Backgrounder – Oxy-firing technology and CO_2 capture and storage

Introduction

Oxy-fuel combustion has the potential to significantly lower the cost of capturing CO_2 from conventional coal-fired power plants.

The process essentially involves feeding a modified conventional boiler with pure oxygen rather than air, and recycling a proportion of the flue gases through the combustion chamber. This has the effect of significantly raising the concentration of CO_2 in the flue gases. The low concentration of CO_2 in the flue gases of conventional power stations is the major barrier to CO_2 capture because it makes it very expensive to separate and process.

Oxy-fuel combustion is one of the priority technologies identified in the COAL21 *"Plan of Action for Australia"* (detail and summary at **www.coal21.com.au**) as being of most relevance to Australia because of its potential applicability as a retrofit option for Australia's existing fleet of coal-fired power stations.

A number of organisations from Australia and Japan (listed below) have formed a consortium to develop a reference design for a demonstration oxy-fuel combustion plant, with CO_2 capture in geological storage, based on the Callide A power station owned by Queensland's CS Energy.

This project will be the first of its kind in Australia, and as far as can be determined, the world. It will be a very significant step forward in Australia's greenhouse response.

The parties have now drawn up a Memorandum of Understanding to guide their collaboration on the project.

The project has two stages:

Stage 1 – Detailed engineering feasibility study on the technical requirements and costs to convert an existing pulverised coal fired boiler (Callide A 30 MWe Unit owned by CS Energy) to oxy-firing.

Stage 2 – Pending the outcome of Stage 1, establishment of an oxy-fired PF demonstration plant capable of producing up to 150,000 tonnes per year of CO_2 for geological storage over a test period of 3 to 4 years.

The following consortium is now undertaking Stage 1 of the oxy-fuel study:

Technology providers:	Ishikawajima-Harima Heavy Industries (IHI)
Electricity Generators:	CS Energy, Stanwell Corporation& Tarong Energy
Coal industry:	Australian Coal Association Research Program (ACARP) & Xstrata Coal
Coal Researchers:	Center for Coal Utilization, Japan (CCUJ), Cooperative Research Centre for Coal in Sustainable Development (CCSD), Cooperative Research Centre for Greenhouse Gas Technologies (CO2CRC), & University of Newcastle (UN)

The oxy-firing process

Oxy-firing of coal fired boilers used for electricity generation involves the combustion of pulverised coal in a mixture of oxygen and recirculated flue gas in order to reduce the net volume of flue gases from the process and to substantially increase the concentration of carbon dioxide (CO_2) in the flue gases – compared to the normal air-firing case. Oxy-fuel should therefore both technically and economically facilitate the capture of CO_2 for subsequent geological storage.

Oxy-fuel technology is of potential importance to power and coal companies at an international level for the following reasons.

(i) The potential for a medium to long-term lower cost and lower technology risk option for achieving near zero emissions from coal-based electricity generation.

(ii) The potential to retrofit this technology to standard pulverised coal fired boilers.

(iii) The prospect of applying the technology to new coal-fired plant with significant reductions in the capital and operating cost of flue gas cleaning equipment such as that used to reduce the concentration of oxides of nitrogen (deNOx plant).

