PROJECT facts

U.S. DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY
NATIONAL ENERGY TECHNOLOGY LABORATORY

Combustion Technologies

09/2004

CATALYTIC UNMIXED COMBUSTION OF COAL WITH ZERO POLLUTION

CONTACT POINTS

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PROJECT COST

$845,425

PROJECT DURATION

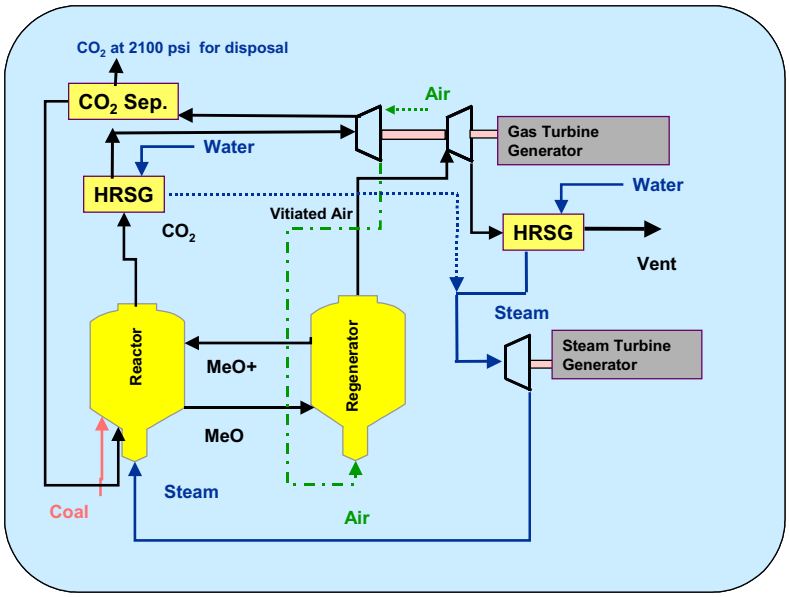
10/01/03 - 9/30/05

WEBSITE

www.netl.doe.gov/coal

Description

Unmixed combustion (UMC) is a GE-proprietary technology that appears to offer superior performance with respect to thermodynamic efficiency and low pollutant emissions. The process converts pulverized coal into separate streams of sequestration-ready CO_2 (including other pollutants such as SO_2, NO_x, and Hg) and a clean hot gas stream for turbines. This approach significantly reduces pollution control costs by reducing the volume of gas that must be cleaned. In addition, NO_x formation due to nitrogen from the air is considerably minimized. The entire process is conducted at elevated pressure, which permits the heat generated by catalyst regeneration to be used in a combined cycle for electricity production and shaft work. Also, the elevated pressure reduces the cost of subsequent CO_2 treatment prior to sequestration. For power generation with gas turbine and steam turbine, preliminary ASPEN Plus simulation suggests that the UMC-Coal concept including CO_2 separation can have a net process efficiency of 43% of coal high heating value (HHV).

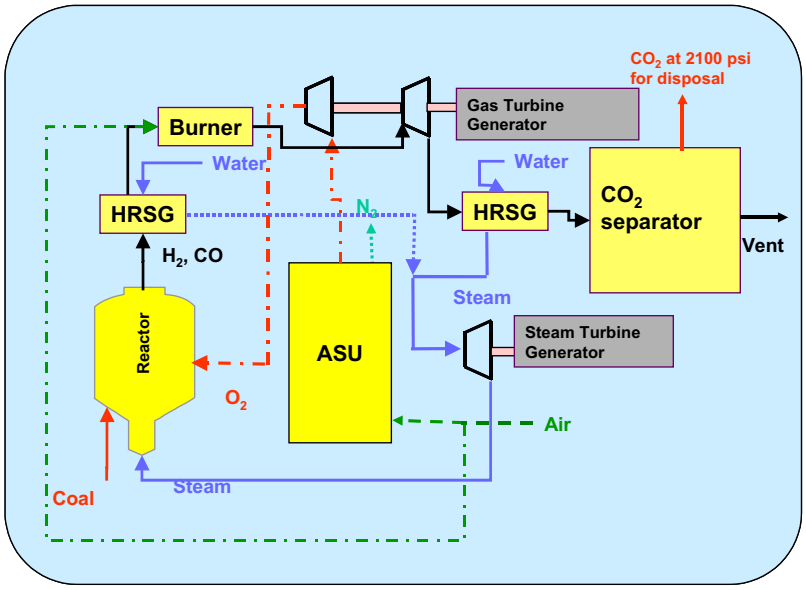


UMC Process Integrated with a Combined-Cycle Plant

PARTNERS

GE Global Research
Irvine, CA

Southern Illinois University
Carbondale, IL



Process Flow Diagram for a Typical IGCC Process with CO_2 Separation

Goals

The goals of this project are as follows:

- Demonstrate in a two-reactor pilot-scale system the unmixed combustion (UMC) of coal with metal oxide catalysts;
- Conduct lab- and pilot-scale tests;
- Perform engineering and economic analyses; and
- Prepare a full-scale conceptual design of the UMC process.

Three-reactor pilot unit will be reconfigured to a two-reactor system.

Accomplishments

As of April 2004, the global process analysis has been completed. The ASPEN Plus simulation suggests an overall process efficiency of 43% of coal HHV, which is about 9% higher than other advanced technologies now being developed to include CO_2 separation.