UltraTech Cement Limited

Bela Cement Works

CII National Award for Excellence in Energy Management 2023 (Integrated Cement)

Team Members (S/Shri)	Designation
Mohan Sarode	HOD (Technical Services)
Avinash Chandra	Energy Manager
SNM Pathak	Deputy Manager

Brief Introduction – Bela Cement

UltraTech Cement is the largest manufacturer of grey cement in India, with a consolidated capacity of 132.35 Million Tonnes Per Annum (MTPA) of grey cement.

UltraTech has 23 integrated manufacturing units, 29 grinding units, one Clinkerisation unit and 8 Bulk Packaging Terminals.

UltraTech Cement has been selected as Superbrand and Powerbrand by the Superbrands Council and Powerbrand India respectively.

It is the preferred cement supplier to the most prestigious infrastructural, commercial and residential projects in India.

Bela Cement Works is located in Madhya Pradesh at a distance of 220 km from Jabalpur and 18 km from Rewa. The unit is around 06 Kms from National Highway No. 7 & 30.

The Unit has a cement manufacturing capacity of 2.6 MTPA and clinker capacity of 2.1MTPA. Commissioned in the year of 1996, Bela Cement Works is a 6700 TPD, 6 Stage 2 String, SLC pre-heater plant which is engineered, manufactured and supplied by M/s Larsen & Toubro Limited (FLS).

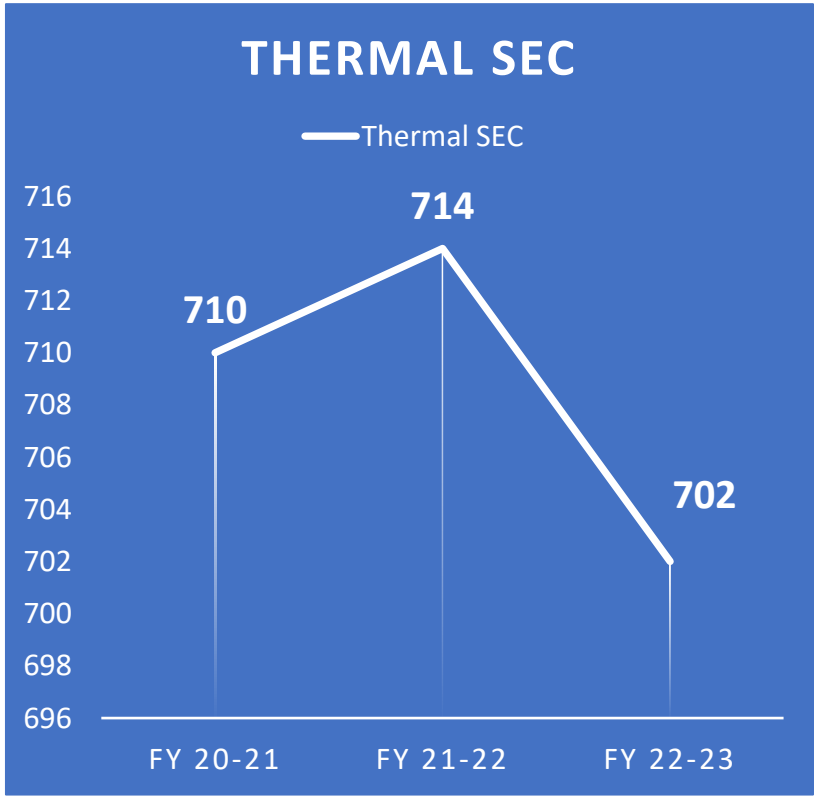
The original capacity of this unit was 4500 TPD, and in the year 2003 it was upgraded to 6700 TPD. The Unit has cement grinding as well as clinker export facility. OPC & PPC grinding facilities are available with product mix of 60:40 ratio.

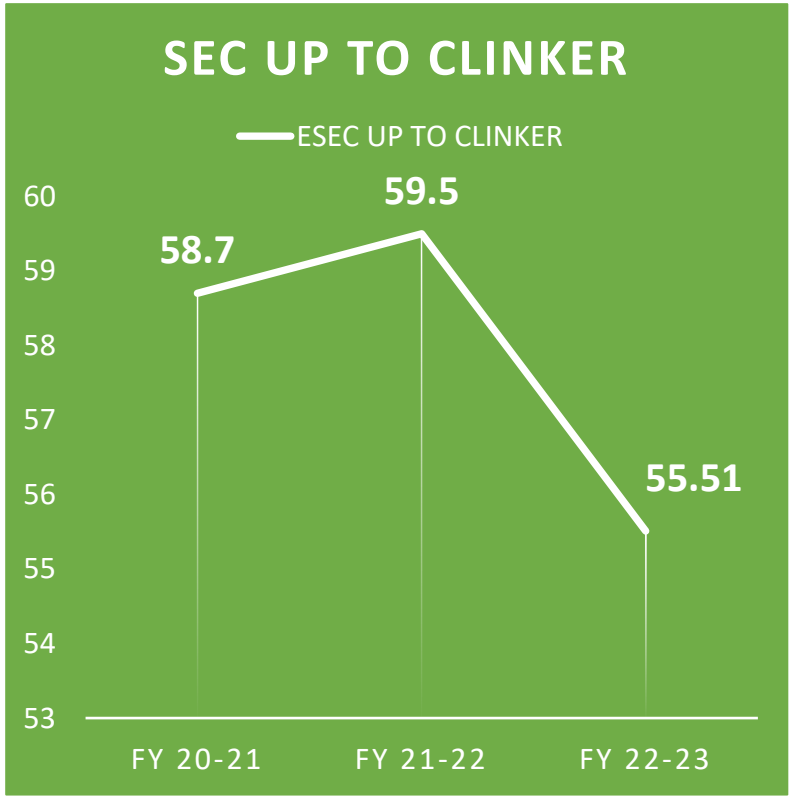
Technology Of Major Sections

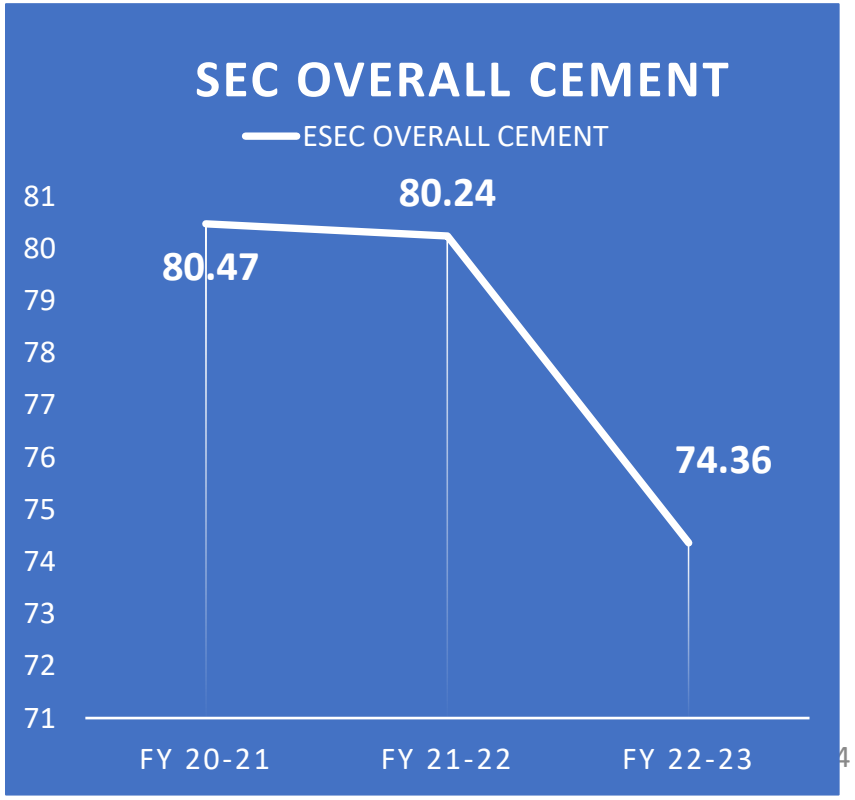
SECTION	TECHNOLOGY	Capacity
Lime stone Crusher	Single Rotor Impactor type (APPM 1822)	900 TPH
Raw Mill	Vertical Roller Mill (Loesche LM 56.4 with LSKS 82 classifier)	470 TPH
Preheater	6 Stage Double String with SLC Calciner	-
Kiln	4.75 meter dia. x 75 meter length (3 roller support with girth gear pinion drive)	6700 TPD
Cooler	Total 3 grate with stationary KIDS. 1st grate IKN, 2nd & 3rd grate FLS.	-
Coal Mill	Vertical Roller Mill (Loesche LM 26.3 with LNV classifier)	50 TPH
Cement Mill-1 with Roller Press	Single chamber mill with KHD Roller press and SKS separator.	270 TPH
Cement Mill -2	Double chamber Mill closed circuit with Sepax separator	170 TPH
Packer	Packers of FLS Ventomatic, Beumer, Spectrum – Total 5 Nos	120 TPH each
TPP	Coal fired AFBC boiler	27 MW
WHRS	Waste Heat Recovery from APH (Air Preheater) & AQC (Air Quenching Cooler)	10.5 MW
Solar Power Plant	PV Module of Longi (540Wp) & Central Invertor of Sungrow	6.017 MW DC

