Introduction

Chemical absorption based capture of CO₂ is an important method for reducing CO₂ emissions from new and existing fossil fuel power plants. The energy penalty associated with CO₂ capture reduces the thermal efficiency of PF plants by about 20%¹.

The CSIRO is currently exploring two main paths for reducing the energy penalty associated with chemical absorption based PCC of CO₂: Through improved solvents, and through improved engineering design.

This poster outlines some of the results of a literature review into possible process improvements that could be tested as part of the CSIRO’s pilot plant PCC activities.

Chemical absorption based PCC of CO₂

The standard plant used for chemical absorption based PCC of CO₂ is outlined in Figure 1.

As only a portion of the CO₂ loaded solvent reaches the bottom of the stripper, it can be stripped much more thoroughly for the same energy input. The ‘ultra lean’ solvent produced as a result is recycled to the absorber top section to ‘polish’ the exiting flue gas.

Another method for reducing the energy penalty associated with the stripper is vapour recompression (heat pumping). Here, vapour leaving the top of the column is compressed, and condensed in the reboiler, providing the energy needed for vapour production in the column. An extension of this concept is the internally heat integrated distillation column, as outlined in Figure 3.

Conclusion

Although there are many suggestions for improvements to chemical absorption based PCC of CO₂, few of these have been tested at pilot scale. This is an area where the CSIRO PCC pilot plant research activities will be used to generate much needed information regarding the applicability of these ‘improvements’ at scales that are much more useful when considering implementation into full size power plants.