Annual Electrical Saving (kWh)	Annual Energy Saving (ToE)	Total Annual saving (Rs, million)	Investment Made (Rs in Million)	Payback (Months)
1	Mill TPH improvement- (229 TPH to 255 TPH in year 2023-24) by a) Mill internal modification b) Process improvement and circuit optimization. Frequent load -unload of Fly ash unloading compressor. c) Idle running: RMH fan and Fly ash fan stopping was in manual	3037157	261.19	18.5	14.5	9.41
2	Mill False air reduction	445372	3.5	2.71	0.5	2.21
3	Packing Plant optimizing bag filter fan RPM, Improving packer RPM, stopping of 110 KW compressor and use of 90 KW compressor for packer and bulk operation,, Use of 7.5 KW compressor for bulk loading, Review of interlocks for reducing idle running	305943	26.30	1.86	0.2	1.29
4	Mill Bag house circuit - Stopping of One compressor	31140	31.34	2.19	0.55	3.01

Encon Projects: FY 2023-24 – SEEC reduction



Encon Projects implemented and benefits

FY 2022-23

S.No	Title of Project	Annual Electrical Saving (kWh)	Annual Energy Saving (ToE)	Total Annual saving (Rs, million)	Investment Made (Rs in Million)	Payback (Months)
1	Installation of Bag filter VFD in Wagon tippler	327140	28.13	2.1	3.5	20
2	Modification in the Gypsum ckt. (stopping of one belt and shortening of two belts)	23616	2.03	0.15	0.5	40
3	Provision of Clinker Tunnel Light on/OFF switch	12264	1.05	0.078	0.08	12.31

FY 2021-22

S.No	Title of Project	Annual Electrical Saving (kWh)	Annual Energy Saving (ToE)	Total Annual saving (Rs, million)	Investment Made (Rs in Million)	Payback (Months)
1	VFD installation in 531FN4(45KW), 561FN3(30 KW)	131966	11.35	0.85	1	14.12
2	VFD installation in 511-FN7-(11 KW)	15836	1.36	0.1	0.4	48
3	Push button fixing the load centers	18396	1.58	0.12	0.05	5

Encon Projects in FY 2024-25: implementation plan

S.No	Title of Project	Annual Electrical Saving (Million kWh)	Total Annual saving (Rs, million)	Investment Made (Rs in Million)	Payback (Months)
1	Mill tph improvement - S rollers upgradation to improve output and reduce SEEC	0.46	184	220	14.34
2	Feed group upgradation to improve output and reduce SEEC	0.23	41	45	10.9
3	Modification of SAC in reverse direction (dual direction operation)	0.19	15.6	45	34.61

Cement grinding – Product wise Mill TPH & SEEC

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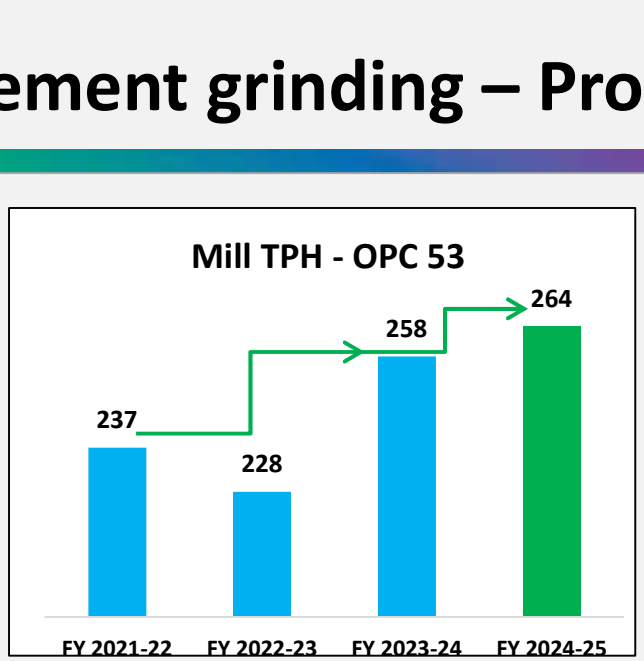

