European Commission

Science for Environment Policy

5 November 2015
Issue 434

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Mobile carbon capture technology removes 1000 kg CO_2 / day from Polish coal power plant

Power plants are a major source of CO_2 emissions and contributor to global warming. This study reports on a portable technology to remove CO_2 from their combustion exhaust gases. Pilot testing on a coal burning plant in Poland captured thousands of kilograms of CO_2 per day. This could be a viable future means of mitigating CO_2 emissions from the power generation sector.

The average temperatures of the past three decades have each been higher than any decade since records began[1]. This is the result of human activity which has released greenhouse gases, especially CO_2, into the atmosphere.

Burning coal, oil and gas produces large quantities of CO_2, making the power generation sector a focus for climate change mitigation strategies. Carbon capture and storage (CCS) technologies can reduce emissions from power plants by capturing the CO_2 and safely storing it.

However, these technologies can be expensive due to the large amounts of energy they require. To avoid an increase in energy prices, new CCS technologies that require less energy are being researched. This study trialled one such technology — a carbon capture plant that removes CO_2 via chemical absorption — in a coal-fired power plant in Poland.
The pilot plant was designed, erected and operated by the Polish Institute for Chemical Processing of Coal in collaboration with an industrial partner, TAURON. The plant absorbs CO_2 using a chemical (amine-based) solvent. The authors say this technology is the most effective for coal-fired power plants and can be implemented with existing units.

The plant is mobile, so it can be tested in various locations, and flexibly designed, which means it can be used to test changes to process. This allowed the researchers to investigate the influence of different process parameters on CO_2 recovery and energy demand (the two most important indicators of process efficiency).

In 2013, the plant was transported and connected to TAURON's Łaziska Power Plant in Poland, where 550 hours of tests were conducted using the solvent monoethanolamine (MEA), a baseline solvent suitable for extended comparisons. During testing, over 90% of CO_2 was removed from the flue gases and in excess of 19 000 kilograms of CO_2 was captured (approximately 1000 kg per day).

Process variations revealed that CO_2 recovery is dependent on a number of factors, including solvent concentration, CO_2 partial pressure and temperature. The amount of CO_2 removed from the flue gas fluctuated by up to 20% depending on these factors, which indicates that operating the process under optimal conditions could generate significant energy savings.

The researchers were particularly interested in process energy demand, as it is the major limiting factor to the widespread implementation of solvent-based CCS. Energy use in the vast majority of tests was below 4 megajoules per kilogram of CO_2, which compared well to available data on the energy demand of amine-based carbon capture processes. Further research by the authors proved that the energy demand could be reduced by using different solvents and introducing technological modifications to the process[2].

These initial tests demonstrate the successful operation of post-combustion amine-based carbon capture. It confirms that this technology is an effective means of reducing the CO_2 emissions of coal-fired power plants, which offers an important proof of concept for policymakers working in the energy sector.

Source: Stec, M., Tatarczuk, A., Więcław-Solny, L., Krótki, A., Spietz, T., Wilk, A. & Śpiewak, D. (2015). Demonstration of a post-combustion carbon capture pilot plant using amine-based solvents at the Łaziska Power Plant in Poland. *Clean Techn Environ Policy*. DOI: 10.1007/s10098-015-1001-2. This study is freely available at: http://link.springer.com/article/10.1007%2Fs10098-015-1001-2

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To cite this article / service: "Science for Environment Policy": European Commission DG Environment News Alert Service, edited by SCU, The University of the West of England, Bristol.

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