BUSINESS MODELS AND INCENTIVES FOR CCUS

Carbon capture utilisation and storage (CCUS) involves capturing carbon dioxide (CO_2) from point sources, usually industrial and power generation facilities, and injecting it deep underground (around 1000 m) for permanent sequestration or reusing it in other fuel and chemical processes. CCUS is a key technology for reaching net zero emission (NZE) commitments and Paris Agreement targets. Both IEA and IPCC projections show CCUS being used across a variety of sectors, including power, industry, and transport fuels. Many countries have also included CCUS in their NZE transition plans, including Canada, China, Europe and the USA (IEA, 2020a; Turan and Zapantis, 2021).

CCUS can be used for decarbonisation in a variety of applications, but it also has positive impacts beyond its emissions reduction potential. These include sustainable development, system balancing, minimising stranded assets, enabling negative emissions, and coal gasification. Thus, CCUS has benefits within the broader energy trilemma of balancing the need for sustainable, affordable, and reliable energy supplies.

Financial and regulatory barriers have inhibited the progress of CCUS, despite its technological maturity. Underdeveloped and somewhat untested business models have lowered investor confidence, and the risks of some projects have seemed insurmountable. This report addresses these problems by exploring and proposing ownership models, revenue models, and policy mechanisms that can overcome the perceived barriers to CCUS deployment.

OWNERSHIP MODELS

Three ownership structures are explored: state ownership, public-private partnerships (PPPs), and a disaggregated business model based on CCUS clusters with separately owned transport and storage (T&S). All the ownership structures are viable, but some countries may prefer one model over another depending on their preference for private or public ownership.

- Where public ownership is considered normal, such as China, vertically integrated projects with single ownership of the entire CCUS value chain are more feasible.
- PPPs allow governments to support first-of-a-kind projects or projects of public interest while maintaining the involvement of private sector players. This strategy can work in any country where governments want to incentivise new projects; the level of public participation and ownership will depend on the national preferences.
- Providing independently run T&S operations allows businesses to focus on their primary activities. It also provides an opportunity to build CCUS hubs around shared T&S infrastructure, increasing cost-sharing and economies of scale.

INCENTIVES AND REVENUE STREAMS

Nine methods of providing revenue, through the market and policy supports, are examined: public financing, command and control regulation, tax credits, carbon prices, feed-in tariffs (FiTs) and contracts

for difference (CfDs), carbon take-back obligation, regulated asset base, CO_2 utilisation, and markets for CO_2 based and low-carbon products. While all the models can contribute to the uptake of CCUS, each project or location will have unique conditions and require a tailored set of supports. It is likely that a combination of methods will be required to overcome the barriers to CCUS deployment.

- Both public and private finance should be mobilised as soon as possible to increase the use of CCUS. Public institutions will probably have to provide the starting capital for some projects to lower the risk for private finance.
- Some incentives will provide wrap-around support but not directly incentivise CCUS projects.
    - Carbon pricing is considered a key element of climate change mitigation policies, but it is a general instrument that cannot guarantee any specific technological changes.
    - Creating a market for low carbon and CO_2-based products could provide a growing source of revenue for CCUS projects, but the opportunity to sell captured CO_2 may not be a sufficient incentive to catalyse individual projects.
    - Only enhanced oil recovery (EOR) has provided a sufficient incentive for project development in the past, but investors are growing wary of relying on EOR as the sole source of revenue because of the volatility of oil markets.
- Other methods provide more direct support by boosting or guaranteeing tariff revenue.
    - In the regulated asset base model, regulators allow a surcharge on consumer tariffs before the infrastructure is operational, redistributing future income to help with upfront costs.
    - FiTs and CfDs also stabilise revenue through price guarantees or government contributions. Tax credits provide revenue support, although it comes at the end of the financial period.
- There is also the approach of requiring businesses to use CCUS.
    - Supply-side policies such as a carbon take-back obligation require fossil fuel extractors to provide for carbon storage to account for the emissions created by their products. This method benefits the entire CCUS value chain because it focuses on storage as the end goal.
    - Governments also have the ability to mandate the use of CCUS through regulation.

CONCLUSIONS

The hub and cluster model is the likely way forward for most CCUS projects. Vertically integrated ownership is usually only economical for EOR projects. For other industries, an independent T&S network is preferable. Locating CO_2 transport hubs in pre-existing industry clusters with multiple emitters provides economies of scale and lowers cross-chain risk. Establishing CCUS hubs and clusters can also be an incentive for more companies to adopt CCUS as they can buy into an operational system.

Work on CCUS projects needs to be ramped up immediately. Various mechanisms can be applied to CCUS projects to move them from the feasibility study stage to reality. However, as projects with long lead times and complex financial requirements, investors need to start planning now in order to realise the full benefits of CCUS for power systems and industrial decarbonisation. Businesses and governments need to select the incentives most appropriate to their situations and use them to launch more projects. Public

financial support can taper off over time as costs decline and markets mature, but policy intervention is needed up front to enable this development.

Each executive summary is based on a detailed study which is available separately from: www.sustainable-carbon.org. This is a summary of the report: Business models and incentives for CCUS by Stephanie Metzger, ICSC/324, ISBN 978-92-9029-647-8, 72 pp, September 2022.