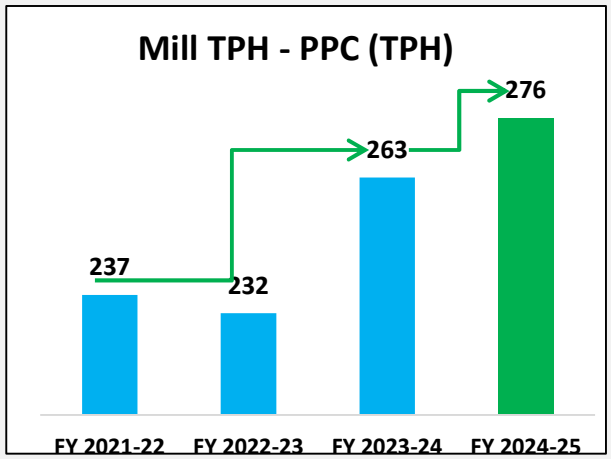

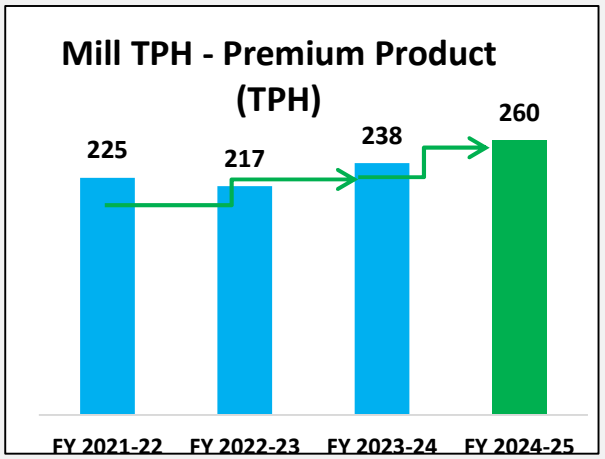

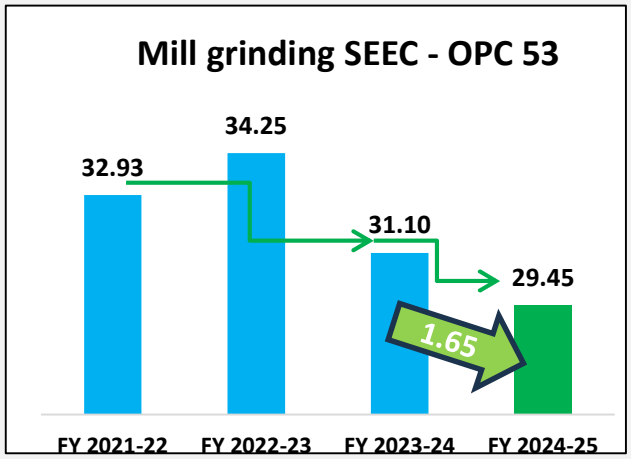

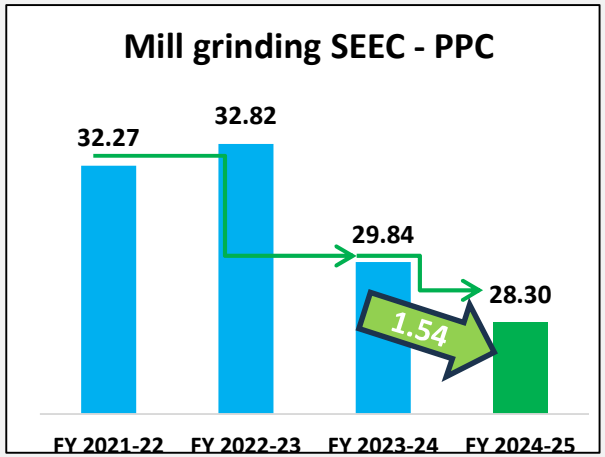

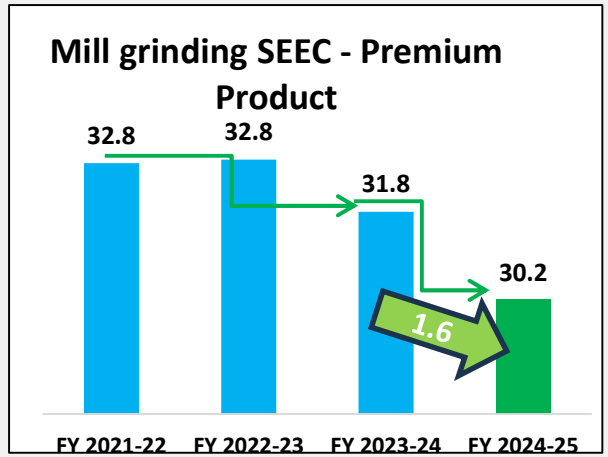

OPC 53 : improvement in Mill tph by 8 tph & reduction in SEEC by 1.65 kwh/t

PPC : improvement in Mill tph by 13 tph & reduction in SEEC by 1.54 kwh/t

Premium Product : improvement in Mill tph by 22 tph & reduction in SEEC by 1.6 kwh/t

