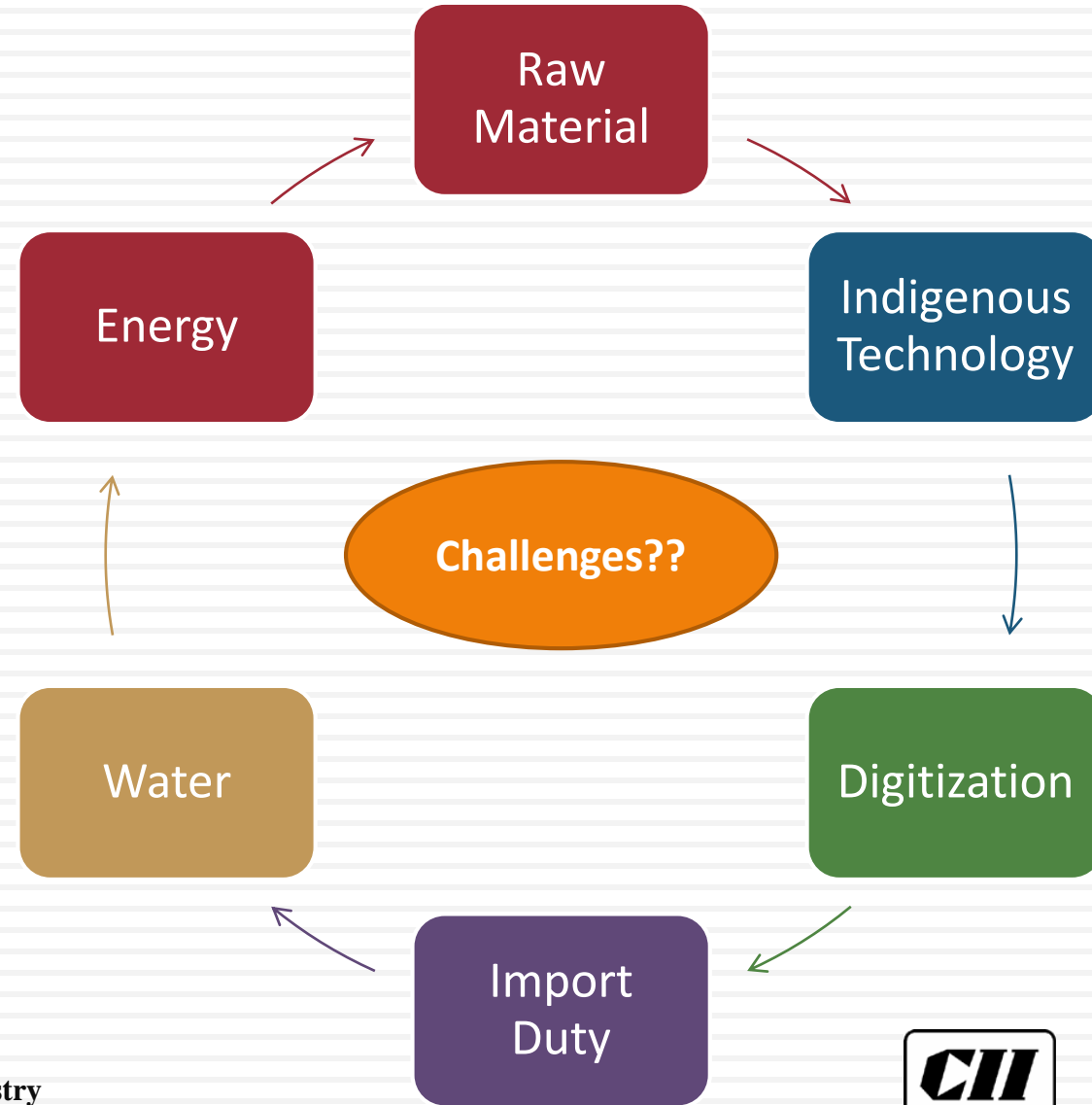


**LOW CARBON TECHNOLOGY
ROADMAP
PAPER SECTOR**



Indian Paper Sector @ 2030

- ❖ Estimated Paper production by 2030 - ~40 million tonne
- ❖ Estimated total energy consumption in 2030 - ~20 million TOE
 - ▣ Energy intensity 1.36 TOE/million USD
 - ▣ Sector contribution to overall energy intensity 1.60%
- ❖ Likely CO₂ emission by 2030 - ~70 million tonne
 - ▣ Contributes nearly 1.2% of total CO₂ emitted by country



- ❖ **Globally many initiative undertaken by government, association & other stake holder**
 - ▣ **To address the environment & social concerns**
- ❖ **One such initiative taken by cement industry with support of all stake holder**

“Low Carbon Technology Roadmap 2050”

