

25th National Award For Excellence in Energy Management 2024

**Dalmia Cement (B) Ltd,
Ariyalur Plant
Welcomes you all !**

Team Members:

Mr. V. Saravanan - Process Head

Mr A. Murugan – Energy Manager

Mr. BR Prasanna Kumar - Env't Head



Group & Company Profile

Specific Energy Consumption

National and Global Benchmark

Energy Saving project Implemented

Innovative Projects

Renewable Energy

Recycled Waste Utilization

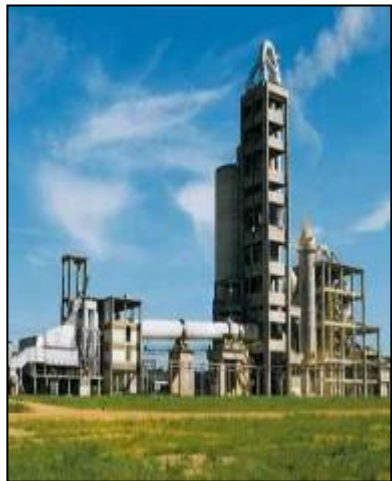
GHG Inventorisation

Net Zero Commitment

EMS System

1. Group Profile

- ▣ **Founded by Shri Jaidayal Dalmia in 1935**
- ▣ **Pan India presence in Cement business**
- ▣ **Capacity of 46.6 Million Tons per annum**
- ▣ **4th largest cement manufacturer in India**
- ▣ **Manufacturing of Special cements like Oil well, Air strip & Railway sleeper grade cement.**



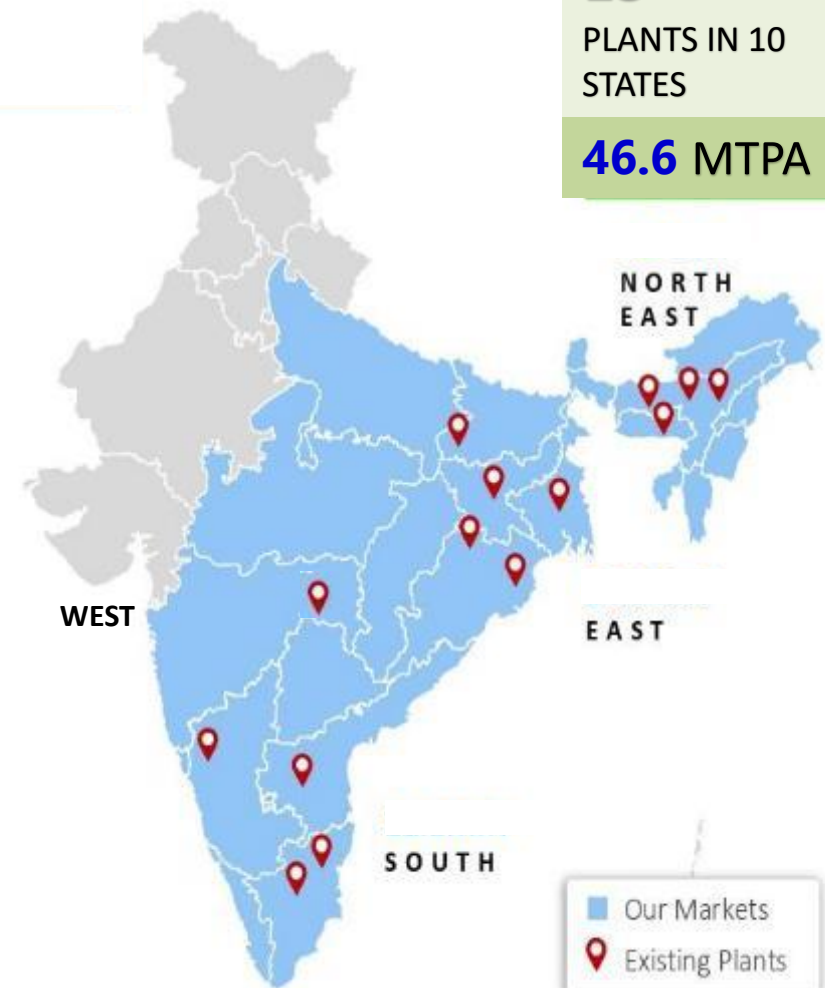
Cement



Power



Sugar



Plant Profile

- **World class cement manufacturing facility available**
- **Installed Capacity:**
 - **Clinker – 2.5 MTPA**
 - **Cement – 4.0 MTPA**
 - **Captive Power Plant – 27.0 MW**
 - **Solar Power Plant – 11.0 MW**



Major Process Equipment Specifications

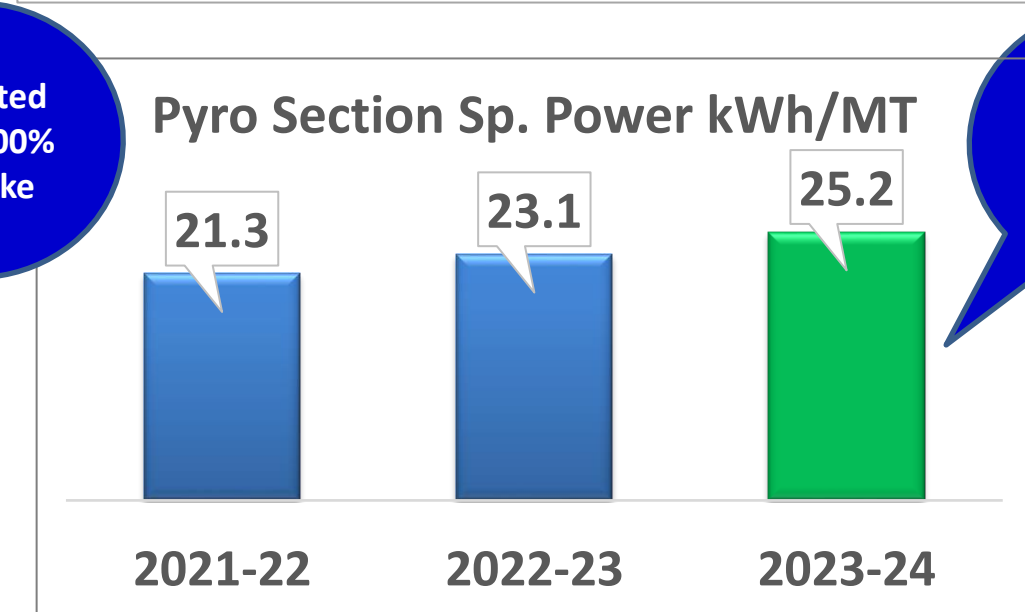
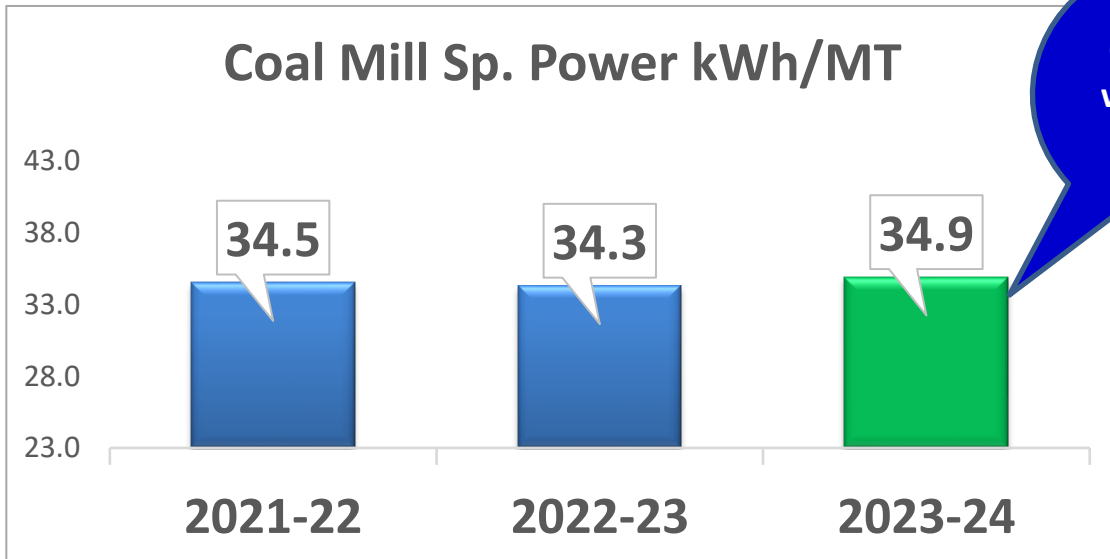
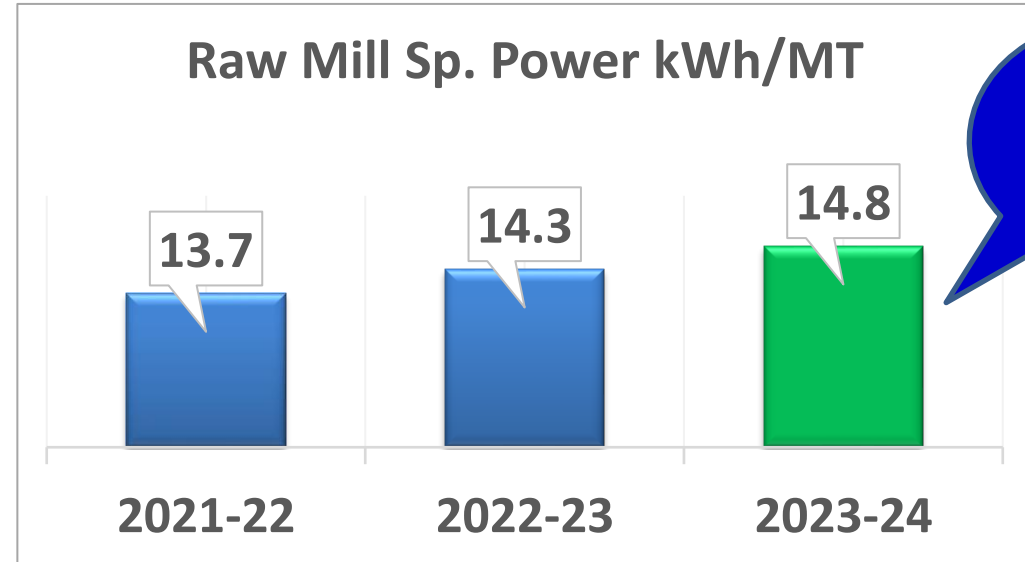
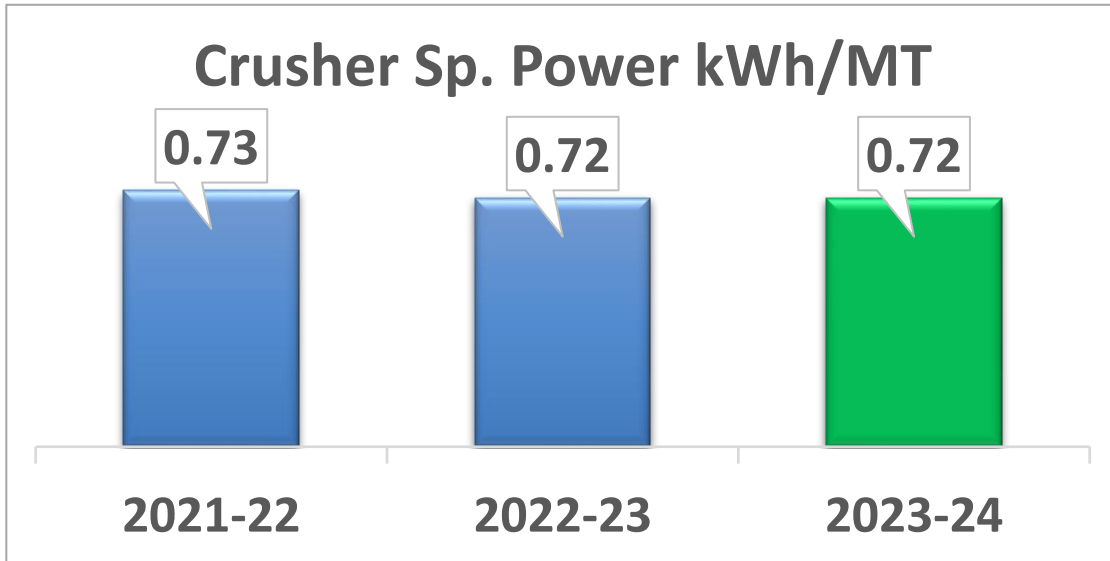
Equipment	Supplier	Rated	Operating	Beyond Capacity
Crusher	MMD	900 TPH	730 TPH	-18.9%
Raw Mill-VRM	Pfeiffer	400 TPH	500 TPH	25.0%
Pyro-5Stage Preheater	FLsmidth	4500 TPD	7000 TPD	60.0%
Coal Mill-VRM	Pfeiffer	40TPH-Coal, 25-Pet-coke	32 TPH (Pet-coke)	28.0%
Cement mill-VRM	Pfeiffer	300 TPH	400 TPH	33.3%



