SNAPSHOT

Detail Design Study for CO_2 Capture and Liquefaction

Project Report Reference: 2017.1055 **Date: 1 May 2017**

Project Description

The project investigated the detail design challenges and conditions to integrate a CO_2 capture plant into an existing abattoir process system. The project also outlined high risk components and potential showstoppers during implementation of the process plant.

Project Content

The project considers the technological challenges to implement a CO_2 capture system into an existing abattoir facility. In addition to the post-combustion capture, the use of pre-combustion scrubbing of available biogas is also considered. In this process, CO_2 can be separated from biogas and treated to meet food grade standards. Both solutions have been considered as means of capturing CO_2 with suitable sizing considerations proposed. The capacity from pre-combustion capture is limited by the quantity and composition of biogas available, whereas, the post-combustion capture from boiler exhaust is capable of meeting large CO_2 demands.

A generic amine absorption process and instrumentation diagram has been developed for both biogas scrubbing and the Stack Gas Recovery System (SGRS). A general composition mass balance and the corresponding CAPEX, OPEX and ROI have been addressed for each system. Several showstoppers that may arise from the implementation of a capture plant have been identified and mitigation solutions are proposed. Other high risk items for a typical amine absorption plant which can potentially reduce operational efficiency and decrease the quality of the end-product have been discussed.

An approach has also been developed for the CO_2 capture plant with regards to sizing and control theory. The operating schedule is analysed to determine optimal plant sizing whilst considering the operating periods and CO_2 usage patterns of a typical abattoir. Additional challenges such as power supply, real estate and risk minimisation for project execution have also been outlined. A roadmap is developed to aid red meat processors in determining an appropriate solution for a given abattoir, whilst considering the existing infrastructure available for integration and the requirements of the capture plant.

The project has investigated the challenges in implementing a CO_2 capture plant at an existing abattoir by utilising existing resources. The on-site plant will allow red meat processors to reduce CO_2 procurement costs and provide flexibility in addressing the CO_2 requirements.

Project Outcome

The project has investigated the technical design challenges for a CO_2 capture plant to be integrated into an existing abattoir. The project has shown the processing industry that an on-site CO_2 capture plant is feasible to offset the CO_2 procurement cost from third parties. By utilising resources available at the existing abattoir, liquefied CO_2 can be captured to meet food grade standards.

Technical outcomes in terms of plant operation and sizing considerations of the biogas scrubber and SGRS were investigated. The biogas scrubber, unlike the SGRS, is very limited in CO_2 capture capacity and hence provides limited flexibility for abattoirs with large CO_2 demands. For either scenario, a sizing methodology is required with consideration into abattoir operations and CO_2 utilisation patterns to provide an optimised design solution.

Potential showstoppers, interface points, high risk components and an operating schedule have been addressed in this project. Integration with existing biogas, boiler, refrigeration and CO_2 infrastructure will enable the abattoir to reduce capital and operational expenditure. High risk components such as corrosion, foaming and amine degradation can be mitigated with careful material selection, regular inspections and maintenance procedures.

From the outcomes of this project, it is evident that any CO_2 capture plant integrated with an abattoir is of a 'micro-scale' when compared to existing commercial process plants used in the oil and gas industry. Therefore, only a concept design was established due to the lack of sizing and operational data on 'micro' process plants. Consequently, a Front End Engineering Design (FEED) study is required to further understand the implications of a 'micro-size' plant on equipment sizing, control and operational boundaries.

Benefit for Industry

The integration of a CO_2 capture plant to an existing abattoir has the potential to provide abattoir owners with substantial cost reductions through the substitution of currently procured CO_2.

This project provides a concept design for an integrated CO_2 capture plant and an in-depth analysis into the potential showstoppers and challenges of integrating to an existing abattoir. The outcomes of this project provides a platform for the red meat processing industry to recognise the potential for reducing operating costs by utilising available resources, and assess the risks involved in implementing such a process system.