

ASPIRE PROGRAMME

Accelerating Smart Power & Renewable Energy in India

Sectoral Workshop on BEST PRACTICES IN ENERGY EFFICIENCY IN CEMENT SECTOR

A PATH FOR DECARBONISATION

March 14, 2023

Udaipur, Rajasthan, India

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ABBREVIATIONS

Abbreviations & Acronyms	
AC	Air Conditioner
AFR	Alternate Fuel Resources
AI	Artificial Intelligence
APBS	Amine Promoted Buffer Salts
APCS	Advanced Process Control Suite
AQC	After Quenching Cooler
ASPIRE	Accelerating Smart Power and Renewable Energy in India
BEE	Bureau of Energy Efficiency
CNG	Compressed Natural Gas
CPP	Captive Power Plant
CU	Capacity Utilisation
DCs	Designated Consumers
EE	Energy Efficiency
ESP	Electrostatic Precipitator
FCDO	Foreign Commonwealth and Development Office
GESI	Gender Equality Social Inclusion
GHG	Greenhouse gases
IDEEKSHA	Industrial Decarbonisation and Energy Efficiency Knowledge-Sharing Platform
IEE	Industrial Energy Efficiency
IEED	Industrial Energy Efficiency and Decarbonisation
IoT	Internet of Things
IT	Information Technology
KEP	Knowledge Exchange Platform
kWp	Kilo Watt Peak
MTOE	Million Tonnes of Oil Equivalent
MW	Mega Watt
NCCBM	National Council for Cement and Building Materials
NMEEE	National Mission on Enhanced Energy Efficiency
OLBC	Overland Belt Conveyor
OPSD	Online Particle Size Distribution

Abbreviations & Acronyms

PAT	Perform Achieve and Trade
pH	Potential Hydrogen
PLF	Plant Load Factor
POSH	Prevention of Sexual Harassment
PPC	Portland Pozzolana Cement
R&D	Research and Development
RDF	Refuse Derived Fuel
RE	Renewable Energy
RTBS	Real-Time Belt Scanning
SPC	Specific Power Consumption
TPP	Thermal Power Plant
UHF	Ultra-High Frequency
UCWL	Udaipur Cement Works Limited
VAM	Vapour Absorption Machine
VRM	Vertical Roller Mill
WHRS	Waste Heat Recovery System



BACKGROUND

India is the second largest producer of cement in the world, with an installed capacity of **500+** million metric tons per annum (MTPA), i.e., **7+**% of the global installed capacity. In 2022, India produced **370+** million metric tons (MT) of cement (**~9%** of global production). Demand for cement in India is estimated to touch **~420 MT** by **FY 2027** and the industry promises huge potential for growth as India has a high quantity and quality of limestone deposits throughout the country. Cement production in India grew at a CAGR of **~6%** in **FY2016-22**, driven by demands in roads, urban infrastructure, and commercial real estate. Private sector companies account for **~98%** of India's total cement production capacity. The cement industry accounts for **~8%** of the **total national emissions in India**, making it critical to decarbonising the sector to aid in achieving India's goal of **net zero by 2070**. As per the Energy Conservation Act of **2001**, a cement plant with an annual consumption of over **30,000 MT** of oil equivalent (MTOE) is notified as a designated consumer (DC). Out of the **206** large cement plants, **175** plants/ DCs, accounting for **65%** (**~325 MTPA**) of India's total cement production capacity, are covered under The Perform Achieve Trade (PAT) scheme of the Bureau of Energy Efficiency (BEE). A total of **175** large cement units are covered under the BEE's PAT scheme, offering **~2.12 MTOE** and **~7.2 MTCO₂e energy savings and decarbonisation potential respectively**. Several leading cement industries in India have announced a wide range of initiatives as a part of the decarbonisation commitments.

The cement sector in the UK contributes **GBP ~1 billion** to the economy each year. **About 10 million tonnes** of Portland cement (**90%** of the cement market in the UK), is produced annually at **12** production facilities across the UK including grindings, and two blending facilities. UK's cement sector offers some key technologies, solutions, and best practices in the areas of:

- Carbon, Capture, and Storage
- Low energy drying technology
- Novel low-carbon cement raw materials
- IT & IoT-based digital technologies/ solutions

The strengths and capabilities of the UK cement sector can be leveraged to facilitate a rapid transition of the Indian cement sector's journey to net zero.

