the ENERGY lab

PROJECT FACTS

Industrial Carbon Capture and Storage (ICCS)

Air Products and Chemicals, Inc.: Demonstration of CO_2 Capture and Sequestration of Steam Methane Reforming Process Gas Used for Large-Scale Hydrogen Production

Background

Carbon dioxide (CO_2) emissions from industrial processes, among other sources, are linked to global climate change. Advancing development of technologies that capture and store CO_2 that would otherwise reside in the atmosphere for extended periods is of great importance. Advanced carbon capture and storage (CCS) technologies offer significant potential for reducing CO_2 emissions and mitigating global climate change while minimizing the economic impacts of the solution.

Under the Industrial Carbon Capture and Storage (ICCS) program, the U.S. Department of Energy (DOE) is collaborating with industry in cost sharing arrangements to demonstrate the next generation of technologies that will capture CO_2 emissions from industrial sources and either store those emissions or beneficially reuse them. The technologies included in the ICCS program have progressed beyond the research and development stage to a scale that can be readily replicated and deployed into commercial practice within the industry.

Project Description

The DOE selected Air Products and Chemicals, Inc. (Air Products) to receive ICCS program funding through the American Recovery and Reinvestment Act (ARRA) of 2009, for its project entitled "Demonstration of CO_2 Capture and Sequestration of Steam Methane Reforming Process Gas Used for Large-Scale Hydrogen Production". For this project, Air Products was to demonstrate a state-of-the-art system to con-centrate CO_2 from two world-class scale steam methane reformer (SMR) hydrogen production plants located in Port Arthur, Texas.

Air Products has successfully retrofitted its two Port Arthur SMRs with a vacuum swing adsorption (VSA) system to separate the CO_2 from the process gas stream, followed by compression and drying processes. This process is designed to concentrate the CO_2 in the process gas stream from the reformer from 10-20 percent to greater than 97 percent CO_2 purity while capturing more than 90 percent of the CO_2 in that stream. The compressed CO_2 is then delivered to a Denbury pipeline for transport to Texas EOR projects in the West Hastings Field, where a monitoring, verification, and accounting (MVA) program ensures the injected CO_2 remains in the under-ground geologic formation.

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PARTNERS

Denbury Onshore, LLC

PROJECT DURATION

Start Date	End Date
11/16/2009	09/30/2017

COST

Total Project Value
$430,648,802

DOE/Non-DOE Share
$284,012,496 / $146,636,306

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U.S. DEPARTMENT OF ENERGY

Port Arthur 2 plant

The project is currently in operation. Completed project activities include engineering and design, award of all air permits, construction, commissioning, and plant startup. The MVA program to monitor the injected CO_2 was designed and the implementation started once CO_2 capture began. The project successfully captured and sent for sequestration the one millionth metric ton of CO_2 in April 2014.

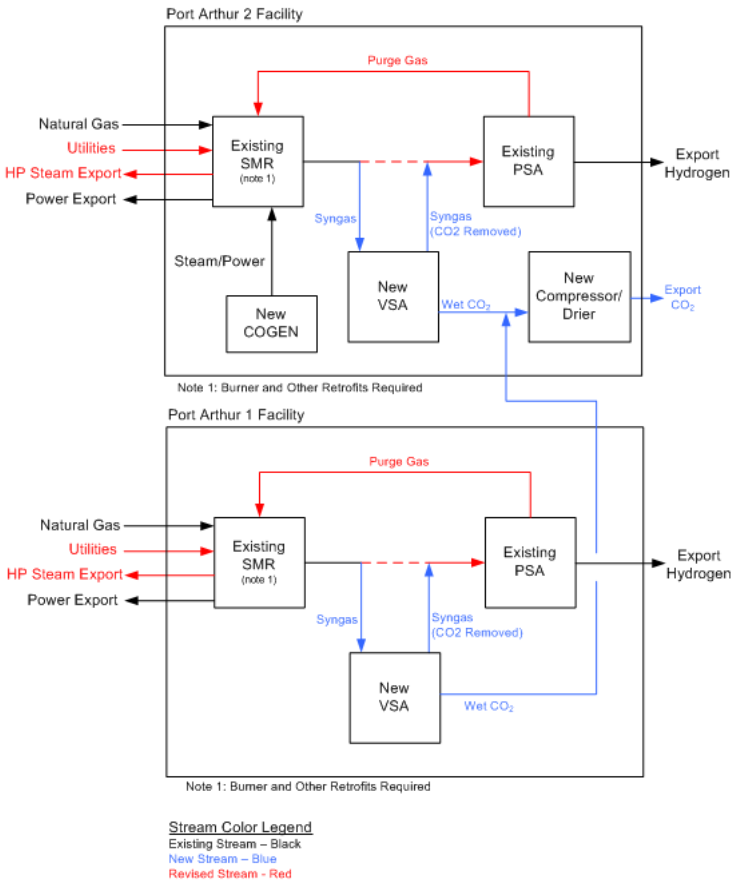
Goals/Objectives

The project goal is to advance CCS technologies from the demonstration stage to commercial viability. The project objective is to capture CO_2 from two SMR hydrogen production plants and store it in an oil reservoir for EOR in order to successfully demonstrate the technology and maximize the economic viability of commercial-scale CCS.

Benefits

Overall, the project is addressing climate change concerns, enhancing U.S. economic and energy security, and boosting domestic oil production. Specific project advantages and benefits include:

- Capturing approximately one million metric tons per year of CO_2, that would otherwise be emitted to the atmosphere, for permanent sequestration in geologic formations for EOR applications.
- The CO_2 used for EOR will result in approximately 1.6 to 3.1 million barrels of additional annual domestic oil production.
- The technology application is significant with the U.S. on-purpose hydrogen market for refinery use estimated to be almost four million tonnes annually. The two Port Arthur SMRs represent 4.3 percent of this market.



CO_2 System Sketch

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