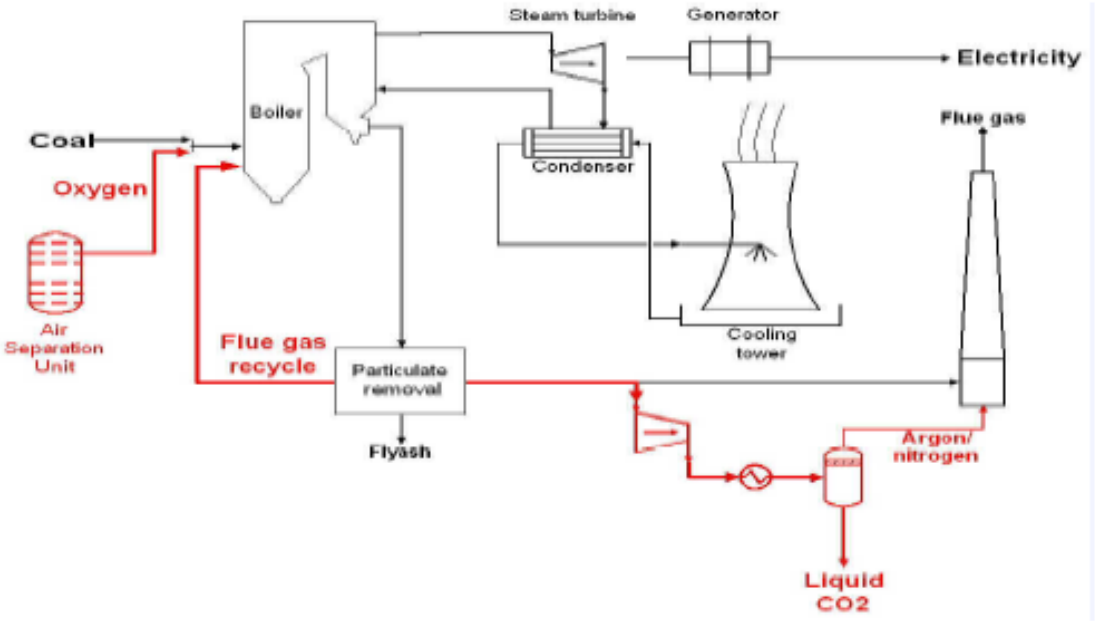

Fig.1 Oxygen Combustion with Recycled Flue Gas (broad lines indicates new components)

The project

The oxy-fuel feasibility study, to be conducted over a nominal two year period, is centered on a single Callide A (30 MWe) Unit in central Queensland firing Callide coal.

The feasibility study will be augmented with additional fundamental work on Acland (domestic/export thermal coal) and Rolleston premium export thermal coal. The primary deliverable from the feasibility study will be a reference design with comprehensive technical and cost details for an oxy-fired retrofit of an existing Australian PF boiler, as the basis for a first-of-a-kind demonstration plant.

The feasibility study (Stage 1) is made up of the following specific tasks:

Task 1 - Fundamental oxy-firing studies
Task 2 - Oxygen production and CO_2 capture studies
Task 3 - Boiler retrofit studies
Task 4 - CO_2 geological storage (preliminary study)
Task 5 - Oxy-firing potential applications in Japan, South East Asia and Australia

The anticipated cost of the feasibility study is $3 million.

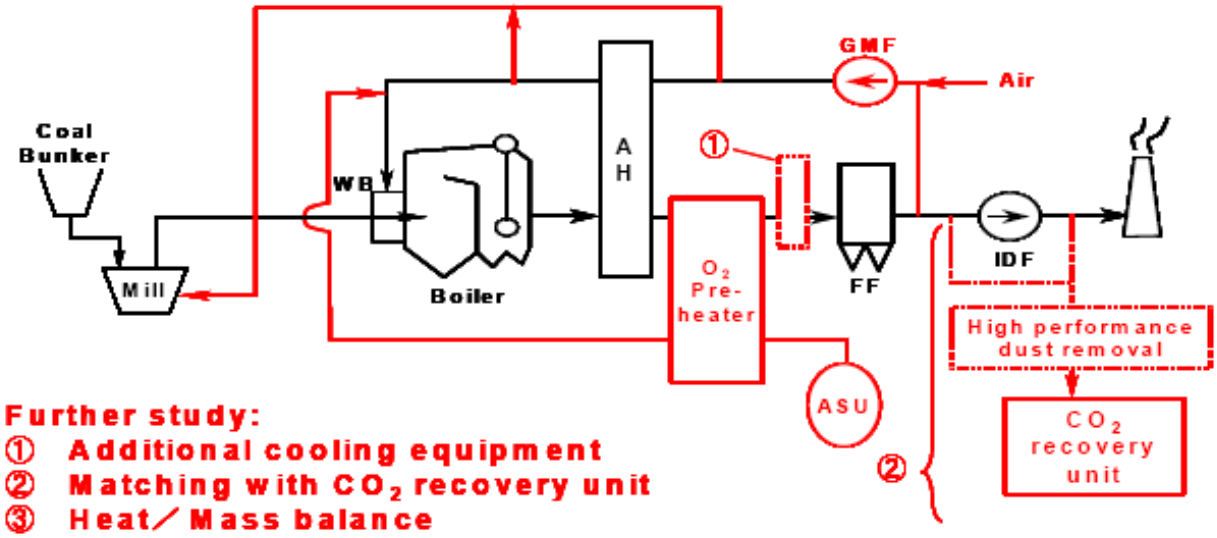

Figure 2 – Callide A boiler, showing additional oxy-fuel items and CO_2 recovery