In view of the above, a one-day sectoral workshop was organised in Udaipur, Rajasthan (India) on 14th March 2023 under Accelerating Smart Power and Renewable Energy in India (ASPIRE) programme¹. The workshop was jointly organised by FCDO and the Bureau of Energy Efficiency (BEE). The theme of the workshop was - **“Best Practices in Energy Efficiency & Decarbonisation in Cement Sector”**. During the workshop, the stakeholders deliberated on best practices, technologies, and policy interventions required to accelerate the decarbonisation of the cement sector. In the workshop, some key organisations from the UK Cement sector presented various leading best practices and technologies adopted in the UK.

¹About ASPIRE Programme

Accelerating Smart Power and Renewable Energy in India (ASPIRE) is a bilateral programme implemented by Foreign Commonwealth and Development Office, Government of UK in association with Ministry of Power and Ministry of New and Renewable Energy, Government of India. KPMG is the lead delivery partner for the ASPIRE programme. Idam Infrastructure Advisory Private Limited (India) and Carbon Trust (UK) are the key consortium members.

Objectives of the Workshop



Apprise stakeholders about the IDEEKSHA platform and its key functionalities



Provide an overview of impact of the PAT scheme and various IEED measures implemented in the cement sector



Share best practices/ technologies for enhancing IEED and identify learnings from UK experience



Disseminate knowledge and information on new and emerging IEED technologies available globally including from the UK

Highlights

72

participants from
India and UK

4

interactive
technical sessions

Active participation from
various leading cement
manufacturers in India along
with technology providers
from the UK and India
(including senior officials
and executives)

Active participation of women including **5** women speakers

INAUGURAL SESSION



(L – R) Mr. Vivek Negi, Mr. Balawant Joshi, Mr. Naveen Sharma, Ms. Radhika Tomar, Mr. K. K. Chakarvarti, Mr. Sunil K. Khandare (Virtually)

Speakers



Ms. Radhika Tomar
Head-Energy Sector Reform,
British High Commission



Mr. Sunil K. Khandare
Director, Bureau of Energy
Efficiency (BEE)



Mr. Naveen Sharma
Whole Time Director, Udaipur
Cement Works Limited (UCWL)



Mr. K. K. Chakarvarti
Sr. Advisor, IDEEKSHA,
(ASPIRE Team)



Mr. Balawant Joshi
Managing Director, Idam Infra
(ASPIRE Team)



Mr. Anurag Sirola
Manager, KPMG India
(ASPIRE Team)

Session Summary

- Globally, cement sector accounts for **~8%** of total CO₂ emissions
- Indian cement manufacturers are amongst the top-performing global cement manufacturers in terms of production facilities, technology, and energy efficiency
- Leading cement industries in India have taken several initiatives to decarbonise their operations and enhance energy efficiency:
 - Cement industries in India achieved **~36% reduction in CO₂ emission** levels from **1.12 tCO₂/t** to **0.719 tCO₂/t** of cement produced from **1997 to 2017**
 - The specific energy consumption of Indian cement manufacturers stands at **670 kcal/kg of clinker** and **~68 kWh per tonne (t)** of cement, which is at par with global standards
 - The current clinker factor of cement plants in India stands at **0.77** i.e., **770 kg** of clinker is required to produce **1t** of cement with the addition of additives
- IDEEKSHA (Industrial Decarbonisation and Energy Efficiency Knowledge Sharing) platform developed under the ASPIRE programme in collaboration with BEE. The platform was launched by Shri R. K. Singh, Hon'ble Cabinet Minister of Power and New & Renewable Energy on March 1, 2023, during 21st Foundation Day Event of BEE
- Decarbonisation of the cement industry can be enabled by focusing on the following aspects:
 - Installation of Renewable Energy (RE) projects
 - Implementation of waste heat recovery systems (WHR)
 - Fuel switching or electrification of cement kiln operation
 - Increase in usage of alternate fuels (AF)
 - Improving resource efficiency
 - Adoption of new and emerging technologies such as Carbon, Capture, and Storage
- Udaipur Cement Works Limited (UCWL) has made significant efforts in enhancing its energy efficiency and to decarbonise its operations. Some of the measures include:
 - Target to achieve **net-zero** status by **2040**
 - More than **48%** of its total electricity requirement is met from renewable sources i.e., solar and WHR systems
 - First and only cement company in India to install **1 MWp** of a floating solar unit at an abandoned pit in the mines area, setting a new standard for innovation and sustainability

