Bite-size Climate Science

# Carbon Capture and Storage

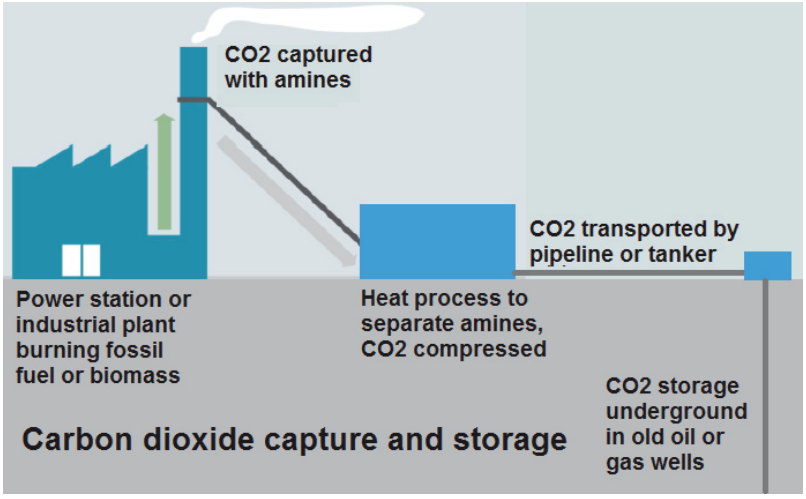
## Magic bullet or conjuror's illusion?

SALISBURY ECO-HUB ALLIANCE

Carbon capture - capturing the carbon dioxide ($CO_2$) from the emissions of conventional power stations and industrial plants, or even from the the atmosphere - is technically possible, as is the process of storing $CO_2$ underground in old oil wells, but could it really be a practical solution to the problems of climate change, or is this an illusion based on wishful thinking?

## It can be done - but at a cost

There are a number of fairly straightforward chemical reactions which can capture $CO_2$, both from industrial and power station flue gases and from the atmosphere itself. Most use a class of chemicals called amines, which bond with $CO_2$, allowing it to be separated out. However, this requires a supply of amines, and creating or obtaining those amines itself requires the creation of industrial capacity and the expenditure of energy. Once extracted, the $CO_2$ has to be released from the amines by heating (more energy), then compressed and transported and finally stored deep underground, all of which requires more energy and infrastructure.




Adding carbon capture and storage (CCS) to our existing energy and industrial processes could cut their $CO_2$ emissions by 80 to 90%, but would reduce efficiency and substantially increase costs.

## Can it be scaled up enough to make a difference?

CCS is still at an early stage of development. In 2018 all the CCS installations in the world captured just 40 million tonnes (Mt) of $CO_2$: in 2019 the UK alone emitted 351 Mt $CO_2$ - almost nine times as much - and global emissions were nearly 40 billion tonnes (Gt). Although more facilities are now being built, there is a long way to go, and it is likely to be many years before there are enough to make a sizeable impact on total global emissions.

Even if carbon capture could be rapidly increased, there are question marks over the amount of storage capacity that could be accessed. The UK's total verified off-shore $CO_2$ storage capacity is just 1 Gt (1,000 Mt) - less than 3 years' worth of UK emissions at the current rate.

## It appears to be an attractive option - at least for some

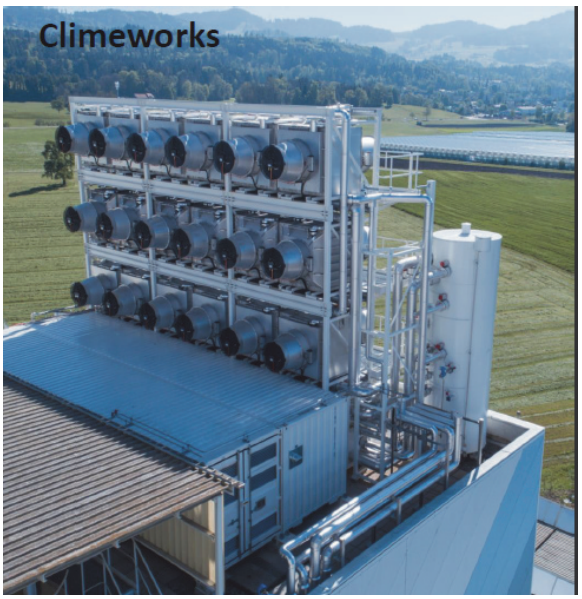
Despite the costs, and big uncertainties over whether it can be made to work on the scale which would be necessary to prevent catastrophic climate change, carbon capture and storage (CCS) seems very appealing to some people. Political leaders have delayed taking sufficient action to cut emissions, or hoped that CCS would be a technological fix which would allow them to avoid making difficult decisions. For many powerful people with a large financial vested interest in carrying on with business as usual, and for some consumers fearing the loss of affluent lifestyles, it seems to offer the route of least change. It is no surprise that the greatest advocates and lobbyists for CCS include oil and gas companies and the states with the largest oil reserves, such as Saudi Arabia.

# A dangerous distraction, or a vital back-up?

Many climate campaigners see CCS as a distraction from the urgent transition to renewable energy, a conjuring trick by the oil industry to keep themselves in business. Retrofitting CCS to old fossil fuel power stations (as the UK government has done with Drax in Humberside) seems a poor investment now that wind and solar power produce energy far more cheaply. If governments choose to rely on the uncertain promises of CCS and delay phasing out fossil fuels, they may be making a big mistake.

Drax (pictured right) was the UK's largest coal-fired power station, but has been converted to burn woodchip with CCS. It is Europe's largest biomass and CCS pilot project, and imports 7 million tons of woodchip from the USA annually.

Drax remains controversial. It is owned by a private company, making huge profits and buying back shares from its own directors, while freezing investment and saying its future is in doubt if it doesn't get more government subsidies. Ofgen has started an investigation into its sustainability claims about its woodchip fuel, which has also been questioned by government ministers.




However, the Intergovernmental Panel on Climate Change (IPCC) report in 2018 concluded that we are likely to overshoot the target of limiting climate change to 1.5° C, so that some form of carbon capture technology will be needed to bring $CO_2$ levels back down again.

The Climeworks plant near Zurich (left) captures 900 tonnes of $CO_2$ directly from the atmosphere each year. Like other Direct Atmospheric Capture (DAC) plants, it uses energy rather than generating it. If we have to rely on DAC to keep the Earth from overheating, it could account for 25% of global energy demand by 2100.

Current costs of DAC range from $30 per tonne in Iceland (using surplus geothermal heat) to $100 per tonne. For the technology to take off on a large scale, the most crucial question will be "who will pay?"

# So is carbon capture the answer to climate change?

Some form of carbon capture (probably DAC) will have to be part of the eventual solution if we fail to cut emissions sufficiently in the short term, as now seems almost certain. However, relying on carbon capture to make more than a marginal contribution to reducing $CO_2$ emissions overall would be a reckless gamble.

By far the greatest emphasis has to remain on cutting down emissions by phasing out fossil fuels as rapidly as possible, conserving energy wherever possible, and managing a rapid transition to clean renewable energy sources.

We also need to concentrate on the available natural mechanisms of carbon capture and storage - preserving the world's remaining forests and planting more, restoring peatlands and bogs, and enabling the oceans to absorb more carbon, for example by planting more sea grasses.

**We must not let new emerging CCS technologies distract us from these priorities.**

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