PETRA NOVA PARISH HOLDINGS

W.A. Parish Post-Combustion CO_2 Capture and Sequestration Project

NETL

NATIONAL ENERGY TECHNOLOGY LABORATORY

PARTNERS

Hilcorp
Mitsubishi Heavy Industries, America
Sargent & Lundy
TIC
University of Texas, Bureau of Economic Geology

COST

Total Project Value
$1,000,000,000[2]

DOE Share
$190,132,425

PROJECT DURATION

Start Date - 06/01/2010

End Date - 12/31/2019[1]

PROJECT NUMBER

FE0003311

[1]This is the period of performance recognized under the DOE Financial Assistance Award. The commercial project may be continued well beyond the DOE's involvement.

[2]This is the total value of the project, which includes costs outside the scope of the DOE project.

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BACKGROUND

Carbon capture and storage (CCS) technologies offer the potential to significantly reduce CO_2 emissions from coal-fueled electric power generation facilities and mitigate the anthropogenic contribution to atmospheric greenhouse gases, while substantially reducing or minimizing the economic impacts of the solution.

The U.S. Department of Energy (DOE) is providing financial assistance to demonstrate the commercial viability of advanced technologies that will capture CO_2 and store it in deep geological formations, with concomitant beneficial use in enhanced oil recovery (EOR) operations. Demonstration projects, such as the Petra Nova project, will increase the electric power industry's confidence in advanced CCS technologies and help launch these technologies into the commercial marketplace.

PROJECT DESCRIPTION

DOE is providing financial assistance to Petra Nova Parish Holdings, LLC (Petra Nova) to demonstrate the addition of a commercial-scale post-combustion carbon capture technology at the coal-fired W.A. Parish Generating Station (PGS) located southwest of Houston in Thompsons, Texas. The project is demonstrating the ability of an advanced amine-based CO_2 capture system to capture 90 percent of the CO_2 emitted from a flue gas stream equivalent to 240 mega-watts (MWe) in size. The host power generation unit will not be derated because the power and thermal energy required to operate the CO_2 capture and compression system is provided by a cogeneration plant comprising a combustion turbine with a heat recovery boiler. This advancement is anticipated to reduce carbon capture costs and increase system flexibility and efficiency.

The captured CO_2 is being compressed and transported to an operating oil field for use in EOR and, ultimately, for sequestration. The scale of the project, at 240 MWe, was set to be large enough to immediately induce significant oil production.

A portion of the flue gas from W.A. Parish Unit 8 that has already been treated to reduce nitrogen oxides, particulate matter, and sulfur dioxide (SO_2) is being diverted from the existing stack to the CO_2 capture system. Flue gas entering the CO_2 capture system is first routed to the flue gas cooler for conditioning (i.e., cooling, dehydration, and additional SO_2 removal). The flue gas is cooled because CO_2 is preferentially absorbed at lower temperatures. The cooled flue gas then contacts a circulating sodium hydroxide solution that removes 98 percent of the remaining SO_2 from the stream, preventing the SO_2 from impeding the amine's ability to react with CO_2.

The conditioned flue gas is then routed to the absorber, where CO_2 is captured by the amine-based solvent through a chemical reaction. The CO_2-rich solvent stream is sent to the regenerator, or stripper, where the CO_2 is released from the solvent using low-pressure steam. Heat from the steam breaks the weak bond between the CO_2 and the solvent, liberating the CO_2 and leaving the solvent behind so that it may be reused for additional CO_2 capture. The captured CO_2 is compressed, dried, and transported via an 80-mile pipeline to the West Ranch oil field near Vanderbilt, Texas.

The West Ranch oil field has produced oil continuously since 1938 under a series of different owners. In recent years, production rates at West Ranch have declined through conventional production techniques. To increase production, CO_2 captured from Parish Unit 8 is being injected into the field for EOR. Carbon dioxide injection helps lower the oil viscosity and reduce forces that trap the oil in the reservoir. The CO_2 provides a driving force to sweep oil from the reservoir that could not be recovered during primary and secondary phases of production. Once the oil reaches the surface, it enters a recycle facility where it is separated from the CO_2, which is being re-injected for additional use. To ensure that the CO_2 remains permanently stored underground, a monitoring program was developed and implemented to determine whether CO_2 or other fluids are migrating from the production formation in the planned EOR area.

Production at the West Ranch oil field is expected to increase from roughly 500 barrels per day to 15,000 barrels per day. The West Ranch Field oil field holds an estimated 60 million barrels of oil recoverable from EOR operations.

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GOALS/OBJECTIVES

The project goal is to advance fully integrated CCS technologies from the demonstration stage to commercial viability. The project objective is to (1) remove CO_2 from treated flue gas from an existing coal-fired electrical generating station and (2) compress and transport pipeline-quality CO_2 to a storage site for use in EOR.