TECHNICAL SESSION I

PERFORM, ACHIEVE, AND TRADE SCHEME FOR THE CEMENT SECTOR

Speakers



Mr. K. K. Chakarvarti
Sr. Advisor, IDEEKSHA,
ASPIRE Programme



Mr. Vivek Negi
Joint Director, BEE

Key Takeaways

- Perform, Achieve and Trade scheme is a flagship scheme of BEE under the National Mission on Enhanced Energy Efficiency (NMEEE). PAT scheme is a regulatory instrument to reduce specific energy consumption in energy-intensive industries, with an associated market-based mechanism to enhance the cost-effectiveness through certification of excess energy saving which can be traded
- PAT Cycles I-III (2021-2020) implemented by BEE have resulted in energy savings of **24.34 MTOE** and emission reduction of **105.86 MTCO₂e** across **13** covered large energy-intensive industrial sectors
- In the cement sector, thermal and electrical energy consumption account for **~70%** and **~30%** of the total energy consumption, respectively
- Total energy savings achieved by **14** designated consumer (DCs) industries from the cement sector was **0.149 MTOE**

- PAT scheme has brought significant changes in the cement industry, including the following:
 - Helped in the promotion of advanced energy-efficient technologies.
 - Promoted exploration of Low clinker content cement.
 - Capacity building and awareness of plant personnel towards energy efficiency.
 - Constitution of Sectoral Advisory Group Committee.
 - Assists in the mitigation of GHG emissions and reduction of the carbon footprint of the industry.
 - Promoted adoption of an Energy Management System
- R&D proposals in association with the National Council for Cement and Building Materials (NCCBM):
 - Design of an Alternative Fuel dryer for cement plants by utilising cooler electrostatic precipitator (ESP) vent air
 - Detailed research study of solar thermal energy for medium temperature application (**150°C - 400°C**) in the cement industry
 - Integration of RDF (Refuse Derived Fuel)/ biomass gasification to cement plant calciner to enhance fuel utilisation in the Indian cement industry
- The Government of India undertook the following initiatives to address the issue of significant price fluctuations of ESCerts during PAT Cycle I:
 - Validity of ESCerts extended till the time they are not sold
 - Floor price of ESCerts fixed at **10%** of the price of one TOE of energy consumed for PAT Cycle II i.e., **INR 1,804**