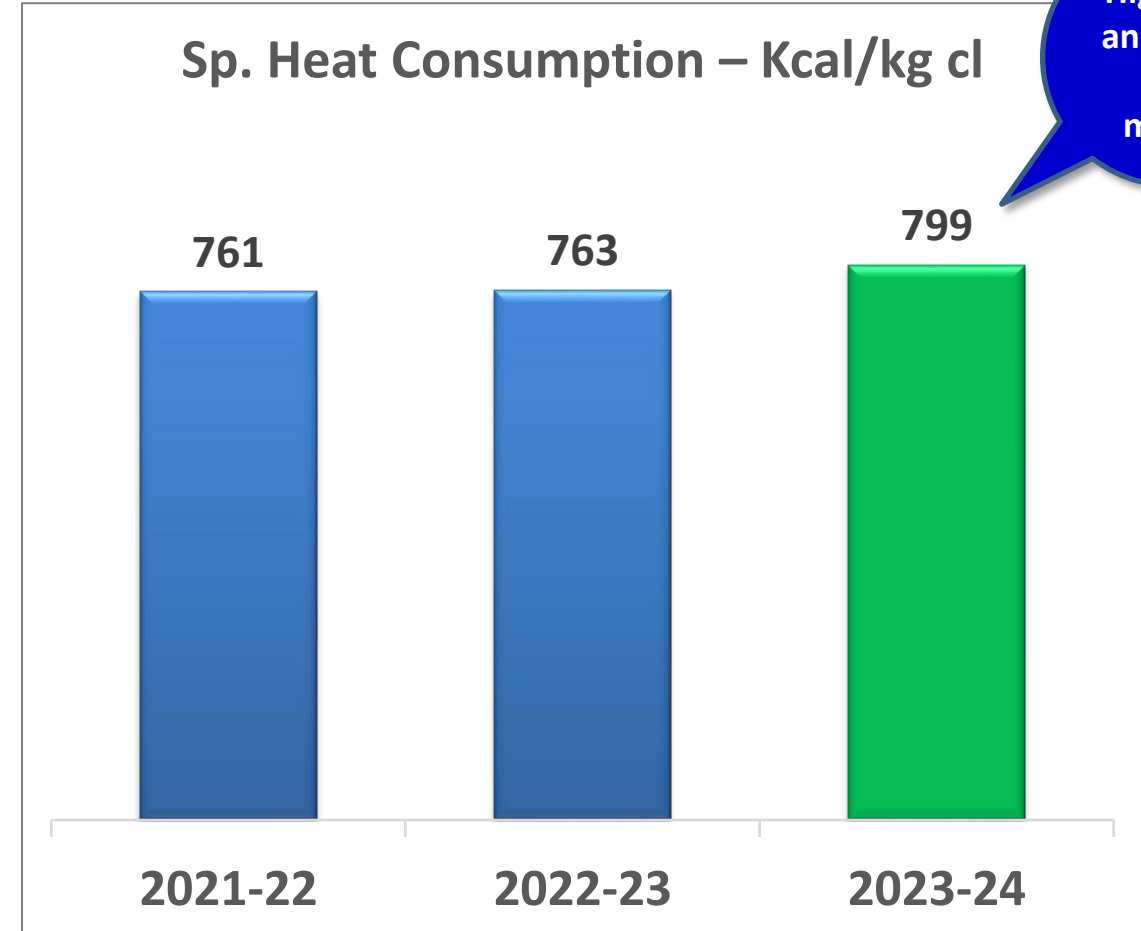
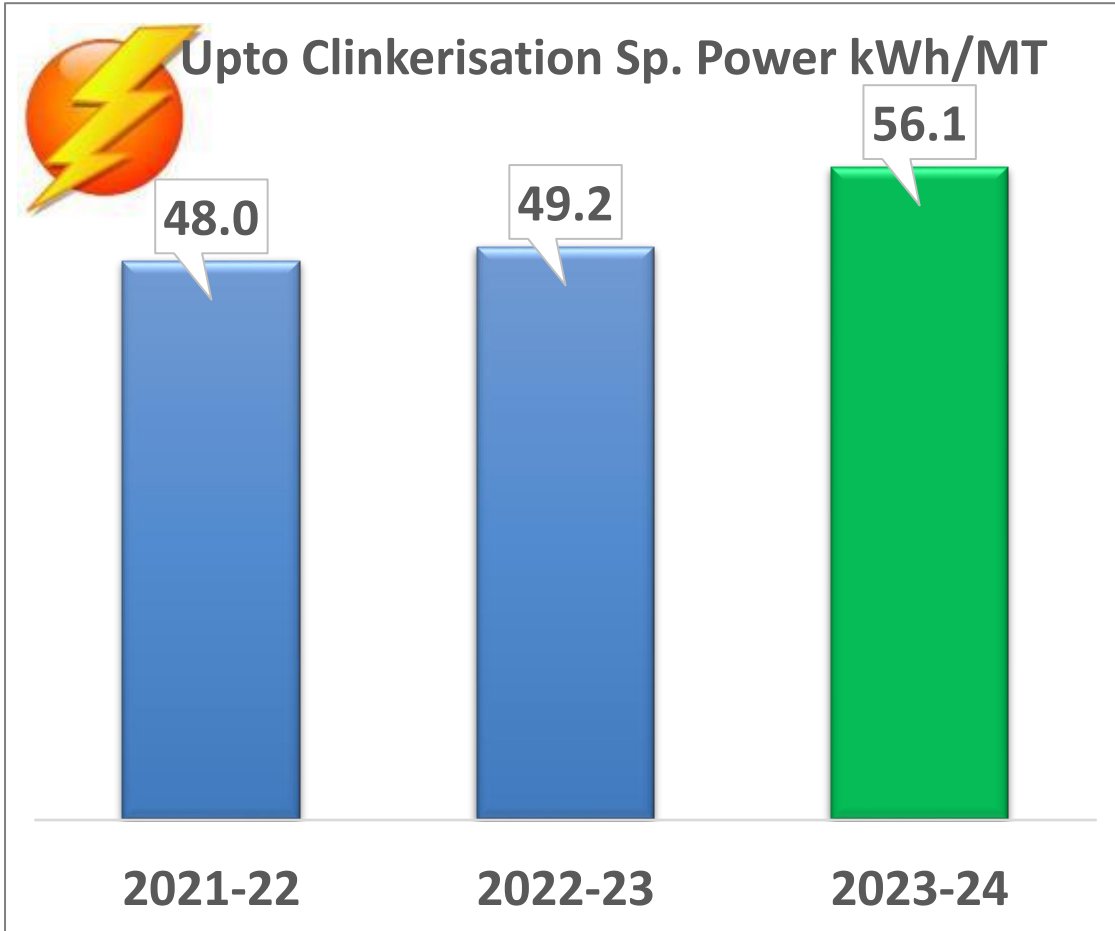
Operational Performance



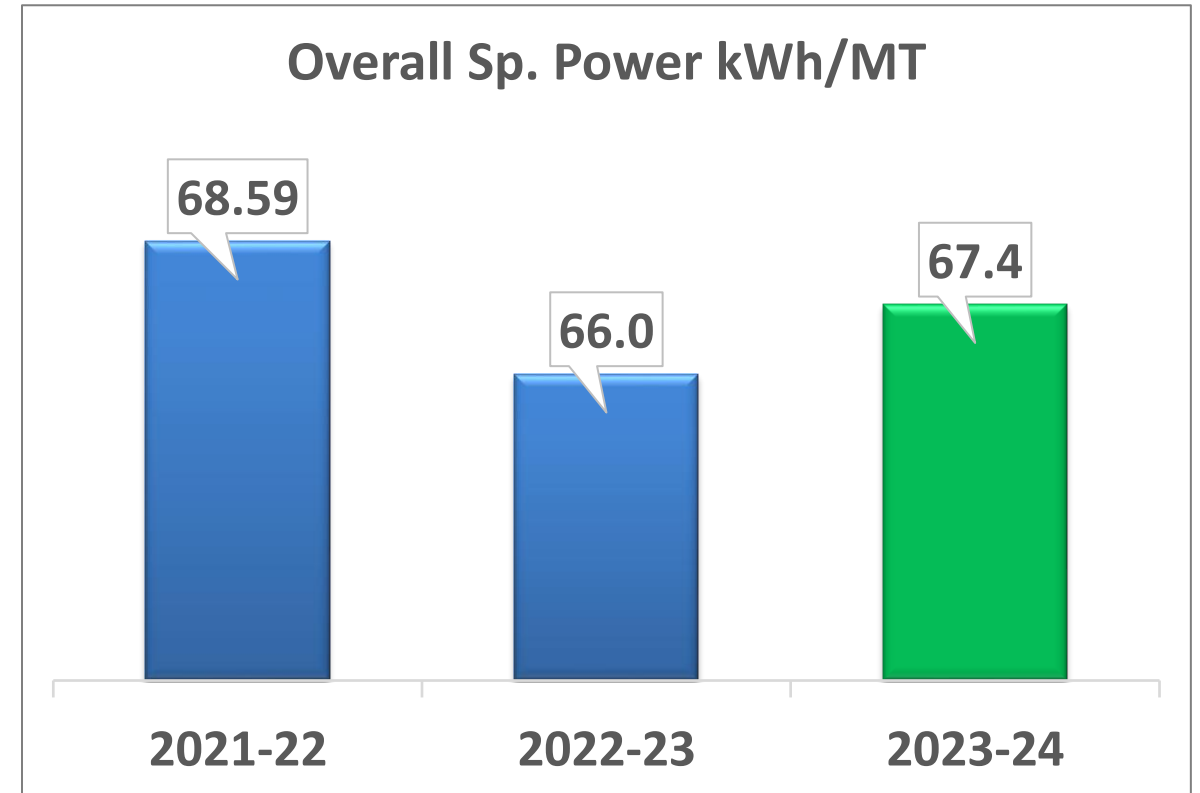
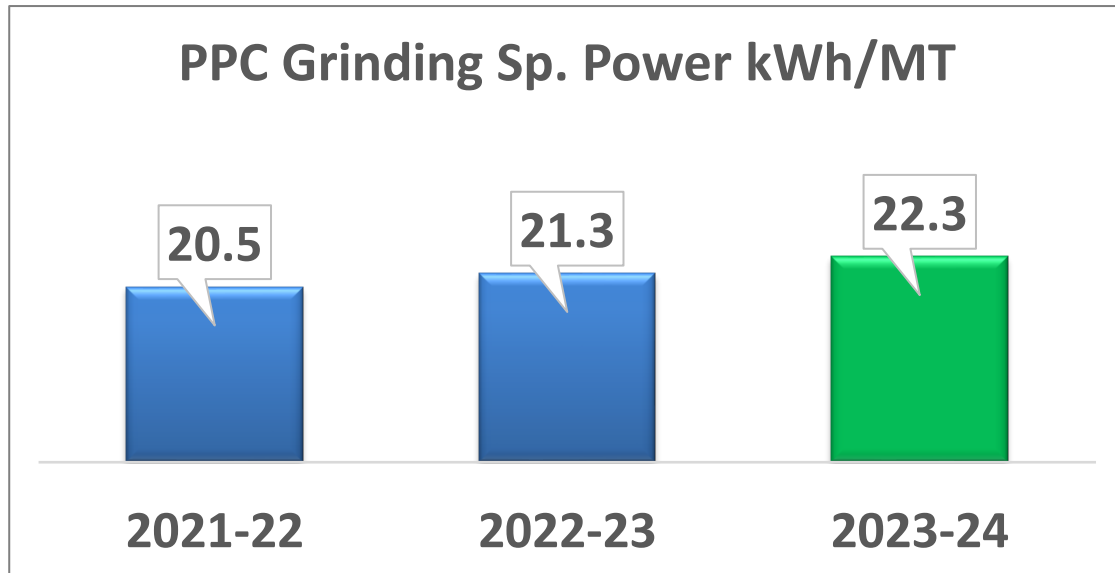
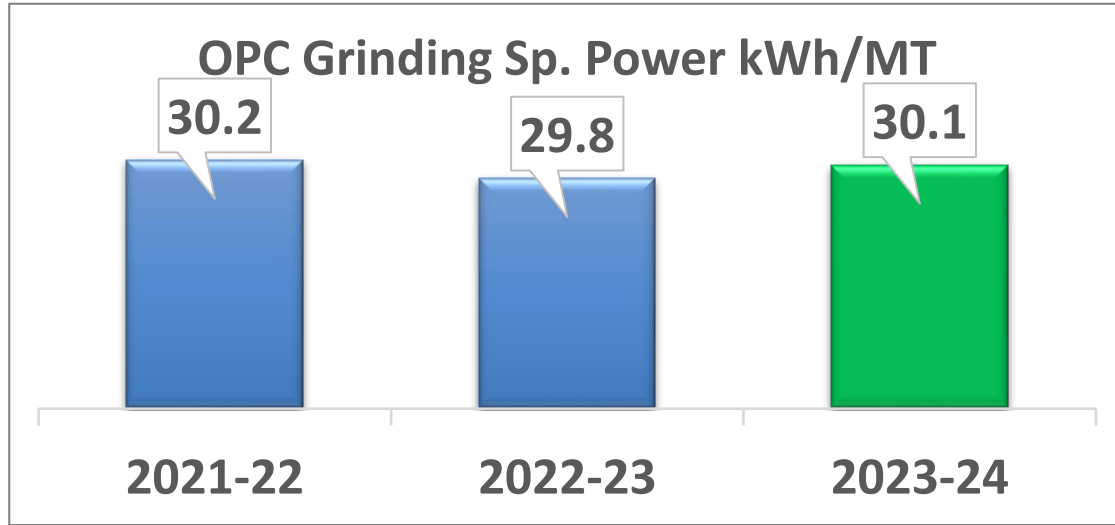
2. Specific Energy Consumption – 3 Years