Project Structure & Role

Roadmap partners



wbcscd



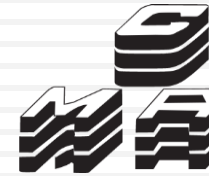
iea

Implemented in
Two Phases

In consultation with



Communication
partner



Phase 1:
*Roadmap Preparation &
Identification of Technologies
and Levers*

Principal supporter



Industry supporters – CSI membership



Ambuja
Cement



HEIDELBERGCEMENT

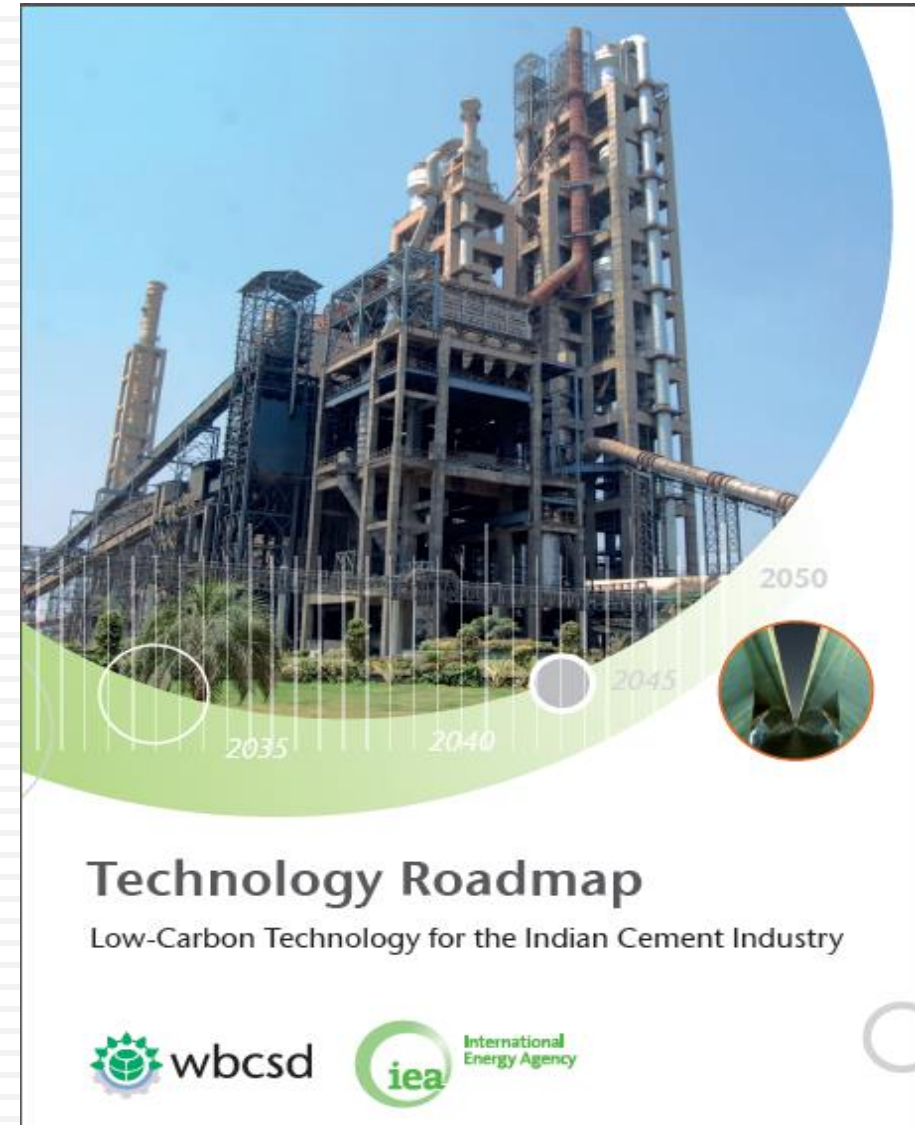


Phase 2:
*Implementation of Roadmap
in Cement Plants*



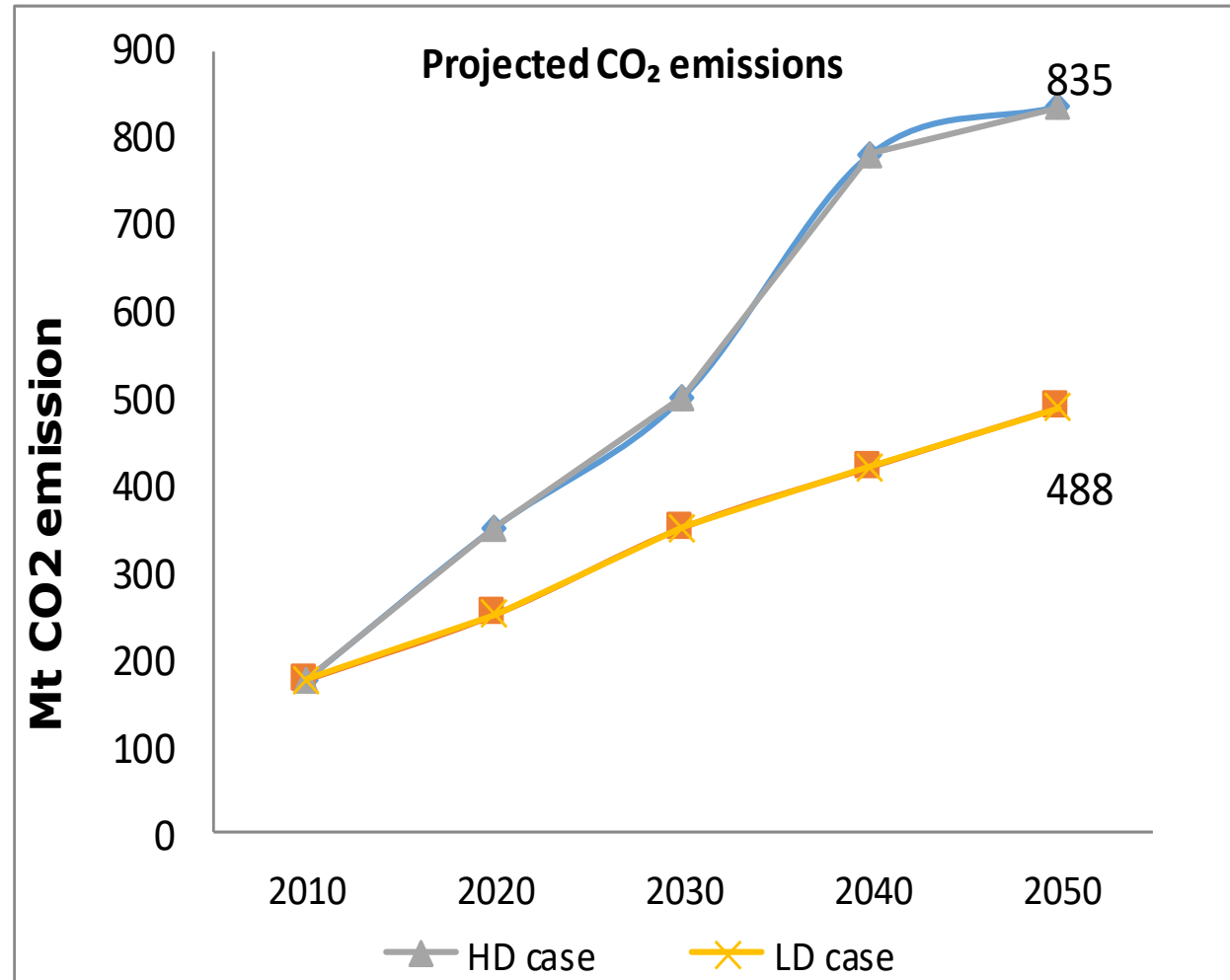
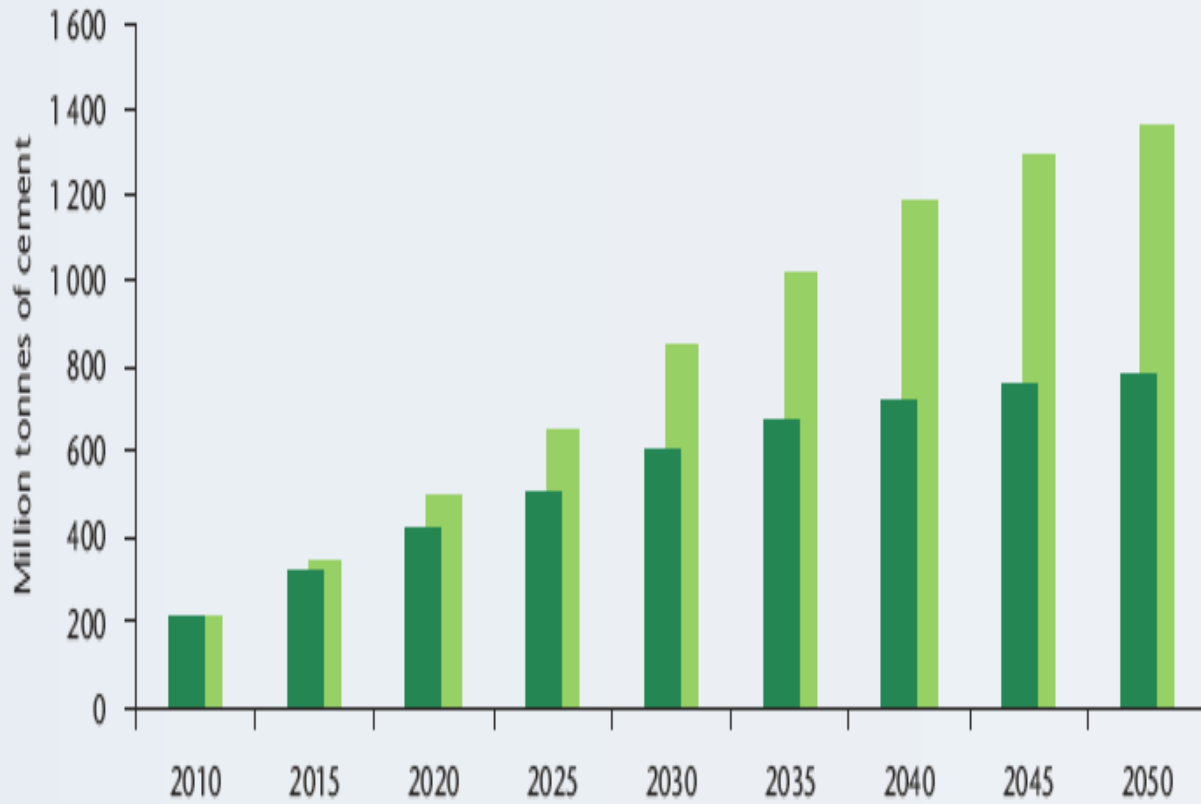
Objective of Roadmap

