Case history

Blender dedusts fly ash with minimal moisture to cut transport costs

A coal-burning electric power plant installs a blender to dedust fly ash and decrease its disposal costs.

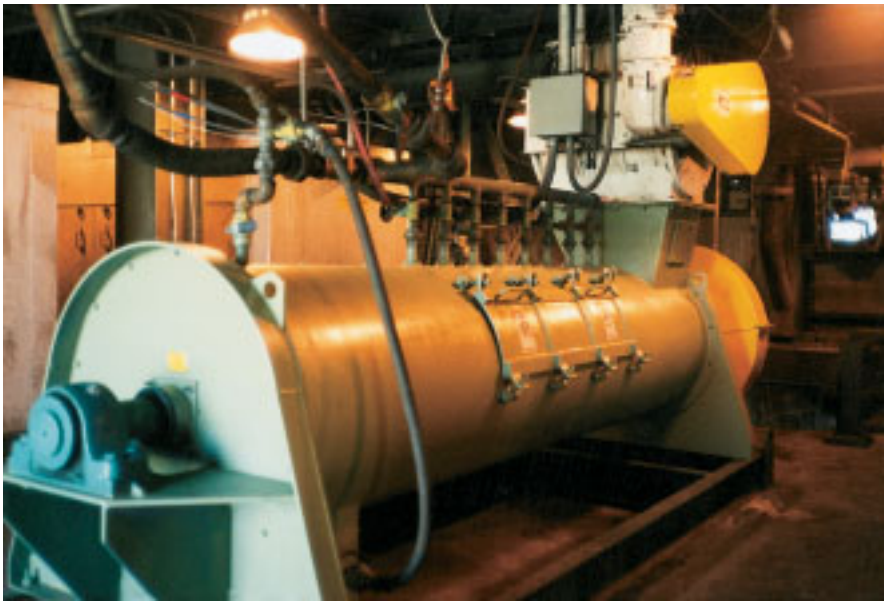
Birchwood Power Partners (BPP) operates a 220-megawatt coal-burning electric power plant in King George, Va. The bituminous coal, which is mined from West Virginia, is transported to the plant for storage prior to use. The coal is then charged into the plant's furnace where it's burned to create heat. The coal-burning process leaves the by-product fly ash. Water tubes that pass through the furnace are heated by the burning coal, creating high-pressure steam that spins the plant's turbines and generates electricity. A high-velocity hot airstream conveys the fly ash from the furnace's outlet to a baghouse where the ash is collected before conveying to a 1,200-ton silo. The filtered air discharges from an exhaust stack. The fly ash is then discharged from the silo and transported to a landfill for disposal.

High costs of fly ash disposal

Prior to 1998, the plant was used as an intermediate capacity facility; it went online only when electricity demand was high. But since 1998, the plant has been operating at a higher capacity to meet the area's electricity demands. "So in those two years, we went from generating an easily manageable amount of fly ash to generating a significant amount of fly ash," says Bob Snell, material handling manager at BPP's plant in King George, Va.

Initially, the company loaded the dry fly ash into pneumatic railcars that transported it to an ash processing facility near Richmond, Va., about 60 miles away. The facility's operators discharged the fly ash from the railcars and processed it through a pug mill, mixing water with it to eliminate dusting. They then loaded the moist fly ash into dump trucks, which hauled it to a landfill.

"As the plant produced more fly ash, loading it into the pneumatic railcars became cumbersome and expensive because of certain logistic issues concerning the fly ash removal and rail transport contracts," says Snell.



The rotary airlock (upper right) feeds 70 to 80 tons of fly ash per hour into the blending chamber, where moisture is added for dedusting.

The cost was large enough that BPP quit using the pneumatic railcars and switched to pneumatic tanker trucks. While the dry fly ash was still sent to the Richmond fly ash processing facility, using trucks cut costs because the company now paid for only the actual weight shipped. Yet it was still paying transportation costs for the 120-mile round trip and processing and disposal fees to the landfill.

These extra costs led the company to search for a better way to dispose of the fly ash. The company petitioned the county and the state to use the fly ash as a daily cover at the landfill located next to its plant, which would allow BPP to substantially decrease its fly ash transportation costs.

