G20 India Presidency 2023
1st ENERGY TRANSITIONS WORKING GROUP MEETING

Financing needs for new age critical clean energy technologies:
CO_2 Capture, Utilization, and Storage (CCUS)

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वसुधैव कुटुम्बकम्
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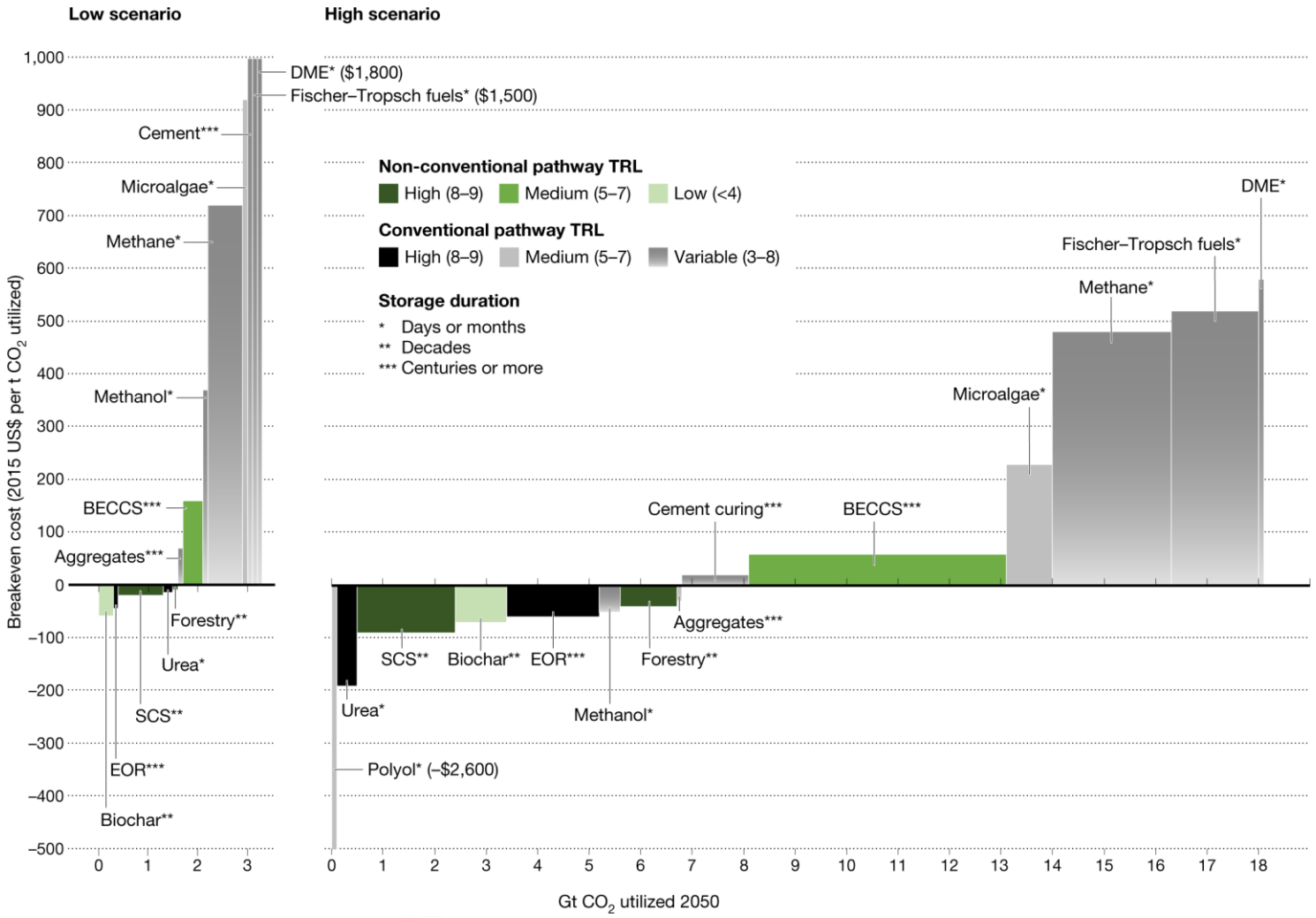
Macroeconomic Impacts of CCUS