- ❖ To reduce CO₂ emission intensity from 0.63 tCO₂/t cement in 2010 to 0.35 tCO₂/t cement in 2050
- ❖ Reduction potential of 44% from baseline year of 2010
- ❖ Roadmap aims to provide
 - ▣ Identification of technology (particular relevance to India)
 - ▣ Supportive policy framework
 - ▣ Investment needed



Growth Scenario

Projected cement production in India

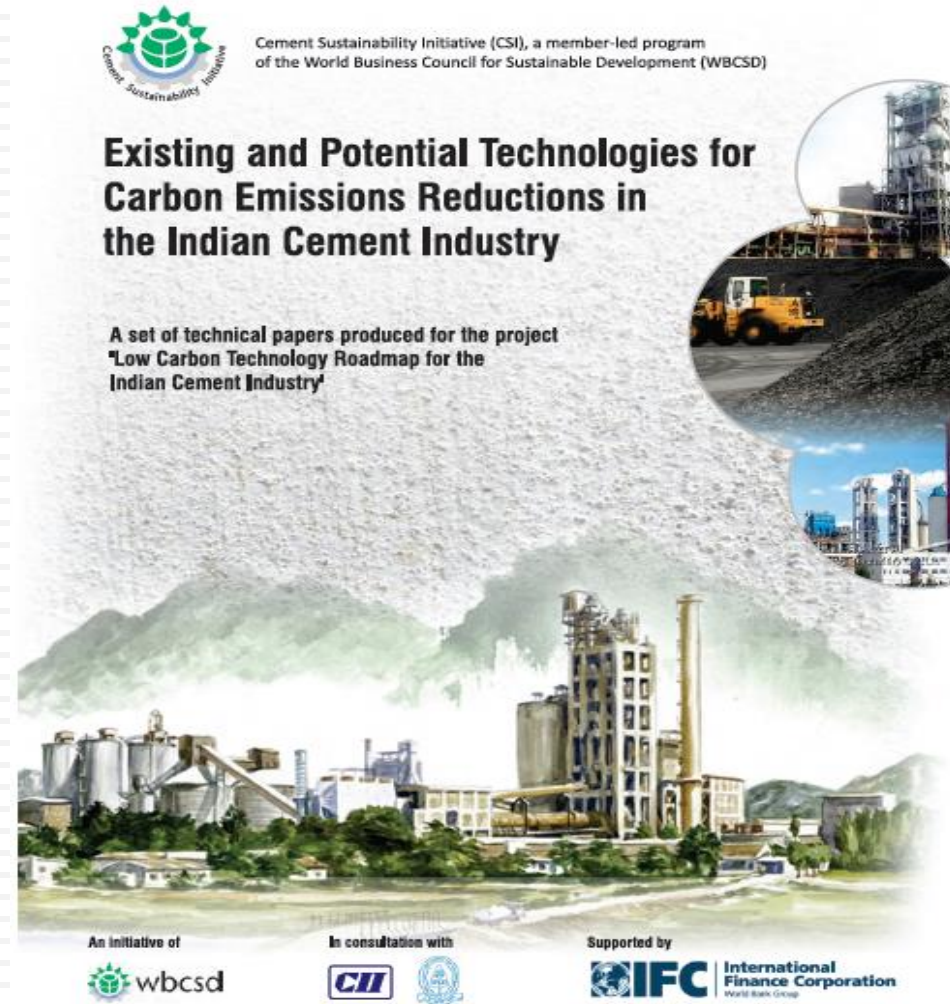


Strategies for CO₂ Emission Reduction

1. Improving Thermal & Electrical Energy Efficiency
2. Alternative fuel & raw material uses (AFR)
 - Less carbon intensive than conventional fuels/natural raw materials
3. Use of Alternate Raw Material
 - ▣ Focused on reducing clinker to cement ratio
 - ▣ Clinker making highly energy intensive process & direct CO₂ emission
4. Use of Emerging & Innovative Technologies
 - ▣ Waste Heat Recovery System
 - ▣ Solar Power Generation
 - ▣ Carbon Sequestration

Technical Paper

- ❖ To Support carbon emission reduction leaver –
A set of technical paper produced
- ❖ Consists of 27 Technical Paper
- ❖ Outlines – Present Status, Impact on Energy Efficiency, Anticipated Benefits, Potential CO2 reduction, Cost estimation, Barriers & Constraint for implementation



Example. Technical Paper No 7 – Energy Efficiency Improvement in Auxiliary Equipment

❖ Present Status

- ❑ Auxiliary equipment consumes 10% of total electrical energy in cement
- ❑ Conveyors, Blowers, Compressors, Pumps etc.

❖ Technology Proposed

- ❑ Centrifugal Blower – High design efficiency, Inbuilt VFD, precise control, Saves 30% power compared with conventional lobe blowers
- ❑ Centrifugal Compressor – Low specific energy consumption 0.13 kW/CFM, Used for base load of more than 2000 CFM
- ❑ VFD for Pumps & Screw Compressors – Better control system leads to reduced power consumption

Example. Technical Paper No 7 – Energy Efficiency Improvement in Auxiliary Equipment

❖ Anticipated Benefits

- ❑ Thermal saving : None
- ❑ Electrical saving : 0.5-1.0 kWh/tonne of cement
- ❑ CO₂ reduction : 0.1-1.0 kg CO₂/tonne of cement

❖ Primary influencing parameters

- ❑ Cost of power, layout feasibility, present level of energy efficiency & technology adoption

❖ Cost estimation

- ❑ Blower & Compressor – Rs. 25000/kWh
- ❑ LT VFD – Rs. 6000/kWh & HT VFD – Rs. 10000/kWh
- ❑ Energy efficient pump – Rs. 6000/kWh