Specific Energy Consumption – 3 Years



Specific Energy Consumption – 3 Years

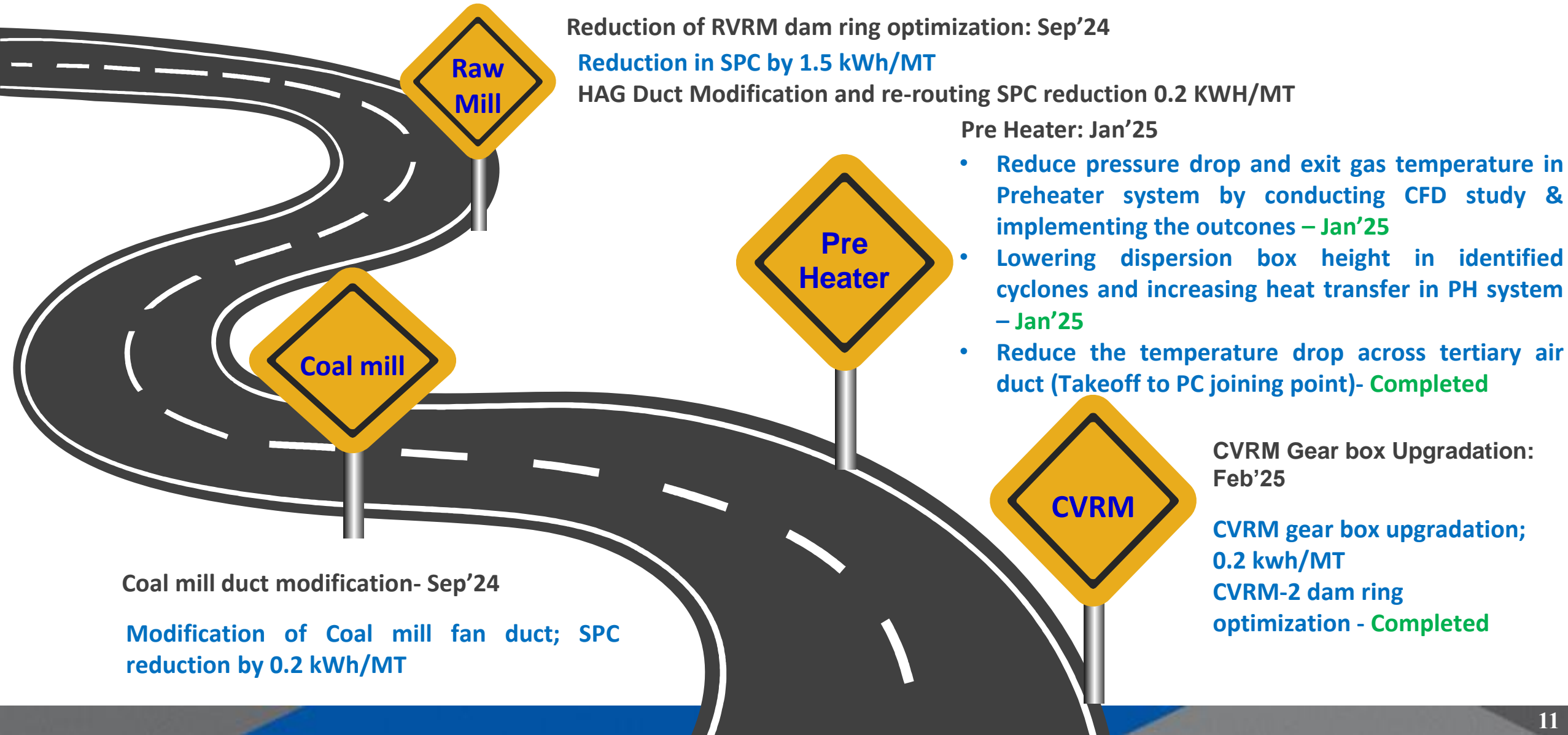


3. Information on Competitors, National & Global benchmark

ENERGY BENCHMARKING			
Parameters	Electrical SEC (kWh / T of Cement)	Thermal SEC (kcal / kg of Clinker)	TSR%
Comparison of specific energy consumption (SEC)			
SEC : Dalmia Cement –Ariyalur Plant	66.0	763	38% *
SEC Values for Competitor - 1 :	69.30	735	~ 20%
SEC Values for Competitor - 2 :	71.40	746	0 to 10%
SEC Values for Competitor - 3 :	71.65	758	0 to 5%
National Benchmark for SEC :	56.14	676	-
International Benchmark for SEC :	55.0	670	
SEC Target for FY 2023-24 :	63.3	760 with 35% TSR	
Please mention the sources / references for the furnished data (National & International Data)	<i>As per CII Bench marking details (National & International Data)</i>		

Road Map to Achieve Benchmark/National/Global Best

Reduction of Electrical Energy Consumption



Road Map to Achieve Benchmark/National/Global Best

Reduction of Thermal Energy Consumption



4. Energy Saving projects implemented in last three years

Year 1	With Investment				Without Investment	
	No. Of Proposals	Investments in Lakhs	Savings in Lakhs	Payback Months	No. Of Proposals	Savings in Lakhs
2021-22	10	163	549	3.6	2	277
2022-23	8	501	85	270	2	2.1
2023-24	9	615	110	70.4	1	2.0
Total	27	1279	744	344	5	281.1



List of Major Encon project in FY 2023-24

Savings: INR 56.1 Millions


Sl. No.	Title of Project	Annual Electrical Saving (kWh)	Annual Electrical Cost Saving (Rs million)	Annual Thermal Saving (Ton/year)	Annual Thermal Saving (Rs million)	Total Annual Savings (Rs million)	Investment Made (Rs million)	Payback (Months)
1	Enhancement of productivity in Raw Mill by up-gradation of Classifier	1246780	9.1	-	-	9.1	40	4.39
2	Up-gradation of Preheater Fan with high efficiency impeller	782210	5.7	-	-	5.7	20	3.50
3	Up-gradation of Baghouse Fan with high efficiency impeller	391105	2.9	-	-	2.9	8	2.80
4	Up-gradation of Clinker Cooler with IKN Cooler	3259210	23.8	4179.0	39.1	62.9	237	9.96
5	Up-gradation of Pre-calciner by duct height extension	-	-	1045.0	9.8	9.8	53	5.41
6	Reduction of radiation loss in Pre Heater by applying Heat Resistance Paint	-	-	209.0	2.0	2.0	10	5.00
7	Reduction of PH pressure drop by retro-fitting of Top Cyclone	260737	1.9	313.0	2.9	4.8	20	4.16
8	Up-gradation of Cement Mill Classifier with High Efficiency	1046787	7.6	-	-	7.6	144	18.84
9	Enhancement of CVRM mill output by retro-fitting of CVRM gear box	697858	5.1	-	-	5.1	83	16.29
Total		7684687	56.1	5746	53.8	109.9	615	70.35

List of Major Encon project in FY 2022-23

Sl. No.	Title of Project	Annual Electrical Saving (kWh)	Annual Electrical Cost Saving (Rs million)	Annual Electrical Cost Saving (Rs million)	Total Annual Savings (Rs million)	Investment Made (Rs million)	Pay Back Months
1	Solar Power plant in plant campus to utilize renewable energy for plant operation	8671023	3754	74.65	74.65	480	77
2	PPC DIP Power reduction by Process Optimization by Classifier Seal Gap reduction , Nozzle ring optimization and usage of Grinding Aid	477937	204	4.11	4.11	1.3	4
3	Nozzle ring optimization in Raw mill for Productivity improvement	287272	48	2.47	2.47	0	-
4	Installation of new silo feed elevator with capacity of 550 TPH to enhance the CVRM PPC output by 20 TPH	252000	113	2.16	2.16	19.5	108
5	Raw Mill RABH Fan power reduction by reduction in false air	106260	14	0.91	0.91	0.24	3.1
6	Coal mill nozzle ring modification to improve productivity and reduction in mill run hours	98820	48	0.85	0.85	0.1	1.4
7	Chiller efficiency improvement through optimization of operating parameters	60000	-	0.51	0.51	-	0
8	CVRM new conveying system with RAL for reject dust handling to reduce load and power in fly ash elevator	12965	6.9	0.11	0.11	0.05	5
9	Providing APFC panels with detunes filters for stacker reclaimer power distribution.	3330	0.4	0.02	0.02	0.17	71
	Total	99,69,607	4188.3	85.79	85.79	501.36	

Savings: INR 85.79 Millions

List of Major Encon project in FY 2021-22

Sl. No	Title of Project	Annual Electrical Saving (kWh)	Annual Electrical Cost Saving (Rs million)	Annual Thermal Saving (Ton/year)	Annual Thermal Saving (Rs million)	Total Annual Savings (Rs million)	Investment Made (Rs million)	Payback (Months)
								
1	Reduction of Pressure drop across Raw Mill nozzle ring by modification of nozzle pattern	384411	2.65			2.7	1	5
2	Up-gradation of Coal Classifier with high efficiency	460420	3.18			3.2	4.99	19
3	Reduction of Radiation losses by applying heat resistant paint in kiln shell			252	3.46	3.5	0.8	3
4	Increase in Clinker Liquid content by increasing KF alumina from 3.2 to 3.5%			1051	14.41	14.4	0.0	0
5	Cyclone -3 Dip tube replaced with new thereby PH exit reduced by 20 Deg C			1051	14.41	14.4	3.8	3
6	TAD temperature increased by replacing damaged duct portion with new duct around 20m			1261	17.29	17.3	3.3	2
7	PC Outlet temperature fluctuations optimized by implementation of Puzzy logic in EO System			840	11.52	11.5	0.8	1
8	In AFR discharge chute jamming was completely avoided by providing Air Blaster & SS plate	26673	0.18			0.2	0.4	26
9	Enhanced shredder productivity by installation of ARCO plate instead of MS plate	80018	0.55			0.6	0.5	11
10	Enhanced OPC productivity from 260 to 290 TPH and reduction of Sp. Power consumption	1922339	13.26			13.3	0	0
11	Cement Bag house False air reduced by 1% by replacement of anval rotary air lock type	240292	1.66			1.7	0.7	5
Total Saving		31,14,154	21.5	4,454	61.1	82.6	16.3	2.4

Energy Saving project implemented in FY 2023-24

Reduction of SPC in Cement Mill (CVRM) in PPC DIP

Constrain:

