CO_2 Capture Project®

CCP PROJECT FACTSHEET

OXY-COMBUSTION FLUID CATALYTIC CRACKING DEMONSTRATION

Field Testing of CO_2 Capture Technology for Oil Refineries

OVERVIEW

The CO_2 Capture Project (CCP) is undertaking a field demonstration of an oxy-combustion capture technology on one of the processes in a refinery which generates the highest CO_2 emissions - the Fluid Catalytic Cracking (FCC) unit. The test is expected to bring closer to reality a cost-effective technology capable of capturing up to 95% of FCC CO_2 emissions, equating to some 20-30% of total CO_2 emissions from a typical refinery.

The demonstration is taking place at a large pilot scale FCC unit at a Petrobras research complex in Parana state, Brazil. It began in March 2011 and full results will be available in 2012. The demonstration is expected to confirm the technical and economic viability of retrofitting an FCC unit to enable CO_2 capture through oxy-combustion.

The field test is part of the CCP's work to develop next generation technologies that will make CO_2 Capture and Storage a practical and cost effective option for reducing CO_2 emissions from fossil fuels.

THE PROJECT

Goals

The main goals of the project are:

- Test start-up and shut-down procedures
- Maintain stable operation of the FCC unit in oxy-combustion mode
- Test different operational conditions and process configurations
- Obtain reliable data for scale-up

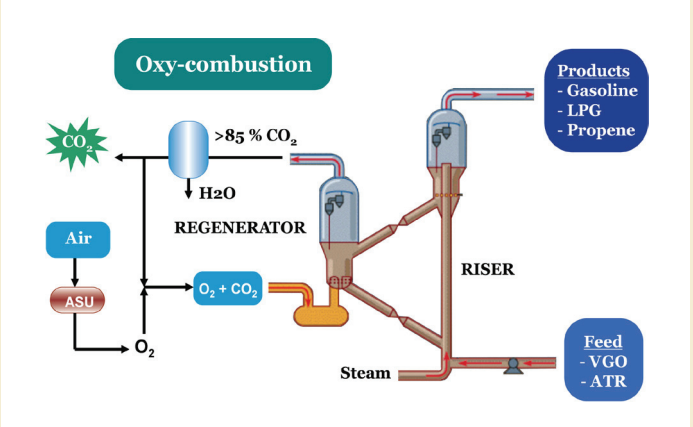
Timeline

Full results will be available in 2012.

Oxy-Combustion to Reduce FCC Emissions

The refinery is a challenging environment, with many different operations producing emissions. In a refinery, the FCC unit converts heavy, lower-value hydrocarbon feedstock into lighter, more valuable products. This unit is often the largest single source of CO_2 emissions in a refinery.

Traditionally, air is used to regenerate the catalyst by burning off coke deposited on the catalyst during the conversion process. In the oxy-combustion mode, air is replaced by pure oxygen, which is diluted with recycled CO_2, to maintain thermal balance and catalyst fluidization. Oxy-combustion in a FCC unit is a challenging, though promising, technology for CO_2 capture.



Equipment

The pilot FCC unit has the capacity to process up to 33 bbl/d of hydrocarbon feed (emitting1 ton/d of CO_2), and it consists of an adiabatic riser, stripper and regenerator, which allows simulation of a commercial FCC unit, including the energy balance.

The retrofit of the unit for oxy-combustion operation involves the design, construction and installation of an Oxygen Supply System (OSS) and a CO_2 Recycle System (CRS). There is also a need to develop and design a control strategy for start-up and continuous operation.

The two systems consist of the following equipment:

Oxygen Supply System (supplied by Linde Gas)

- Liquid O_2 tank
- Vaporizer system
- Flow and pressure control skid
- Gaseous O_2 injector
- Piping

CO_2 Recycle System (supplied by TecnoProject Latina)

- Catalyst fines and SOx removal unit
- Recycle compressor
- CO_2 storage tank
- Gas analyzers
- Piping

BACKGROUND

As significant emitters of CO_2, oil refineries face unique and considerable challenges in managing their emissions. The major emitting sources from a typical refinery are heaters, boilers, hydrogen plants, and fluid catalytic cracking (FCC) units.

This multi-source environment, with wide variation in the characteristics of the sources, requires a multi-faceted development approach for capture technology. Initial evaluation of pre-combustion, post-combustion and oxyfiring technologies by the CCP indicated that pre-combustion and oxyfiring could deliver a 35-40% cost advantage over post-combustion.

Simplicity is the key to efficient capture in such an environment – and oxyfiring is seen as an attractive option to take forward for capturing emissions from an FCC unit. A techno-economic evaluation of oxyfiring and post-combustion amine absorption for CO_2 capture from the FCC regenerator was conducted. Both processes are able to achieve the required specifications and recovery level. Although the post-combustion option had a lower capital cost, the lower operational costs for oxyfiring delivered a lower overall capture cost.

Oxyfiring is, as a result, now considered a preferred technology for FCC emissions capture. It can be used in “new builds” and, possibly retrofitted to existing FCC units. However, a number of issues remain to be addressed by the demonstration – such as possible corrosion of existing equipment, thermal balance, catalyst attrition and coke burn rate. Also, health and safety considerations need to be assessed given the presence of gaseous oxygen on site.

ABOUT THE CO_2 CAPTURE PROJECT

The CO_2 Capture Project (CCP) is an award-winning partnership of several major energy companies working to advance the technologies that will underpin the deployment of industrial-scale CO_2 capture and storage. To find out more visit www.co2captureproject.com