TECHNICAL SESSION II

SHARING OF BEST PRACTICES BY INDIAN CEMENT UNITS

Speakers



Mr. Nitin Jangid
UCWL



Mr. Ronit Singh
UCWL



Mr. Vikas Garg
UCWL



Ms. Shikha Trivedi
UCWL



Mr. Hitesh Kotharia
Aditya Cement,
Chittorgarh



Mr. Diwakar Naidu
Aditya Cement,
Chittorgarh



Mr. Anil Bijolia
Aditya Cement,
Chittorgarh



Mr. Rajnikant
Manawat, Process
Expert Services



Ms. Karishma
Vikram Cement,
Neemuch



Mr. S. Rao
Vikram Cement,
Neemuch



Mr. Rakesh
Vikram Cement,
Neemuch



Mr. Chandan
Vikram Cement,
Neemuch



Ms. Pooja
Vikram Cement,
Neemuch



**Mr. Chandan Kumar
Parasar**
Orient Cement



Mr. Pankaj Tiwari
J. K. Lakshmi
Cement Ltd., Sirohi



Mr. Manoj Ubana
J. K. Lakshmi
Cement Ltd., Sirohi

Key Takeaways

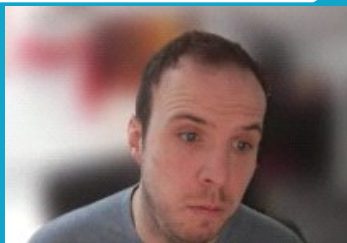
Company	Measures adopted to enhance energy efficiency/enable decarbonisation
UCWL	Target to be carbon neutral by 2040 through the below key measures: - Improving blended cement by 20% (CO₂ reduction by 160 kg) - Increasing RE and EE in the total energy mix (CO₂ reduction by 30 kg) - Increasing use of alternate fuel resources (AFR) & reducing coal by 15% (CO₂ reduction by 45%) - Transition from diesel-based bulkers to electric-based rakes for green transportation of bulk loose cement in association with Container Corporation of India Ltd. This innovative step to enhance logistical efficiency and environment conservation has resulted in saving of ~20,000 kg CO₂ per rake movement UCWL has adopted the following IT-based emerging technologies: - IoT Sensors for real-time condition monitoring of equipment - Real-time belt scanning system (RTBS) in Overland Belt Conveyor System (OLBC) - Online Particle Size Distribution (OPSD) system for mills - AI-based “Advanced Process Control Suite (APCS)” for kiln & mills optimisation - Tracking of Vehicles by UHF (Ultra High Frequency)
Aditya Cement, Chittorgarh	Energy conservation best practices adopted: - Reduction in Specific Power Consumption (SPC) of raw mills through in-house modifications & optimization - Increase in WHRS generation by improving - AQC (After Quenching Cooler) boiler inlet temperature - Technology Upgradation from the fanned cooling tower to fan-less cooling Tower - Replacement of Package AC (Air Conditioner) with VAM (Vapour absorption machine) - Improvement in Grid Power Factor Low-carbon initiatives undertaken: - Enhance WHRS power generation - Increase fly ash absorption in PPC (Portland Pozzolana Cement) from 31 to 35% keeping the same Cement Strength at 1 day and 28 days - New alternate local vendors developed for sustainable sourcing of raw mix additives like Bauxite & Red Ochre High grade
Vikram Cement, Neemuch	Committed to be net-zero by 2050 and has adopted the following best practices: <u>Renewable energy utilization</u> – Installation of 8.9 MWp ground mounted solar PV and 482 kWp rooftop solar plant <u>Systematic Improvement & Innovation</u> – - Installation of VAM system in place of Centralise AC - Replacement of old non-efficient reciprocating compressor with screw compressor of same capacity - Installation of air loss trap in place of electronic drain at air receivers - Use of astrological daylight timer for street lighting & plant buildings

Company	Measures adopted to enhance energy efficiency/enable decarbonisation
	• <u>Digitalisation</u> – ○ Use of predictive AI-based model for Kiln operation and Optimisation ○ IoT-based vibration measurement & analysis ○ Advance AI for boiler reliability & performance, and AI based system to increase cement mill productivity • <u>Alternate Fuel & Raw (AFR) Material Utilisation</u> – Increased utilisation of agro & liquid fuel and plastic waste
Orient Cement	• Optimisation of grinding media without affecting productivity and quality • Interconnection of compressed air line for unloading multiple Flyash bulkers at a time • Replacement of reciprocating compressor with screw compressor • Derated cement silo extraction blower as per the required air quantity for transportation
J. K. Lakshmi Cement Ltd., Sirohi	• Usage of Fly Ash chemical gypsum and jarosite to improve clinker factor • Usage of various AFR (Liquid, hazardous, and non-hazardous waste) • Continuous increase in usage of renewable energy resources (WHRS & Solar) • Usage of TPP (Thermal Power Plant) fly ash as a fuel • Use of rainwater harvesting system
Industry best practices for ensuring energy efficiency during plant shut down	• Welding of the cyclone down pipe flanges to avoid false air • All main doors and pocking holes should be closed with asbestos/ ceramic ropes • Use of graphite ropes in the flaps movement area • Ensure proper sealing of both the Kiln outlet and inlet during shutdown to reduce false air