"We got permission from the county and the state to use the landfill next to us.The landfill would use the fly ash as a daily cover for the trash," says Snell. "Just before they shut down at night they'd cover the trash with a mixture of fly ash and soil. But to use the new landfill, we'd have to condition the fly ash before transporting it there. That's when I started looking for a machine to perform that operation in-house."

Searching for the right equipment

Snell had worked with pug mills in the past and knew that a pug mill typically adds about 35 to 45 percent moisture to dedust fly ash. Because the extra water weight would increase the transportation costs, he wanted a machine that added only 20 to 25 percent moisture.

"I already knew about some mixer and blender companies. But when I started looking for information about blenders on the Internet, I came across Scott Equipment and its HST blender," says Snell. "After learning about this blender, I contacted the supplier to talk with a sales rep for more specific information. I wanted to know if the supplier had ever dealt with fly ash and if this blender could dedust fly ash with only 20 to 25 percent moisture."

Snell also talked with four other suppliers about machine capabilities and prices, but Scott Equipment was the only company that offered to run dedusting tests on the fly ash using only 20 to 25 percent moisture. So in February 1999, Snell rented a truck, loaded on twenty 55-gallon drums of fly ash, and drove to Minneapolis.

"The supplier invited me up to its test facility to test the fly ash and prove what the blender could do with it. In my experience, you normally don't get that."

The blender's eight spray nozzles inject more than 200 gallons of recycled wastewater per minute and operate independently of each other.

Snell spent 2 days at the supplier's test facility testing the fly ash on a scale model of the blender he was interested in. The supplier ran 15 to 20 tests with varying amounts of moisture to show Snell how the blender operated with different percentages of water and material feedrates.

After the tests, Snell traveled back to King George, Va., and presented the information to the plant manager and plant engineer. With their approval, Snell called the supplier and ordered an HST blender, along with a rotary airlock to regulate the fly ash feedrate from the silo to the blender.

The blender

The HST blender is suited for continuously mixing a small amount of liquid with a large amount of dry material. The unit's three main components are a structural steel frame, the blender vessel, and an optional rotary airlock. The structural steel frame supports the blender vessel and its motor. The rotary airlock bolts onto the blender's inlet and controls the material feedrate from the silo into the blending chamber.

The blender is 13½ feet long, 90 inches wide, and about 8 feet tall from the floor to the rotary airlock's top. The blender is constructed of carbon steel but can be constructed of other materials to suit the application requirements.

The blender's cylindrical blending chamber is 30 inches in diameter and 120 inches long. A solid carbon steel shaft supported by two outboard pillow block bearings runs the length of the blending chamber. A 100-horsepower, explosion-proof electric motor rotates the shaft, and graphite packing glands prevent fly ash from leaking out around the shaft.

Carbide hard-faced carbon steel beater blades are threaded into the shaft in a helical pattern, like a screw thread that continuously wraps or spirals around a shaft. The beater blades direct the material through the blending chamber and provide full blender wall coverage, eliminating material buildup in the blending chamber.

Because the beater blades are threaded into the shaft, the pitch of each beater blade can be adjusted to direct the material flow through the blending chamber. While most beater blades are pitched to direct the material to the blender's discharge, others can be pitched flat to hold the material or pitched in reverse to direct the material back to the blender's inlet, providing a longer material retention time.

After working its way through the blending chamber, the material exits through the discharge at the blending chamber's bottom. The material discharges by gravity, with no restraining gate.

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The rotary airlock is 45 inches wide, 45 inches long, and about 32 inches tall, and it weighs just over 1,500 pounds. A 3-horsepower electric motor rotates the airlock's rotor at 20 rpm and meters 4 cubic feet of material per revolution into the blending chamber (about 70 to 80 t/h). Both the shaft motor and rotary airlock motor are powered by a 460-volt, three-phase power source. The motors work independently of each other.

An operator controls the blender's operation with an Allen-Bradley control panel (far right).

To dedust the fly ash during blending, the supplier added an external 2-inch-diameter, high-pressure water spray line with eight independently operating 1-inch spray nozzles. The spray line crosses the blending chamber's top, and the spray nozzles are spaced 8 inches apart. The nozzles are threaded into predrilled holes and mounted flush with the blending chamber's interior wall.