- Paris Climate Change Agreement puts Energy systems mitigation with CO_2 capture, utilization and storage (CCUS) as increasingly important over the next three decades.
- It has the potential to reduce the magnitude of stranded assets in the fossil fuel supply chains.
- More than 50% reduction in stranding of power plants and fossil reserves by likely availability of CCUS
- $1-2 trillion of global benefits through availability of CCUS through lower stranding, carbon reduction towards Net Zero
- CCUS availability could aid in employment security in two ways:
  - It would avert the job losses of close to 20 million individuals, who are engaged in the coal supply chain globally
  - It would create new jobs in development for CO_2 capture technologies, and monitoring/storage of long-term CO_2 storage

Marginal Abatement Costs for CCUS to decrease with scale

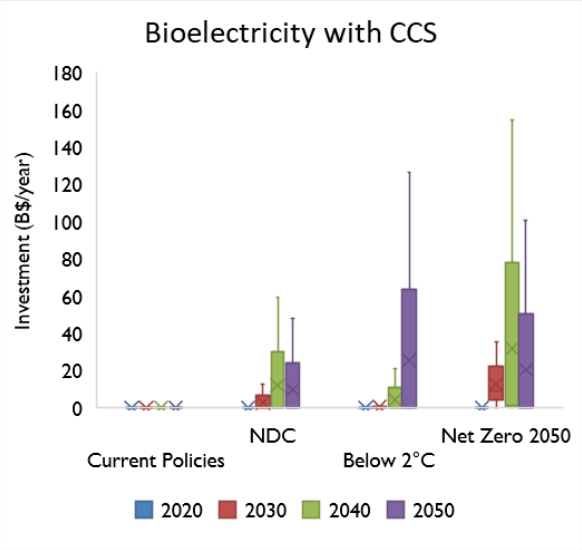


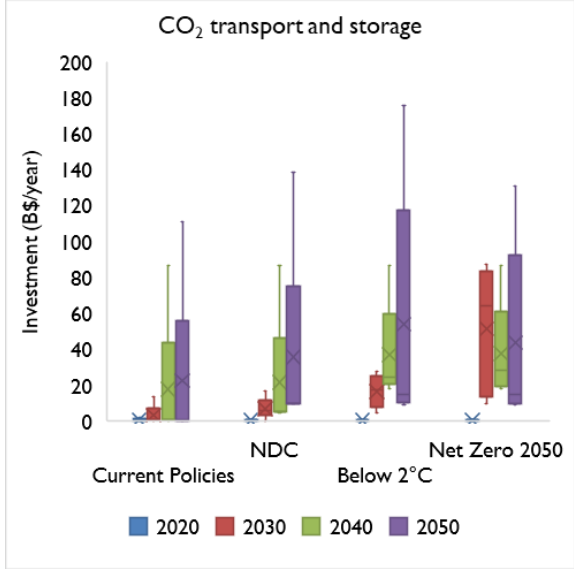
Source: Hepburn et al. (2019)

- Currently, CCUS requires a high carbon price to be feasible – at this stage, it can come from government or multilateral support
- Cost of CCS ~ \$50-120/t-CO_2 for power sector, lower for high-purity industrial sources
- Cost of CCU ~ (-\$80) to \$1800/t-CO_2 now but can come down to (-\$500) to \$580/t-CO_2 through economies of scale
- Shows the importance of low-cost financing

Financing Needs for CCUS Projects

- Depending on national context, countries may have higher investment in CCUS in coal, gas or bioenergy at the capture end
- $22-32 billion/year required for CO_2 transport (pipeline) and storage infrastructure by 2040 in "Below 2ºC" scenario *(Network for Greening the Financing System [NGFS] data)*
- Market size for CCU may increase from a couple of hundred billion dollars in 2030 to $4-5 trillion in 2050
- Prominent CCU investments likely to be seen in precast concrete, aggregates, animal feed, formic acid and methanol *(U.S. National Academies of Sciences study, 2022)*
- These investments will have a long-ranging impact by providing returns for 30-50 years
- Data shown for select categories from NGFS (right side)