❖ Condition, Barriers & Constraints

❑ Technical

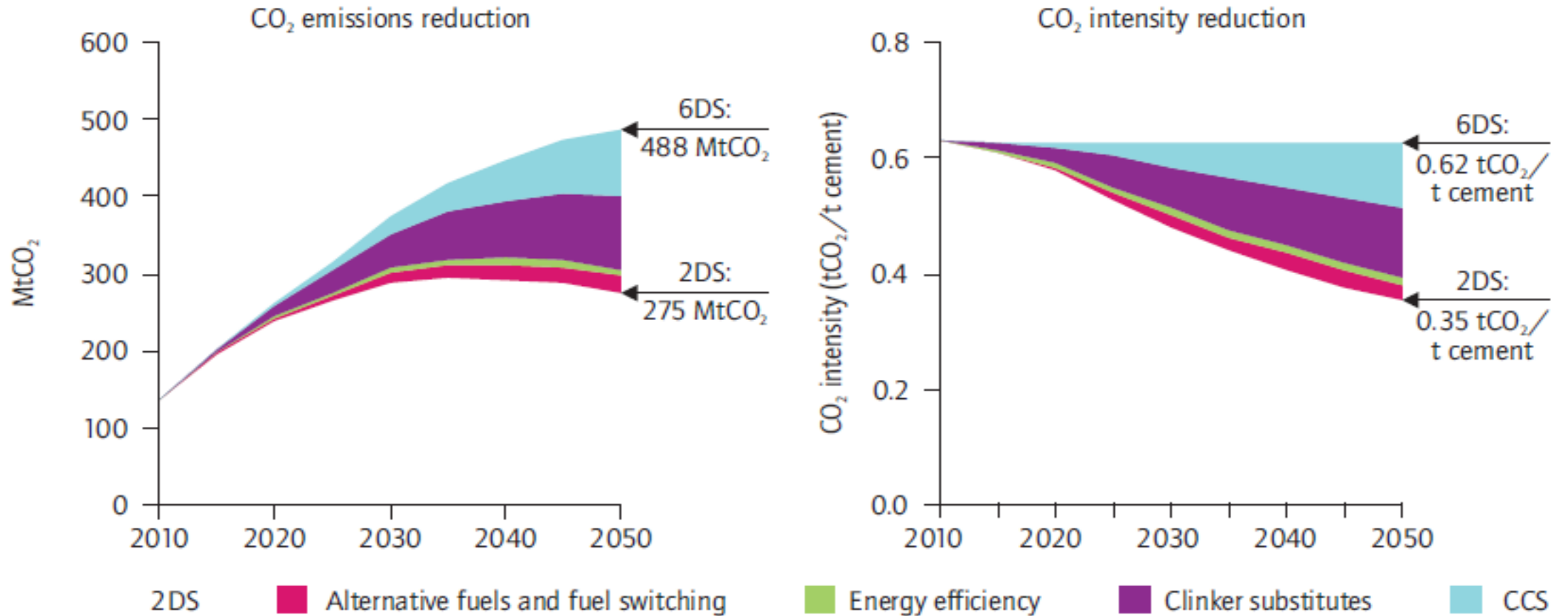
- Layout could pose certain constraint

❑ Policy – None

❑ Financial

- High investment

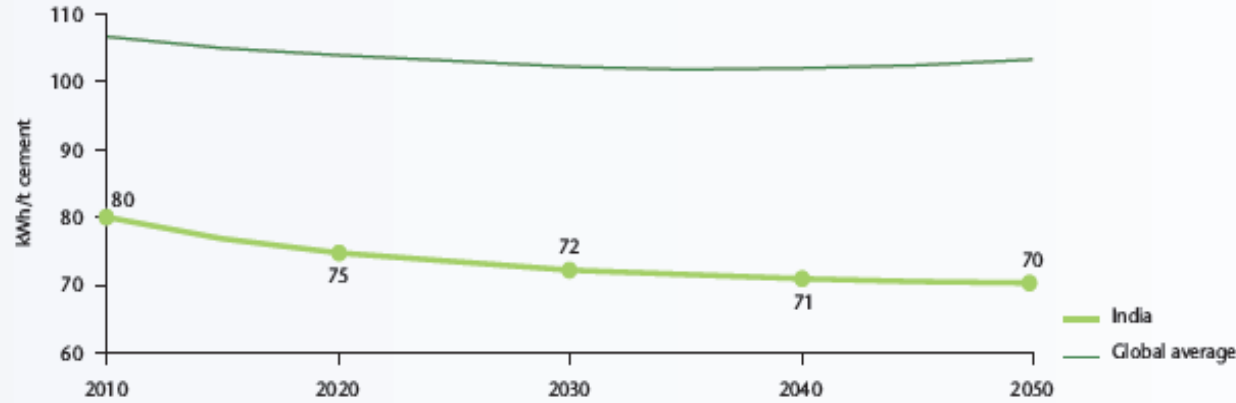
Potential Energy Saving/Emission Reduction from Implementation of Different Leavers



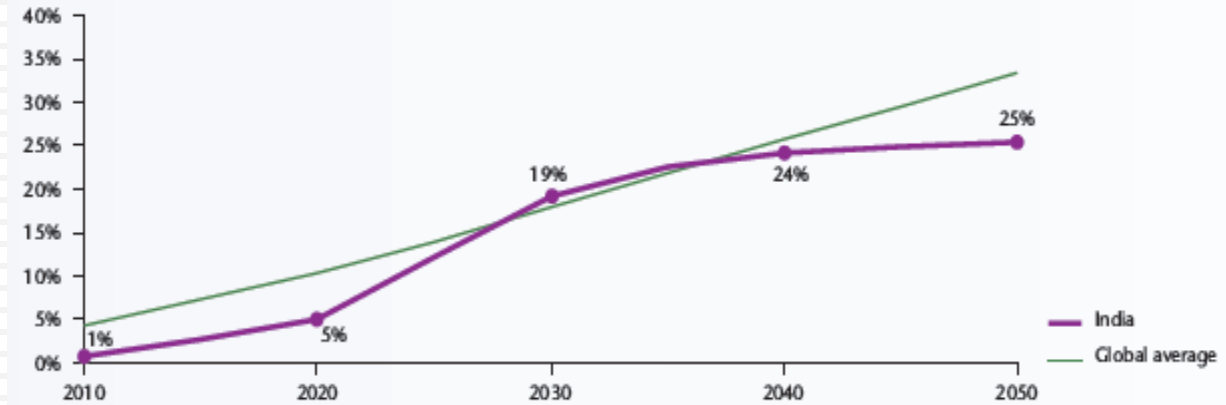
Notes: Includes only direct CO₂ emissions from cement manufacturing; indirect emissions from the use of electricity are not taken into account.

Key Indicators to Reach 2DS Scenario

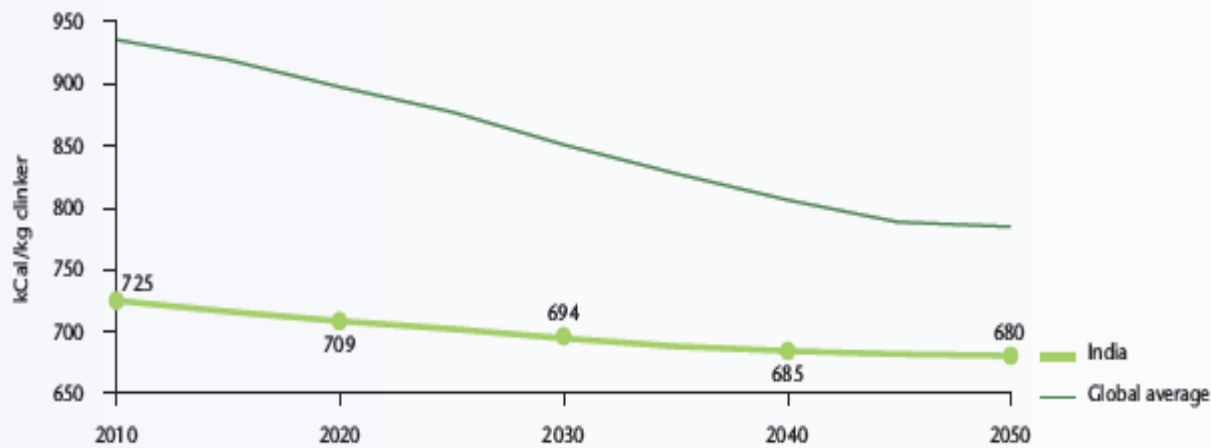
Progress indicator for specific intensity of electrical requirements (excl. potential from WHR)