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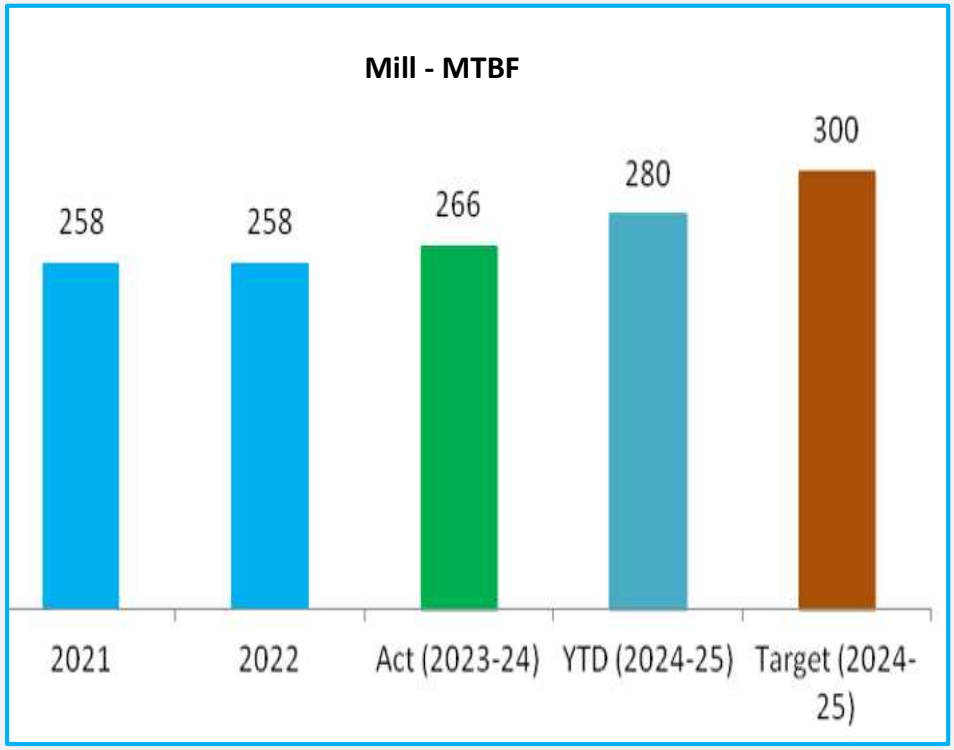
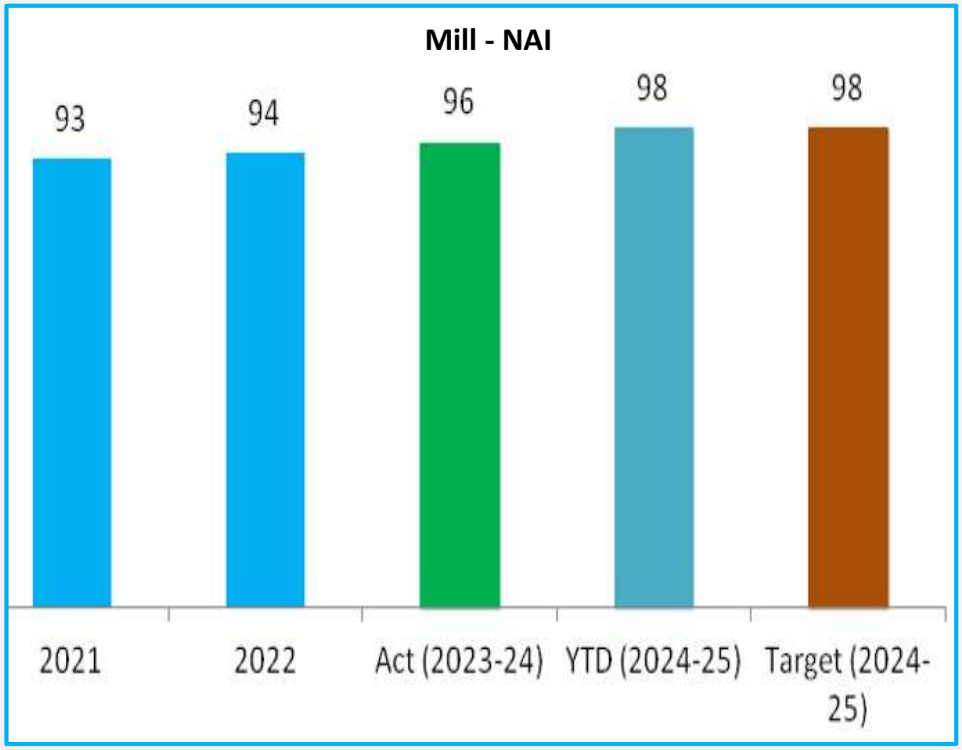