TECHNICAL SESSION III

LOW CARBON & DIGITAL TECHNOLOGIES FOR THE CEMENT SECTOR FROM THE UK

Speakers



Mr. Aaron Lucid
Carbon Upcycling, UK



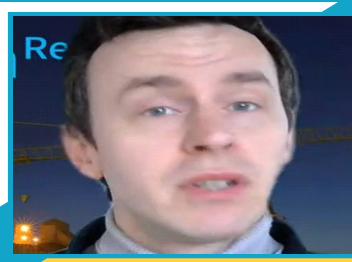
Mr. Niraj Singh
Carbon Clean, UK



Mr. Chris Every
Coomtech, UK



Mr. Anand
Hitech Facility, Authorised
Partner of Centrica, UK



Mr. Daniel Summerbell
CarbonRE,
Delta Zero Cement, UK



Mr. Dalraj Nijjar
Concrete4change, UK



Ms. Selin Murat
Carbon8, UK

Key Takeaways

- **Carbon Upcycling** transforms low-reactivity materials into SCMs (supplementary cementitious materials) that surpass the minimum standards for use in concrete, thus tackling two massive problems:
 - Unmanageable amounts of industrial CO₂
 - Landfills of industrial by-products and natural minerals
- **Carbon Clean's** patented Carbon Capture Technology using CDRMax™ process allows capturing more carbon at the lowest cost, all while meeting strict environmental criteria. The CDRMax™ process captures carbon dioxide from the industrial flue gases or off-gases emitted from power plants, boilers, kilns, and chemical facilities. The process produces carbon dioxide with purities ranging from **95%** to **99%**, which can then be sold, reused, or sequestered
- **Coomtech** highlighted that millions of tonnes of materials are dried using inefficient old thermal drying technology, wasting vast amounts of energy and generating millions of tonnes of CO₂. Coomtech's kinetic drying technology can dry cementitious products with up to **75%** less energy and emissions than traditional drying technologies
- **Centrica's** patented technology driven by wireless sensors & advanced analytics from power radar software enables machine-level energy management systems for enhancing operating margins and driving sustainability across the organisation
- **CarbonRE's** artificial intelligence and machine learning platform known as "Delta Zero Cement", can harness existing industrial data to produce sophisticated modeling of energy-intensive processes and optimise fuel use, resulting in reductions in specific heat consumption, with lower operating costs and lower emissions
- **Concrete4Change** is developing a novel technology for carbon sequestration within the concrete, helping concrete manufacturers and construction industry achieve net zero
- Carbon-intensive practices, lead to high-embodied carbon products with single-life material management and the associated landfill cost. **Carbon8's** technology enables a closed-loop system, recycling waste streams through carbon sequestration. Carbon8 converts carbon and residues into sustainable value streams with its TRL 9 technology which permanently captures and utilises CO₂

TECHNICAL SESSION IV

SHARING OF ENERGY EFFICIENCY BEST PRACTICES & TECHNOLOGIES BY INDIAN TECHNOLOGY SUPPLIERS

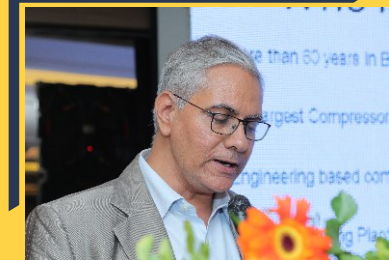
Speakers



Mr. Madhusudan
IKN India



Mr. Ketan Goel
Invotech Industrial
Solutions Pvt. Ltd.



Mr. Jayraj Thakar
Kaishan Machinery
India Pvt. Ltd.