SEC last 3 year FY 20-21 to FY 22-23

Specific Energy	FY 20-21	FY 21-22	FY 22-23	% Improvement (wrt last year)
Thermal SEC (Kcal/kg of Clinker)	710	714	702	1.68
Electrical SEC (kWh/T)				
▪ Up to Clinker	58.70	59.50	55.51	6.71
▪ Overall Cement	80.47	80.24	74.36	7.33

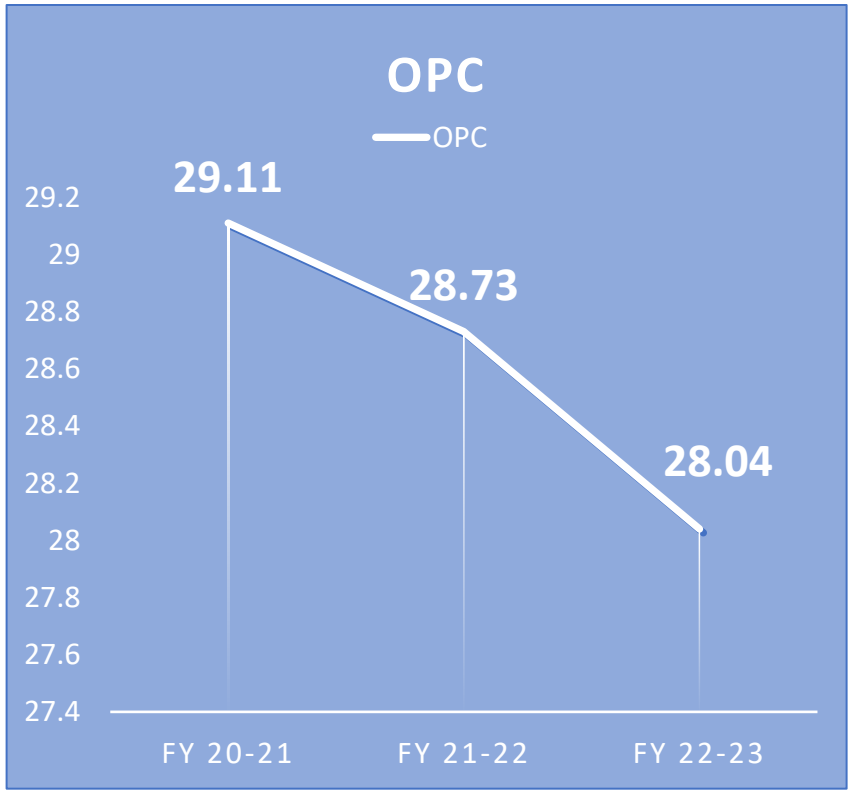


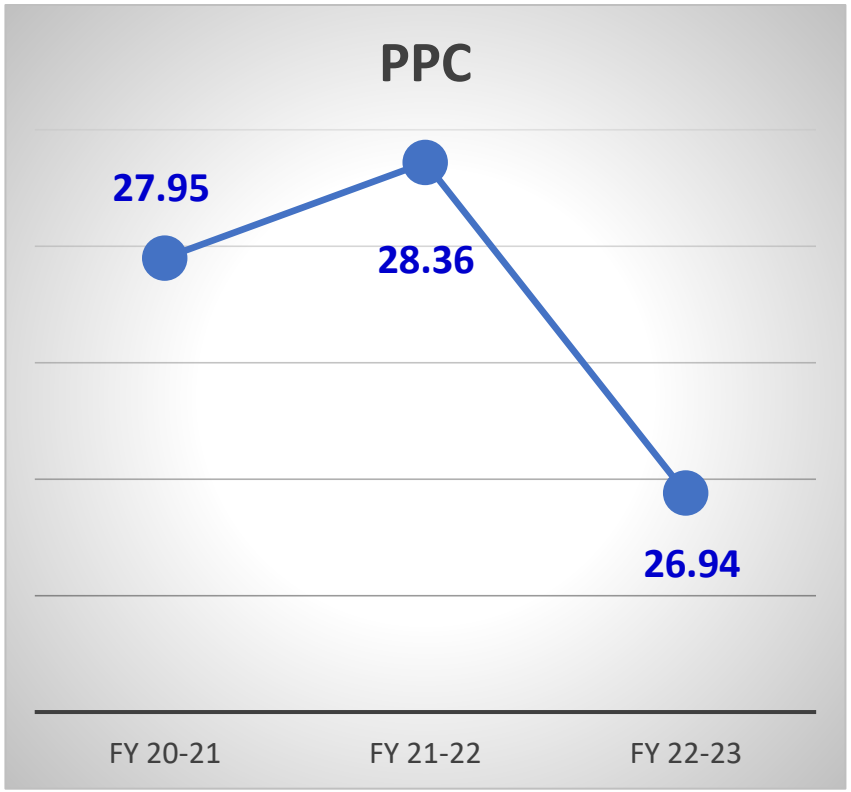


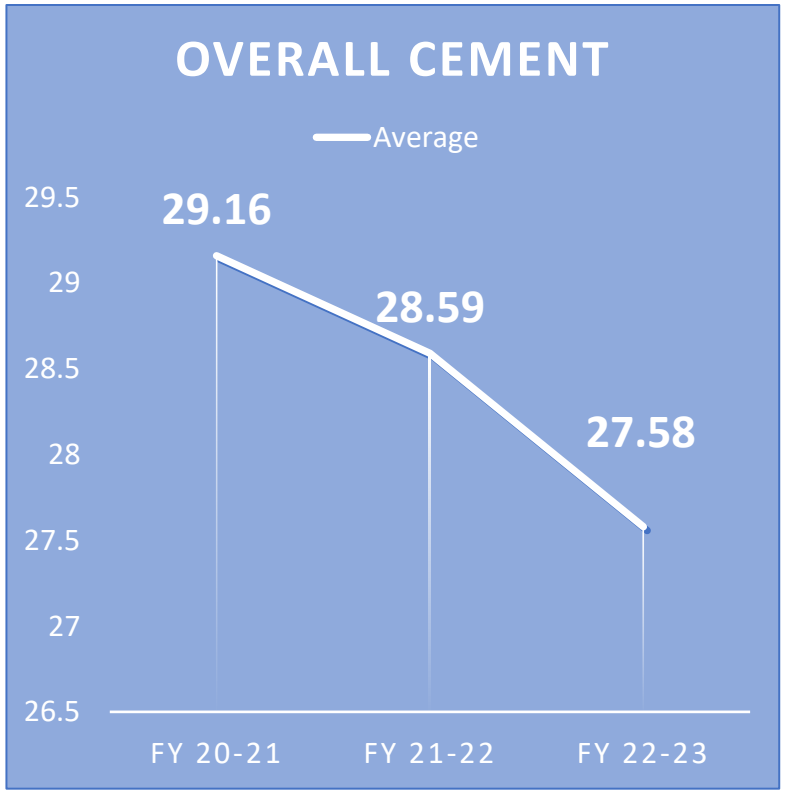


SEC Cement Grinding (kW/MT Cement)