The nozzles spray water in a cone-shaped pattern into the blending chamber, spreading the water out like a spotlight. Each nozzle has a valve that allows an operator to shut it off, allowing the operator to determine where the water will be added in the chamber during blending. This also allows the operator to better control the fly ash's moisture because there are no moisture content controls inside the blending chamber; it's all done manually.

Three 10-by-41-inch doors — two on one side of the blending vessel and one on the other — allow easy access for maintenance and cleaning.

Dedusting fly ash with less moisture

In May 1999, the blender and rotary airlock arrived at BPP's plant. Prior to installation, the company bolted the rotary airlock to the blender's top. After installing the blender, the company connected the blender's water spray line to a water source and con-

nected its operating components to an already-present Allen-Bradley control panel, which controls the blender's operations.

The company installed the blender inside its fly ash silo under the silo's discharge. The control panel is located near the blender in the same room. The company also has a remote control panel in a control room underneath the blending room, where an operator can watch each truck as it's being filled and shut down the blender when the truck reaches capacity.

A knife gate, which is connected to the control panel, charges the fly ash in the silo to the rotary airlock. To start the blending process, an operator turns on the blender and rotary airlock and then opens the knife gate, allowing the fly ash to flow. As soon as the knife gate opens, the spray line automatically kicks in.

The blender uses 200 gallons of recycled wastewater per minute — about 35,000 to 50,000 gallons each day — to dedust the fly ash. When the fly ash discharges from the blender, a telescoping chute directs it into a dump truck.

"We process approximately seventy tons of fly ash per hour. And we average about 22 percent moisture content in the fly ash when it discharges from the blender. That's an average, because the moisture content is affected by humidity, heat, and wind," says Snell. "The fly ash discharges into a regular dump truck. The driver has about a ten-minute run to the landfill and then comes back for another load."

The blender's ability to dedust the fly ash with only 20 to 25 percent moisture reduced the fly ash's transportation weight and the company's overall transportation costs more than a pug mill could at 35 to 45 percent moisture.

An important factor in maintaining a trouble-free blending operation is keeping the blender clean and following a regular maintenance schedule.

"We take care of the blender ourselves because it's a very simple machine to maintain. We clean it at the end of each day. It only takes about fifteen minutes," says Snell. "To clean it, we flush the blending chamber with water, which gets out the bulk of the material. Then we open the three access doors and knock away any remaining material with a high-pressure power washer. Other than that, we grease the blender's two pillow block bearings with regular machine grease once each month."

Reducing fly ash disposal costs

One of the main benefits the company has experienced since installing the blender is the reduction in its fly ash disposal costs. The blender's ability to dedust the fly ash with only 20 to 25 percent moisture reduced the fly ash's transportation weight and the company's overall transportation costs more than a pug mill could at 35 to 45 percent moisture.

"We still have the county and landfill fees, but we've eliminated processing fees and cut down on transportation costs. When you pay by the ton for transportation, the less water you have to put in the fly ash, the less it costs you to transport it," says Snell. "And because we recycle the wastewater from our plant, we don't have any extra costs involved with that."

Snell bought 10 extra beater blades with the blender just in case one broke during operation, but so far none of them have broken. "The blender has been in operation just over two years now, and we've processed more than 229,000 tons of fly ash through it," Snell says. "We've had no maintenance failures or problems. We just pulled all sixty-eight beater blades out and I noticed a little wear on them — only about ⅜ inch of wear in two years, though. I'll probably replace them all next summer."

"One reason we went with this blender is because it's a mid-price machine. I looked at other blenders, and the suppliers wanted four times what we paid for this one," says Snell. "Another thing that impressed me was that Scott Equipment invited me up to its test facility to test the fly ash and prove what the blender could do with it. In my experience, you normally don't get that — you buy the blender, put it in, and then you make it work."

Snell says the blender also installed the way the company said it would. "As soon as we had power to it, we started using it. It has a very low learning curve, and the guys got used to it right away. And if something ever happens to the blender that we can't repair, the supplier has a field service technician who will come out and look at it." **PBE**

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