# Limitations of CCS and CDR

## Why in news?

The draft decisions taken at COP28 at Dubai have referred to the abatement and removal of carbon emissions using carbon capture and storage (CCS) and carbon-dioxide removal (CDR) technologies.

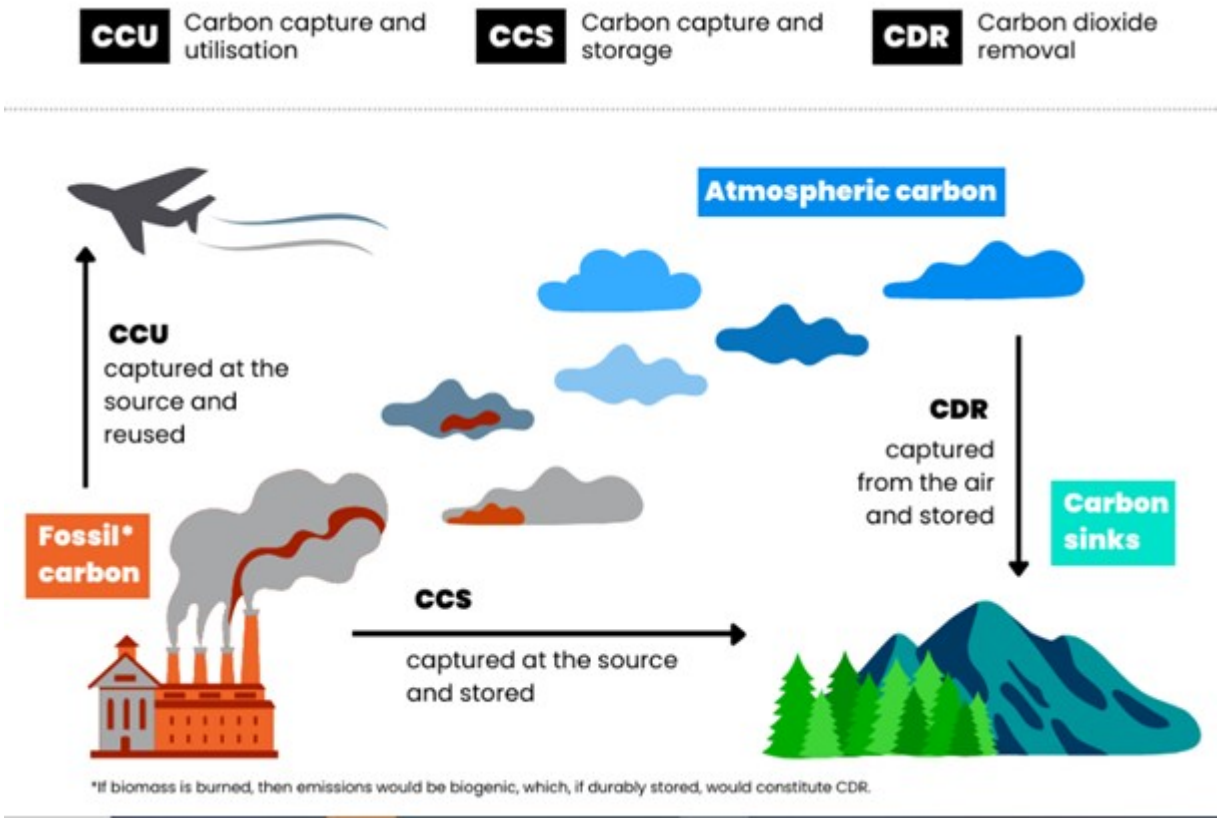
## What are 'unabated' fossil fuels?

- **Unabated -** Doing nothing to reduce the carbon dioxide (CO2) and other greenhouse gases that are released from the burning of coal, oil, and natural gas.
- According to IPCC, unabated fossil fuels are those "*without interventions* that substantially reduce GHG emissions.
- At COP28, the term "unabated fossil fuels" has come to mean the combustion of these fuels ***without using CCS technologies*** to capture their emissions.
- **Abated -** Attempts to decrease the release of polluting substances to an acceptable level.

## What are CCS and CDR?

> *CDR and CCS are distinct, but some CO2 removal methods (e.g., direct air capture) may share the same capture processes or long-term storage infrastructure used for conventional CCS.*

- **Carbon capture and storage (CCS)** – CCS refers to technologies that can ***capture $CO_2$ at a source of emissions*** before it is released into the atmosphere.
- These sources include the fossil fuel industry (where coal, oil and gas are combusted to generate power) and industrial processes like steel and cement production.
- It is a three-step process, involving:
  - Capturing the CO2 produced
  - Transporting the captured CO2
  - Storing it deep underground
- **Carbon-Dioxide Removal (CDR) –** Uses technologies, practices, and approaches to ***remove CO2 from our atmosphere*** through deliberate and intentional human actions.
- *CDR* captures CO2 from the atmosphere and locks it away for years in plants, soils, oceans, rocks, saline aquifers, depleted oil wells, or long- lived products like cement.
- It can be *natural* (afforestation or reforestation) or *use technologies* (direct air capture), where machines mimic trees by absorbing $CO_2$ and storing it underground.
  - For example: Enhanced rock weathering and BECCS (Bioenergy with carbon capture and storage)




## How well do CCS and CDR need to work?

- According to 6th Assessment Report (AR6) of UN's IPCC, ***climate mitigation relies a lot on the use of CDR*** in achieving the goal of limiting the world's average surface temperature increase to 1.5 degrees C with no or limited overshoot.
    - If $CO_2$ emissions continue at current levels, we will have a 50% chance of exceeding 1.5 degrees C compared to pre-industrial levels in 7 years.
- There is more than a 50% chance of limiting warming to 1.5 degrees C assuming if the world can ***sequester 5 billion tonnes of $CO_2$ by 2040*** which is more than India emits currently every year.

*Direct mitigation refers to reducing our reliance on fossil fuels with renewable energy sources like solar and wind power.*

## What are the limitations of CCS?

- **Under developed technology**– CCS haven't demonstrated *feasibility* at large scale despite decades of development.
- **Higher costs** – It is cheaper to shut down a coal plant and replace it with some combination of wind, solar and batteries in comparison to attaching a carbon capture device to the plant.
- **Additional energy needs** – It create new energy needs for the transport and long-term storage of carbon.
- **Creates room to emit GHGs -** A Germany-based climate science and policy institute, revealed that reliance on CCS *could release an extra 86 billion tonnes of greenhouse gases into the atmosphere* between 2020 and 2050.

- **Underperformance** - A 2022 study by the Institute for Energy Economics and Financial Analysis (IEEFA) found that *most of the 13 flagship CCS projects worldwide have either failed* entirely or underperformed.

## What are the limitations of CDR?

- **Affect land rights** – Higher land demand for planting trees and deploying large-scale CDR methods *deprive indigenous communities of their land rights*.
- **Threaten food security** – It *compete with other forms of land-use, like agriculture* that is crucial for ensuring food security.
- **Affect biodiversity** – It might alter existing land usage and thereby *impact habitat and survival* of different organisms.
- **Impact of climate change mitigation** – Deploying CDR technologies in large tracts of land might counteract from using land to generate renewable energy resources.
    - For example, the ***2023 'Land Gap' report*** shows over reliance of government on land-based CDR to offset fossil fuel emissions thereby *shifting their mitigation burden away from reducing fossil fuel use*.
- **Uncertain future** – There is need to identify viable and scalable CDR methods and to figure out who will pay for CDR at scale in the future.

**References**


1. The Hindu| Limitations of CCS and CDR
2. The Indian Express| Unabated Fossil Fuels