Cement Grinding	FY 20-21	FY 21-22	FY 22-23	% Improvement
OPC	29.11	28.73	28.04	2.40
PPC	27.95	28.36	26.94	5.00
Overall	29.16	28.59	27.58	3.53







Awards & Accolades : National & Global Benchmarks / Standards

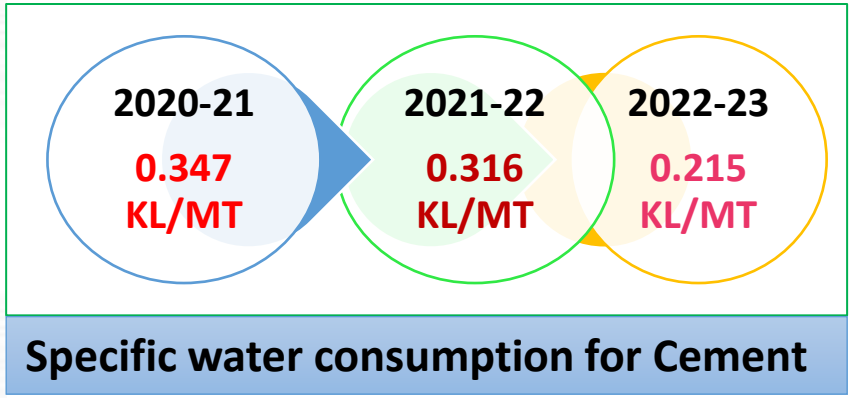
GOLD AWARD – ENVIRONMENT PRESERVATION

SMART MANUFACTURING SUMMIT & AWARDS 2022

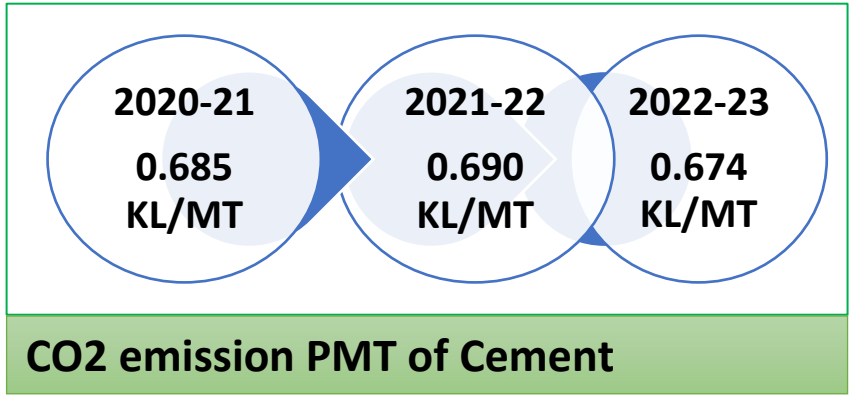
BUREAU OF ENERGY EFFICIENCY - EXHIBITION & DISSEMINATION OF TECHNOLOGIES IN WHRS IN INDIAN CEMENT PLANTS

MINES ENVIRONMENT & MINERAL CONSERVATION WEEK

Bela Cement Works is honored with British International Safety Award-2023.



Specific water consumption for Cement

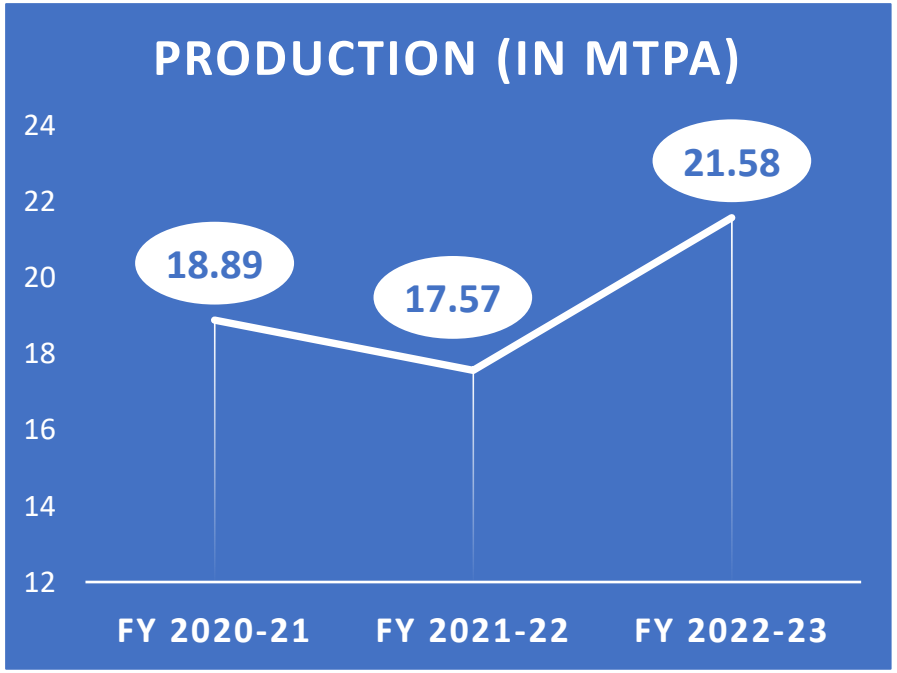


CO2 emission PMT of Cement

Energy Saving project implemented Last 3 year

Year	No of Energy Saving Projects	Investment (INR million)	Electrical Saving (Million kWh)	Thermal Saving (Million kCal)	Total Savings (INR Million)	Impact on SEC / SHC (Electrical kWh / MT Cement or Kcal/Kg Cement)
FY 2020-21	4	5.05	0.985	0	4.923	0.518
FY 2021-22	2	10.05	1.468	0	8.340	0.830
FY 2022-23	4	27.68	3.138	0	19.413	1.452

FY 20-21	FY 21-22	FY 22-23
Saving of 0.985 Million Units	Saving of 1.468 Million Units	Total Saving of 3.138 Million kWh



TOTAL SAVING IN 3 YEARS

5.591 Million kWh

Rs 30.75 Million

Energy Saving project implemented Last 3 year

SL. NO.	Name of Energy Saving Projects FY 2020-21	Investment (INR million)	Electrical Saving (Million kWh)	Thermal Saving (Million kCal)	Total Savings (INR Million)	Impact on SEC / SHC (Electrical kWh / MT Cement or Kcal/Kg Cement)
1	Installation of VFD in identified drives – A) K21FN3: B) CT pump cement mill: C) RP pump	1.5	0.196	0	0.980	0.103
2	Operating CEP to maintain the Deaerator level by VFD control rather than control valve	0.3	0.0228	0	0.114	0.01
3	Replacement of conventional HPSV lights with LED fittings – in cement plant & Colony & installation of astronomical timer in lighting circuit and presence sensors in offices	2.45	0.659	0	3.294	0.349
4	Replacement of low efficiency air conditioner in the plant with higher efficiency air conditioners	0.80	0.107	0	0.535	0.056

Energy Saving project implemented Last 3 year

SL.NO.	Name of Energy Saving Projects FY 2021-22	Investment (INR million)	Electrical Saving (Million kWh)	Thermal Saving (Million kCal)	Total Savings (INR Million)	Impact on SEC / SHC (Electrical kWh / MT Cement or Kcal/Kg Cement)
1	Reduce power consumption in RABH compressor by reducing set point	0.10	0.055	0	0.315	0.03
2	Installation of high efficiency impeller for preheater fan for kiln string	9.95	1.413	0	8.025	0.80

Energy Saving project implemented Last 3 year

S. No.	Name of Energy Saving Projects FY 2022-23	Investment (INR million)	Electrical Saving (Million kWh)	Thermal Saving (Million KCal)	Total Savings (INR Million)	Impact on SEC / SHC (Electrical kWh / MT Cement or Kcal/Kg Cement)
1	Raw mill optimization, false air arresting, nozzle and armour ring optimization	9.50	1.980	0	11.88	0.917
2	Fanless cooling tower for post Clinkerisation circuit as old system consuming more power	0.85	0.0614	0	0.368	0.028
3	Installation of MV VFD for BFP2 to run at lower RPM according to required flow for energy saving	5.40	0.571	0	3.6	0.264
4	Replacement of conventional motor with IE3 energy efficient motors	11.93	0.526	0	3.565	0.243

