

# Chilling news for carbon capture

A carbon dioxide capture process using chilled ammonia looks like a promising way of reducing the efficiency penalty normally associated with post combustion capture technologies and achieving future overall costs comparable with IGCC plus capture. A pilot plant is planned, with start up scheduled for next year.

In the not too distant future, provision for carbon dioxide capture and storage (CCS) is likely to be required for new coal fired power plants in many parts of the world, and a number of projects with CCS, based on both IGCC and high-efficiency advanced supercritical units, are at the planning stage. But what is to be done about the large population of existing pulverised coal (PC) fired power plants, and those currently under construction or close to the start of construction – planned before carbon capture was quite so high on the agenda as it is now? They can't simply be shut down and abandoned. Indeed, on some scenarios it has been estimated that for stabilisation of atmospheric carbon dioxide levels at 550 ppm, around 1100 GWe of coal fired capacity may need to be operating with CCS by 2050. As Bob Hilton, business development director, Alstom Environmental Control Systems, puts it, "Saving the existing coal fleet is key – we must be able to retrofit CO<sub>2</sub> capture."

Modifying the combustion process so that combustion takes place in oxygen, or, more likely, a mixture of oxygen and recycled flue gas, is a promising option, considered to be potentially backfittable, although requiring burner modification and installation of equipment for oxygen separation (which, with current technologies, is energy intensive).

Perhaps more readily backfittable (assuming there is somewhere to dispose of the carbon dioxide) are post combustion technologies, in which the carbon dioxide is scrubbed from the flue gas. Amine scrubbing is a well established capture technology and has been employed in refineries and at coal fired power plants to produce food grade carbon dioxide, eg for fizzy drinks and for freezing chickens. But it comes with a large efficiency penalty, principally because of the energy needed to provide steam for regeneration of the amines.



WE Energies' Pleasant Prairie power plant, site of the chilled ammonia capture pilot plant

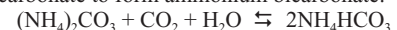
A number of projects are now underway that are aiming to reduce the energy requirements and the costs of post combustion scrubbing technologies, notably a series of tests at the Esbjerg coal fired plant in Denmark being conducted as part of the EU sponsored Castor programme.

## Why chilled ammonia?

There is certainly considerable scope for improving amine based technology and optimising it for power generation applications, but energy requirements and costs remain a challenge. It is for this reason that Alstom has recently embarked on a project to build a 5 MW chilled ammonia capture pilot plant in the USA. The project is being carried out in collaboration with the Electric Power Research Institute (EPRI) and We Energies, whose executive vice president, Rick Kuester, recently described the development of cost-effective carbon dioxide capture technology as "one of the most

important environmental challenges facing the utility industry in the 21st century."

The chilled ammonia process has the potential to dramatically reduce the energy required to capture carbon dioxide and isolate it in a highly concentrated, high pressure form. In laboratory testing sponsored by Alstom, EPRI, Statoil and others, the process has demonstrated the potential to capture over 90% of CO<sub>2</sub> at a cost that is estimated to be far less than for other carbon capture technologies. The chilled ammonia process involves the absorption of CO<sub>2</sub> by ammonium carbonate to form ammonium bicarbonate:



The absorption occurs at low temperature, preventing ammonia release but achieving high capture efficiency.

Moderately raising the temperature in a regenerator releases the captured CO<sub>2</sub>. Thus the chilled ammonia process has exactly what one is look-