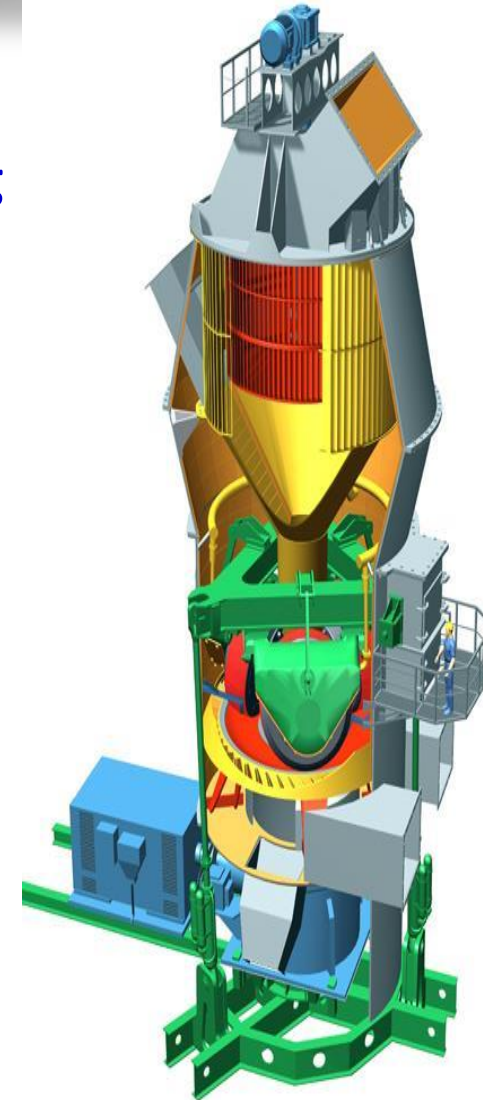
Reduction of Specific Power Consumption in Cement Mill Grinding

Project Details :

- PPC DIP Power reduction by Process Optimization
- Nozzle Ring Optimization.
- Classifier Seal Gap Optimization.
- Grinding Aid dosing Optimization

Benefits

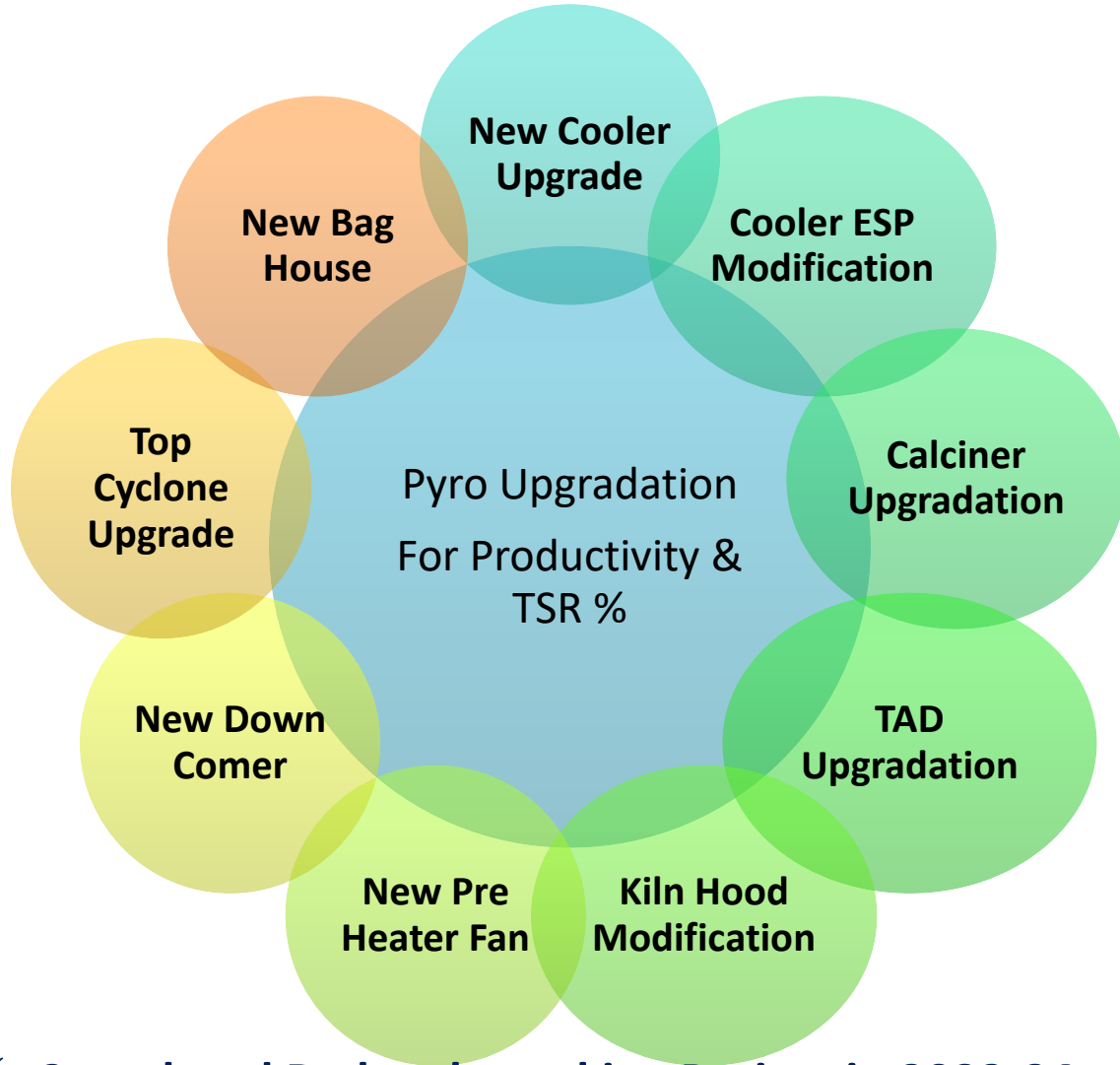
- ☑ Investment – Nil – Inhouse Modification
- ☑ Cost Saving – 4.11 Lakhs/annum
- ☑ Payback – 4 months



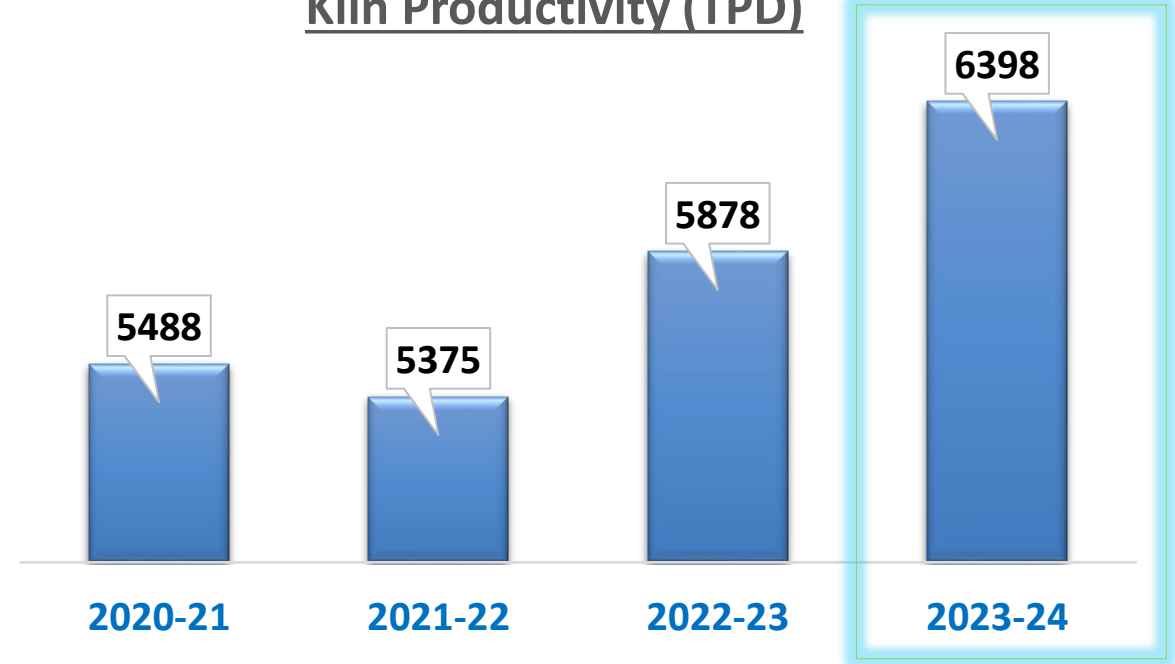
6. Innovative Projects



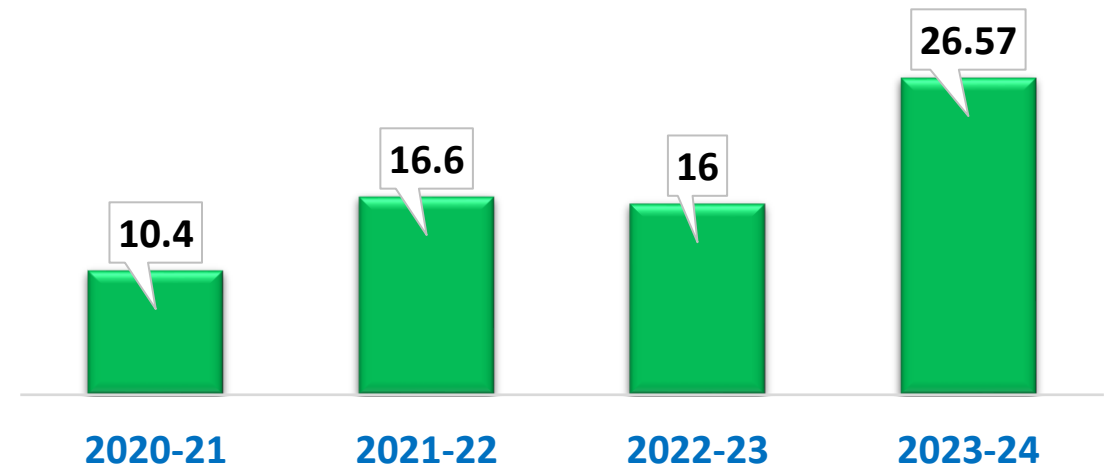
A. Innovative Approach to Improve the Productivity & TSR



Kiln Productivity (TPD)



