United Nations
Economic Commission for Europe

SUSTAINABLE ENERGY | CLEANER ELECTRICITY PRODUCTION

Carbon Capture and Storage Fact Sheet

The threat of climate change and the importance of fossil fuels in global energy supply have recently stimulated significant interest in carbon capture and storage. The most important application of carbon capture is in power generation, the sector that is responsible for around 40% of global energy related CO_2 emissions.

What is CCS: Carbon capture and storage (CCS), sometimes called carbon capture, utilization and storage (CCUS), prevents large amounts of CO_2 from being released into the atmosphere. The technology involves capturing CO_2 produced by large industrial plants, compressing it for transportation and then injecting it deep into a rock formation at a carefully selected and secure site, where it is permanently stored.[1]

How does CCS work: CCS involves the following three major steps:

►**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, cement plants and petrochemical facilities.

►**Transport**: Once separated, the CO_2 is compressed and transported (usually by pipeline) to a suitable site for geological storage.

► **Storage**: After transportation, the captured CO_2 is injected into deep underground rock formations, often at depths of one kilometre or more.[1]

Today's reality: The world burns 22 million metric tonnes of coal a day, a cubic kilometre of natural gas every 2.5 hours and 92.7 million barrels of oil a day (a rate that can fill an Olympic pool every 15 seconds). This rate of consumption creates 107 million tonnes of CO_2 emissions every day.

CCS is vital for the environment: In order to constrain CO_2 emissions to levels consistent with a less than 2°C rise in global temperatures, modelling by the International Energy Agency (IEA) shows that CCS will need to contribute about 14% of the cumulative emissions reductions required through 2050 compared to a 'business-as-usual' approach. A power generating unit equipped with CCS could reduce CO_2 emissions to the atmosphere by approximately 80–90% compared to a plant without CCS.

Capturing CO_2 from sectors other than power generation is also very important. The IEA projects that around half of the CO_2 captured up to 2050 in order to meet climate goals will need occur outside of the power sector, in areas such as steel, cement and petrochemical production.

[1] Global CCS Institute http://www.globalccsinstitute.com

The Economics: CCS can play an important role in a least-cost approach to climate change mitigation. Economic modelling shows that use of CCS would significantly reduce the cost of meeting the goal of stabilizing atmospheric concentrations of CO_2 below a 2°C target. Without CCS, the costs of climate change mitigation would increase by 138%.[2] While a power plant equipped with a CCS system is more expensive than conventional fossil-fuel fired power technology (CCS increases the energy used for power generation by about 25-50%) here are opportunities to offset the increased cost through generating revenues from selling the captured CO_2 for processes such as enhanced oil recovery (EOR). The injection of CO_2 into oil reservoirs for EOR has been practised in the United States for four decades and can significantly increase oil recovery from suitable fields. Where anthropogenic CO_2 is utilized, the process results in permanent storage of CO_2 in the oil reservoir.

Success Stories: CCS system technology is increasingly being deployed around the world. The world's first large-scale CCS project in the power sector commenced operations in October 2014 at the Boundary Dam power station in Saskatchewan, Canada. Two additional large-scale CCS projects in the power sector – at the Kemper County Energy Facility in Mississippi and the Petra Nova Carbon Capture Project in Texas – are planned to come into operation in 2016. Construction is also underway on the world's first large-scale CCS project in the iron and steel sector, the Abu Dhabi CCS Project in the United Arab Emirates (UAE). These four projects are among the 22 large-scale CCS projects in operation or construction around the world – double the number at the beginning of the decade.

There are also another 14 projects in advanced development planning, nine of which are in the power sector. A further 19 projects are in the early stages of development planning.

Boundary Dam - In October 2014, the world's first application of carbon capture technology on a large-scale power plant was opened at Boundary Dam in Saskatchewan, Canada. The Project captures and stores about 1 million tonnes of CO_2 per year. The captured CO_2 will mainly be used for EOR at the nearby Weyburn oilfield, where upwards of 25 million tonnes of anthropogenic CO_2 sourced from a gasification plant in North Dakota has already been securely stored through EOR operations since 2000. [3]

Boundary Dam CCS Power Plant [3]

Sleipner and Snøhvit – The Sleipner and Snøhvit CCS projects in Norway have injected and stored close to 20 million tonnes of CO_2 in offshore waters for well over a decade. Monitoring has successfully tracked the movement of CO_2 within the Sleipner storage reservoir, and there is no evidence of leakage from either site.

The Global CCS Institute's "Global CCS Status Report 2014" provides a comprehensive update: www.globalccsinstitute.com/in-focus/global-status-ccs-2014.

UNECE Recommendations on CCS

UNECE member States agreed on recommendations to UNFCCC on how CCS and CCS for Enhanced Oil Recovery (EOR) should be treated in a Post-Kyoto Protocol Agreement in November 2014 and these have now been submitted to the UNFCCC. The Recommendations are available on the UNECE website at: www.unece.org/energy/se/cep.html

[2] Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Synthesis Report (AR5)

[3] SaskPower http://www.saskpower.com/about-us/media-information/news-releases/saskpower-launches-worlds-first-commercial-ccs-process/