

FY07-LIX(59)-151

“Upgrade and Refurbishment of a Bench-Scale Entrained-Flow Slagging Gasifier”

Submitted by: EERC

Principal Investigator: Steve Benson, Ph.D.

PARTICIPANTS

<u>Sponsor</u>	<u>Cost Share</u>
National Center for Hydrogen Technology	\$75,000
North American Coal Corporation	\$75,000
EPRI	\$75,000
NDIC	<u>\$129,000</u>
Total Cost	\$ 354,000

Project Schedule - 7 Months

Contract Date – 3/4/07

Start Date – 3/1/07

Completion Date – 10/31/07

Extended to – ~~April 30, 2008~~

– ~~August 31, 2008~~

– January 31, 2009

Project Deliverables

Status Reports:

6/1/07 (✓); 9/1/07 (✓)

Final Report: ~~12/31/07 (-)~~

4/30/08 (-)

8/31/08 (-)

1/31/09 (✓)

OBJECTIVE / STATEMENT OF WORK:

To help overcome the challenges of utilizing lignite coal with commercially available gasification systems, a bench-scale entrained-flow slagging gasifier will be built by upgrading and refurbishing an existing bench-scale gasifier, which will be used for syngas production, cleanup, and separation testing.

STATUS

Through June 1, 2007

North American Coal Corporation and EPRI have been added to the project as sponsors. Combined with the funding from NDIC and NCHT, the project is now fully funded.

Major design work on the system has been completed. Some of the system components have been ordered, including the solids feeder and the two lower pressure vessel sections beneath the gasifier. The heating elements and internal ceramic tubes have been ordered.

Through September 1, 2007

Major system components were ordered and have arrived at the EERC. Building construction delays have resulted in gasifier construction.

Through March 31, 2008

Refractory pours were completed for the lower pressure vessel sections of the gasifier. The forms for the upper sections were procured and a test pour was started.

FINAL REPORT SUMMARY

Purpose of the Project: The Energy & Environmental Research Center (EERC) developed a consortium to upgrade and refurbish a bench-scale entrained-flow slagging gasifier, which can be used for testing North Dakota lignite.

Work Accomplished: An entrained-flow gasifier (EFG) has been constructed that will reach temperatures up to 1500°C and pressures up to 300 psi. The solid feed system feeds nominally 8 lb of pulverized coal an hour with an operating range of 4–20 lb/hr. The system is capable of operation under air- or oxygen-blown conditions and with recycle if desired.

Project Results: Construction of the EFG has been completed, and operating pressure and temperature have been reached. The system is housed in the EERC's National Center for Hydrogen Technology (NCHT) demonstration facility. The main gasifier and gas cleanup equipment is located in the NCHT demonstration area. The control computer is located in the NCHT control room. A dry solids feed system is used that enables the gasification of dried lignite coal. Coal reaches slagging temperatures in the gasifier, and the melted ash and hot gas are cooled with a water quench system. Slag collects in a refractory-lined slag pot. The system is integrated with a hot-gas filter vessel for particulate removal and a series of quench pots for condensation of water and tars. Optional gas cleanup equipment including a sulfur removal system and several fixed-bed reactors are also integrated with the gasifier to provide a wide variety of testing options. Two gas analyzers measure the concentration of major, minor, and trace species in the syngas.

Potential Applications of the Project: A bench-scale system is now available for gasifying North Dakota lignite under EFG conditions. North Dakota lignite coal mines and coal users now have a vehicle for testing the behavior of their fuels in a system that simulates the conditions of many commercially available gasifiers.