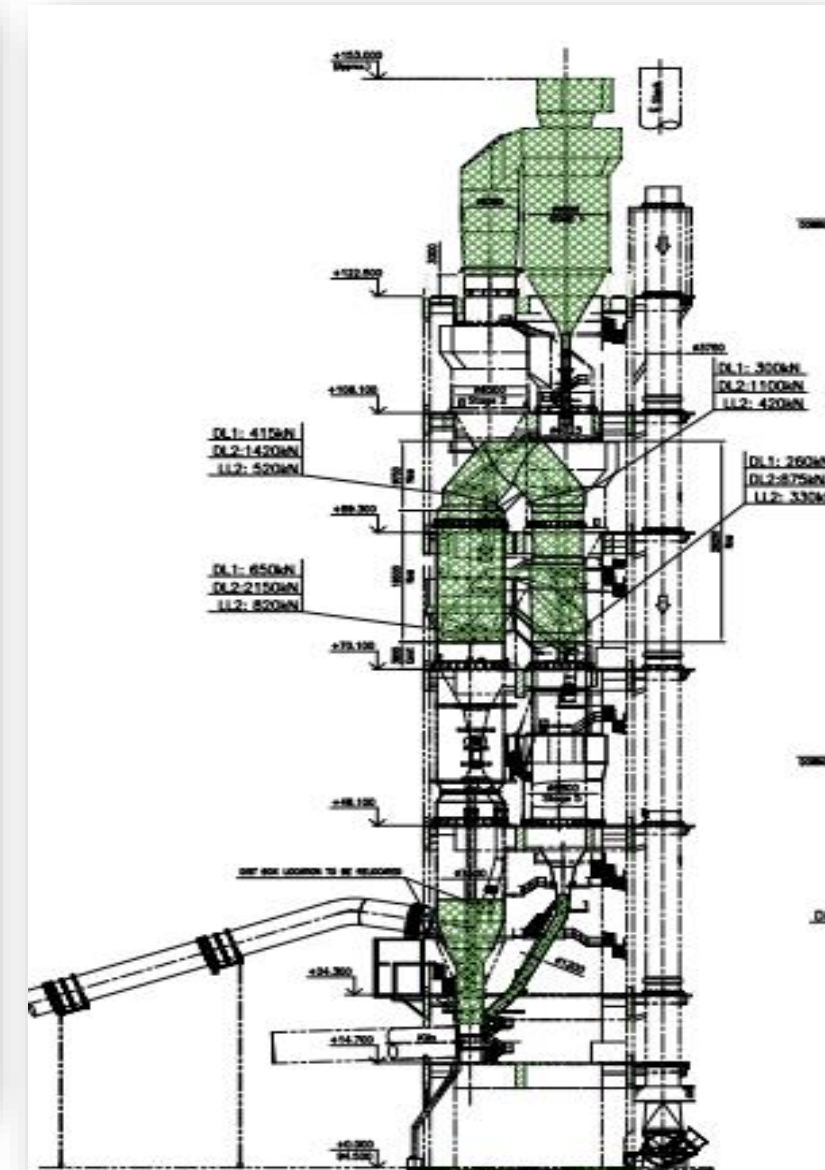
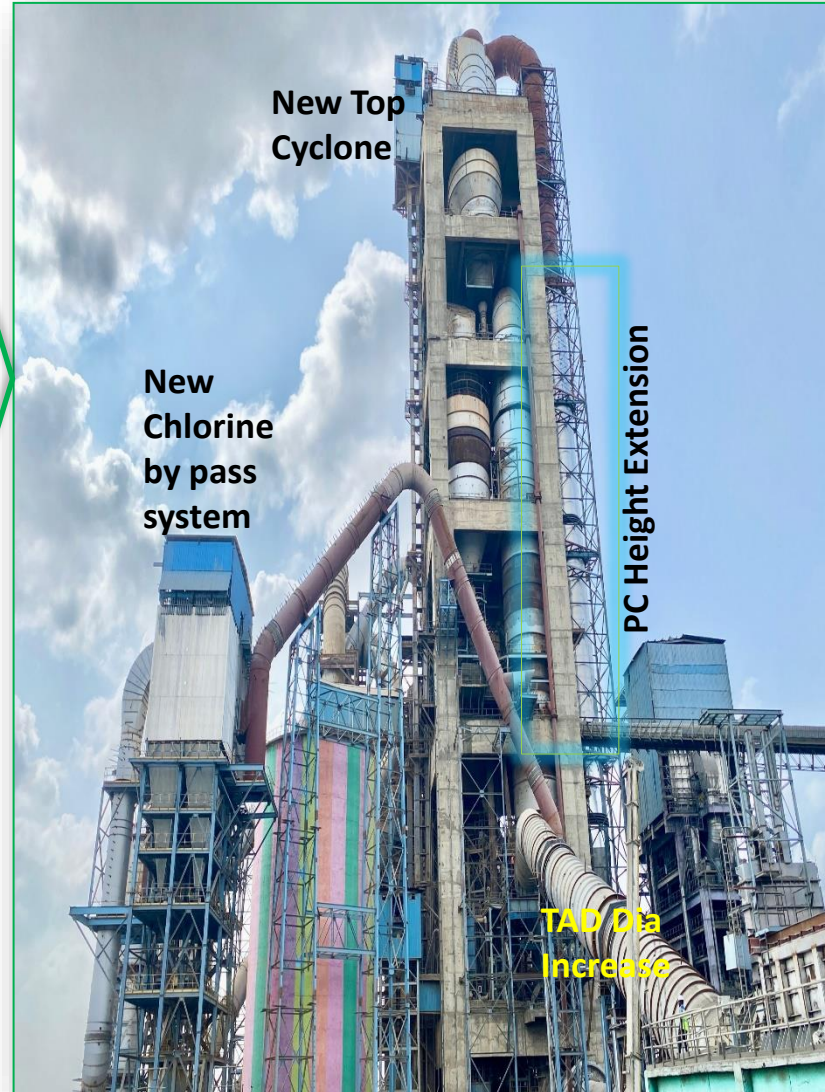
TSR %



- ✓ Completed De bottle necking Project in 2023-24
- ✓ Kiln Operating at 7000 TPD and 38% TSR Model

Pyro Productivity & TSR Improvement

Pyro Upgradation to Reach 7000 TPD Clinker Production with 38% TSR



Completed Successfully in 69 Days with investment cost of INR 220 Cr

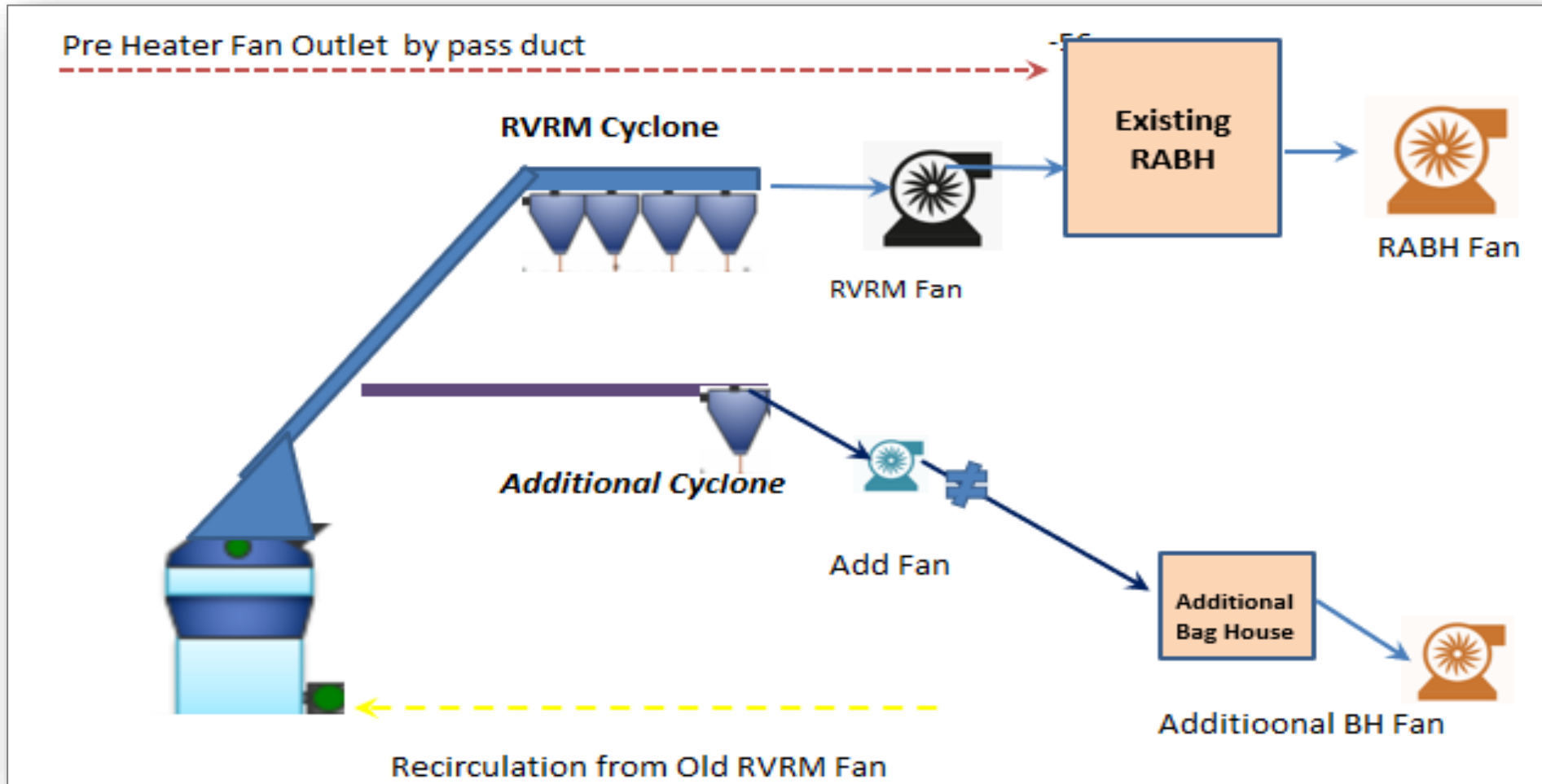
B. Raw mill (RVRM) Productivity Improvement to reduce Power

