

# Advanced Hybrid™ Filter Technology

## Commercial Application

The *Advanced Hybrid™* filter is an emission control technology that removes fine particles from exhaust gases of coal-fired power plants, incinerators, and mineral-processing facilities as well as recaptures valuable product from process gases in the pharmaceutical and chemical industries.

## Commercial Need

Harmful substances listed in the Clean Air Act Amendments of 1990 include the group of hazardous air pollutants (HAPs) associated with fine particles. Tight environmental standards will require coal-based power plants to be much cleaner and more efficient than today's technology allows.

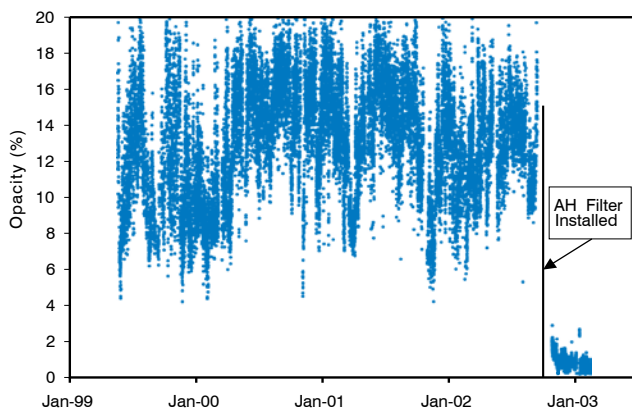
Other industries such as the pharmaceutical industry recover fine particulate matter (PM) from process gases as valuable products. There is a need for improvement on efficiency and cost-effectiveness of current baghouse applications.

## Current Approaches

Electrostatic precipitators are inadequate for fine-particle capture, and fabric filters have high pressure drop and short lifetime because of filter blinding. Although people have been trying to combine the two mechanisms, technical challenges remain such as protection of the bags from electrically induced damage and suppression of particle reentrainment.

## Technological Advantage

The *Advanced Hybrid™* filter integrates electrostatic precipitation (ESP) and filter bag technologies into the same housing. The unique synergy between these two technologies suppresses particle reentrainment and thus creates a compact, durable, cost-effective, and highly efficient particulate matter collection system that is superior to either technology by itself.



Opacity levels measured before and after installation of the *Advanced Hybrid™* filter show excellent emission control at a 2-million-acfm coal-fired power plant.

## Benefits

- Superior collection efficiency (> 99.99%) for all particle sizes.
- A long, effective bag life, as the bags are well protected and cleaned without normal dust reentrainment.
- System size reduction of approximately 30% to pulse-jet baghouses (less than the normal number of ESP components and 65%–75% fewer bags than a conventional fabric filter) as it operates at a high filtration velocity.
- Low energy consumption during continuous operation.
- Easy to implement and retrofit, as there is little reliance on external control parameters.
- Easy access to PM recovery, as it is an open structure.

## Market Information

The initial market for the *Advanced Hybrid™* filter is coal-based power plants. For 2008, the worldwide power plant baghouse market is estimated at US\$653 million. Currently, the markets for the other applications are at least similar in size, with considerable growth potential in the future.

## Industry

A wide range of industries that are dealing with or are affected by various PM emissions can benefit from this technology. Industries that require PM recovery in their products will also be interested in this technology.

## Development Stage

The concept is well proven in pilot-scale tests and is currently being demonstrated in a 500-MW full-scale coal-fired power plant, as well as in a 250,000-acfm cement-manufacturing plant.

## Partners

We are constantly looking for new strategic partners to develop, demonstrate, and commercialize different aspects of the technology. Partners for the *Advanced Hybrid™* filter have been as follows:

- Otter Tail Power Company



- U.S. Department of Energy  
National Energy Technology Laboratory



- Southern Environmental Incorporated



- W. L. Gore & Associates



- ELEX



## Type of Collaboration

We are currently looking for commercialization partners for coal-fired power stations, incinerators, mineral-processing facilities, and other large-scale, high-dust applications on a worldwide basis.

In addition, we are continuously advancing the technology and looking for development and demonstration partners interested in hot-gas cleanup or in recapturing valuable products, such as in the pharmaceutical industry.

## Intellectual Property Rights

We hold worldwide patents on the *Advanced Hybrid™* filter technology:

- U.S. Patent 6,544,317 and foreign filings
- U.S. Patent 5,938,818 and foreign filings



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