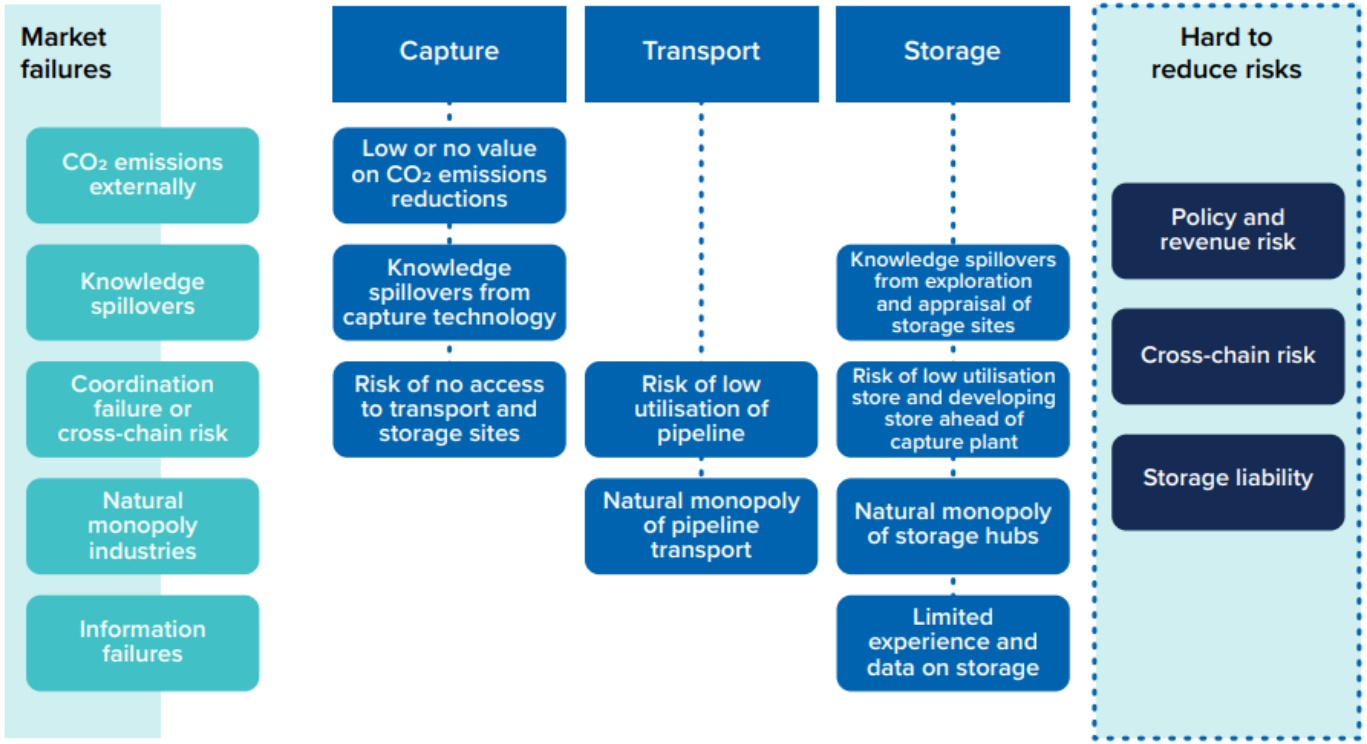




Risks Associated with CCUS Supply Chains

- Because of large coordination required across the CCUS supply chains, a number of risk factors may emerge in CCUS implementation.

- CCU is associated with lesser risks:
  - No storage liability
  - Available market for the products
  - Higher public support



Market failures across CCUS supply chains

Source: Zapantis (2019)

Financial Risks for Implementation of CCUS

- Revenue risks are currently crucial and inhibitory for power sector CCS projects.
- CCUS used for enhanced oil recovery could face additional revenue volatility during times of low crude oil prices
- Due to the large and diversified nature of CCUS projects, cross-chain risks also exist because the profitability of each supply-chain component depends on other components, which may not yet be ready.
- Failure of any one component may lead to low load factor for the plant under emission constraints.