Classifier Upgradation

New Additional Cyclone

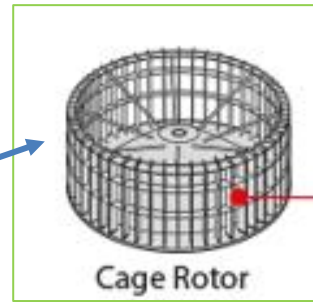
New Additional Fan

New Additional Bag House & Fan



Productivity Improvement ~20% achieved

Raw mill (RVRM) Productivity Improvement



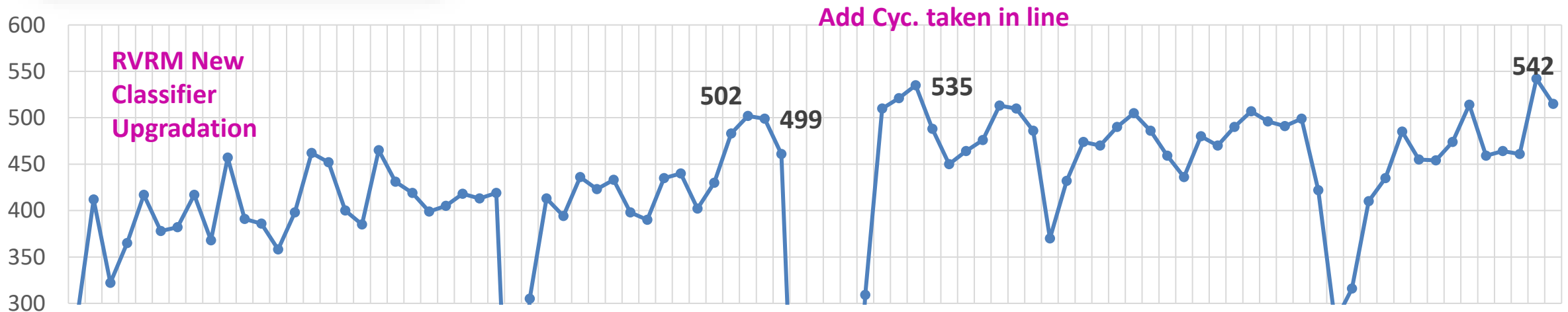
Classifier
Upgradation

New RVRM
Cyclone & Fan

RVM
Production
from 400 to
500** TPH

Production : 400 to 500 TPH
Specific Energy: 17 to 15.5 Kwh/MT

Raw Mill Production



C. Pre-processing system - Upgradation

Upgradation of Pre Processing System with Latest Technologies



Additional Shredder



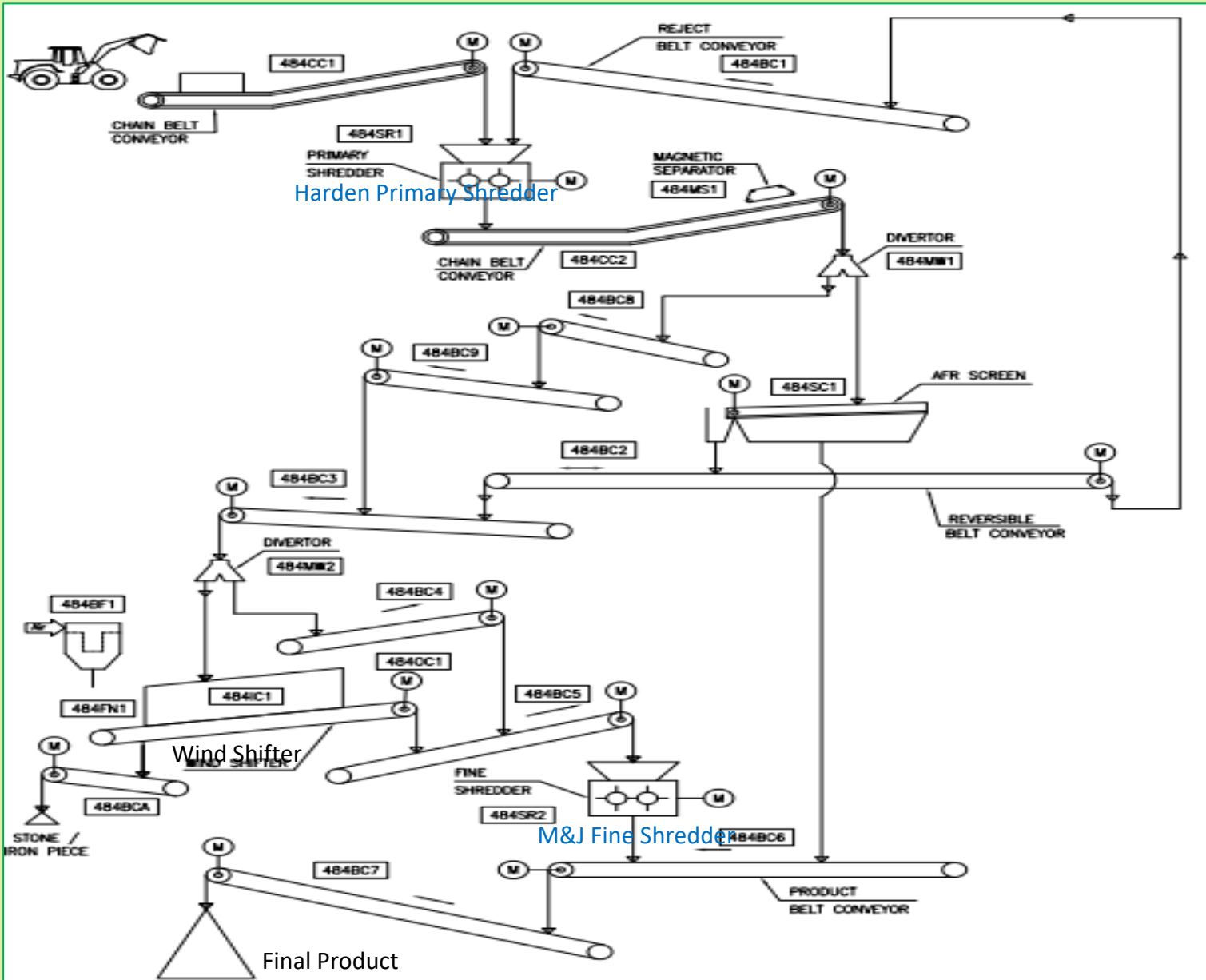
Wind Shifter



Fine Shredder

- New Primary Shredding System 40 TPH.
- Wind Shifter for segregation of Heavy weight Particles.
- Fine Shredder 25 TPH for size less than 30 mm
- Investment: 35 Crores

3. AFR Preprocessing Circuit Process Flow Diagram



Unique Features of New Recycle (First time in DCBL Group)

- Receipt in Primary (Harden) Shredder
- Screen (NIHOT) - 40mm size final ptd
- Higher Size to wind shifter to elimination of high dense
- Reject of shifter taken out separately .
- Output to Fine Shredder (M&J).
- Output PC feeding or storage
- Separate provision for Primary Shredder to operate standalone mode bypassing Fine Shredder.

New Shredder Circuit Sample – Sieve Analysis

Description	Cumulative (Passing) %									Moisture %
	300 mm	200 mm	100 mm	80 mm	70 mm	40 mm	25 mm	10 mm	<10 mm	
Primary Shredder Input	33.56	30.45	26.30	23.53	20.07	13.15	10.73	6.23	--	36.40
Primary Shredder Output	71.19	58.85	48.56	46.91	41.98	36.21	25.93	13.58	--	35.10
Fine Shredder Input	60.75	50.93	43.93	41.59	40.19	30.84	25.70	17.29	--	35.00
Primary Shredder Reject	63.70	56.85	46.23	44.52	39.73	31.85	22.95	10.96	--	34.10
Product Sample	100.00	100.00	100.00	93.31	81.59	49.37	25.10	11.72	--	34.90



M&J New Fine Shredder Input



M&J New Fine Shredder Output

TSR% Increased from 25% to 38%

7. Utilization of Renewable Energy Resources - Onsite

Replacement of Electrical Energy with Renewable Energy	Annual Energy Generated in 2020-21 (million kWh)	% Share	Annual Energy Generated in 2021-22 (million kWh)	% Share	Annual Energy Generated in 2022-23 (million kWh)	% Share	Annual Energy Generated in 2023-24 (million kWh)	% Share
Wind Energy	21.98	50	21.49	50	24.34	50	25.94	50
Replacement of Thermal Energy with Renewable Energy	Equivalent Annual Fuel Savings in 2020-21 (million kcal/year)	% Share	Equivalent Annual Fuel Savings in 2021-22 (million kcal/year)	% Share	Equivalent Annual Fuel Savings in 2022-2023 (million kcal/year)	% Share	Equivalent Annual Fuel Savings in 2023-2024 (million kcal/year)	% Share
Solar Thermal Energy	-	-	-	-	11	100	141.6	100

Renewable Energy – Solar Power Plant

11Mwp SOLAR POWER PLANT DALMIA CEMENT (BHARAT) LIMITED, ARIYALUR



AC CAPACITY: 9.24 MW

DC CAPACITY: 11 MWp

TOTAL NO OF PVMODULES: 20188 NOS

TOTAL NO OF INVERTERS: 42 NOS

PLANT COMMISSIONING DATE :- 21.07.2022



Generation: **141.6** Lakhs Units

CO₂ emission reduction

Battery Operated Vehicles



Solar Panels for Security Vigilance room



Road Map to RE100



LCoE (Levelized cost of energy):

Levelized energy cost for 25 years for Off-site RE Projects in both Opex & Capex



Installation of Off site solar plant: Jan'25

Completion of under going projects for Off Site and On Site solar projects of 24 MW

Off Site Wind Farm: Mar'25

- Installation of ~ 16 MW wind farm

RE purchase from third party under OPEX: Oct'24

Addition of Solar projects capacity in Opex mode based on economic feasibility in replacement to CPP or Grid

8. Pre-processing and Co-processing circuit

Pre-processing

➔ **Full Fledged Feeding System was installed with investment of 46 Crores**

Size Reduction

- Shredding

Separation

- Screening
- Metal Separation

Mixing

- Blending
- Homogenization

Co-processing

Feeding

- Controlled Extraction
- Weigh Feeder

Conveying

- Belt conveyor
- Metal Separation

Feeding

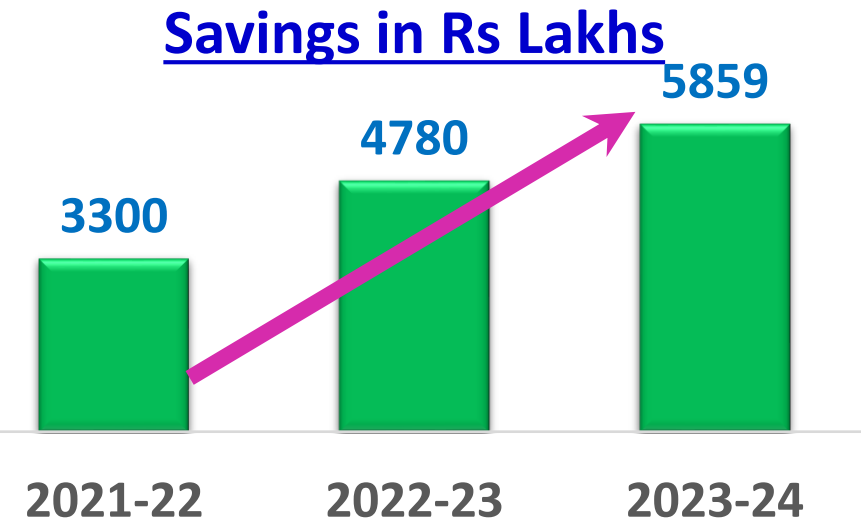
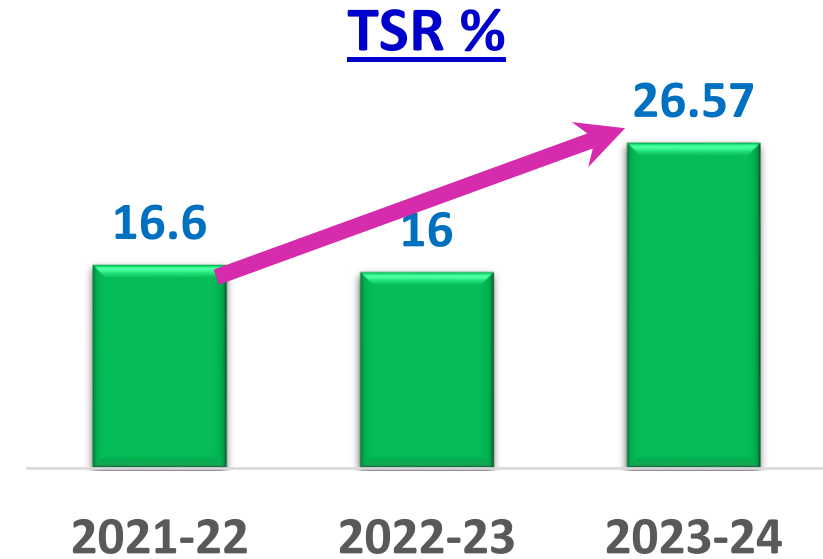
- Proper Controlled
- Proper Sealing



Clean & Green is Sustainable & Profitable

FY	2021-22		2022-23		2023-24	
MATERIAL	Qty, (MT)	% TSR	Qty, (MT)	% TSR	Qty, (MT)	% TSR
RDF	33495	7.90%	39239	8.90%	32733	5.92%
Plastic waste	14502	5.90%	16846	6.50%	24831.1	7.78%
Carbon black	3192	1.60%	3537	1.90%	112.795	0.05%
Cotton Waste	1064	0.30%	1064	0.30%	1115.54	0.24%
SCF	703	0.30%	687	0.30%	2127	0.73%
Paint Sludge	655	0.20%	455	0.20%	37.01	0.01%
Resin Waste	526	0.20%	766	0.20%		
Tyre Chips	294	0.10%	133	0.10%		
Solid Waste Mix	129	0.00%	233	0.00%	2047	0.42%
ULB					5992	1.84%
MLP					12752	4.23%
Shredded RDF					15925.5	3.15%
Shredded Biomass					2600	0.43%
Coir waste					6442.32	1.43%
Herbal waste					1435.4	0.26%
Other AFR's	437	0.10%	566	0.10%	378	0.09%
Total	54996	16.60%	63526	18.50%	108529	26.57%

Green Raw Material	2021-22	2022-23	2023-24
Lime Sludge - MT (Wet)	4735	9111.2	5041.643
Total Quantity-MT	4735	9111.2	5041.643



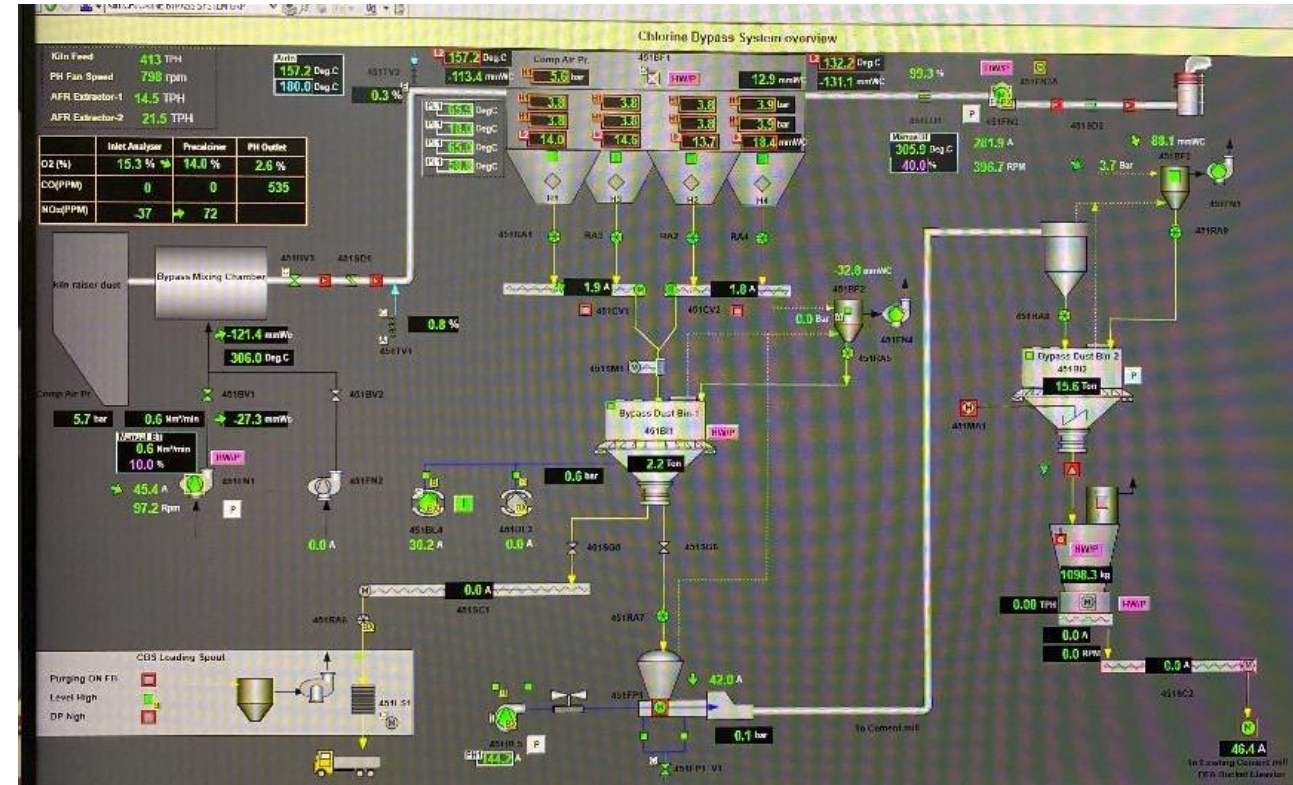
Trommel Screen system Installed with capacity of 40 TPH



