PROJECT **facts**

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

Combustion Technologies

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QUALIFICATIONS OF CANDLE FILTERS FOR COMBINED CYCLE COMBUSTION APPLICATIONS

CONTACTS

Robert R. Romanosky
Advanced Research Technology Manager
National Energy Technology Laboratory
3610 Collins Ferry Road
P.O. Box 880
Morgantown, WV 26507
304-285-4721
robert.romanosky@netl.doe.gov

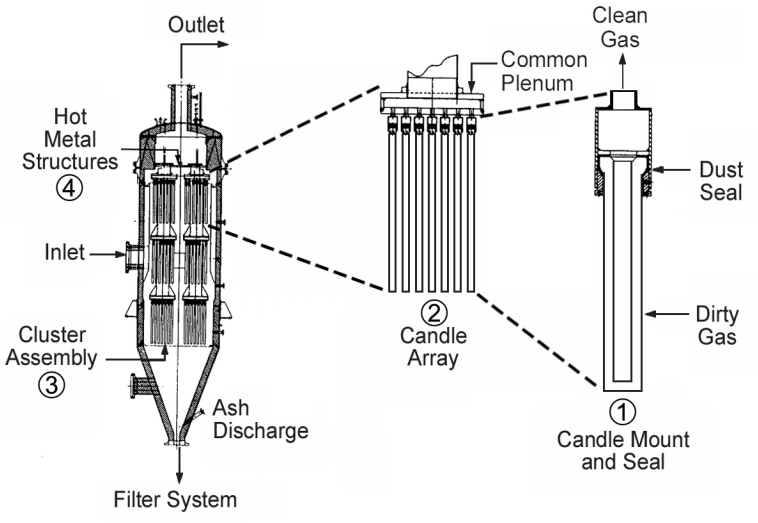
Jenny Tennant
Project Manager
National Energy Technology Laboratory
3610 Collins Ferry Road
P.O. Box 880
Morgantown, WV 26507
304-285-4830
jenny.tennant@netl.doe.gov

Dr. Tomasz Wiltowski
Southern Illinois University
Dept. of Mechanical Engineering & Energy Processes
Carbondale, IL 62901-4709
618-536-5521
tomek@siu.edu

Background

In order to make oxygen-fired combined cycle combustion feasible, it is necessary to have a reliable high temperature particulate cleanup system. It is well established that oxygen-fired combined cycle combustion is more efficient than conventional steam cycles or simple cycle gas turbines; however, in an oxygen fired combined cycle system, particulates from combustion must be removed from the hot gas stream before it enters the turbine. To obtain combustion power plant efficiencies above 41%, the particulate cleanup system must be able to operate above 1600 ºF. Current state-of-the-art cleanup systems cannot operate at high enough temperatures. For instance, metal filters cannot withstand temperatures over 1450 ºF. If there is no particulate removal system that can operate reliably at high temperatures, there is no future for oxygen-fired combined cycle combustion, or the improved efficiencies this combustion system will bring.

Ceramic filters may be able to operate at these high temperatures reliably enough to solve this problem. In late 2001, after years of development, composite ceramic filter tests strongly indicated that the temperature reliability issues of those filters had finally been overcome. This project will continue that work, and will test the durability and reliability of these ceramic filters, using a slip stream from the Southern Illinois



Siemens Westinghouse Ceramic Candle HGF Configuration

ADDRESS

National Energy Technology Laboratory
1450 Queen Avenue SW
Albany, OR 97321-2198
541-967-5892

2175 University Avenue South
Suite 201
Fairbanks, AK 99709
907-452-2559

3610 Collins Ferry Road
P.O. Box 880
Morgantown, WV 26507-0880
304-285-4764

626 Cochrans Mill Road
P.O. Box 10940
Pittsburgh, PA 15236-0940
412-386-4687

One West Third Street, Suite 1400
Tulsa, OK 74103-3519
918-699-2000

PROJECT DURATION

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10/01/2003

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9/30/2006

CUSTOMER SERVICE

1-800-553-7681

WEBSITE

www.netl.doe.gov

University (SIU) boiler. Use of the SIU boiler will result in the filters being tested under typical utility and industrial power plant cyclic conditions, at temperatures from 1600 ºF to 1800 ºF. Furthermore, the gas composition in an oxygen fired combined cycle system will not contain any more or less corrosive particles or gases than will be encountered in the test project.

The ceramic candle filter that will be tested in this project represents a new generation of ceramic materials. The filters will be fabricated from Nextel 610 alumina fiber, Saffle chopped fiber, and an alumina bond using vacuum winding technique. If these candle filters can be shown to be durable in the 1600ºF to 1800ºF range, then oxygen fired combined cycle combustion suddenly will become a viable development path for highly efficient combustion.

Goals

- Identify and demonstrate the stability of ceramic candle filter elements at temperatures representative of oxygen-fired combined cycle conditions;
- Define ceramic candle filter element life-span based on long term high-temperature testing;
- Assess ceramic filter elements in terms of residual materials properties and operating life; and
- Address the suitability of ceramic filters for use in oxygen fired combined cycle combustion operations.

Accomplishments

- Acquired candle filters from the vendor;
- Completed the detailed design for the entire test system, including the slip stream from the SIU steam boiler plant;
- Obtained all necessary permits to modify the SIU steam boiler plant; and
- Obtained a filter vessel, and began refurbishment for the project.

SIU's AFBC System