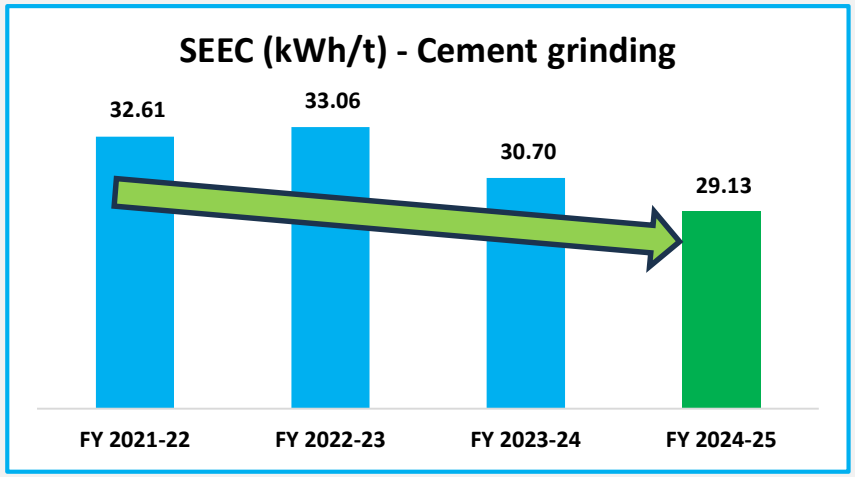
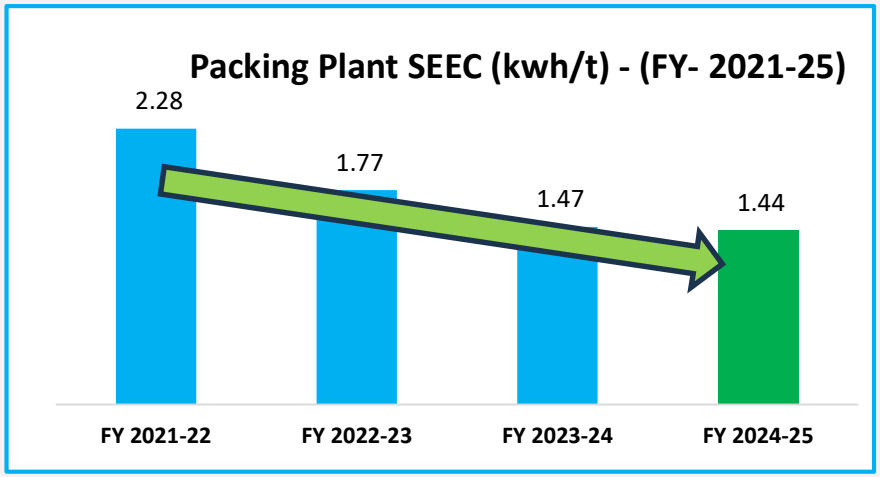
KPI's improvement : Mill MTBF and NAI