- ✓ Reduction in overall ash to 5 to 6 %
- ✓ Separation of Stones and oversize material
- ✓ GF CV increase by 200 Kcal
- ✓ Investment: 80 Lakhs

New Chlorine Bypass System Installed and Commissioned in Nov 2023

Designed chlorine by pass for achieving TSR 38%



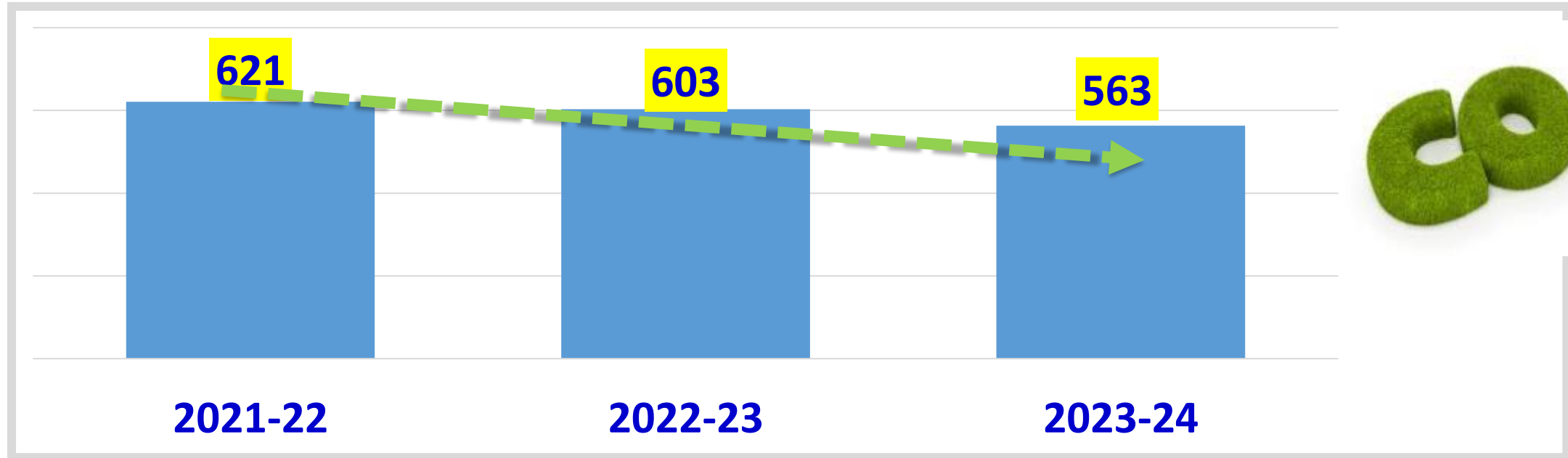
Impact on quality & production

Actions taken to achieve desired quality

Clinker Production	TPD	5500	5500	5500	7000 **
% TSR	%	6%	15%	20%	30%
Raw meal LSF	%	97	100	101	102
KF alumina %	%	3.3	3.35	3.45	3.6
% of RM fineness on 90 mic	%	18	17	16	16
% of Coal fineness on 90 mic	%	3	2.5	2	1.5
Clinker C ₃ S	%	49	48	48	48
Clinker free lime	%	1.6	1.8	2	2
Clinker chloride %	%	0.04	0.07	0.095	0.085

** Chlorine bypass in operation

CO2 emission (Scope-1) – Kg/ MT of Cement



Short Term:

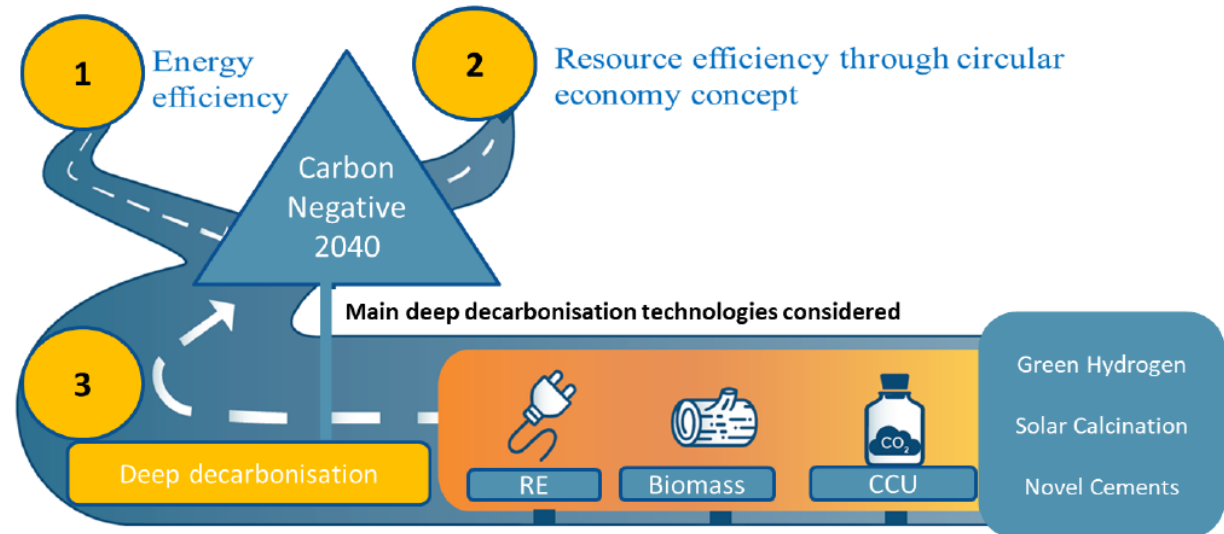
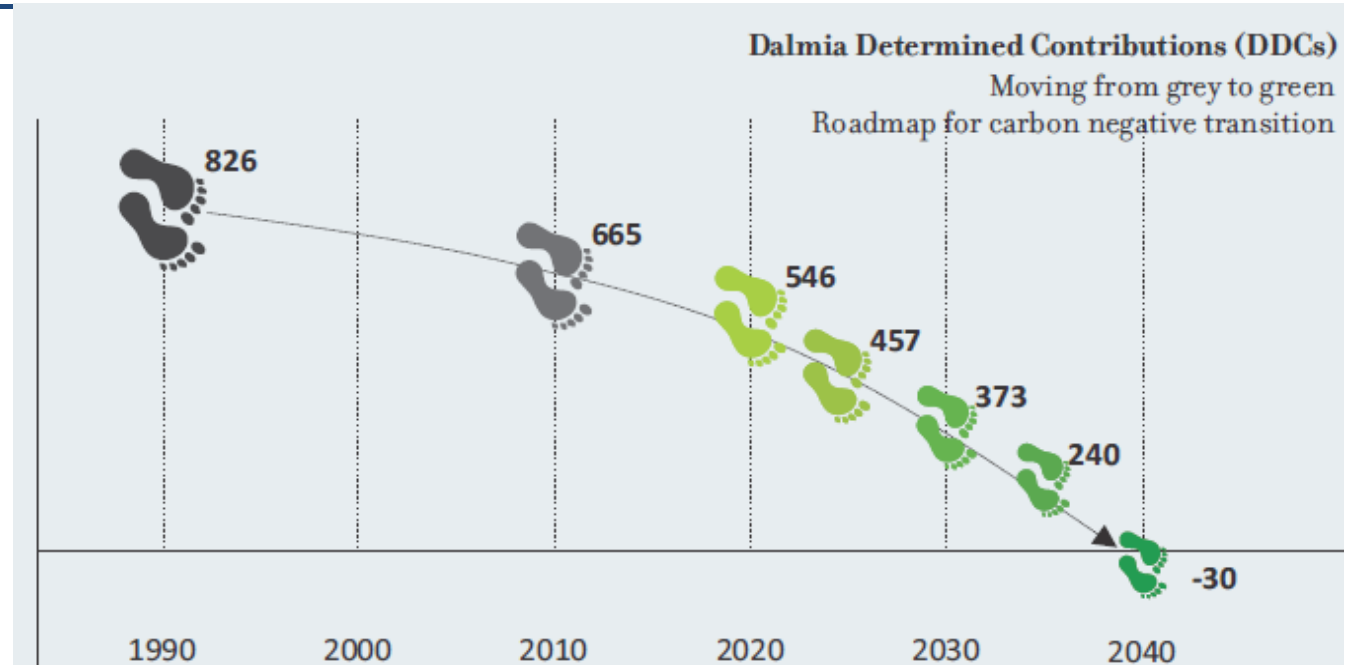
- Increase the AFR utilization from 35 to 40%
- Increase of PPC product ratio from 50 to 80%
- Utilization of Renewable energy to 50%

Long Term:

- Negative carbon footprint on 2040
- Carbon Capturing & Utilization
- 100% AFR utilization in PC

Dalmia Determined Contributions (DDCs) for Roadmap 2040

- ❑ Usage of 100% renewable Power under fossil free electricity initiative by 2030 (RE100) – **11.0 MW Solar inside Plant Planned 8.0 MW Wind Farm & 24 MW Solar by 2025 and exchange.**
- ❑ Double energy productivity by 2030 (EP100) – **Debottle neck project completed**
- ❑ Renewable biomass and waste to replace fossil fuel use by 2035 – **Currently 38% TSR, focus to 45%**
- ❑ Carbon Capture and Utilisation (CCU) for process emissions and carbon Sequestration by 2040 and adoption of other advance green technologies. – **Knowledge partners tied up and pilot study in progress**





“Companies such as Dalmia Cement and Mahindra are driving innovation. But we need many more to join them”. **Hon’ble UN Secretary-General Mr. António Guterres (Aug. 2020)**

Source: <https://www.youtube.com/watch?v=G5FBpm4-6eg>



Hon’ble UN Secretary General invited Dalmia Cement to share its actions and commitments on climate change during UN General Assembly along with 63 country heads at the UN Climate Action Summit, New York.

10. Carbon Net Zero Commitment



Technical Assistance Consultant's Report

Project Number: TA-9686 REG

Integrated High Impact Innovation in Sustainable Energy Technology - Prefeasibility Analysis for Carbon Capture, Utilization and Storage (Subproject 2)

Prefeasibility Study on Carbon Capture and Utilization Cement Industry of India

REVISED REPORT

October 2021

sectors where CO₂ emissions are mostly from energy usage, significant proportion of CO₂ emissions from cement industry are process centric. Without practical alternatives, the sector needs carbon capture, utilization and storage (CCUS) to achieve its climate change goals.

Dalmia Cement (Bharat) Limited ('DCBL'), one of the leading cement companies in India, has announced to become carbon negative by 2040. Carbon capture and Utilisation (CCU) is one of the key levers identified by the company to achieve its goal, considering 55-60% GHG emissions in cement plant are attributable to cement process. The company is exploring the feasibility of building a large-scale demonstration CCU plant in its Ariyalur cement facility.

This study is being commissioned to assess the techno-economic pre-feasibility of the CCUS options in the Ariyalur cement factory with support from Asian Development Bank (ADB). Key findings of this study are presented below.

Capture CO₂ from a cement plant

Despite a lack of commercial CCUS projects in the cement sector, there are numerous demonstration and pilot CCUS projects at cement plants around the world. Most applicable CO₂ capture technologies (commercially applied in other industries) for cement industry are post combustion and oxy-fuel combustion technologies. Post-combustion technologies are preferred as it is commercially available and applied to other dilute CO₂ streams (power stations) and it does not interfere with the operation of cement production.