Mantra: "Basics" for Survival and "Digital" for Enhancement

- Ensure Daily inspection Model by workmen to senior management
- Ensure 100% PM07 compliance by all section
- Capture abnormalities during site round & fast action on closure of the same
- Maintain basic condition of equipment & Follow CLIT standard and improve visual at site
- Improve communication down the line & engagement at site by GRT culture

Basics

- Reduction in standard deviation & Raw mix design as per fuel mix
- Plant operation in narrow band
- Quality as per AQN – maintaining A/S ratio close to 1

- Upkeep of critical spare & readiness, Track and manage inventory
- Ensure Hot Standby Equipment availability
- Replacement of old/ obsolete Spare with higher efficiency
- Installation of Magnetic pulley @ Conveyor Belt Drive pulley
- Zero Foreign Material/ Metal in circuit

- Implement the recommendation of Breakdown and Shutdown Why-Why analysis
- Use of predictive Maintenance-NDT, Vibration, Oil testing, Thermography, EDD, Ultrasound.
- Residual Life value analysis by predictive maintenance

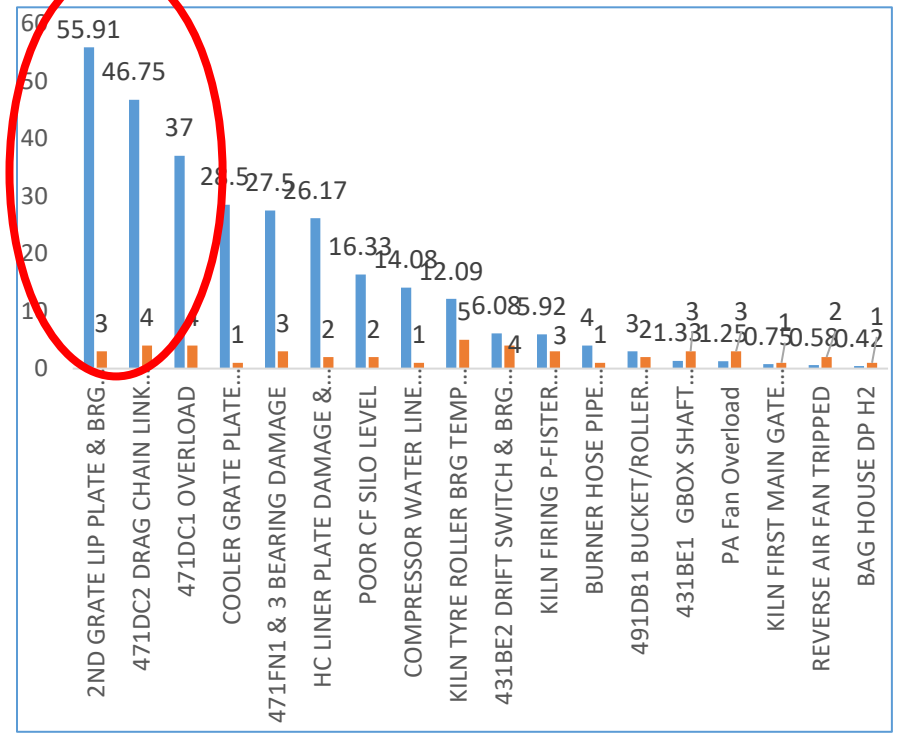
CONCEPT: Power of 1

Mission - 1	Benefit Monthly (Rs. Lac)	Benefit Yearly (Rs. Lac)
Reduction in 1 stoppage Hrs. of Kiln, RM, CO, CM	3.83	40.8
1 Rs. Reduction in Power cost	180	1920
1% increase in PI in Cement	13.43	143.23
1% Fly ash increase in PPC	10.28	109.63
1 Kcal/Kg reduction in Heat consumption	2.61	27.84
1% reduction in false air RM, CO, Kiln	1.77	21.22
1 unit reduction in SP. Power consumption in Clinker	1.80	19.20
1 unit reduction in Power consumption in CMPP	1.80	19.20
1 ton réduction spillage Cement	0.64	6.78
1 ton reduction residual fly ash	0.23	2.40

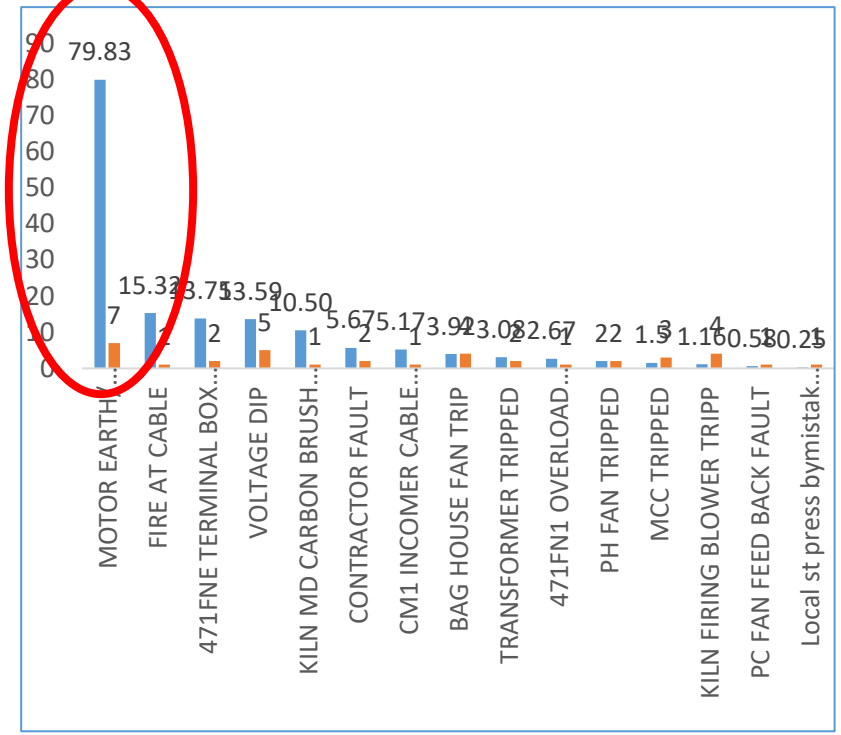
Delta Change in Kiln Breakdown

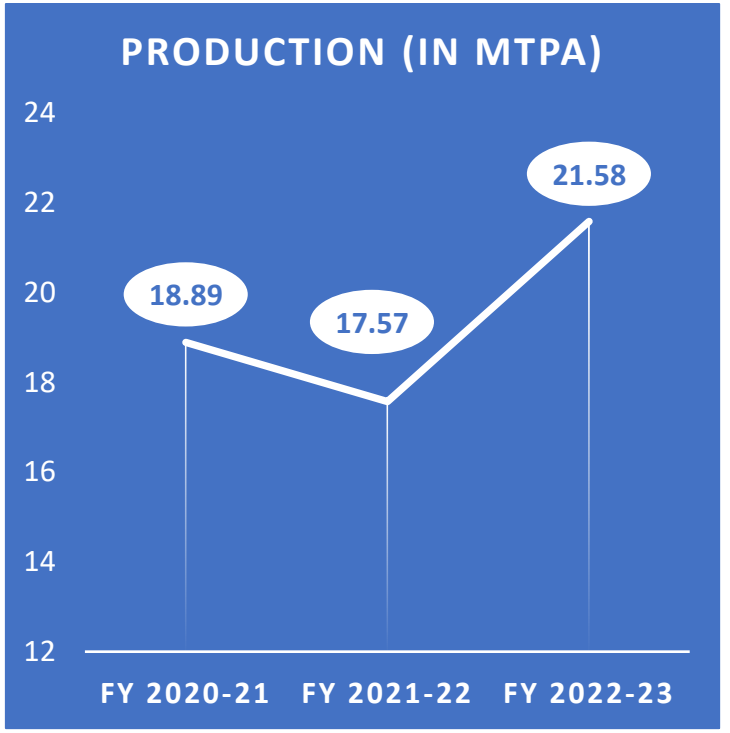
FY	FY20-21		FY21-22		FY22-23		% improvement	
DEPTT	BRK HRS.	FRQ (NOS)	BRK HRS.	FRQ (NOS)	BRK HRS.	FRQ (NOS)	BRK HRS.	FRQ (NOS)
MECH	96.75	18	48.25	8	36.0	4	61%	74%
ELEC	64.08	11	58.25	9	4.75	1		
INST	2.67	5	10.83	5	0	0		
PROCESS	33.92	4	29.5	1	16.3	1		
TOTAL	197.42	38	146.83	23	57.05	6		

