Novel Dry Coal Deshaling Technology Removes Waste Rock from Coal and Saves Energy

The elimination of the energy used to transport and process waste material mixed with mined ore represents a significant opportunity to increase the energy efficiency of the mining industry. The opportunity is even more important in coal mining, where the reduction of waste rock mixed with coal increases the heating content of the product, while reducing the concentrations of ash, sulfur, and mercury, which decrease the value of the product and contribute to harmful emissions.

The current project ”Development of a Novel Dry Coal Processing Technology” led by the University of Kentucky in the mining R&D Portfolio of the Industrial Technologies Program (ITP) is developing and commercializing an innovative, dry coal preparation deshaling plant module (FGX) designed to separate coal from waste rock at the extraction point, and prior to shipping. The low cost treatment plant is small enough to be mobile and has applications at mines without dedicated treatment plants. These plants frequently ship unprocessed coal containing up to 60-70% waste over tens of miles. The plant module may also be used to upgrade feed to conventional coal washing plants, thus reducing the energy and water use of existing plants.

The FGX 5 tph Mobile Coal Deshaling Pilot Plant

The FGX process works by separating the higher density rock (mostly shale) from lower density coal with a dry air table technology. The FGX technology achieves density-based separation using the vibratory motion of a sloping separation deck with perforations to allow passage of a fluidizing air stream. The separating compartment consists of a deck, vibrator, air chamber and hanging mechanism. A centrifugal fan powers air flow through holes in the deck surface at a rate which transports and fluidizes the particles. Less dense coal particles are quickly separated, while higher density particles settle to the base of the fluidized bed, where they are channeled by vibratory motion toward the discharge end of the table.


Left: Design of the FGX Air Table (table feeds right to left)
Right: Separation of Product on FGX Table (right is clean coal, left is rock tailings)

Project partner Eriez Manufacturing Co., a major supplier of processing equipment to the coal industry, has constructed a 5 ton per hour (tph) pilot-scale plant. University of Kentucky and Virginia Tech researchers have used the pilot plant to test the benefits of the FGX unit at a variety of coal mine sites. The pilot plant treatment achieved the following results at an Andalex Resources, Inc. mine in Utah which mines and sells untreated bituminous coal:

- Nearly 100% of coal was retained;
- 70% of the high density waste rock was rejected;
- The heating value of the product was upgraded from 11,513 to 12,691 Btu/lb;
- The ash content of the product was lowered from 18.21 to 10.76%;
- The sulfur content of the product was lowered from 1.61 to 1.49%;
- Overall rejection values of 54% of the ash bearing material and 29% of the sulfur were achieved.

These test results were featured in a 2006 article in “Coal Preparation Society of America Journal”.

Eriez is leading the effort to commercialize FGX Technology in the US, with technical support from the University of Kentucky and Virginia Tech. In pilot tests, run-of-mine coal has been treated at an estimated cost of $0.50/ton which includes manpower requirements. The company has already received orders for 120 tph and 240 tph commercial size plants. In a test on a Texas lignite coal, the SO_2 and mercury contents were reduced by about 45% and 65%, respectively, while recovering 85% of the feed mass. Future tests will be conducted on eastern bituminous and anthracite coals. The project has an estimated potential energy savings of 270 trillion Btu/year.

For more information on this technology contact:

Rick Honaker, University of Kentucky
(859) 257-1108,

rhonaker@engr.uky.edu

or,
Joseph B. Renk III, National Energy Technology Laboratory
(412) 386-6406,
Joseph.Renk@netl.doe.gov

For a fact sheet on the project see:
http://www.eere.energy.gov/industry/mining/pdfs/noveldrycoal.pdf