It is technologically feasible to build and operate a 500,000 tonnes per year CO₂ capture plant at the Ariyalur plant, using chemical absorption with amine-based solvents. A conceptual design for an amine-based solvent carbon capture plant was completed with major equipment sizing and costing.

Outcome

- Feasibility of CCU and CCS for long term perspective
- Regulatory frameworks
- Implementation challenges
- Policy & Collaboration with partners

11. Green Purchase Policy

Dalmia Cement (Bharat) Limited, Ariyalur Green Purchase policy

1. Aim at making our value chain environmental friendly and responsible.
2. Committed to comply with the requirements of local laws and regulations related to environment in which it operates and from where it sources any material, product or services.
3. Realize that the scope and nature of operations of our suppliers vary and hence emphasis on these principles may vary accordingly.

The following shall be followed at DCBL, Ariyalur shall:

Energy:

- a. All new purchases of electronic items & energy-using appliances shall be energy efficient equipment's.
- b. All copiers and printers purchased or leased shall be capable of double-sided copying/printing.
- c. Complete phase out of incandescent, fluorescent light sources & CFL bulbs into LED.
- d. Insisting suppliers strive towards enhancing the efficiency and performance of the equipment and processes by continual improvement, monitoring and assessment of technology.
- e. Identifying the scope of replacing conventional sources of energy with sustainable and renewable sources in their operations thereby fighting for climatic change.

Issue No: 1

Revision No: 2

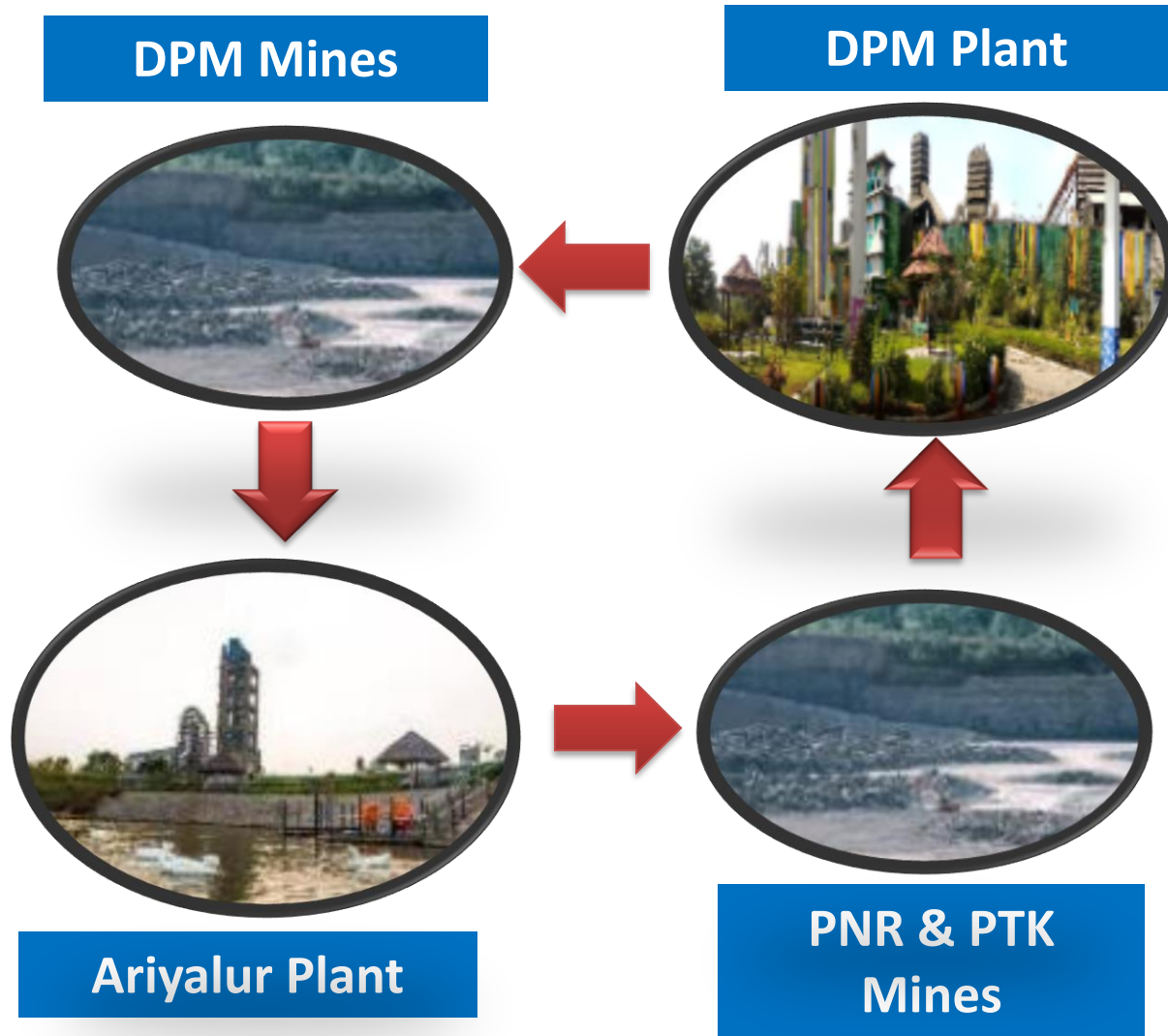
Date: 01.06.2022

Robert.T

Unit Head

Green Supply Chain

Limestone Round Trip Concept



Vehicle Backhauling



Implementation of ISO 50001/Green Co/IGBC rating

ISO -50001:2018



Green-Pro Certification from CII



- ❖ Increased PPC Cement Production from 50% to 80%.
- ❖ Utilizing waste materials from other industries like;
 - Dry & Wet Fly ash – TPP up to 33.5%.
 - Gypsum waste from Chemical industries up to 2%.
 - Clinker CC ratio reduced & thereby reduction in CO₂ emission.

Team work, Employee Involvement & Monitoring

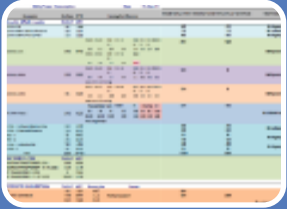
Daily Monitoring and Reporting System



On line Energy management System (EMS) and Knowledge Manager



Online Specific power consumption is monitored by CCR Operators



Software for identification of Compressors run hrs, Idle running hours of Major Equipment & Raw water Consumption



Production Software (PHP) for making Daily Production & Power Report & Circulating to all Executives by using IOTs & Clouds

Daily Review Meeting Chaired by Technical Head



Team work, Employee Involvement & Monitoring

Mobile Application apps

Plant Operation Server

Robot Automation Server - Quality

Energy Management Server

Gateway

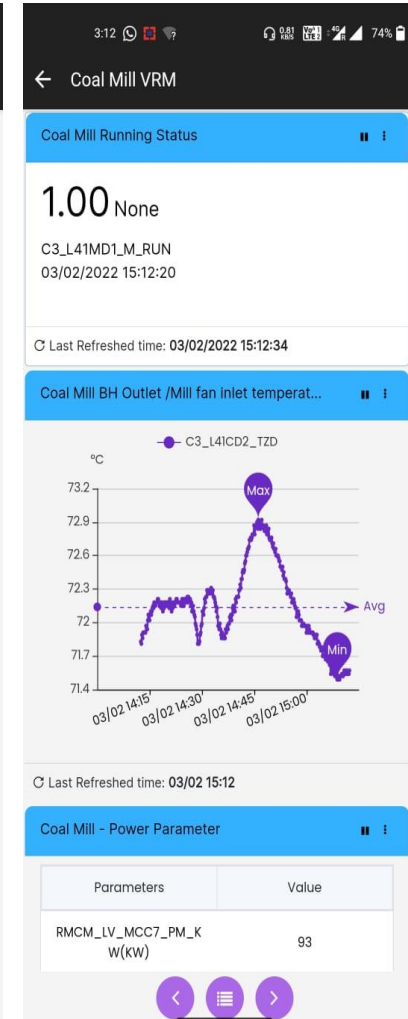
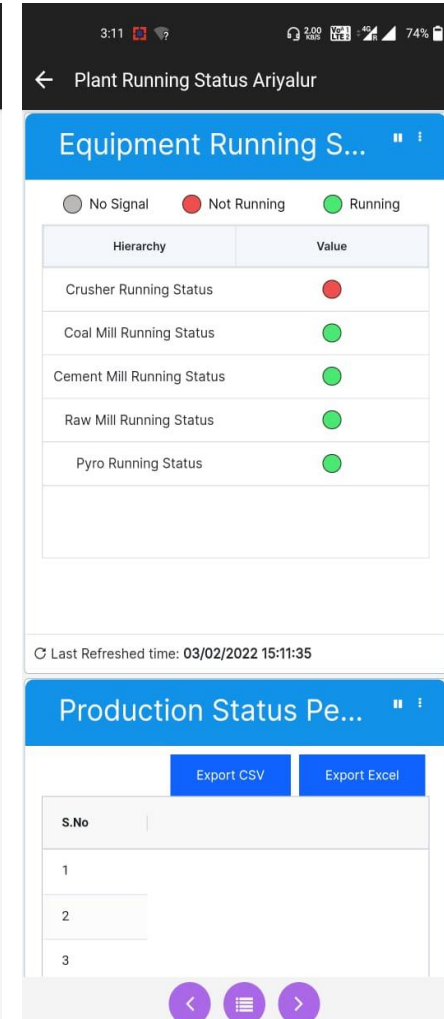
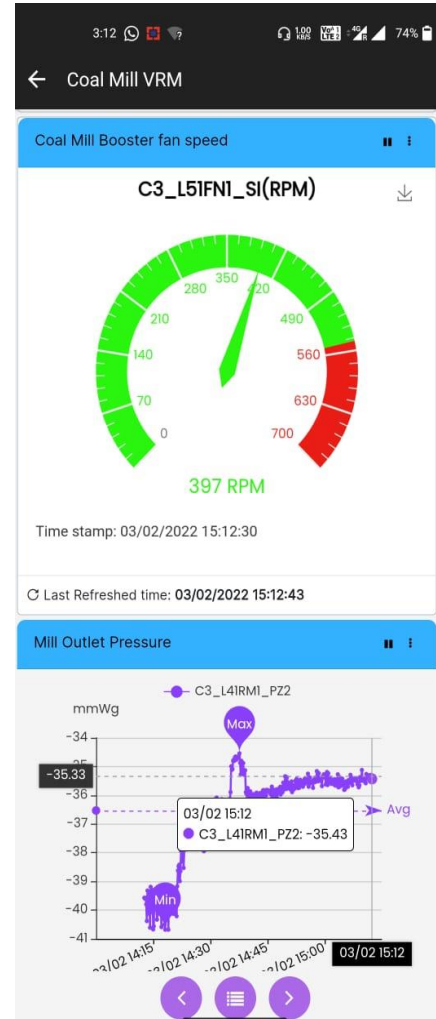
Secured Data Diode

Cloud



Benefits:

- Real Time data monitoring
- Automated alerts
- Improve the reliability and productivity
- Scalable for AI



1. Reduction of Pressure drop across nozzle ring by modification of nozzle pattern (M/S Mechwell Design) that was learned and it was implemented in Raw Mill– Reduced the sp. Power consumption – 0.16 kWH/MT
2. Reduction of Radiation losses by applying heat resistant paint (ES 70HT silicon paint) in kiln shell and it was implemented in Kiln shell– Reduced the SHC– 1.2 Kcal/Kg.Clinker
3. Temperature drop reduction across TAD and reduction in SHC ~ 2 to 3 Kcal /kg Clinker

CII Energy Award – 10 Consecutive years



2012-13



2013-14



2014-15



2015-16



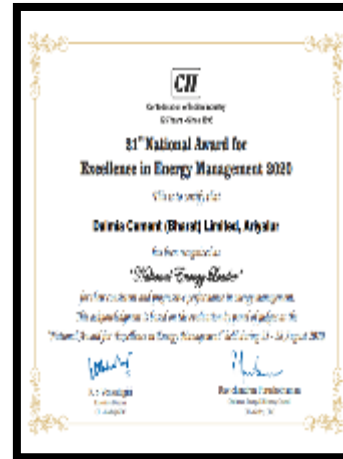
2016-17



2017-18



2018-19



2019-20



2020-21



2022-23

Thank you