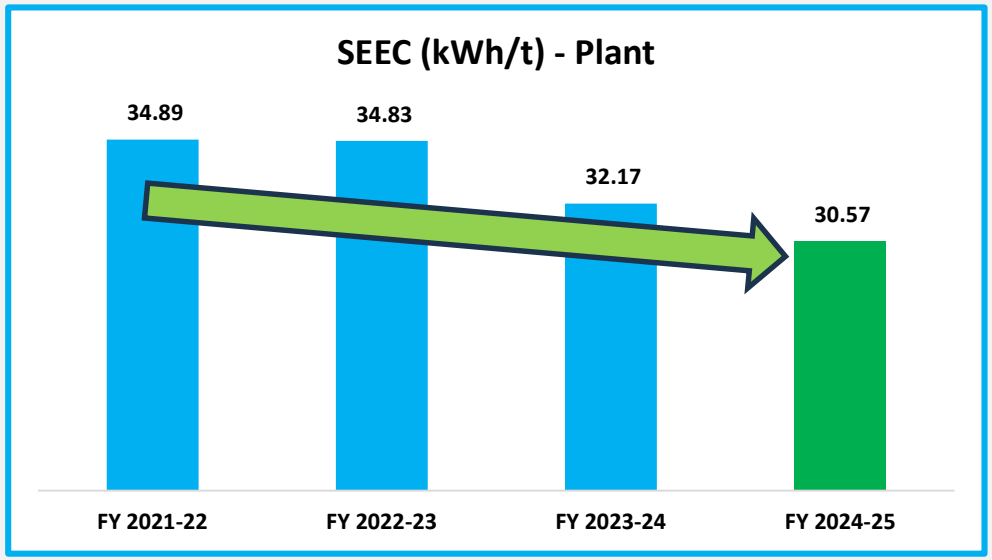


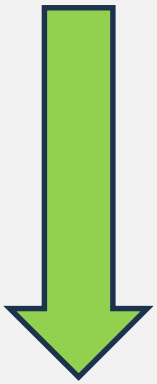


Energy Excellence : Plant



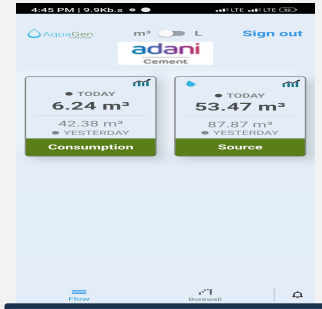


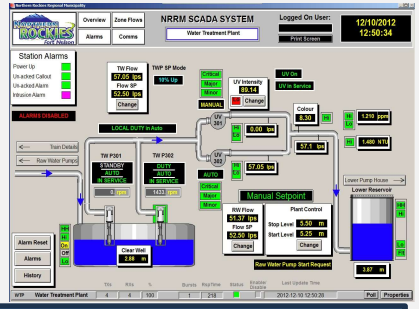




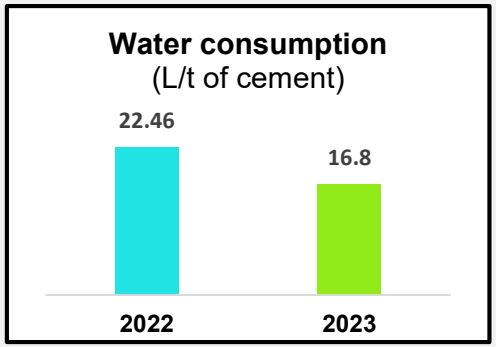
Environment: Water Positive Digital Improvement

Water Positive





Mobile Apps – for Water consumption tracking



Water Positive Initiatives –

- **Brainstorming session and action log** are defined to optimize and reduce the water consumption. Earlier no measuring device.
- **Installed Digital Apps based flow meters** (4 Flow meters and 1 Piezometer level sensor).
- Mill water consumption reduced.
- **Process interlock are provided and alert SMS** for high water consumption as per set limit.
- **Cloud based report are generated** and ease to track, analysis and optimize the consumption.