Pareto- Mechanical Stoppage



Pareto- Electrical Stoppage



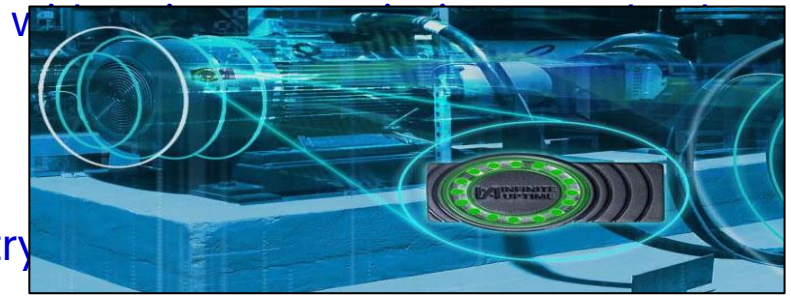


Innovative Projects Implemented

"Digital" for Enhancement

Digitalization is the use of digital technologies and digitized data to impact how work gets done, transform how customers and companies engage and interact, and create revenue. There are various advantages to digitalization including increased energy efficiency, productivity, lower operational costs, improved customer experience, higher agility, enhanced employee morale, improved communication, increased transparency, improved competitive advantage, and faster decision making.

Incorporating powerful techniques can bring about a ***Smart Cement Plant***, which can reduce energy consumption & increase productivity along with reliability while complying w



- ***Industrial Internet of Things (IIoT),***
- ***Artificial Intelligence (AI), and***
- ***Machine Learning (ML)***

are some state-of-the-art technologies behind the new revolution in industry

The measures which has helped in attaining our journey of Energy Excellence are as follows:

- ***IOT – Reliability Enhancement***
- ***AI - Kiln real-time visibility on the health of the Kiln***
- ***Auto Process Control – Process Optimisation***
- ***Optimisation through ML – Process Efficiency***
- ***IOT based flow sensors – Resource Conservation***
- ***Dashboard Reporting – Cloud Technology***

“Digital” for Enhancement

Digital “FUTURE NEXT”

VISION : “ZERO MANUAL INTERVENTION” & “GENERATING 8-9% EBIDTA”

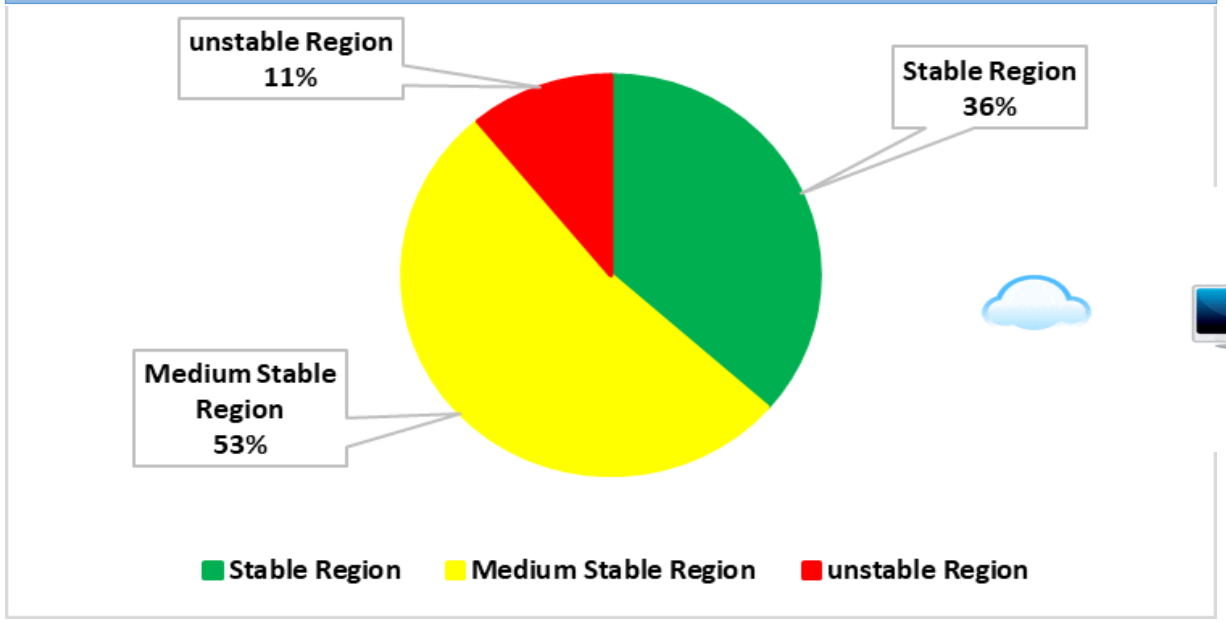
Bela on 80+ Nos of DIGITAL PROJECTS

- **KILN OPERATION CONSISTENCY**: Reducing process variation by KCX-AKXA for Process Reliability: 18 Loop controller provided in system for system correctness with limited or negligible manual intervention
- **24X7 Monitoring**:
  - 328+ IIoT Sensors installed on gearbox, motor with predictive modelling concept
  - 10nos Online bearing temperature monitoring for DBC & bucket elevators
- **BIRD EYE:** Use of Drone Technologies for Visual, Thermal, Thickness measurement
- **REDUCING SD:** CF Silo extraction gate & Auto Sampler counter in DCS
- **SMART CAMERA:** Online monitoring of manual activities in pre-heater hot zone
- **Permanent Magnet indication** at RAW MILL

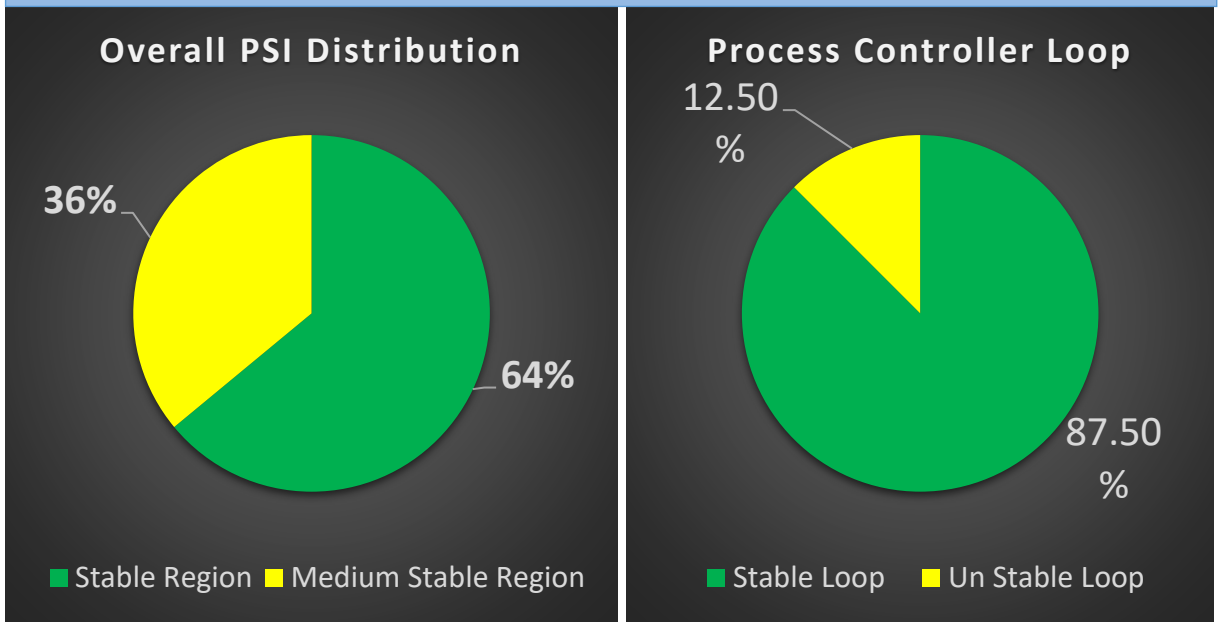
“Digital Results” – Kiln Operation Consistency

Target: Monitor, Detect, Diagnose, Resolve Present Variability, Reduce Yellow Regions & Maximize Green Zones

Before – AKXA – Process Optimizer



After – AKXA – Process Optimizer



Projects: AKXA – Process Optimizer	UOM	Savings Achieved	Rs Cr / Annum
Savings in terms of: ✓ SHC – Specific Heat Consumption ✓ SPC – Specific Power Consumption ✓ KCx – Kiln Consistency ✓ PSI – Process Stability Index	Kcal/kg clinker	10	4.01
	kWh/MT clinker	1.5	1.65

"Digital Results" – IIOT Sensors

Objective:

- To improve MTBF through Online Condition Monitoring,
- Reduction in surprise failure
- Reduction in Unplanned downtime.