Financial Risks for Implementation of CCUS

- The products generated by CCU would require a viable and stable market price.
- Several products generated by CCU have price volatility associated with them, e.g., CO_2 methanation pathway.
- Investment risks would exist unless there is some pricing security for ‘green products’ synthesized using CCU.
- Storage liability risks are present in CCS projects particularly, while almost nil in CCU.
- The storage operator may potentially be penalized for any long-term leakage. So it is important to manage liability risks even though risk of CO_2 leakage has been very low so far.

Examples of Measures for Improving Bankability of CCUS Projects

- Sequestration tax credits and Investment tax credits for reducing revenue risks
- The sequestration tax credits could provide a higher incentive for CO_2 that is not stored/utilized due to absence of markets. These credits must be indexed to inflation.
- Current CCUS projects are largely based on one-to-one models, where one single large point source sends CO_2 to one sink, which adds to cross-sector risks. Abating this risk requires development of hub-and-cluster models, where networks of sources and sinks are formed. This would de-risks investments in CCUS in addition to achieving economies of scale.
- Reducing financial risk aversion to storage liability requires a clear standard for operators, which includes the time duration until which they will be liable for leakages and leakage limits.

Financial Interventions for Enabling CCUS

- Multilateral agencies and developmental financial institutions are more likely to be key sources of finance for CCUS projects.
- As CCUS matures and the sector de-risks, commercial lenders may also become important financiers.
- An important component of low-cost finance for CCUS is in the form of *outcome-based sustainability loans* or *sustainability linked loans (SLLs)*.
- Under SLLs, proceeds may be borrowed for any activity, but the lending interest rates are lower if certain ESG criteria are being met.
- Green bonds could also be deployed, such as by multilateral development banks (MDBs), governments and financial corporates. Several such Green Bonds, however, preclude key CCUS applications, such as retrofit of coal fired power plants.
- Investment tax credits are being provided in countries such as the United States, where incentive of $180/t-$CO_2$ (in direct air capture) and $85/t-$CO_2$ (point source CO_2 capture) exist along with limitations to the sectors and capture thresholds of plants.

Financial Interventions for Enabling CCUS

- Climate related financial disclosures are critical to driving investments in CCUS. The Task Force on Climate-related Financial Disclosures sets clear guidelines for such disclosures.
- For CCUS projects, a clear disclosure methodology should be developed that includes Scope 1, 2 and 3 emissions, how the project contributes to national GHG emission avoidance, support of CCUS research and public engagement activities aimed at CCUS deployment.
- Suitability of revenue treatments such as production tax credits and/or capital incentives would depend upon the fuel type.
- If private sector finance is itself inadequate to lower the price of electricity or commodities, governments and/or MDBs may subsidize such products via viability gap funding (VGF).
- VGF may be beneficial to early movers to reduce 'wait and watch' until the financial market provides a robust coverage for CCUS.

Financing Landscape

- Financing capacity of GCF, GEF, MDBs and other funds is not enough to invest in CCUS projects.
- As per the project life cycle of CCUS projects, appropriate financing mechanism should be designed and adopted.
- Grant Based Funding for technical assistance and demonstration of CCUS technologies, especially in EMDCs
- In the short term, viability gap funding by MDBs, DFIs and other global funds could be a potent mechanism to improve the bankability and viability of CCUS projects globally, especially in EMDCs.
- Create a dedicated fund at global level to fund CCUS projects at commercial scale and crowd-in investment from private investors.

Some Instruments to Finance CCUS Projects

- Green Bonds
- Outcome-based sustainability debt (Bonds/Loans)
- Syndicated Loans (Co-financing)
- Collective investment vehicle (Structured Equity Funds)
- Guarantees
- Credit Default Swaps

International Cooperation

- It is essential that CCUS is brought within the ambit of carbon markets in the medium-to-long terms.
- While the EU Emission Trading Scheme and some other markets include CCUS, it should be considered whether the geographical boundary of such projects may be outside the region so that carbon mitigation credits may be traded across G20 countries.
- Technical assistance should be provided to G20 countries for effective domestic assessment of sink potential.
- Requisite funds may be provided to explore storage capacity such that future large point sources of CO_2 are sited around sinks with high readiness.

