PROJECT facts

U.S. Department of Energy
National Energy Technology Laboratory

Environmental and Water Resources

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Advanced Hybrid Particulate Collector

U.S. Department of Energy Supports New Clean Air Technology for Coal-Fired Power Plants

PRIMARY PROJECT PARTNERS

Energy & Environmental Research Center
Grand Forks, North Dakota
(Primary Contractor)

W.L. Gore & Associates, Inc.
Elkton, Maryland
(Technical and Financial Partner)

Big Stone Power Plant
Operator:
Otter Tail Power Company,
Fergus Falls, Minnesota
Owners:
Montana-Dakota Utilities,
NorthWestern Public Service,
and Otter Tail Power Company

ALENTEC
Huntington Beach, California
(Subcontractor)

PROJECT PARTNERS

ELEX AG
Switzerland

CUSTOMER SERVICE

(800) 553-7681

WEBSITE

www.netl.doe.gov

Goal

Tighter environmental standards will require U.S. coal-based power plants to be much cleaner and more efficient than today's technology allows. The U.S. Department of Energy's (DOE) goal is to develop, by 2010, power systems that are at least 10 times cleaner than current coal-burning plants. DOE also seeks to accelerate the commercialization of highly efficient, affordable technologies that support the use of coal—by far the nation's most abundant energy resource—as a reliable energy source.

Harmful substances listed in the Clean Air Act Amendments of 1990 include the group of hazardous air pollutants (HAPs) associated with fine particles. By finding ways to remove these fine particles from combustion products, coal-fired power plants can substantially reduce the emissions of these pollutants. In addition, many plants have a need for better fine-particle control to limit opacity - the gray or brown plume from the exhaust stack that reinforces the public's perception of coal plants as "dirty."

Researchers at the University of North Dakota's Energy & Environmental Research Center (EERC) are working with DOE, W.L. Gore & Associates, Inc., and Otter Tail Power Company to develop the Advanced Hybrid Particulate Collector (AHPC). Tests to date show that the AHPC can provide greater than 99.99% particulate collection efficiency for all particle sizes, for use with all coals, at a cost that is competitive with or lower than existing technologies.

Description

Fine-particle emissions contribute to visibility-reducing haze and have been linked to human health problems. The AHPC is a pollution prevention technology that removes these fine particles from exhaust gases of coal-fired power plants, incinerators, and minerals processing facilities. It is a unique concept that closely integrates electrostatic precipitation (ESP) and filter bag technologies into the same housing to create a compact, durable, very cost-effective, and highly efficient particulate matter collection system.

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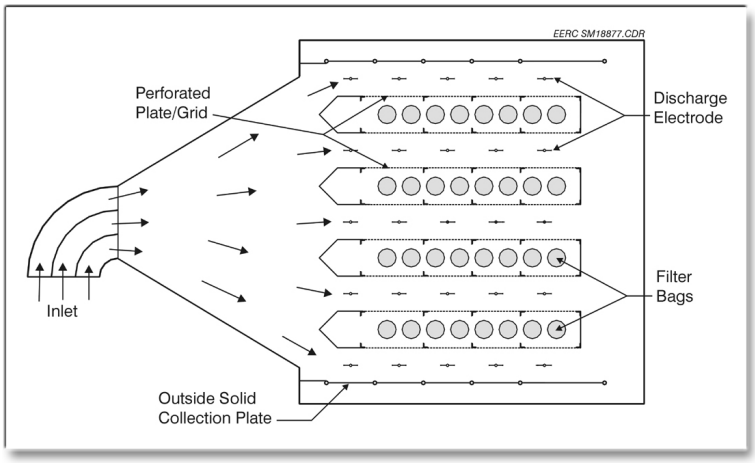
Market Potential

Control of fine particles from industrial plants represents a very large market worldwide. Currently, the size of this market is estimated at $5 billion annually. Possible stricter regulation of fine-particle emissions in the United States could open an even larger market in the future for the AHPC technology. Additionally, the need to expand the baseload generating capacity in the United States will increase the market for clean coal-fired power systems, which would be an ideal application for the AHPC. It is expected that the cost of the AHPC technology will be less than the cost of conventional, less effective options currently used for fine-particle control.



The unique configuration of the AHPC promotes a synergy between these two technologies whereby the filter bags are able to operate at high filtration velocity (smaller-size device) and be cleaned without the normal concern of dust reentrainment. About 90% of the particles are collected on the ESP plates before they ever reach the bags; the fine particles that escape the plates are collected by the highly efficient and durable GORE-TEX® membrane filter bags. When pulses of air are used to clean the filter bag surfaces, the dislodged particles are thrown back into the ESP fields where they have another opportunity to be collected on the plates. Operating experience suggests that the GORE-TEX® bags will provide excellent performance over a very long, effective life. This leads to low operating costs since filter bag replacement is a key cost component.

AHPC requires far fewer components than either a conventional ESP or fabric filter. It has less than half the normal number of ESP components and 65%–75% fewer bags than a conventional fabric filter. This translates into an overall smaller system size.

A demonstration unit has been operational since July 1999, filtering 15,000 m^3/hour of flue gas from the Big Stone coal-fired power plant. The Big Stone plant is operated by Otter Tail Power Company and is co-owned by Montana-Dakota Utilities, NorthWestern Public Service, and Otter Tail Power Company. The unit has exhibited very stable operating levels while maintaining low energy consumption during continuous operation. This has been achieved while cleaning the filter bags on-line and meeting particulate matter capture efficiency levels greater than 99.99%. Fine-particle emissions are so low that the air leaving the fine-particle control device is cleaner than the air entering the power plant. This would qualify the AHPC as a "zero emissions" technology for fine particles.