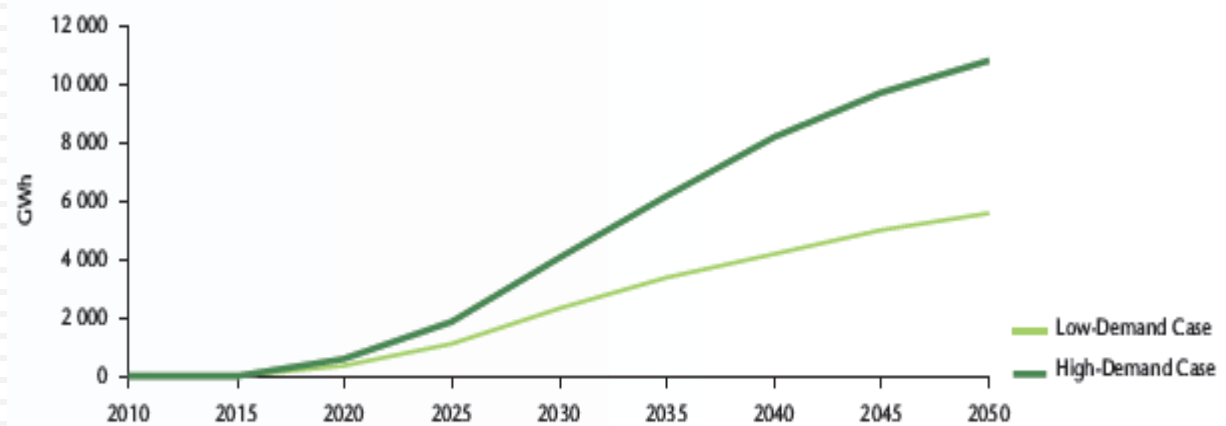
Progress indicator for share of alternative fuels and raw materials (AFR) in thermal energy use



Progress indicator for specific intensity of thermal heat requirements

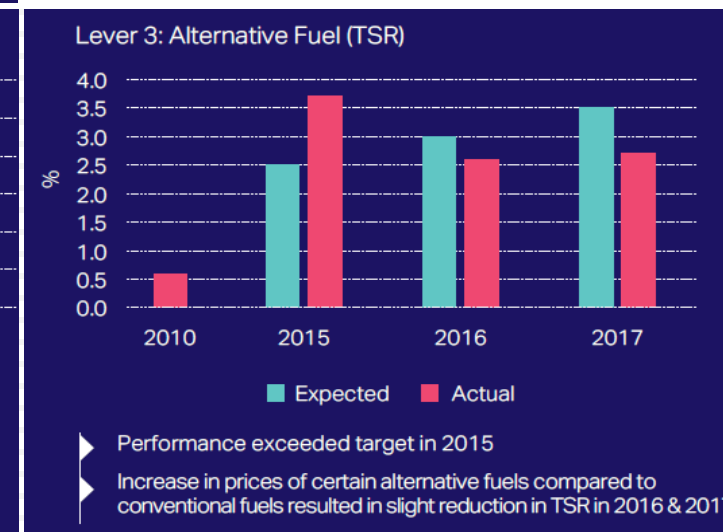
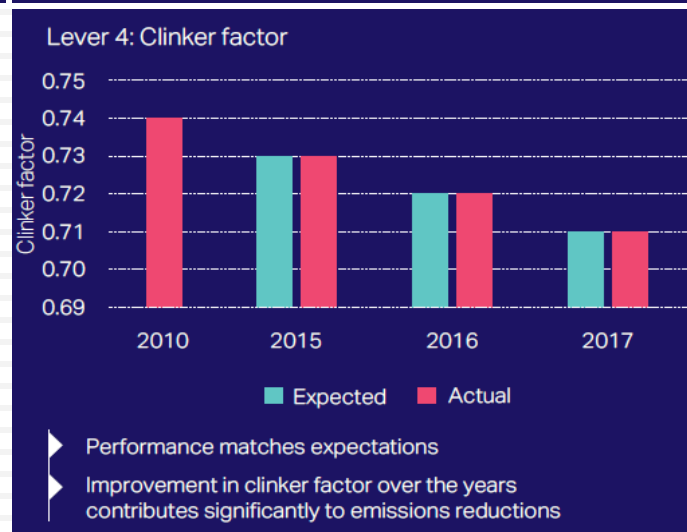
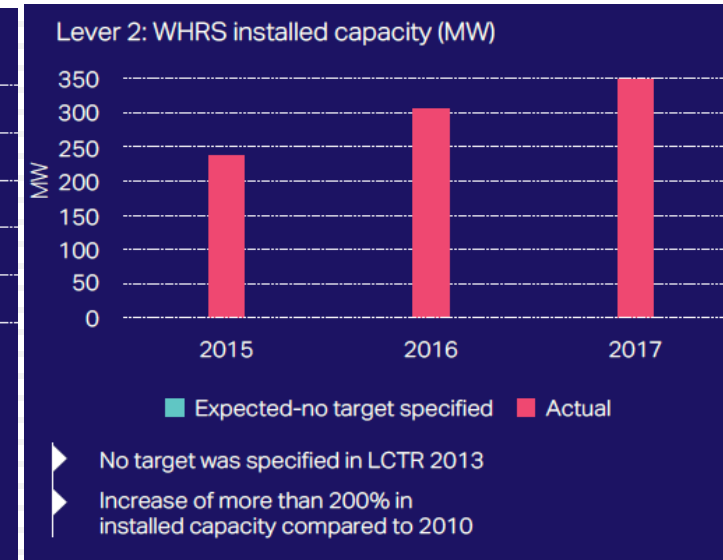
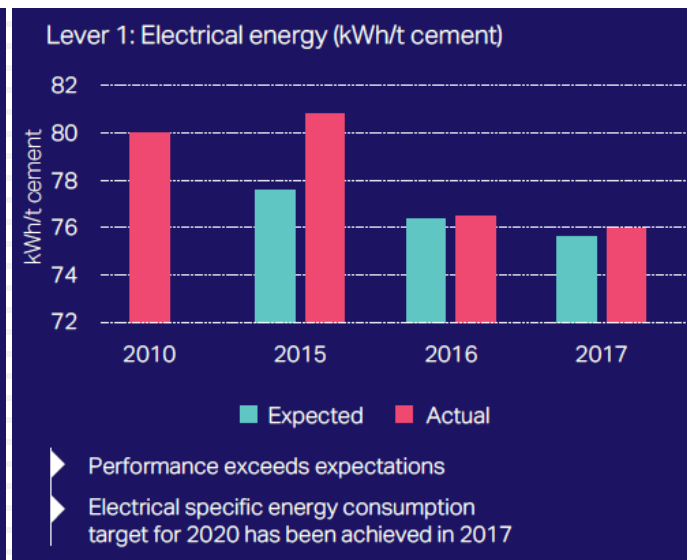
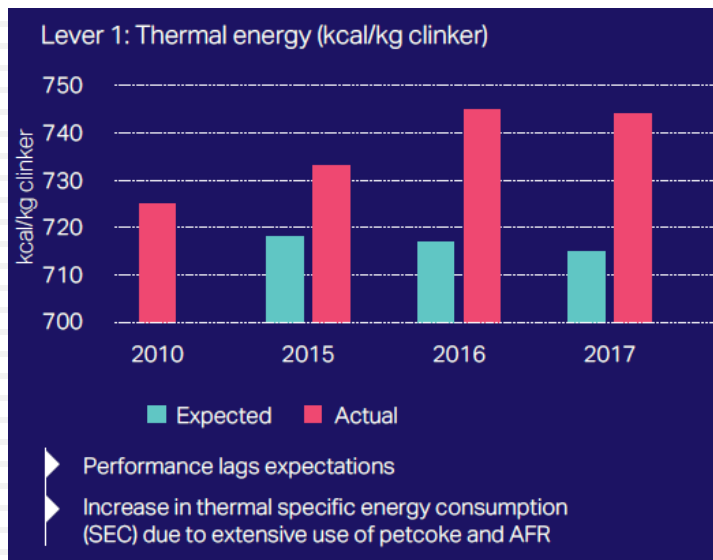


