A new CO₂ capture technology for existing power plants

Most industrialised and rapidly developing countries are building and planning substantial investments in new coal-fired power plants, despite major emissions of CO₂ and other pollutants. New research suggests that technology using calcium oxide (lime) has potential as an inexpensive carbon capture technology for power plants, which would enable emissions to be reduced.

Until zero (or near zero) emission power plants become available, medium-term climate change mitigation measures include carbon capture technologies, predicted to be capable of limiting CO₂ emissions from power plants by 80-90 per cent.

One method of capturing carbon uses the ‘carbonation-calcination cycle’, whereby CO₂ is removed from the flue gas via a chemical reaction with calcium oxide (CaO). This produces CaCO₃ - a combination of CO₂ and CaO. The CaCO₃ is then heated to a high temperature to create a further reaction which separates out the CaO and CO₂. This produces concentrated CO₂ which is available for storage. The technique has the added advantage of also capturing sulfur dioxide (SO₂), a pollutant from high-sulfur coals which is responsible for acid rain. Waste products from this process can be used by the cement industry.

The researchers propose a new CO₂ capture technology using these reactions which uses specialised equipment that can be retrofitted to existing power plants.

Advantages of this method include:
- The original plant does not need to be altered to add this technology
- Plant operation is not affected
- As SO₄ emissions are also removed, this eliminates the need for a separate unit and associated costs
- The reactions release large amounts of energy as heat, which can also be used to create steam to drive turbines generating additional power

In terms of CO₂ capture, the researchers calculate that the proposed technology would reduce CO₂ emissions from 0.781 Kg CO₂ / net kW h to 0.122 Kg CO₂ / net kW h. This would lead to a capture cost of around 16 Euros per tonne of CO₂, which would increase the cost of electricity from 37.9 Euros/MWh to 48.3 Euros/MWh, in their test case. The technology requires development and pilot study, but has the advantages that similar equipment already exists for other processes. This offers the potential for faster development of this technique compared with other CO₂ capture technologies.

Once captured, the CO₂ is compressed, transported and stored in geological formations, either on land or in the ocean. The European Commission has recognised carbon capture and storage (CCS) as part of its CO₂ reduction efforts by bringing forward an enabling legal framework for CCS in January 2008. The European Council has supported the goal of having 10-12 CCS demonstration plants operating by 2015.


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