Carbon capture: environmental impacts

Before regulators extend subsidies to carbon capture projects or require all new plants to use carbon capture technology, they should consider the environmental effects of the technologies. Recent research explored the effects that carbon capture systems could have on the emissions of acid gas pollutants, such as nitrogen oxides and sulphur oxides, from power stations. New research also suggests that water consumption increases when some types of power plant are fitted with carbon capture systems.

In the short to medium term, fossil-fuel fired power plants are expected to deploy carbon capture technologies to cut global greenhouse gas emissions, and research is underway to explore the environmental impacts of these technologies. Recent research investigated emissions of acid gas pollutants and CO2 from power plants with and without carbon capture.

The results show that the effect on the acid gas emissions of an individual plant depends on a combination of two factors. First is the application of the capture process itself. This is unlikely to increase significantly the emissions of acid gas pollutants. On the contrary, the solvents used to capture CO2 from the flue gases will remove some nitrogen oxides and sulphur oxides. The second is the energy penalty that the capture technology imposes. Because currently available carbon capture technologies reduce the efficiency of power plants, more fossil fuel will need to be burned to generate the same amount of energy.

The resulting increase in nitrogen oxide emissions, however, is small, estimated at 5 per cent for natural gas-powered plants and 24 per cent for coal-fired plants, while at least 80 per cent of the CO2 generated will be captured. Sulphur dioxide is produced mainly by coal combustion. The authors estimate coal-fired power stations equipped with capture technologies are likely to reduce sulphur dioxide emissions by at least 96 per cent. This will be driven by a need to avoid expensive losses of the solvents used to capture CO2.

More important than the impact on individual plants is the effect on projected emissions from the energy sector as a whole when CCS is (a) enabled or (b) made mandatory. Recent work shows that under both scenarios, emissions reduce significantly relative to a business as usual scenario, because of indirect effects such as fuel-switching.

Water consumption, however, may be an issue for carbon capture systems which rely on solvents to remove CO2 from flue gases. A new study estimates that the amount of water used for thermal cooling at US pulverised coal plants with CO2 capture equipment could double by the year 2030. This increase in water consumption may make these systems less suited to dry regions. Alternatively the researcher suggests that new technologies that reduce the demand for water need to be developed in the longer term.

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