



## Retrofitting Existing Industrial Capture unit – ACORN Project

Jia Li<sup>1</sup> Zhanggui Hou<sup>2</sup> Hazel Robertson<sup>3</sup> David Pilbeam<sup>3</sup> Tim Dumenil<sup>3</sup> Steve Murphy<sup>3</sup> Sam Gomersall<sup>3</sup> Alan James<sup>3</sup>

<sup>1</sup>University of Sheffield, UK

<sup>2</sup>CNOOC, China

<sup>3</sup>Pale Blue Dot, UK

### Abstract

Carbon capture from industrial emission sources is considered as early opportunities and low-cost option for emission reduction around the world. In Europe, most of the existing industrial emission sites have a combination of different emission sources, such as power, cement, steel, paper and pulp. Due to the tight regulation in environmental control and concerns of greenhouse gases emission, new industrial sites are rarely permitted. As a result, most of the recent projects are built within exiting industrial areas. Some of the existing industrial area could be rather far from a potential CO<sub>2</sub> storage site or have limited access to a CO<sub>2</sub> storage site, therefore, the prosperity of capturing CO<sub>2</sub> from those industrial sites might be over estimates.

This paper evaluates the capture technologies for St Fergus gas terminal in the UK. The project is part of the European ACT funded integrated ACORN project, which aims at delivering a low-cost carbon capture and storage (CCS) system in north east Scotland by 2023. The region has proposed two large scaled CCS demonstration projects which capture carbon dioxide from power plants and store it at the North Sea. This ACORN project will build on existing research such as an appraisal of potential CO<sub>2</sub> storage sites and options to re-use oil and gas assets, to move the project from proof-of-concept towards design studies.

The novelty of the project includes a first of a kind assessment on retrofitting the existing St Fergus Gas Terminal, located to the north of Aberdeen. The existing unit at St Fergus Gas Terminal captures CO<sub>2</sub> from the sour gas from offshore gas production. The new function of the unit will capture CO<sub>2</sub> from flue gas from emission sources nearby by. Then captured gas will then be compressed to a series of offshore pipelines, three of which could be redeployed according to previous studies. The St Fergus gas network is also connected to the UK National Gas Grid and a dedicated pipeline to the Central Belt, where other large-scale emission sources can be linked to this network (ACT, 2017). The long-term object of the project is to expand the St Fergus CCS hub and create a regional CCS network in Scotland.

The existing north Scotland gas network and the offshore gas network provides the project will a low-cost pipeline reusing potential. While retrofitting the existing industrial unit not only reduce the total cost, but also reduce the time needed compared with a completely new-built project. All the reason mentioned above can accelerate the proposed operation date by early 2020.

In this paper, different commercial available capture technology is evaluated and compared with a simple retrofit design of the existing unit. The existing gas processing unit condition is assessed and the potential to scale up the existing unit as minimum extra cost is calculated. Then, the cost of introducing new technologies and installing new facilities to the existing site within the proposed project start up time is estimated. Capex to design, build, install & commission plant and risk assessment is carried out to fully understand the pros and cons of the overall design.

The results from this initial assessment, which forms the capture package of the pre-feasibility study to prepare the ACORN project for the FEED study before the investment decision is made for the site will be presented in the end. The low-cost and resources reuse concept of this project can be used for projects around Europe and other part of the world. As one of the urgent need for the CCS industry is to increase the actual CCS project numbers and project the cost cutting solution. The project can also expand its current gas network to re-introduce the Hydrogen network in the North Scotland. With the right set of circumstances, Acorn could become the gateway of Carbon Capture and Storage to the North Sea and help the UK meet its climate targets.

#### Reference:

ACT, 2017. About ACT ACORN, Available at <http://www.actacorn.eu>. Last Accessed: 5/Jan/2018