Key Takeaways

- IKN India provides cutting-edge technology for the cement industry, including 'KIDS 4.0' - a revolutionary Clinker Inlet Distribution System designed to tackle the challenging operating conditions that arise from the use of alternative fuels and high-sulphur content
- Invotech Industrial Solutions Pvt. Ltd. offers innovative technologies to arrest false air and enhance energy efficiency for various areas such as upper cyclones, VRMs (Vertical Roller Mill) & power plants (up to 180°C), for bag-house & bag-filters of raw mill, cement mill, and coal mill, etc.
- Kaishan Machinery India offers energy-efficient low-pressure compressors which can operate between **2 to 3 bar**

CONCLUDING SESSION

Speakers



Mr. K. K. Chakarvarti, Sr. Advisor, iDEEKSHA, ASPIRE Programme

Key Takeaways

- Enhancing energy efficiency and decarbonisation of industries, particularly in the cement sector, is crucial to achieving sustainability & India's energy transition to net zero.
- ASPIRE programme intends to support large energy-intensive industries in the adoption of low-carbon technologies and solutions through collaboration with global technology suppliers including from the UK.
- Coomtech's Kinetic Air Drying Technology, Carbon Clean's CCUs technology, and CarbonRE's AI & ML platform offer significant potential in enhancing energy efficiency and help in decarbonisation of the cement sector. Stakeholders from the Indian cement industries expressed significant interest in these technologies. Stakeholders highlighted the need for programmatic interventions for the transfer of technologies and accelerating the deployment of such novel low-carbon technologies
- The workshop deliberated on innovative measures adopted by Indian cement manufacturers and new-age technologies and solutions required to accelerate the decarbonisation of the cement sector

FEEDBACK FROM THE PARTICIPANTS

- Around **71%** of the participants responded that they were more than satisfied with the outcomes of the workshop (*provided an 8 + rating on a scale of 10*)
- About **65%** of the participants rated the quality and content of the delivery as more than satisfactory (*provided an 8 + rating on a scale of 10*)
- The technical session III-Low Carbon & Digital Technologies for Cement Sector by UK Technology Suppliers was highly appreciated by the participants
- Many participants recommended similar sectoral workshops for the cement sector
- Participants expressed their interest to know more about the following IEE (Industrial Energy Efficiency)/Decarbonisation technologies from the UK:
 - Waste heat recovery and utilisation output
 - Low carbon technologies
 - Energy, data management, and reporting
 - Recycling technology and process
 - CCUs technology
- Women account for **~10%** of total employee strength in most of the participating cement organisations
- Some of the initiatives undertaken by participating organisations to promote Gender Equality and Social Inclusion (GESI) include:
 - Recruiting female candidates from campus placements and conducting classroom trainings on Equality & Inclusion at the workplace to generate awareness
 - Training and course on POSH (Prevention of Sexual Harassment) law
 - Creating GESI-related awareness

“The workshop provided a comprehensive understanding of the latest advancements in energy efficiency and decarbonisation within the cement industry”

Mr. Ashish Das
Manager Shree Cement

“The event offered an insightful platform for sharing best practices and emerging technologies”

Mr. Nitin Gupta
Manager, Production
Birla Corporation Limited

“Adopting best practices from peer plants and promoting horizontal deployment while fostering the development of novel ideas”

Mr. Bharat Bhudhan
Project Engineer
NCCBM, Faridabad

CONCLUSION



Group photograph of participants

The response to the sectoral workshop has been positive with significant participation from BEE officials, leading Indian Cement industries, and technology and solutions providers from India and UK. The workshop appears to have provided a platform for national and international organisations to share their best practices and technologies for enhancing IEED measures in the Indian cement sector. The workshop successfully promoted GESI through the active participation of stakeholders from marginalised groups from large energy-intensive industries. This workshop is expected to have a demonstrable and long-lasting on-field impact in due course of time. The upcoming tasks to ensure the momentum include:

- Provide handholding support to large energy-intensive industries including the cement sector in identifying technologies & solutions, technology suppliers, and financing avenues for enhanced adoption of IEED interventions.
- Plan and organise online seminar / B2B meetings with cement industry stakeholders in close collaboration with UK technology suppliers such as Coomtech, Carbon Clean, Centrica, CarbonRE, Carbon8, etc.
- Create more discussion forums to facilitate the exchange of knowledge and information that will aid in the formulation of policies.



