Post-Combustion Capture R&D at CSIRO

Paul H.M. Feron - CSIRO Energy Technology / Coal Technology Portfolio

Introduction

CSIRO has developed a post-combustion CO_2 capture (PCC) R&D program consisting of two major components, a pilot plant programme and a laboratory research programme, which are operated in an integrated manner. The programme is almost exclusively focused on reactive liquid absorption liquids for the capture of CO_2. An overview is given in Figure 3. In addition to the usual challenge of cost-reduction of the capture process, the challenges for PCC in Australia are also the quality of flue gases, which necessitates extensive pre-treatment and the lack of sufficient cooling water. A typical flow sheet of an integrated PCC process is shown in figure 1.

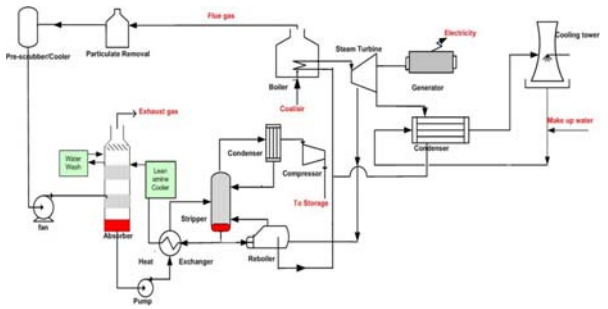

Figure 1: Reactive liquid absorption process integrated into coal fired power plant.

Pilot plant program objectives

- Hands-on experience for future operators
- Identification of operation issues and requirements
- Testing ground for existing and new PCC technologies

Figure 2 shows two pilot plant facilities [1].

Figure 2: CSIRO pilot plants in Australia. Left: PCC pilot plant at Loy Yang Power based on amines. Right PCC pilot plant at Delta Electricity Munmorah Power station based on aqueous ammonia.

Laboratory Research objectives

- Support to pilot plant operation and interpretation of results, technically and economically
- Develop novel solvents and solvent systems which result in lower costs for capture
- Addressing Australian specifics (flue gases, water)

The ongoing laboratory programme has addressed a large number of candidate liquid absorbents [2].

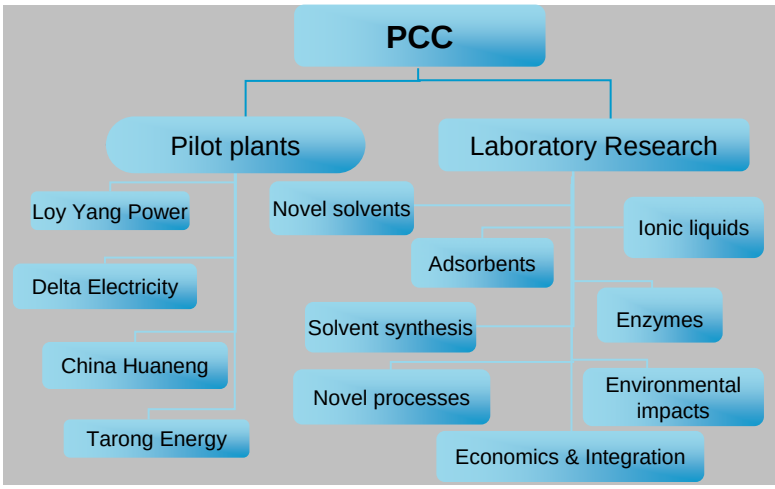

Figure 3: CSIRO PCC R&D Program overview

Learnings to date:

1. PCC using liquid absorbent based technology is a viable option to capture CO_2 from flue gases in Australian coal fired power plants.
2. The costs for PCC are between A$60 and A$110 per tonne CO_2 avoided for the standard liquid absorbent, with a sizeable scope for reduction of these costs.
3. Cost reductions can be achieved by a further focus on reduction of the capital costs in addition to the reduction of the energy penalty of the PCC process.
4. The flue gas quality of Australian power plants is such that FGD and possibly De-NOX need to be installed to enable the current commercially available PCC processes. This emphasises the need for more robust liquid absorbent technologies.
5. The nature and extent of the environmental impacts as a result from PCC processes are not well understood and require further investigation urgently.

Next steps

All the capture technologies under development are supported by patents and patent applications and they will be progressed towards a commercial product in partnerships with industry. This includes:

- A new amine based solvent formulation
- A dedicated aqueous ammonia process
- Ionic liquids formulation and carbon based sorbents
- An enzymatic stripping process

Furthermore the planned PCC demonstration projects in New South Wales and Victoria will be supported using the research infrastructure set up by CSIRO.

Australian Government
Department of Resources, Energy and Tourism

LOY YANG POWER · TARONG ENERGY · Delta electricity

Victoria The Place To Be

References

1. **Post-combustion capture R&D and pilot plant operation in Australia**, Aaron Cottrell et.al., Energy Procedia, Volume 1, Issue 1, February 2009,1003-1010
2. **Carbon Dioxide Postcombustion Capture: A Novel Screening Study of the Carbon Dioxide Absorption Performance of 76 Amines, Graeme Puxty et al,,** *Environ. Sci. Technol.* **2009,** *43,* 6427–6433

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Further information
contact:Paul Feron
phone: +61 (0) 2 4960 6022
email: paul.feron@csiro.au
www.csiro.au