Progress indicator for additional electricity generated through WHR at cement plants



Note: Potential for electricity generated through WHR is not assessed at the global level, so a global comparison is not possible.

Snapshot of Progress



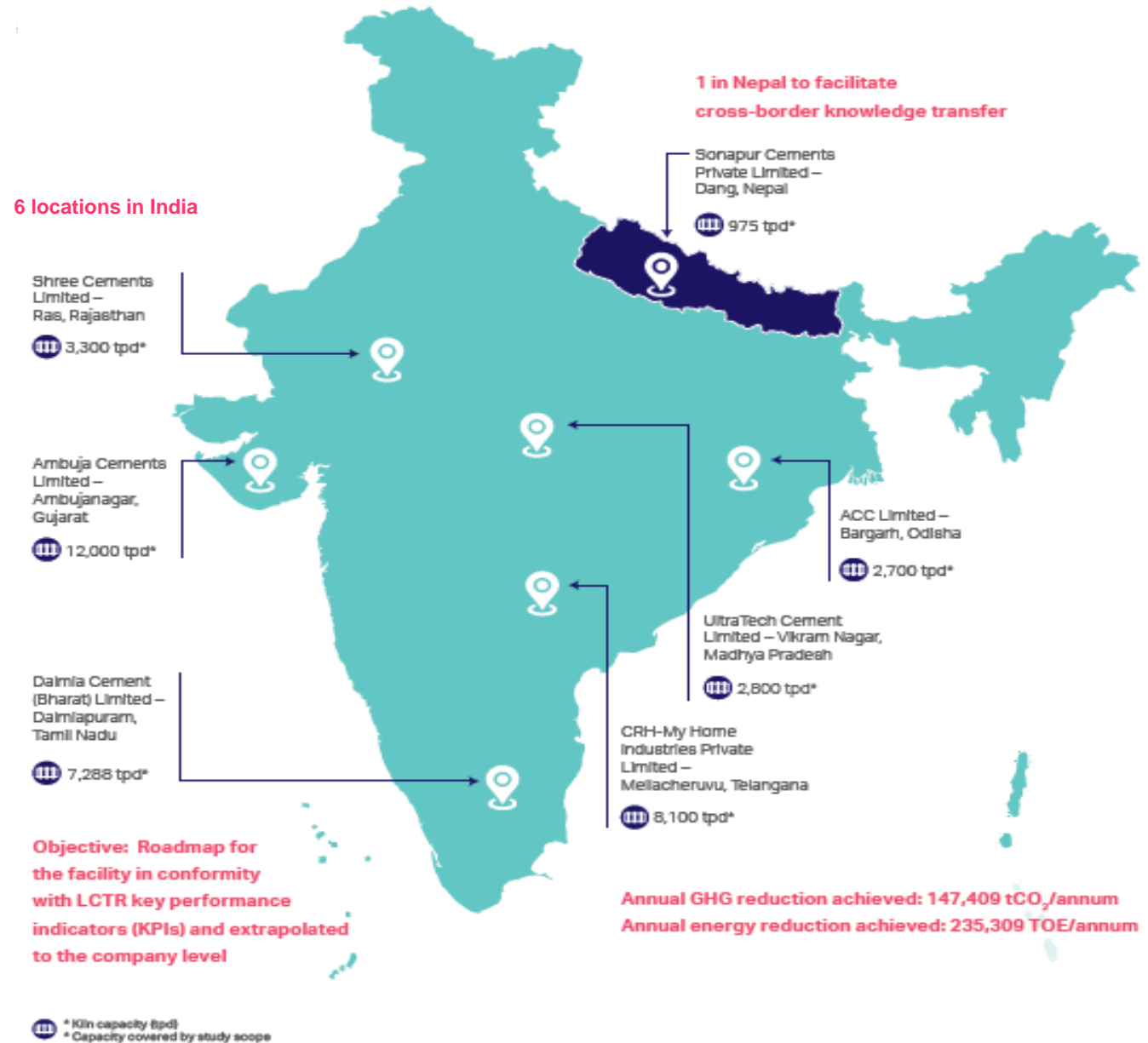
- 5-fold increase in alternative fuel consumption (1.5 million tones used)
- Global best in energy efficiency
- Sector achieved targets for 2020 in 2017
- Progress beyond 2030 looks challenging



