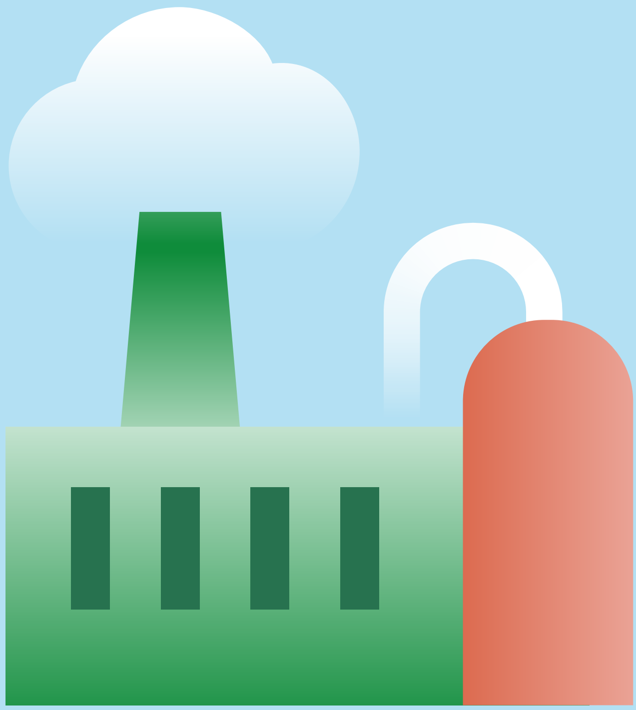
THE CCUS HUB

THE CCUS HUB PLAYBOOK

A guide for regulators, industrial emitters and hub developers

INDUSTRIAL EMITTERS



4.2 INDUSTRIAL EMITTERS

Hard-to-abate industrial companies in sectors like cement, steel, chemicals, fertilizers and waste-to-energy are increasingly looking at CCUS as part of their pathway to net zero. Finding the right business model to finance carbon capture is still tough, but that is changing in some countries as carbon prices rise, new low carbon product standards are introduced, and innovation funding is directed to companies in hard-to-abate sectors to speed up decarbonization. The emergence of CCUS hubs is making it easier to embrace CCUS, without having to take responsibility for building pipelines and drilling storage wells – and without long-term liability for the stored carbon dioxide.

WHAT ARE THE PROS AND CONS OF A CCUS HUB FOR AN EMITTER?

A CCUS hub takes carbon dioxide from several emitting sources, such as heavy industries and power, and then transports and stores it using common infrastructure. For emitters, the hub offering opens up CCUS as a decarbonization option without them having to take responsibility for building pipelines, drilling storage wells and monitoring carbon dioxide storage.

The downside is that developing a CCUS hub is complex. The value chain typically consists of a hub developer, that initiates and manages the value chain; multiple emitters who guarantee to capture and supply carbon dioxide; and a single transportation and storage company (that could serve several hubs).

Many industrial emitters with different industrial processes and specific regulatory constraints need to be pulled together in a big infrastructure project. So, it is important to communicate clearly to the hub developer and/or transport and storage operator what it will take to optimize your production operations – while capturing carbon dioxide.

Multiple parties need to take their Final Investment Decision at the same time for the CCUS hub development to proceed, representing a major project development risk. Possible solutions to the timing risk faced by emitters include creating a contractual structure where the transport and storage operator guarantees to take carbon dioxide or taking a direct ownership share in the T&S company.

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HOW DOES CARBON CAPTURE AND STORAGE WORK?

In the exhaust from industrial processes and fossil fuel powerplants, carbon dioxide is mixed in with nitrogen, oxygen and other gases. So CCUS first separates out the carbon dioxide. The main method currently used to do this is amine scrubbing. Flue gas is piped into the bottom of a vertical reactor vessel, where it rises up through a mist of a carbon dioxide absorbing liquid (usually an amine solution). The scrubbed gas is released at the top, with typically 90% or more of its carbon dioxide removed. The amine then goes to another vessel where high-temperature steam takes out the carbon dioxide. Finally, the near-pure carbon dioxide is compressed ready for transport.

In this early phase, emitters may need to test this technology on their processes. This will depend on the maturity of the capture technology and the industrial applications it has already been applied to. Testing would require additional expenditure by the emitter in the feasibility (pre-FEED) phase.

Before committing to expensive FEED studies, the emitter needs to get a clear understanding from the transport and storage operator that the proposed reservoir has sufficient permanent storage capacity and that the injection wells will work.

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IS CARBON CAPTURE A COMMERCIALLY VIABLE WAY TO DECARBONIZE?

The exact cost of carbon capture depends to a great extent on the mixture of gases captured. If there is a high proportion of carbon dioxide, at high pressure and on a large scale, it is relatively easy to capture, making costs lower than for dilute or low-pressure exhaust gases.

Compression costs will vary depending on the capture and associated industrial process but can be high to meet pressure specifications. For industries making fertilizers or ethanol, capture cost is well below $50 per tonne; for steel it can be around $100 per tonne, rising up to around $250 per tonne for aluminium. Local storage and loading costs may be relevant if transportation of carbon dioxide to the permanent storage site is done by truck, ship or rail.

Emitters need certainty on the specifications around purity and pressure of carbon dioxide to be delivered to the transport and storage operator. The tighter the specifications, the higher the costs for the emitter. Impurities such as water, nitrogen, sulphur oxide, nitrogen oxide, carbon monoxide, hydrocarbons and mercury can have major implications, for example corrosion, for carbon dioxide transportation and storage infrastructure, and on how the carbon dioxide behaves once it is injected into the target reservoir deep underground.

Depending on their location, emitters may be able to secure income from multiple revenue streams, including compliance (carbon) markets such as the EU ETS, tax credits, voluntary carbon markets, carbon dioxide as a commodity and low carbon product markets.

Government support to emitters typically takes the form of capital grants and operational cost funding, through a contract for difference on a carbon price, as in the UK and Netherlands, or a storage tax credit combined with a low carbon fuel standard, as in the US.

Emitters are likely to recover their capex on investments in carbon capture over a longer period of time than is normal for other investments. Returns will effectively be regulated as opposed to market driven.

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WHAT SORT OF RISKS DO EMITTERS FACE?

A key part of the commercial negotiations between the emitter and transport and storage operator focuses on the allocation of risks. Emitters face project risks around technology, construction, price and operations, which are common to any infrastructure investment. For hubs, the specific project risks are around volume, leakage and multi-stakeholder project development.

Emitters' hard-to-reduce risks include revenue risk, relating to an insufficiently high carbon price, cross-chain risks arising from the interdependency of the CCUS value chain, and long-term storage liability risk.

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WHAT ARE THE QUESTIONS EMITTERS SHOULD ASK THEMSELVES?

- What forms of government support are in place for emitters to capture carbon dioxide?
- Will the proposed incentives provide appropriate support for our industry?
- Are the necessary regulations in place for my capture project?
- What revenue streams are available to our project?
- What are my likely returns on investment?
- How certain are we that carbon dioxide storage is sufficient and ready to be used?
- Will we need to test the capture technology on our processes?
- What are the carbon dioxide specifications required by the transport and storage operator?
- What are the compression costs?
- Are there any local storage and loading costs?
- How are we dealing with project and operational risks?

> Read more about how industrial emitters are using CCUS hubs as part of their decarbonization pathways – Fortum, Holcim, BASF