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