Additional Investment Required to Reach 2DS Scenario

Low-Demand Case					
USD billion	2010-20	2020-30	2030-40	2040-50	2010-50
New kilns and refurbishments	3 to 4	1	1	1	6 to 7
Clinker substitution	0.1	0.2	0.1	0.1	0.5 to 0.6
Alternative fuels	3	2	1	0	6 to 6
Carbon capture	0	3	6	8 to 9	17 to 19
Total	6 to 7	5	8	10	29 to 32
High-Demand Case					
USD billion	2010-20	2020-30	2030-40	2040-50	2010-50
New kilns and refurbishments	4 to 5	0	-2 to -3	-1	1 to 0
Clinker substitution	0.1	0.2	0.1 to 0.2	0	0.4 to 0.6
Alternative fuels	3 to 4	4	3	2	12 to 13
Carbon capture	1	5	11 to 13	16 to 17	33 to 36
Total	8 to 9	9 to 10	13 to 13	17 to 18	46 to 50

Phase-II of Roadmap – Accelerating Implementation



Achievements

	Unit	Potential identified	Reduction achieved (projects implemented as of February 2017)
Number of energy-saving proposals	Number	350	190
Investment	INR million (USD \$ million)	6,084 (95.8)	1257 (19.79)
Electricity savings	MWh/ annum	233,606	111,487
Energy savings	TOE/annum	856,178	235,309
Energy cost savings	INR million/ annum (USD \$ million/annum)	1553 (24.46)	543 (8.54)
Total CO ₂ emissions reductions from energy-saving projects	tCO ₂ per annum	508,762	147,409

Roadmap Impact – New Policy Framework

- ❖ **Central Pollution Control Board (CPCB) guidelines on Preprocessing & Co-Processing of Hazardous & Other Waste in Cement plants and the Hazardous Waste Management Rule 2016**
- ❖ **Guidelines on uses of refuse derived fuel in various industry, Ministry of Housing & Urban affairs (MoHUA) 2018**
- ❖ **Solid Waste Management Rules 2016**
- ❖ **Issuance of Standards for Composite Cement, Bureau of Indian Standards (BIS) IS 16415:2015**

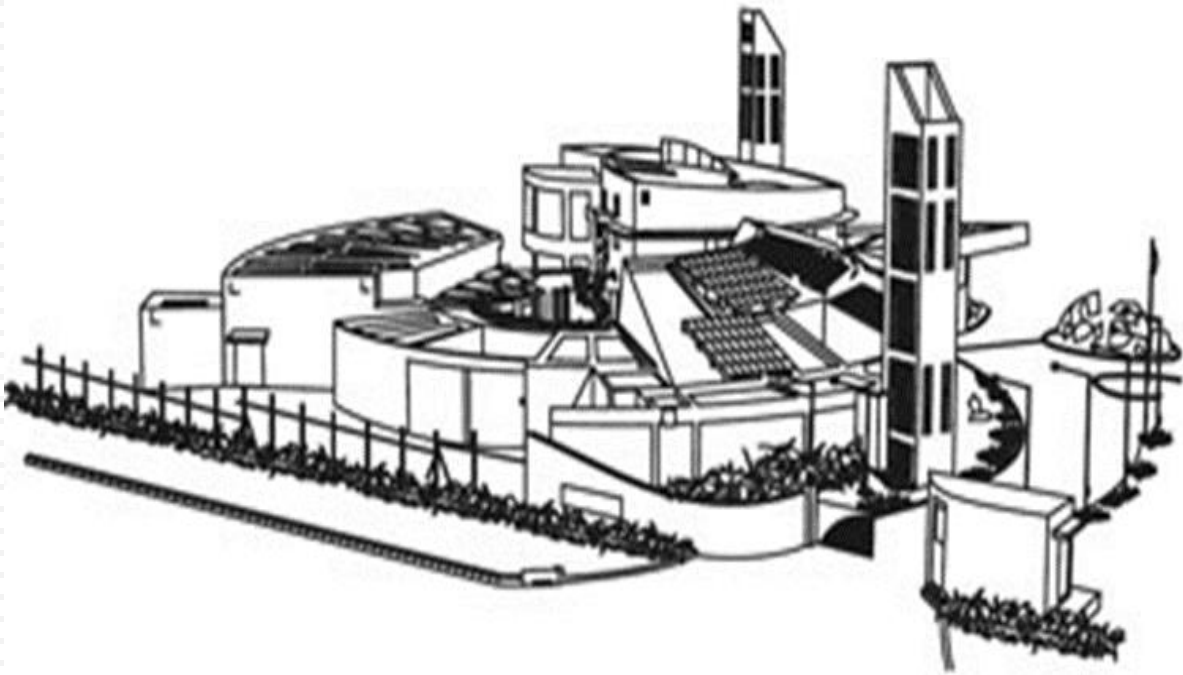
Roadmap Impact – Market Transformation

- ❖ **Capital Investment Cost Reduction from 15 Cr./MW to 10 Cr./MW for WHRS**
- ❖ **Many plants started co-processing waste as alternative fuels**
- ❖ **Seven Cement Plant set up pre-processing facility to convert non homogenous waste into alternative fuel of desired quality**
- ❖ **Increase addition of Flyash & Slag**
- ❖ **Pilot Study – Production of LC3 Cement – New Variant**
- ❖ **Installation of CFBC boiler**
- ❖ **Installation of Centrifugal Compressor for base load**
- ❖ **Plant Level policy intervention – Purchase of IE3 & IE4 motors**

Conclusion

- ❖ **Low Carbon Technology Roadmap will help sector in various way**
 - ▣ **Key policy intervention required**
 - ▣ **Evaluation of financial requirement**
 - ▣ **Possible carbon emission reduction potential**
 - ▣ **Identification of various challenges and barriers**
 - **Technical, Financial, Policy**
 - ▣ **Identification of scalability potential of technology in context to Indian scenario**
 - ▣ **Enhance research & development capabilities, skills, expertise & Innovation**

THANK YOU!



Parag Mundada
Associate Counsellor
Confederation of Indian Industry
CII - Godrej Green Business Centre, India



mundada.parag@cii.in



+91 40 4418 5143



www.greenbusinesscentre.com || www.cii.in