the ENERGY lab

PROJECT FACTS

Clean Coal Power Initiative (CCPI 3)

Hydrogen Energy California Project: Commercial Demonstration of Advanced IGCC with Full Carbon Capture

Background

A need exists to further develop carbon management technologies that capture and store or beneficially reuse carbon dioxide (CO_2) that would otherwise be emitted into the atmosphere from coal-based electric power generating facilities. Carbon capture and storage (CCS) technologies offer great potential for reducing CO_2 emissions and mitigating global climate change, while minimizing the economic impacts of the solution.

Under the Clean Coal Power Initiative (CCPI) Round 3 program, the U.S. Department of Energy (DOE) is providing financial assistance, including funding under the American Recovery and Reinvestment Act (ARRA) of 2009, to industry to demonstrate the commercial viability of next generation technologies that will capture CO_2 emissions and either sequester those emissions or beneficially reuse them. Once demonstrated, the technologies can be readily considered in the commercial market-place by the electric power industry.

Artists Rendition of HECA 250 MW IGCC Plant with Carbon Capture and Storage

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U.S. DEPARTMENT OF ENERGY

PROJECT DURATION

Start Date
10/01/2009

End Date
06/01/2019

COST

Total Project Value
$4,008,132,814

DOE/Non-DOE Share
$408,000,000 / $3,600,132,814

Government funding for this project is provided in whole or in part through the American Recovery and Reinvestment Act.

Project Description

DOE is providing financial assistance under CCPI Round 3 to Hydrogen Energy California LLC (HECA), along with private capital cost sharing, to demonstrate an advanced coal-fired generating plant that co-produces electricity and fertilizer products. The project will employ integrated gasification combined cycle (IGCC) technology to nominally generate 400 megawatts (MW; gross) and up to 280 MW (net) of electricity and produce approximately one million tons per year of fertilizer using a 75 percent coal and 25 percent petroleum coke fuel blend. The fertilizer could be a combination of urea ammonium nitrate (UAN), urea, or other fertilizer equivalent, with the proportion dependant on market and commercial conditions. The CO_2 off-take agreement contemplated by HECA will enable geologic storage of CO_2 at a rate of approximately 2.5 million tons per year. The captured CO_2 will be transported via pipeline to the Elk Hills oil field, approximately four miles away from the power plant, for use in enhanced oil recovery (EOR). The design of these integrated facilities allows operating protocols that optimize: (1) the efficiencies of the physical plants while allowing steady state operation of the gasification unit; (2) the use of hydrogen to match product output volumes with demand under the terms of the urea/UAN and power off-take contracts; and (3) maximize the use of the project's capital investment.

The project will utilize the Mitsubishi Heavy Industry (MHI) two-stage gasification technology and combined cycle power block. A Rectisol® acid gas removal system will be employed to achieve the intended CO_2 capture efficiency. Water quality and availability issues are addressed by utilizing local brackish groundwater treated on-site to meet all industrial process water requirements. The brackish groundwater will be supplied from the Buena Vista Water Storage District (BVWSD), which is a local water district with some groundwater sources not suitable for agricultural use. The project will also incorporate a Zero Liquid Discharge (ZLD) system. All project wastewater, including wastewater generated from the IGCC, raw water treatment, and cooling tower blowdown will be directed to ZLD system(s) with the recovered water recycled for reuse in the process. This further reduces the water demands of the project.

Goals/Objectives

The goal of the project is to design, build, and operate a greenfield, commercial scale, fully integrated, advanced IGCC power plant and fertilizer production facility with carbon capture and storage in Kern County, California. The project is designed to achieve at least 90 percent CO_2 capture efficiency while geologically storing approximately 2.5 million tons per year in an EOR application.

Benefits

The project will be among the cleanest of any commercial solid fuel power plant built or under construction and will significantly exceed the emission reduction targets for 2020 established under the Energy Policy Act of 2005. In addition, emissions from the project plant will be well below the California regulation requiring baseload plants to emit less greenhouse gases than comparably-sized natural gas combined cycle power plants. The CO_2 captured by the project will enable geologic storage at a rate of approximately 2.5 million tons of CO_2 per year and will increase domestic oil production.

Specific project benefits include:

- Achieving approximately 90% CO_2 capture efficiency.
- Geologically storing approximately 2.5 million tons of CO_2 per year.
- Incorporating the beneficial use of CO_2 for EOR and geologic storage. EOR brings economic and energy security benefits.
- Meeting California's increasing power demands by generating low-carbon hydrogen power.
- Maximizing the use of local, non-potable brackish groundwater for all process and cooling needs will maintain area freshwater aquifers for agricultural use. All project wastewater will be directed to the 100 percent ZLD system, with the recovered water recycled for reuse in the process.
- Providing a low carbon footprint for California's key agricultural market and substantially lowering foreign imports of fertilizer to the U.S.
- Boosting California's economy by creating 2,000 local construction jobs and about 140 permanent operational positions.