Carbon Capture and Utilisation (CCU) Technologies

Prelims: *Current events of national and international importance | Environment*

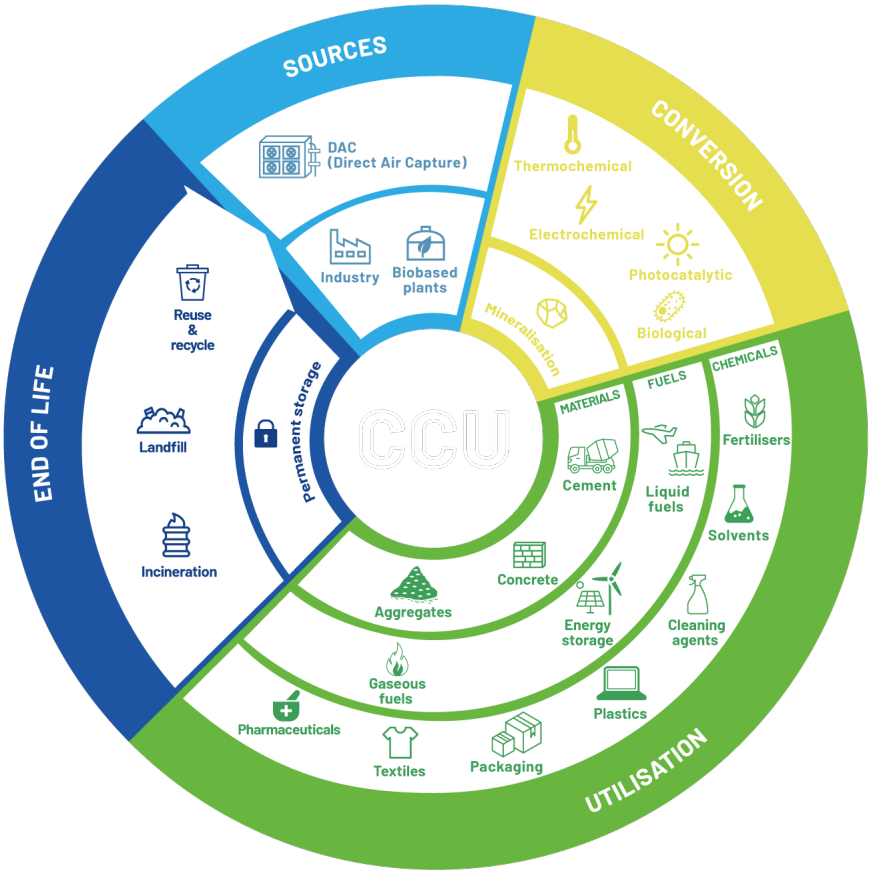
Why in News?

Recently, CCU Technologies has been in focus amid India's efforts to scale up low-carbon technologies to reduce emissions from hard-to-abate sectors.

- **CCU Technologies –** Technologies that capture CO_2 emissions from industrial sources or directly from the air and convert them into useful products, unlike in CCS.

  Carbon Capture and Storage (CCS) *is where CO_2 is Captured permanently stored underground rather than reused*.

- **Aim –** To ***utilise the captured CO_2 in the economy as inputs*** for fuels, chemicals, building materials, or polymers.
- **Framework –** CCU follows the 3 Rs of the Circular Carbon Economy (CCE)
- **Remove –** First step aims to remove the amount of carbon entering the atmosphere through innovative 'point-of-source' carbon capture technologies.
- **Reuse –** Using captured CO_2 directly without chemically altering the carbon molecules.
- Example – CO_2 for industrial processes like the carbonation of drinks.
- **Recycle –** Captured CO_2 is converted into value-added products or alternative energy sources through chemical processes.
- Example – Production of synthetic fuels, chemicals and materials from CO2.
    - For instance, CO2 combined with hydrogen creates synthetic hydrocarbons for use in transportation or feedstock for the chemical industry.



- **India's Need for CCU – Source of CO_2 –** Mainly from Iron, steel, cement, fertilisers, and refineries. They are highly carbon-intensive and hard to decarbonize or hard-to-abate Sectors.
    - CCU offers a sustainable solution to this issue while simultaneously creating new industrial value chains.
- **Net-Zero –** Aligns with *India's net-zero targets for 2070* and pushes to build a circular, low-carbon economy.

India has consistently ranked as ***the world's third-largest emitter of CO_2.***

- **India's CCU Status – Research Funding** – Supporting CCU through research funding from the Department of Science and Technology.
- **Union Budget 2026 –** Provides a total outlay of Rs. 20,000 crore (over 5 years) for Carbon Capture, Utilisation, and Storage (CCUS).
    - **Initial Allocation –** *Rs. 500 crores to the Ministry of Power for R&D.*

- **Policy Roadmap –** The Ministry of Petroleum and Natural Gas has presented the draft 2030 roadmap for CCUS.
- **Private Initiatives –** The Adani Group is developing an Indo-Swedish CCU pilot project in collaboration with IIT Bombay to transform captured CO_2 into fuels and materials.
    - **Industrial Testbed –** JK Cement is working on a CCU for uses like lightweight concrete blocks and olefins.
    - **Bio-CCU Platform** – Organic Recycling Systems Limited (ORSL) is leading *India's first pilot Bio-CCU platform, converting CO_2 from biogas into bio-alcohols and chemicals*.
- **Global Practices – EU –** EU Bioeconomy Strategy and Circular Economy Action Plan support CCU to transform CO_2 into feedstocks, promoting circularity and sustainability.
- **U.S.A –** The U.S. employs a mix of tax credits and funding to expand CCUs, especially for fuels and chemicals derived from CO_2.
- **UAE –** The UAE's Al Reyadah project and planned CO_2-to-chemicals hubs use CCU with green hydrogen.

References

1. TH | Carbon Capture and Utilisation Technologies
2. WEF | CCU

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