International Cooperation

- In light of the 2023 G20 Presidency theme, “One Earth, One Family, One Future”, it is recognized that many countries outside the G20 would also emerge as hubs of economic and industrial development over the next three decades.
- While GHG emissions are currently low for countries outside the G20, these may rise and CCUS may have to be deployed by them as well.
- It is therefore suggested that primary-level screening of CCUS opportunities is carried out in these geographies as well.
- G20 could facilitate these funds for G77 countries as part of developing CCUS knowledgebase and databases globally.

Concluding Remarks and Recommendations

- Storage assessments, acceptance in global carbon markets, and G20 level supportive policies would encourage investments in CCUS.
- Equity and debt investments in CCUS demonstration projects can be fully or partially guaranteed in EMDCs.
- Project developers can assess the viability of large-scale commercial deployment and test the technical suitability per the country's domestic conditions.
- Research efforts must be diversified into CCU because of its near-term prospects and large public acceptability.
- Existing and planned financing mechanisms should incorporate CCU, where relevant.

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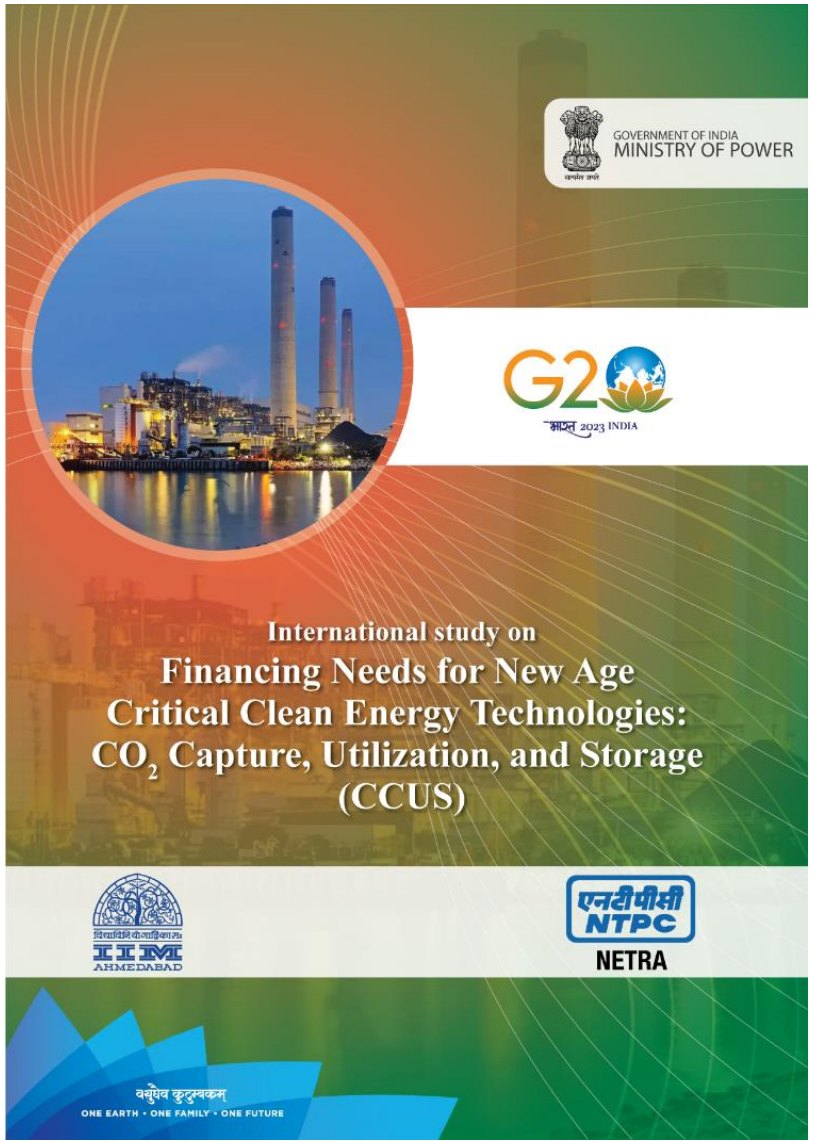

Thank You

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