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ANNEXURE

ATTENDANCE SHEET

S.No.	Name	Designation	Organisation
1	Mr. Sumit Kumar	Subject Matter Expert	Chitkara University
2	Mr. Nitin Gupta	Manager	Birla Corporation Ltd, Chandaria unit
3	Mr. Chandan Kumar Parasar	Manager-Production	Orient Cement Ltd.
4	Mr. Ketan Goel	Sr. Manager	Invotech Industrial Solutions Private Limited
5	Mr. Sandeep Gautam	Sr. Manager (Mechanical)	JK Cement Works, Nimbahera
6	Mr. Dheeraj Bohra	Assistant Manager (Electrical)	JK Cement Works, Nimbahera
7	Mr. Rajnikant Manawat	Director	Process Expert Services
8	Mr. Madhusudan		IKN India
9	Mr. B.P Saggu	Joint President, Strategy & Planning	Aditya Cement Works
10	Mr. Anil Bijoliya	Senior Manager-Technical Services	Aditya Cement Works
11	Mr. Diwakar Naidu	Manager-Technical Services	Aditya Cement Works
12	Mr. Ramesh Rao	General Manager	Ultratech Cement Ltd. (Unit: Vikram Cement Works), Vikram Nagar, P.O. Khor- 458470, Dist: Neemuch (M.P.)
13	Mr. Chandan Srivastava	Manager	Ultratech Cement Ltd. (Unit: Vikram Cement Works), Vikram Nagar, P.O. Khor- 458470, Dist: Neemuch (M.P.)
14	Ms. Karishma Rajput	Trainee Process	Ultratech Cement Ltd. (Unit: Vikram Cement Works), Vikram Nagar, P.O. Khor- 458470, Dist: Neemuch (M.P.)

S.No.	Name	Designation	Organisation
15	Mr. Srinivasa Rao	Manager	Ultratech Cement Ltd. (Unit: Vikram Cement Works), Vikram Nagar, P.O. Khor-458470, Dist: Neemuch (M.P.)
16	Ms. Saloni Gupta	Trainee Mech-1	Ultratech Cement Ltd. (Unit: Vikram Cement Works), Vikram Nagar, P.O. Khor-458470, Dist: Neemuch (M.P.)
17	Mr. Rakesh Sharma	Sr. Manager	Ultratech Cement Ltd. (Unit: Vikram Cement Works), Vikram Nagar, P.O. Khor-458470, Dist: Neemuch (M.P.)
18	Mr. Khalid Parwaze	Sr. Manager (E&I)	UltraTech Cement Ltd., Patliputra Cement Works
19	Mr. Hemraj Gadhwai	Asst. Manager	Ultratech Cement Ltd. (Unit: Birla White)
20	Mr. Vikas Garg	Mgr.	UCWL
21	Mr. Ronit Anil Singh	AM	UCWL
22	Mr. Nitin Jangid	A.M	UCWL
23	Ms. Shikha Trivedi	A.M.	UCWL
24	Ms. Shefali Bartaria	Sr. Officer	UCWL
25	Mr. Hitender Kumar	AM	UCWL
26	Mr. Yogendra Singh	AM	UCWL
27	Mr. Ajay Sharma	DM	UCWL
28	Mr. Manish Samdani	DM	UCWL
29	Mr. Ashish Agarwal	AM	UCWL
30	Ms. Priyanka Chhipa		UCWL
31	Mr. Inder Raj Vyas	Manager	Ultratech Cement Ltd. (Unit: Birla White)
32	Mr. MAHESH UPRETI	DIRECTOR	MG THERM INDUSTRIES PVT LTD.