Thondebhavi Plant- Vision

Energy Excellence @ Thondebhavi Plants

Volume Growth

1.9 MTPA upto 2025-26
4.9 MPTA in 2026-27
7.9 MTPA in 2027-28

Product Portfolio

OPC – 38%
PPC- 44%
Con+ -18%

Long Term Raw Material Security

- Availability PG, CF & DFA with from L1 sources as per quality parameters.

Renewable Energy

Solar power 8MW open access from 200 Mwp (Khavda project)

Clinker Factor

71.7 % as per product mix with maximization of Fly ash%.

Health & Safety Safety

Zero Fatality, improvement in LTI free days by effective implementation of Safety guidelines

Manpower Productivity

Training
Man days >5 man days/employee

Logistics

- Dispatches 1.9 MTPA
- GIGO< 1.5 hours
- Lead reduction by 7.5 .
- Primary freight reduction by 3.9 %.
- TDC reduction by 3.5% (YOY-2024)

Efficiency & Reliability

- SEEC < 25 kWh/T
- Fly ash C plus > 32%
- Fly ash PPC >34.50%
- Quality compliance – 100%

Mill MTBF – 320 Hrs.
Mill PRI – 93%.
Mill NAI – 98%

Environmental Regulations

- EC from 2 MTPA to 8 MTPA
- Statutory compliance -100%•
- Notices from Regulatory - 0
- Reduction of water consumption – 10%
- Plantations of saplings – 2000 numbers

Growth with Goodness

Thondebhavi – Improvement road map

Results

2022-23
- **Cement Volume:** 1.61 Mio.Ton

2023-24
- Volume from 1.55 Mio Ton to 1.71 Mio ton
- PPC Flyash % : 33.5% to 34.5 %
- SEEC : < 29.13 KWh/ton

2024-25
- Volume 1.9 MTPA
- Clinker Factor 72.3
- SEEC < 28.7 KWh/tn
- Proposed 3 MTPA GU Project-Phase 1

2025-26
- Volume 7.9 MTPA
- Clinker Factor 71.7
- SEEC < 25 KWh/tn

Efforts

2022-23
- Replacement of Mill Tyres with sintercast
- Slag hooper – Installation of polymer liner
- CFA hooper Modification for 60% usage.
- Installation of VFD in compressors.
- Implementation of DERS scheme.
- Installation of online water monitoring system.
- Launched ACC super Product.

2024-25
- **S Roller modification to grinding roller in Sep-Oct'24 (1st installation in the World for 56.3+3 Type mill).**
- Side arm charger reversal at Wagon tippler.
- Complete overhauling of Apron feeder.
- 8 MW Power from Solar park (200 MW)
- BCFC wagon unloading system for DFA

2026-27
- Volume 4.9 MTPA
- Tyre replacement
- SEEC < 27.3 Kwh/t
- Proposed 3 MTPA GU Project-Phase 2

Net Zero commitment

- The Company is committed to reduce its carbon footprint. It is a signatory to SBTi to be Net Zero by 2050. ACC Limited commits to reduce Scope 1 GHG emissions 21.3% per tonne of cementitious material by 2030 from a 2018 base year.
- ACC Limited also commits to reduce Scope 2 GHG emissions 48.4% per tonne of cementitious material within the same timeframe.

These includes:
1) Improved technology
2) Energy efficiency
3) Use of renewable energy
4) Use of green energy like WHRS
5) Use of alternate fuels
6) Use of alternate raw materials
7) Reduction in clinker factor and having larger share of green

