

Application notes: Capturing carbon dioxide from coal fired power plants

Australian coal (higher heating value with lower ash content - @10%) price has varied from \$60 (2019) to \$200 (2022) per metric ton (MT). Coal with higher ash content, lower heating value or sub-bituminous coal is generally sold cheaper. In Australian coal with heating value of @23.7 MMBTU/MT (25MJ/kg) equates to US\$2.5 to US\$8.44/MMBTU. Economically coal is always more attractive than oil (\$120/barrel and at 5.7 MMBTU/ barrel =\$21.0/MMBTU) or natural gas (LNG at \$25/MMBTU).

If 90% or more of the carbon dioxide emissions are economically captured from a coal fired power plant, then coal would become, both, economically and environmentally attractive. Carbon dioxide emissions from coal fired boiler are 11 to 15% by volume as compared to 3% in the gas turbine exhaust. The air fuel ratio is about ~2:1 in coal fired boilers and ~45:1 in gas turbine-driven generators. This makes capturing carbon dioxide from flue gases of coal fired boilers more economical. Exhaust gas pressure of about 1.3 bar absolute is required to overcome pressure drop in the system. Additional heat recovered from the flue gases is used for regeneration heat required for chemical absorption of carbon dioxide.

While old coal fired power plants have thermal efficiency of about 33 to 35%, new plants claim thermal efficiency @ 45%. Carbon dioxide recovery system can be installed from the beginning in new coal fired boilers. In older plants, as the plant cost may have already been recovered, its installation is equally attractive.

Between 2005 and 2006, over a period of 15 months, we carried out desktop engineering study on the available technologies for capture of carbon dioxide, its pressurisation (compression), and sequestration with input from various technology and equipment suppliers. The study also assessed the potential of capturing carbon dioxide from 100 MW coal fired power plant. A technical paper was published, based on the study, in December 2006 issue of Hydrocarbon Processing. The paper is available at the following link:

<https://www.gl-mach.com/wp-content/uploads/2020/08/HP1206-Saxena-reprint.pdf>

A carbon dioxide capture and sequestration facility was built in an existing 150 MW coal fired power plant, in Canada, between 2009-2014. Since 2014 it has been capturing about 2200 tons per day of carbon dioxide for sequestration / enhanced oil recovery from an oil field. Additionally, captured sulphur dioxide is used to produce sulphuric acid. Captured fly ash is sold for use in ready mix concrete.

The captured carbon dioxide can also be converted to methanol or urea and other by products.

There is a global market to sell the captured carbon dioxide credits at US\$20 per ton or more.

Conventional coal fired power plant owners should consider installing carbon dioxide capture facility to improve the economics and long term viability of their business. We have the necessary know-how. Our contact details are given below.