S.No.	Name	Designation	Organisation
33	Mr. Jayraj Thakkar	CEO	Kaishan Machinery India Pvt. Ltd.
34	Mr. Bhagwat Singh	Dy. Manager - Mechanical	Shree Cement
35	Mr. Pushpendra Garhwal	Asst Manager - Energy	Shree Cement
36	Mr. Abhishek Khandelwal	Dy. Manager – Electrical	Shree Cement
37	Mr. Ankit Nagar	Dy. Manager - Process	Shree Cement
38	Mr. Pankaj Sharma	Manager – Power Plant -SMP (Process)	Shree Cement
39	Mr. Suresh M Patel	Assistant GM	Tata Chemicals
40	Mr. Jai Prekash Gupta	Director	GVS Consulting Engineers LLP
41	Mr. Ashok Kumar Singhi	Director	GVS Consulting Engineers LLP
42	Mr. Lokesh Pancholi	Energy Manager	JK Cement Works, Jharli, Jhajjar, Haryana
43	Mr. Pankaj Tiwari	Sr. Manager	JK Lakshmi Cement Ltd., Sirohi
44	Mr. Tikam Chand	Dy Manager	JK Lakshmi Cement Ltd., Sirohi
45	Mr. Manoj Ubana	Dy Manager	JK Lakshmi Cement Ltd., Sirohi
46	Mr. Harendra Kumawat	Sr. Engineer	Shree Cement Ltd Ras
47	Mr. Manoj Khandelwal	Sr. Manager	Shree Cement Ltd.
48	Mr. K. K. Chakarvarti	Senior Advisor	iDEEKSHA, ASPIRE Team
49	Mr. Vivek Negi	Joint Director	Bureau of Energy Efficiency
50	Mr. Balawant Joshi	MD	Idam Infra, ASPIRE Team
51	Mr. Rajiv Shukla	Executive Director	Idam Infra, ASPIRE Team
52	Ms. Dhaarna Rawat	Analyst	Idam Infra, ASPIRE Team
53	Ms. Radhika Tomar	Head-Energy Sector Reform	British High Commission
54	Mr. Anurag Singh Sirola	Manager	KPMG, APIRE Team
55	Mr. Naveen Kumar Sharma	Whole Time Director	Udaipur Cement Works Ltd. (UCWL)
56	Mr. Iain Meager*	Associate Director	Carbon Trust, ASPIRE Team
57	Mr. Sunil Shah	Manager	UltraTech Cement Ltd,
			Technical and Performance Monitoring Cell, Mumbai

S.No.	Name	Designation	Organisation
58	Mr. Prateek Sharma	Manager	NCCBM, Ballabgarh
59	Mr. Bharat Bhushan	Project Engineer	NCCBM, Ballabgarh
60	Mr. Abhijeet Khekale	Sr. Manager-Technical Services	Ultratech Cement – Dhar Cement Works
61	Mr. Shailendra Pandey	Vice President	UltraTech Cement Ltd. (Unit: Vikram Cement Works)
62	Mr. Sanjai Kumar Pandey	Sr. General manager	UltraTech Cement Ltd. (Unit: Vikram Cement Works)
63	Mr. Parag Gupta	Sr. Manager	UltraTech Cement Ltd. (Unit: Vikram Cement Works)
64	Ms. Pooja Yadav	PF – QC	UltraTech Cement Ltd. (Unit: Vikram Cement Works)
65	Mr. Dharendra Sankhla		Shree Cement Ltd
66	Mr. Ashish Das	Manager	Shree Cement Ltd
67	Mr. Roheet Badgujar	Dy. Manager	Orient Cement
68	Mr. T. Shreedhar	Asst. Execut.	Birla Corporation Ltd.
69	Mr. Kutesh	CEO	REON Energy
70	Mr. A. C. Verma		Centrica
71	Mr. Harsh Vardhan		Centrica
72	Mr. Anand	Director	Centrica
73	Mr. Niraj Singh	Sales Manager	Carbon Clean
74	Mr. Aaron Lucid*	Development & Partnership Manager	Carbon Upcycling
75	Mr. Chris Every*	Chief Commercial Officer and Founder	Coomtech
76	Mr. Daniel Summerbell*	Chief Solutions Officer and Co-founder	CarbonRE
77	Mr. Dalraj Nijjar*	Co-founder and Chef Commercial Officer	Concrete4change
78	Ms. Selin Murat*	Head of Commercial Partnerships	Carbon8
79	Mr. Bhushan Patil*	International Funder Associate	Carbon Trust, ASPIRE Team
80	Mr. Khan Saba Nashit*	Consultant	Idam Infra, ASPIRE Team

*Attended virtually