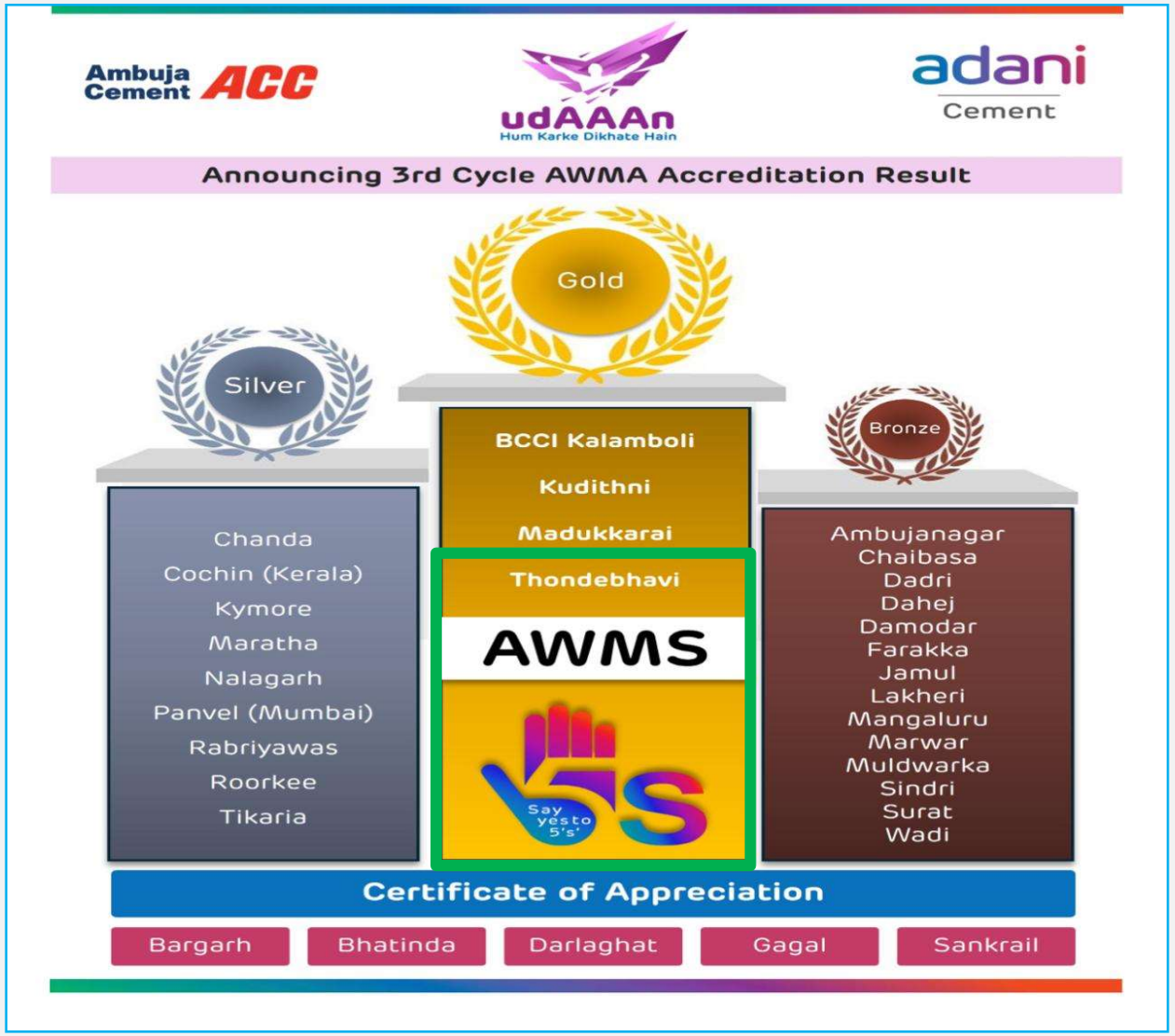
Reward & Recognition : British Safety Council

- ❑ **Safety KPI's achievement:-**
- **LTI free days = 4088 days (Best in AAA)**
- **Achieved Safety Zero Harm >6 Mio Man hours**

Reward & Recognition : Safety from Corporate “AAA”

Safety Excellence : Recognition at AAA Corporate level for Best performing Plant in Safety

Reward & Recognition : AWMS_5S_Gold Award in AAA



Reward & Recognition : AWMS_5S_Gold Award in AAA

Reward & Recognition : AAA and QCFI Efficient unit

Best Grinding Units in AAA : Over all Performance in FY 2023-24

QCFI Award : Efficient and Best Performance award

Awards & Accolades : Energy Award, Quality & Sustainability

मुश्किलों की नहीं सुनते , हम करके दिखाते हैं ..

Thankyou