FACT SHEET

WHAT IS CCS?

Carbon capture and storage (CCS) is an integrated suite of technologies that can prevent large quantities of the greenhouse gas carbon dioxide (CO_2) from being released into the atmosphere.

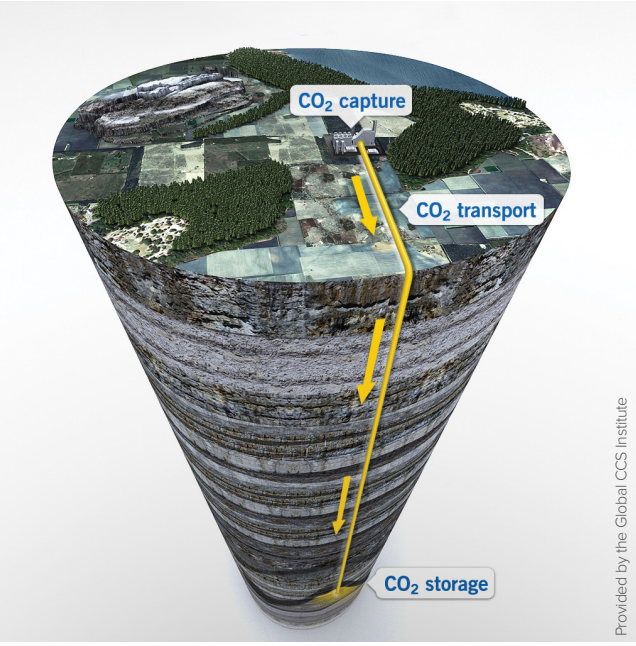
As the name implies, CO_2 is captured before it is emitted into the atmosphere. Captured CO_2 is then transported to a carefully selected and secure storage site, where it is injected deep into a rock formation for permanent storage.

Because CCS can achieve significant emission reductions, it is considered a key option within the portfolio of approaches required to reduce emissions.

There are three major stages involved in this technology:

1. **CAPTURE** – the separation of CO_2 from other gases produced at large industrial process facilities such as coal and natural gas power plants, steel mills and cement plants.
2. **TRANSPORT** – once separated, the CO_2 is compressed and transported, usually via pipelines, to a suitable site for geological
3. **STORAGE** – CO_2 is injected into deep underground rock formations, often at depths of one kilometre or more.

Figure 1: The Carbon Capture and Storage Process



WHY DO WE NEED CCS?

CCS is a climate game-changer. It is one of the few technologies able to adequately displace CO2 from coal and gas-fired power stations and the only technology capable of reducing large-scale emissions from myriad industrial sources.

CCS also has the unique capacity to be retrofitted to many existing complexes to allow them to function cleanly for the term of their natural life.

The Intergovernmental Panel on Climate Change (IPCC) and International Energy Agency (IEA) have both evidenced the critical role that CCS must play in meeting global emissions reduction goals.

CCS is 'of its time'. Through enhanced oil recovery (EOR), it is proving its commercial worth by improving oil recovery from existing fields, using these same fields to permanently store the injected CO2.

Through cleaning old industry and giving it a second life, CCS is preserving jobs and keeping local economies alive.

Most significantly, CCS is starting to demonstrate its climate change prowess in delivering commercial returns in a new energy economy where hydrogen production and bioenergy are starting to gain traction.

And, it is proving itself economically comparable to all other clean technologies.

CAPTURING CO_2

Carbon dioxide can be separated from a carbon emission source either before or after it has been combusted (burnt) to produce energy or other products, such as cement and steel. There are three ways to capture CO_2 that can be applied to the power sector:

- Pre-combustion technology
- Post-combustion technology
- Oxyfuel combustion.

TRANSPORTING CO_2

Once separated from other elements of the flue gas (gas exiting via a chimney or 'flue'), the CO_2 is compressed to make it easier to transport.

Today, CO_2 is already transported most often by pipeline, but also by ship and road tanker, primarily for use in the oil industry where CO_2 is injected into mature fields to enhance oil recovery, as well as for use in the food and beverage industry. However, the scale of transportation required for widespread deployment of CCS is far more significant than present levels.

STORING CO_2

At a suitable geological storage site, the CO_2 is injected into deep underground rock formations, often at depths of one kilometre or more. The CO_2 moves slowly through the porous rock, filling the tiny spaces known as 'pore space'.

Possible storage sites include depleted oil or gas fields, rocks containing unpotable saline water formations or incidental storage during enhanced oil recovery (EOR). these sites generally have an impermeable trap, also called a 'seal-rock', above them. The seal and other geological features prevent the CO_2 from migrating to the surface. Such sites have been demonstrated to securely contain fluids and gases for millions of years.

Once injected, a range of technologies is used to monitor movement of the CO_2 underground. Monitoring, reporting and verifying processes are important to ensure that the CO_2 is safely and permanently stored.

The intergovernmental Panel on Climate Change (IPCC) estimates the world's potential storage capacity at two trillion tonnes, although there could be a "much larger potential" (2005, iPCC special Report).

WHAT CAN BE DONE WITH CAPTURED CO_2?

Generally speaking, there are three possibilities:

1. The CO_2 can be stored securely in deep underground geological formations.
2. It can be used as a value-added commodity. This can result in a portion of the CO_2 being permanently stored – for example, in concrete that has been cured using CO_2 or in plastic materials derived from biomass that uses CO_2 as one of the ingredients.
3. The CO_2 can be converted into biomass. This can be achieved, for example, through algae farming using CO_2 as a feedstock. The harvested algae can then be processed into bio-fuels that take the place of non-biological carbon sources

CCS TODAY

CCS projects have been operating successfully across the world since the mid-1990s. Significant projects include:

- The world's first large-scale CCS project in the power sector commenced operation in October 2014 at the Boundary Dam power station in Saskatchewan, Canada. Two additional large-scale CCS projects in the power sector – at Petra Nova Carbon Capture Project in Texas.
- The sleipner and snøhvit CO_2 storage projects in Norway have stored just under 20 million tonnes of CO_2 into offshore deep saline formations.
- Great Plains synfuels Weyburn-Midale. Since 2000, about 3 million tonnes of CO_2 a year has been captured from a synthetic natural gas plant at Great Plains in the us, and transported for EOR operations at the Weyburn-Midale oilfields, in Canada.

As of 2018, there were 43 large-scale facilities - 18 in commercial operation, five under construction and 20 in various stages of development.

FOR MORE INFORMATION

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