GOVERNMENT OF INDIA
MINISTRY OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF SCIENCE AND TECHNOLOGY
RAJYA SABHA
UNSTARRED QUESTION No. 610
ANSWERED ON 24/07/2025

CARBON CAPTURE AND UTILISATION TESTBEDS

610 # SHRI BANSHILAL GURJAR:
DR. K. LAXMAN:
SHRI DEEPAK PRAKASH:
SHRI BABUBHAI JESANGBHAI DESAI:
Will the Minister of SCIENCE AND TECHNOLOGY be pleased to state:

(a) the objectives and significance of establishing five Carbon Capture and Utilisation (CCU) testbeds in the cement sector and how this initiative supports India's net-zero target by 2070;

(b) the institutions and industry partners involved in the CCU testbeds and the distinct technological solutions being developed at each site; and

(c) the expected impact of these CCU testbeds on CO_2 reduction in the cement industry and their potential for scaling to other hard-to-abate sectors?

ANSWER
MINISTER OF STATE (INDEPENDENT CHARGE) FOR THE
MINISTRY OF SCIENCE AND TECHNOLOGY & EARTH SCIENCES
(DR. JITENDRA SINGH)

(a) The Department of Science & Technology (DST) is in the process of considering the recommendation of the Expert Panel for five Carbon Capture and Utilization (CCU) testbeds in the Cement sector in different parts of the country. The objectives of these CCU testbeds are to capture Carbon Dioxide (CO_2) emission from cement manufacturing and convert it into value-added products like synthetic fuels, urea, soda ash, concrete aggregates, and food-grade CO_2. These testbeds are going to act as a platform for validating and demonstrating CCU technologies at small scale in real industrial settings through Industry-Academia collaborations. This initiative has significant relevance to enable Industrial decarbonisation in the country with special focus on emissions-intensive sectors like Cement by promoting circular carbon economy, thereby aligning well with India's overarching target of net-zero by 2070.

(b) The Expert Panel constituted by DST has recommended five CCU testbeds, and the Department is in the process of considering the recommendations of the Expert Panel for further processing and financial sanctions. The site-wise details of Institutions and Industry partners involved in these recommended CCU testbeds along with proposed technological solutions to be deployed, are given below:

Sl. No.	Site location	Institutions	Industry Partner	Technological Solutions
1.	Chittorgarh, Rajasthan	National Council for Cement and Building Material, Ballabhgarh and Indian Institute of Technology, Roorkee	JK Cement Limited	Oxygen-based Calcination to capture 2 TPD (Tonnes Per Day) of CO_2 and its utilization (0.4 TPD) in lightweight concrete products and olefins.
2.	Sundergarh, Odisha	Indian Institute of Technology, Kanpur	JSW Cement Limited	Carbon-negative using solvent-based carbon capture technology at a scale of 1 TPD and utilizing captured CO_2 for mineralisation into concrete using ICCM (Integrated Carbon Capture and Mineralization) technology

Sl. No.	Site location	Institutions	Industry Partner	Technological Solutions
3.	Rajganjpur, Odisha	Indian Institute of Technology Bombay, Mumbai	Dalmia Cement (Bharat) Ltd.	Water-based catalyst-driven CO_2 capture process, at a scale of 2 TPD, designed for integration within a live cement plant, enabling conversion of captured CO_2 into calcium carbonate, sodium bicarbonate and formic acid.
4.	Kurnool, Andhra Pradesh	CSIR-Indian Institute of Petroleum, Dehradun, Indian Institute of Technology, Tirupati, and Indian Institute of Science, Bengaluru	JSW Cement Limited	Vacuum Swing Adsorption Process for CO_2 capture (1 TPD) from Cement Kiln Gas and its utilization within the construction material value chain.
5.	Reddipalayam, Tamil Nadu	Indian Institute of Technology Madras and Birla Institute of Technology and Science (BITS) Pilani, Goa	Ultratech Cement Ltd.	New kiln burning technology based on oxygen-enriched burning, capture using adsorption/absorption, and mineralization of captured CO_2 (2 TPD) using concrete blocks, waste concrete fines and concrete plant sludge.

(c) The Carbon Capture and Utilization (CCU) testbeds are expected to lower Carbon Dioxide (CO_2) emissions within India's cement sector, which constitutes approximately 7-8% of the Nation's industrial carbon emissions. These recommended CCU testbeds are envisaged to demonstrate the carbon capture and utilization at small scale i.e. up to 02 TPD (Tonnes Per Day). Apart from reduction in CO_2 emissions, these testbeds are expected to generate valuable by-products, such as synthetic fuels and construction materials, and thereby contributing to the circular carbon economy.

Further, the successful implementation of testbeds is going to enable Indian industries to adopt the technologies and scale up them to a full commercial level. These modular solutions have the potential to replicate in other hard-to-abate sectors, including power, iron & steel, oil & natural gas, chemical industry, etc., through customized engineering into pre-existing industrial frameworks.

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