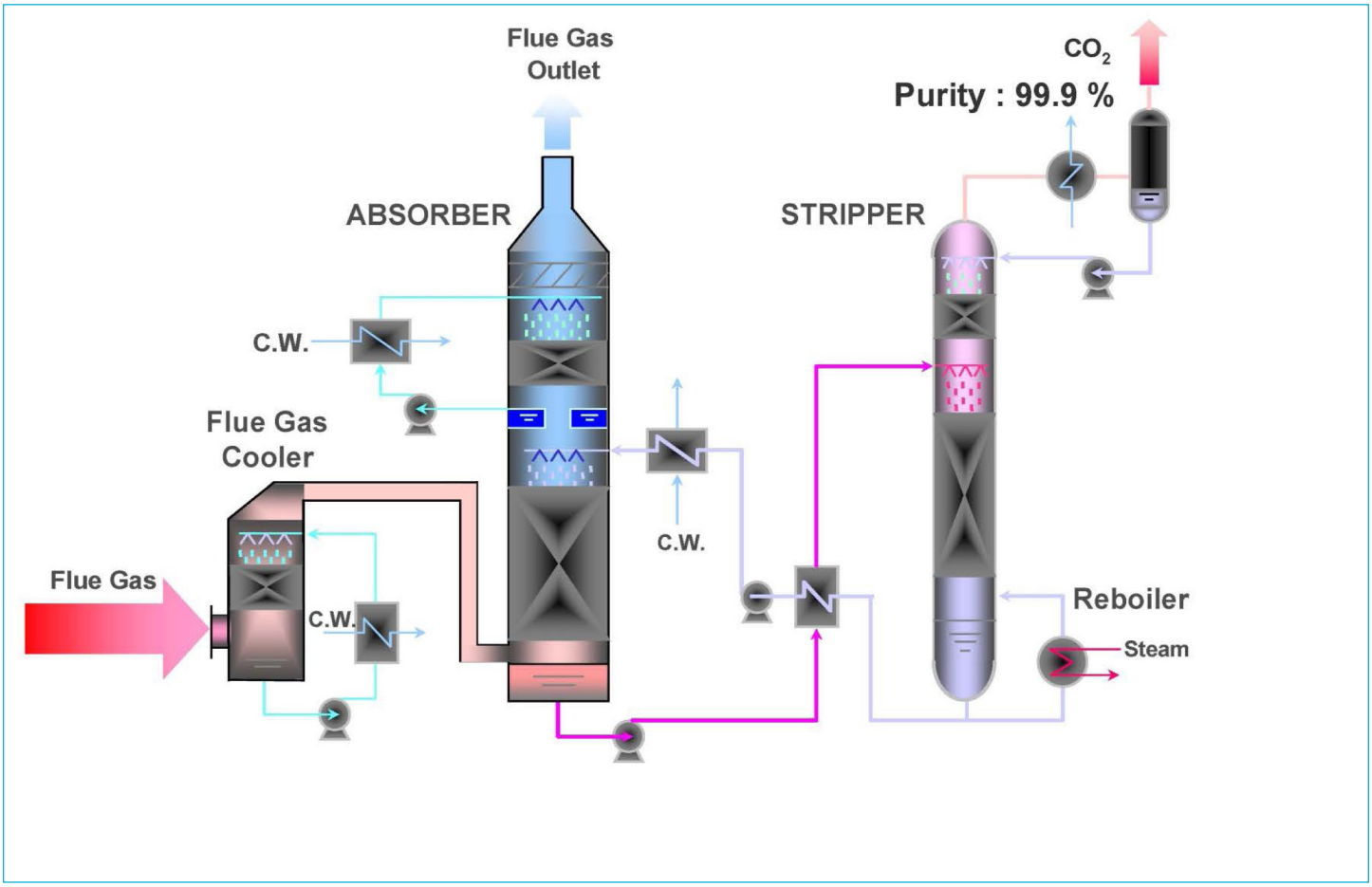
BENEFITS

The W.A. Parish Post-Combustion CO_2 Capture and Sequestration Project is an important step for advancing the commercialization of technologies that capture CO_2 from the flue gas of existing power plants. Enhancing the existing fleet of power plants with CO_2 capture capabilities will enable them to continue producing electricity while simultaneously reducing the impact of CO_2 emissions. Specific project benefits are as follows:

- The capture and storage of up to 1.4 million metric tons of CO_2 per year from a PGS flue gas stream.
- Increased domestic oil production, which contributes to U.S. energy security.
- A path forward for existing coal-fired power plants to continue producing energy while meeting environmental sustainability goals.

PROJECT STATUS

Petra Nova has completed final performance testing and began commercial operation on January 10, 2017. The project is currently delivering CO_2, captured from PGS flue gas, to the West Ranch oil field for EOR operations.



Process Flow for Amine Absorption

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