Implementation @ Bela : Adopted Industry 4.0, digitalization to improve upon reliability & overall machine performance. This has helped to improve :

- Maintenance cost,
- Unplanned downtime,
- Additionally, it also helps to make a safe workplace.

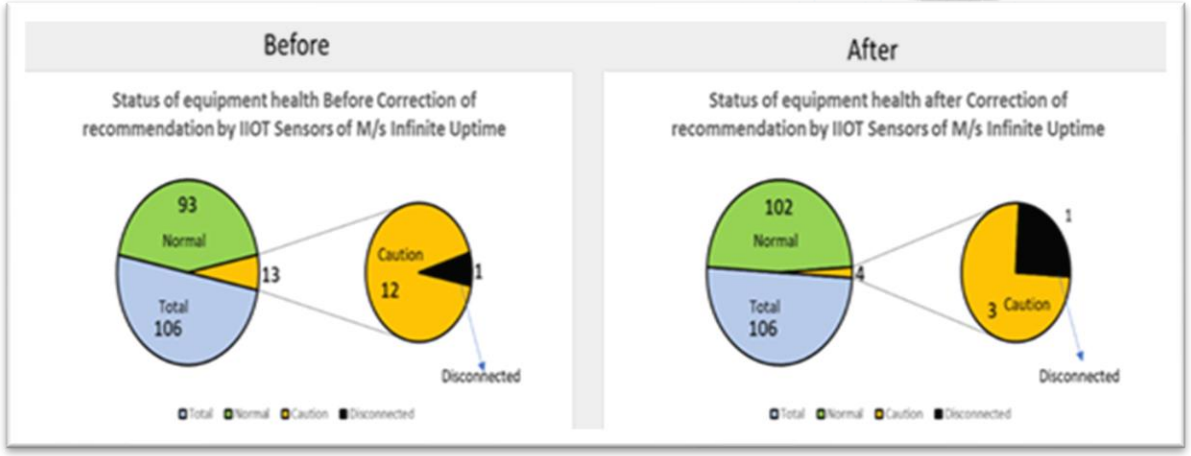
This initiative brings real-time Data with 24X7 monitoring of Equipment Health and Compliance Reporting,

Considering above ,in initial phase we have installed 106 nos. sensor covering 23 nos. of critical equipment. Seeing the performance & benefits achieved, we have now extended sensor installation to total of 74 equipment's with 328 sensors.

Benefits achieved:
Total 24 hrs breakdown saved in Kiln (**Cost savings: Rs 60 lakhs**)

Conclusion: By installation of real time condition monitoring sensor, we are able to proactively predict failure/observation & attend the issue for uninterrupted plant operation.

S.NO	EQUIPMENT	HRS SAVED	ENERGY SAVED (IN KWH)	SAVINGS @ RS 1000/MT (RS LAKHS)
1	471FN1 cooler fan	6	18900	15
2	471FN3 cooler fan	6	18900	15
3	Calciner coal firing blower	4	12600	10
4	TPP PA fan 1 and 2	8	25200	20
5	LS Crusher	12	4368	1



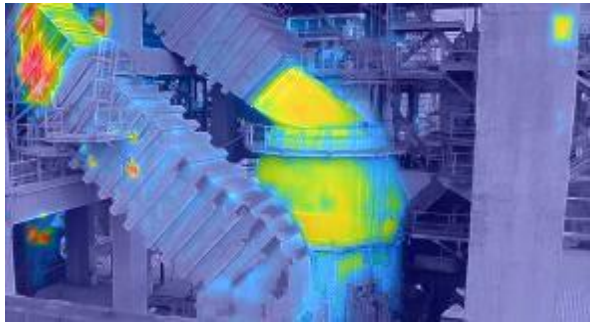
Digitalisation @ Bela – Few Snap Shot

RTD for Bearing Temperature

Air slide Jam Flow sensor

IOT sensor at Cooler Fan

EOW and Packer wise Bag counter



Drone Survey of Assets

Permanent Magnet Indication

VEDA at Load Centre's

Fire Rakshak at Load Centre

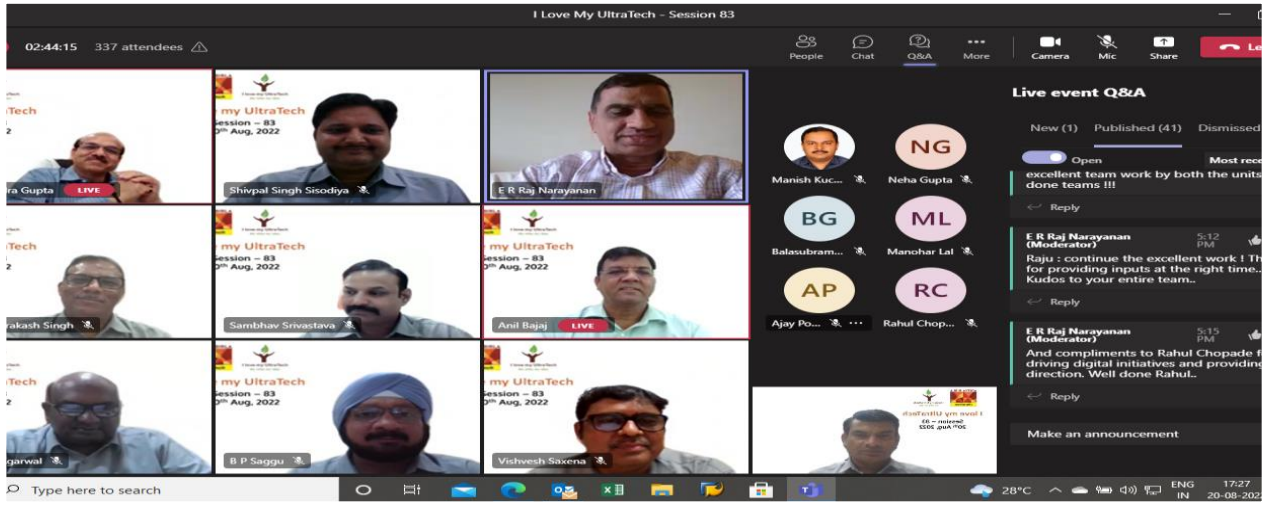
Fence Rakshak with Drone

Smart Camera at PH

Replication Potential of Project

AKXA Process Optimizer & IIOT sensors can be replicated at any Cement Units and possibilities at other industry are also ample.

After piloting these projects in Bela, UTCL other units has also implemented the project, known to improve energy excellence journey through digital transformation.



