SCCS Briefing

What is carbon capture and utilisation?

We recycle metals, plastics, and paper, so why not find uses for the carbon dioxide (CO_2) we currently emit? In fact, there are many processes for which CO_2 is a useful product rather than a dangerous waste material.

CO_2 is currently used to make new products, such as building materials and synthetic fuels, or to tackle fires as a component of fire extinguishers. It is also used widely in the food and drink industry, for example, for fizzy drinks and food preservation.

In much larger volumes, CO_2 can be used in enhanced oil recovery. These applications are collectively known as carbon capture and utilisation, or CCU.

Supply and demand

Commercial-scale carbon capture will enable large quantities of CO_2 to be readily available as a relatively cheap commodity. It makes economic and environmental sense if some of this CO_2 could be put to use before transportation and permanent storage. In addition, converting CO_2 into useful products has the potential to reduce CO_2 emissions, albeit for a shorter timescale than geological CO_2 storage.

As well as the environmental and economic benefits of efficient CO_2 use, the utilisation industry could create jobs and revenue from captured CO_2. Various projects are under way in the UK and across Europe focusing on clusters of industrial activity, where shared CO_2 capture and transport infrastructure can support the delivery of carbon capture and storage (CCS) networks. This could include the demand for, and supply of, captured CO_2 for the utilisation industries.

The role of CCU in climate action

The CCU industry has large and varied potential and there have been innovative developments in recent years. However, climate action requires us to permanently store the very large amounts of CO_2 which are emitted every year – around 40 billion tonnes globally – and remove the CO_2 already in our atmosphere. In most CCU applications, the volumes used will be released back into the atmosphere sooner or later, where they will continue to contribute to climate change.

What are the main categories of CO_2 utilisation?

- **Fuel conversion**: using CO_2 in the manufacture of fuels for transport and heat. This includes electrochemical conversion, developing photo-catalysts to enhance biofuel cultivation, and, for example, the cultivation of CO_2-absorbing algae for use as a biofuel. Trials are also ongoing on making synthetic fuels from captured CO_2 and hydrogen using surplus renewable energy.

- **Chemical conversion**: the transformation of CO_2 in other useful chemicals. CO_2 is already used by the chemical industry to make fertilisers, methanol and other carbon ("organic") chemicals, such as petrochemicals.

- **Mineral Carbonation**: the process of turning CO_2 into solid minerals. This permanently locks the CO_2 away as a carbonate mineral (e.g. $CaCO_3$). These minerals are useful in the building and manufacturing industry and, for example, can be used to make cement.

- **Enhanced Oil Recovery**: CO_2 can be injected into oil fields to increase the amount of oil produced – known as enhanced oil recovery (EOR). If CO_2 injection continues after the oil has been recovered, the amount of CO_2 stored can more than offset the CO_2 resulting from the increased oil produced.

- **Food and drink industry**: CO_2 is used extensively within the food and drink sector, such as creating dry ice to keep products chilled in transit, bottling and adding fizz to soft drinks and alcoholic beverages, extending the shelf-life of different foods, and for the slaughter of livestock for the meat industry.

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