Abstract

Process Economics Program Report 237A

REFINERY CO_2 EMISSION REDUCTION

(December 2011)

Signers of the Kyoto Protocol in 1997 and later, including the European Union, Japan and Australia, agreed to reduce their greenhouse gas (GHG) emissions mainly due to concerns over climate change. The European Council approved a Climate and Energy package in 2009 that sets the path for GHG reduction to 2020, including fuel quality standards and a carbon capture and sequestration regulatory framework. The Council's goal is a reduction of 20% of the baseline 1990 GHG emissions, equivalent to a 14% reduction of the 2005 level (with 3% covered by offsets). The United States faces regulations on CO_2 emissions by the Environmental Protection Agency. Reducing GHG emissions will significantly impact refineries.

The largest refinery sources of CO_2 are large utility boilers and process furnaces, the catalytic reformer and the fluid catalytic cracker unit (FCCU) regenerator. Of these, the FCCU regenerator is a key process for controlling refinery CO_2 emissions. Although CO_2 separation is being demonstrated on a large scale for electric power plants, application in a refinery is just beginning to be analyzed. Pilot plant demonstrations are in progress.

In this report, technologies to reduce CO_2 refinery emissions are reviewed with a focus on absorption by amine solvents and oxy-combustion. We then develop grassroots process economics for capturing CO_2 from flue gas produced by a 40,000 BPSD FCCU by two processes: monoethanolamine absorption and oxy-combustion.

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REFINERY CO_2 EMISSION REDUCTION

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