Next 5 year Strategy @ Bela Vision

Capacity enhancement

- Upgradation of Kiln Cooler 2nd and 3rd Grate
- Raw Mill Capacity upgradation by installation of Vortex Classifier and Roller replacement
- Secondary Crusher to increase Raw mill Capacity
- 2 packer circuit- to increase despatch @ 10500 MTPD
- Installation of Roller press with CM-2

Energy Efficiency Improvement

- Lime stone stacker upgradation for better lime stone homogenization
- Raw Mill-& RABH High efficiency Fan
- RABH Bag replacement 7 compartment
- ***AI - Computer Vision led discovery of Kiln Health to provide real-time visibility on the health of the Kiln***

Safety & Sustainability

- Unloading of Gypsum & Red mud though automated system from WT to Shed
- Under pass at PWD junction
- Underpass at Railway siding gate
- Process optimisation
- Man less operation through Digital initiatives

Cost

- Installation of Solar HM Tower and DG (for general lightening, de-watering pump etc)
- Cement Silo Extraction modification
- Efficiency Improvements Projects
- Calciner string duct replacement
- PH top cyclone replacement with HR+ cyclone

Digitalization

- Crusher Checkpoints for metal sensing in dumper
- Stacker Reclaimer - man less operation
- Intelligent MCC's
- Packing Plant bag counter system
- AI Based monitoring of Input and Output size of Limestone Crusher
- AI based inspection of Fly Ash Bulkers

Reliability

- Upgradation of preheater Change Over Gate
- Kiln Shell replacement work 13 Mtr
- Kiln Outlet tyre replacement and Girth Gear reversal work
- Online monitoring system for Belt bucket elevators
- High resolution Kiln Shell Scanner & Upgradation of UPS System
- Kiln feed elevator belt replacement

Major Encon Project Planned in FY

Year	Title of Project	Annual Electrical Saving (Million kWh)	Annual Thermal Saving (Million Kcal)	Investment (Rs in Million)
2023-24	Cooler Upgradation	-	32175	50
2023-24	Installation of High Efficiency CS Fan along with MVD	4.14	-	40
2023-24	Installation of High Efficiency Bag House Fan	0.96	-	12
2023-24	Installation of Energy Efficient Screw Compressor in Packing Plant & Fly-ash system	0.30		3.9
	TOTAL	5.40	32175	105.9

Utilisation of Renewable Energy

An Onsite Solar Power Plant of 6.017 MW was commissioned on 14th Nov 2022

Onsite Generation				
Year	Technology (Solar/Wind/Biomass)	Installed Capacity (MW)	Consumption (Million kWh)	% of Overall Electrical Energy Consumption
2022-23	Solar	6.017	2.02	0.71%

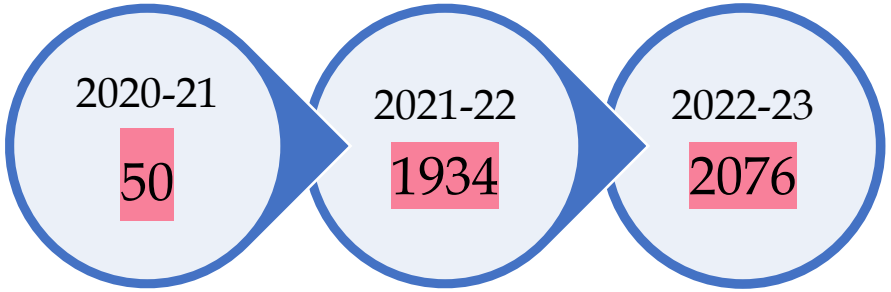
Particulars	UOM	FY 2020-21	FY 2021-22	FY 2022-23
Solar Power usage (%)	%	-	-	0.71%

Waste Utilization and

Waste Utilized as Fuel in last three years

Sl No.	Year	Waste as Fuel	Quantity	GCV	Waste as % of Total Fuel
1	2020-21	Plastic waste	11	4603	0.0001
2	2021-22	BIOMASSBRIQUETTE	209	3418	0.118
		COWDUNG	55	2994	0.031
		PLASTICWASTE	290	3639	0.163
		TOTAL	554	3491	0.312
3	2022-23	BAGGASE	25	4332	0.013
		BIOMASSBRIQUETTE	43	3835	0.022
		CLOTHWASTE	43	4880	0.022
		COWDUNG	11.3	3071	0.006
		PLASTICWASTE	404	3462	0.203
		RICEHUSK	15	3355	0.008
		SAWDUST	4	4567	0.002
		WASTEPOLYBAG	5	3577	0.003
		WOODENDUST	18	4075	0.009
		TOTAL	568	3653	0.284

Enhancement of Thermal Substitution from waste



In Million Kcal

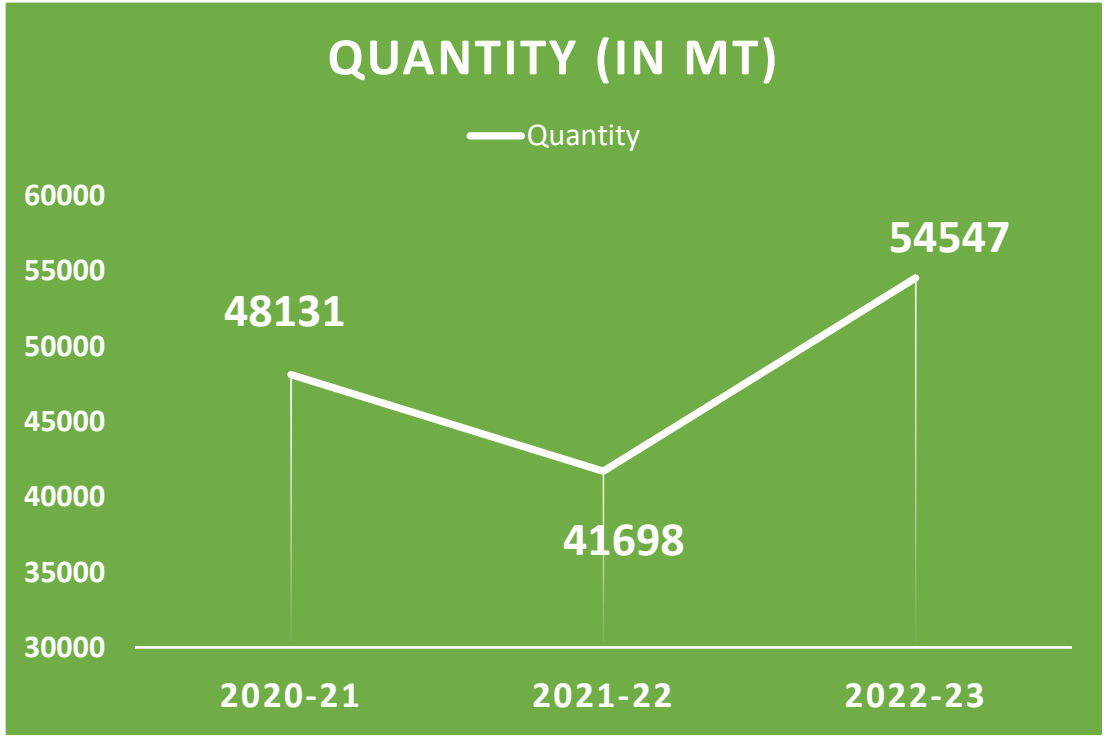
Waste Utilization and Management

Manufacturing of Blended Cement

Waste generated from Power Plant i.e. Flyash is being used in Cement Manufacturing. It results in less use of clinker that leads to use of less amount of limestone.

Waste utilized as Raw Material

Sl No.	Year	Waste as raw material	Quantity	Replaced material	Waste as % of raw material
1	2020-21	TPP Flyash	48131	Clinker	20.26
2	2021-22	TPP Flyash	41698	Clinker	19.77
3	2022-23	TPP Flyash	54547	Clinker	17.78



GHG Inventorisation

1. Climate change (Carbon emissions): -

- Committed to GCCA Climate Ambition 2050 to deliver carbon neutral concrete by 2050.
- GHG emission targets are validated by the Science Based Targets Initiative (SBTi).
- Committed to reduce Scope 1 GHG intensity by 27% upto 2032 from the base year of 2017.
- Committed to reduce Scope 2 GHG intensity by 69% upto 2032 from the base year of 2017.

