

# What are carbon capture and utilisation technologies? | Explained

How can such technologies reduce carbon dioxide emissions? What is the EU Bioeconomy Strategy and Circular Economy Action Plan? How can India scale-up CCU technology?

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For representative purposes. | Photo Credit: Getty Images

## The story so far:

**C**arbon Capture and Utilisation (CCU) refers to a set of technologies that capture carbon dioxide emissions from industrial sources or directly from the air and convert them into useful products. This process removes carbon from the atmosphere and puts it into the economy as inputs for fuels, chemicals, building materials, or polymers. Unlike carbon capture and storage, where captured CO<sub>2</sub> is permanently stored underground rather than reused, CCU uses up the captured carbon.

## Why does India need CCU?

India has consistently been the world's third-largest emitter of CO<sub>2</sub>, with emissions driven largely by power generation, cement, steel, and chemicals. While renewable energy may reduce future emissions, many industrial processes are inherently carbon-intensive and difficult to decarbonise. CCU offers a pathway to reduce emissions from these "hard-to-abate" sectors while simultaneously creating new industrial value chains. It also aligns with India's net-zero target for 2070 and its push to build a circular, low-carbon economy.

## Where does India stand today?

India has begun supporting CCU through research funding from the Department of Science and Technology which has created a specific research and development roadmap for these technologies. The draft 2030 roadmap for Carbon Utilisation and Storage (CCUS) presented by the Ministry of Petroleum and Natural Gas has identified projects that can be used for CCUS purposes. In the private sector, Ambuja Cements (Adani Group) is working on an Indo-Swedish CCU pilot with IIT Bombay to convert captured CO<sub>2</sub> into fuels and materials. JK Cement is collaborating on a CCU testbed to capture CO<sub>2</sub> for applications such as lightweight concrete blocks and olefins. Beyond cement, Organic Recycling Systems Limited (ORSL) is leading India's first pilot-scale Bio-CCU platform, valorising CO<sub>2</sub> from biogas streams into bio-alcohols and specialty chemicals.

## What are other countries doing?

The EU Bioeconomy Strategy and Circular Economy Action Plan explicitly supports CCU as a way to turn CO<sub>2</sub> into feedstocks for chemicals, fuels, and materials, linking it to circularity and sustainability targets. ArcelorMittal and Mitsubishi Heavy Industries, Ltd. are working with a climate tech company, D-CRBN, to trial a new technology to convert CO<sub>2</sub> captured at ArcelorMittal's plant in Gent, Belgium into carbon monoxide which can be used in steel and chemical production. The U.S. uses a combination of tax credits and

funding to scale CCUs, particularly for CO<sub>2</sub>-derived fuels and chemicals. The UAE's Al Reyadah project and planned CO<sub>2</sub>-to-chemicals hubs leverage CCU with green hydrogen.

## What are the risks ahead?

The foremost risk in scaling CCU in India is cost competitiveness. Capturing, purifying, and converting CO<sub>2</sub> is energy-intensive and expensive. Without policy incentives, CCU-derived products will struggle to compete with cheaper, fossil-based alternatives. A second risk lies in infrastructure readiness. CCU requires co-located industrial clusters, reliable transport of CO<sub>2</sub>, and integration with downstream manufacturing, all of which are unevenly developed across Indian industrial regions. Finally, the absence of clear standards, certification, and market signals creates uncertainty for investors and limits demand for CO<sub>2</sub>-derived products.

India has taken positive steps through the development of roadmaps to achieving CCU, and their appropriate implementation will be necessary for achieving India's goals.

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