2. Biodiversity Management ：

- Complete biodiversity assessment for all integrated plants by 2024.
- Committed to No Net Loss of Biodiversity in line with our Group Biodiversity Policy

3. Water Management:

Become 5 times Water Positive company by 2024

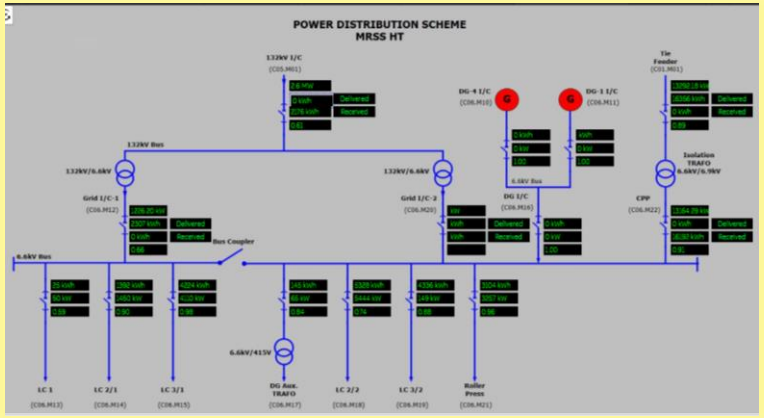
EMS System and other requirements

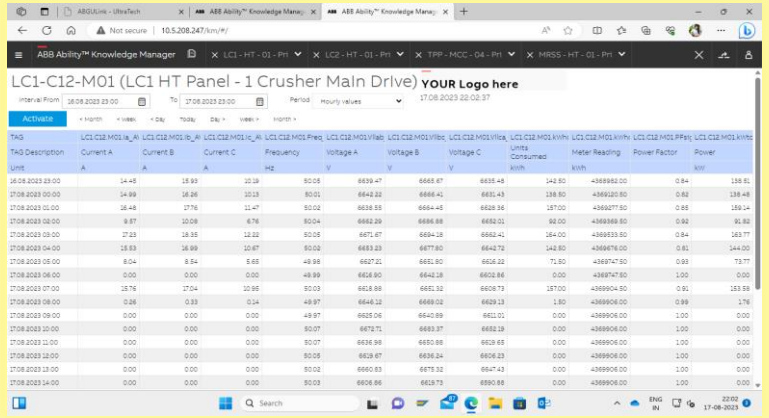
Energy Management :

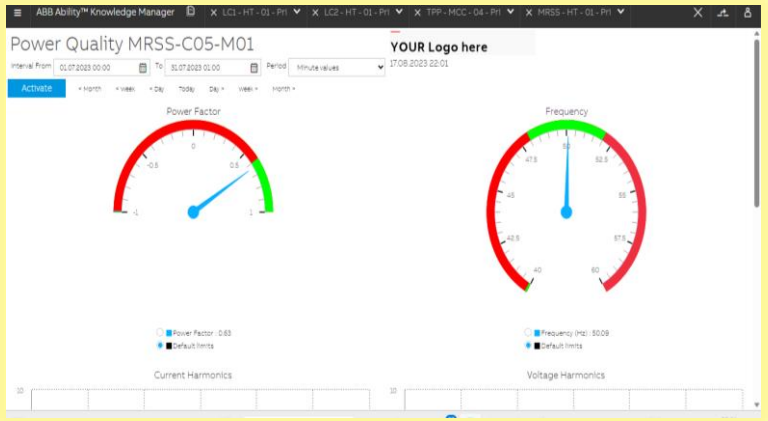
- Committed to double the energy productivity under the EP100 program of 'The Climate Group
- Scale up the share of green power in the overall power mix to 34% by FY2024
- Voluntarily committed to the Task Force for Climate-related Financial Disclosure (TCFD)

Energy Monitoring System:

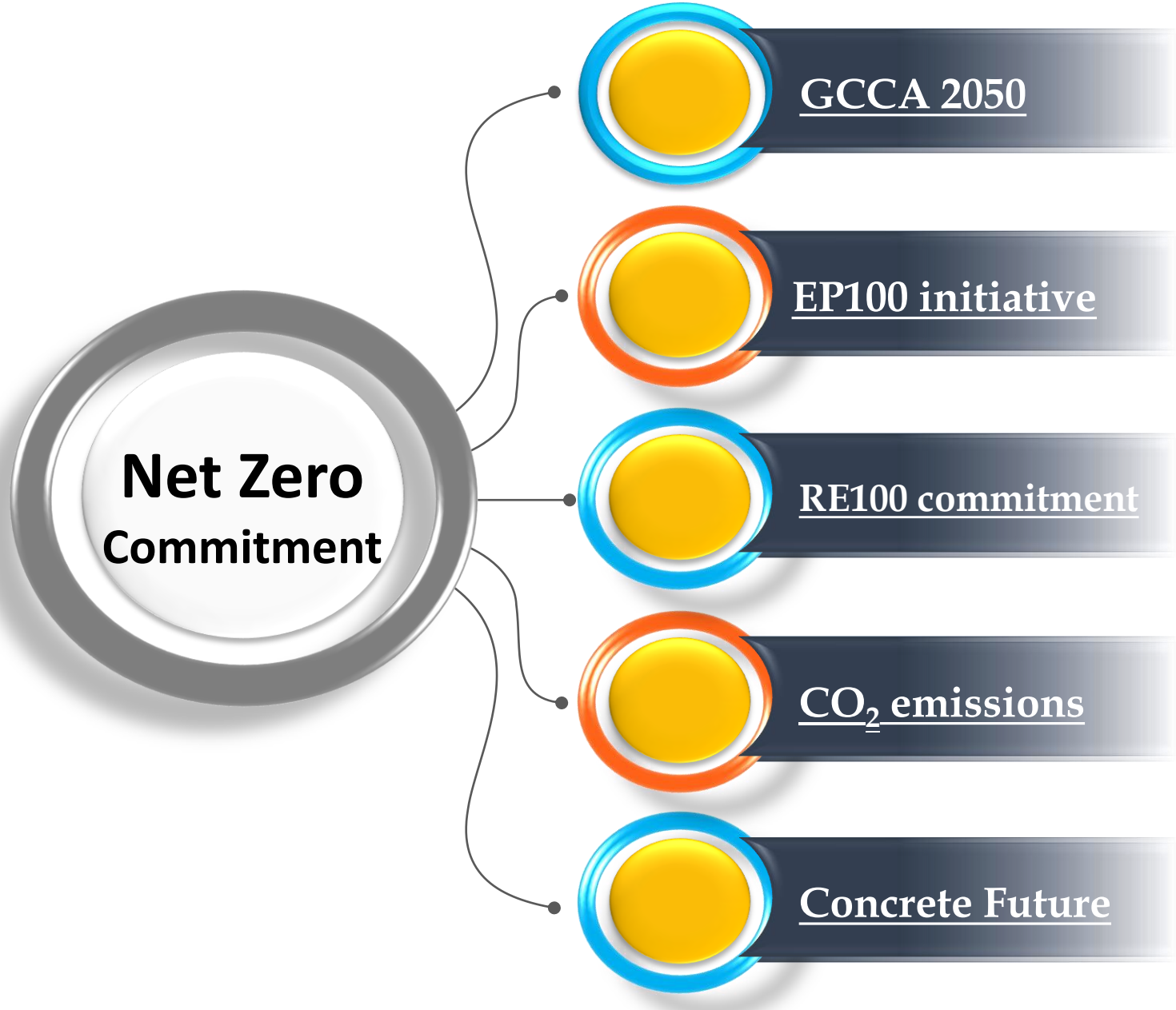
- At Bela Cement Works, Energy Monitoring System of ABB Ability Knowledge Manager is being used from last 3 years to analyze the scope of improvement in Electrical Energy Consumption using different options like power consumption of each minutes, graphs, mimics & dashboard representation etc.







Net Zero Commitment



UltraTech Cement Limited, announced its commitment to the **GCCA 2050** Cement and Concrete Industry Roadmap for **Net Zero Concrete**

Part of its **EP100 initiative**, UltraTech targets to double energy productivity by FY35, from the base year of FY10

As part of its **RE100 commitment** led by the Climate Group in partnership with CDP, the Ultratech aims to meet 100 per cent of its electricity requirement through renewables sources by 2050

Committed to produce carbon neutral concrete by 2050 and to fully contribute to building the sustainable world of tomorrow. The Roadmap also includes a sectoral commitment to cut **CO_2 emissions by a further 25% by 2030**

The '**Concrete Future**' roadmap is built around a seven-point plan actions to reduce the amount of CO_2 intensive clinker in cement, reduce fossil fuels, and accelerate innovation in products, process efficiency & breakthrough technologies including carbon capture

ADITYA BIRLA
UltraTech

Thank You