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Technologies for Clean Use of Coal

In the domain of policies related to energy, this country has many problems, including acid rain and costs of imported oil. A recent report from the Department of Energy's Energy Research Advisory Board is a rich source of information on these matters.* The document lists 13 to 15 categories of technologies under development for clean use of coal. In describing their status, the report indicates that progress is being made and that federal co-funding of demonstration facilities would expedite diminution of acidity of rain. Substitution of coal for oil could also be increased.

Coal-fired utility boilers are responsible for 70 percent of the SO₂ and 20 to 25 percent of the NO_x emitted in this country. The boilers east of the Mississippi account for 16 million tons of SO₂ and 4.5 million tons of NO_x. Only about 10 percent of the boilers are subject to New Source Performance Standards. The current technology for reducing pollution, flue gas desulfurization (FGD), is costly; it reduces energy conversion efficiency, and the usual sludge is a potential polluter of ground water. A new technology, Limestone Injection Multistage Burner (LIMB), appears to be markedly superior to FGD. The LIMB technology is based on injection of a sorbent—limestone, for example—directly into the furnace and its subsequent reaction with SO₂ leading to dry calcium sulfate. The LIMB technology is relatively low cost, both for retrofit and operation. It can reduce both SO₂ and NO_x by 50 to 60 percent for retrofit applications.

The procedures used to achieve reduction of NO_x in the LIMB technology are of possible broad application in industrial and other combustors that emit large amounts of NO_x. In the LIMB technology, the major burning occurs in a primary stage. Reduction of NO_x is accomplished in a second combustion zone that is made reducing in nature, by, for instance, injection of natural gas. The combustion is completed after the second zone at temperatures at which little NO_x is formed.

The major coal seams of the Midwest have sulfur contents on the order of 3 to 4 percent and around 10 percent ash. Usually more than half the sulfur is in the form of pyrite (FeS₂), a heavy mineral. When coal is ground down to small particles, the noncoal pyrite and ash can largely be removed through physical methods such as flotation of coal on a heavy liquid. A slurry of 60 percent coal particles and 40 percent water can be moved by pipeline. Demonstrations of use of a slurry with particles about 100 micrometers in size as a substitute for residual oil have been conducted. When the coal is ground to about 40 micrometers or less, performance as an oil substitute appears to be very promising. The total use of oil products in utility and industrial boilers is about 2 million barrels per day. Many utility boilers ordinarily fired by oil are now idle. A lower cost substitute for oil would restore their usefulness. An alternative to coal slurries is the use of two-stage combustion—that is, the coal is gasified in one burner and the gases oxidized in a second boiler previously used for oil or natural gas.

For new industrial and utility boilers, the emerging best technology is fluidized bed combustion. This method is currently being employed successfully in many small- to moderate-sized applications. It leads to low emissions of SO₂ and NO_x and has the potential of superior energy efficiency. The utilities are in the process of testing it as a retrofit in installations of about 100-megawatt capacity.

To expedite practical application of clean use of coal, full-scale demonstration plants must be built and operated. Private industry, the Electric Power Research Institute, and the Environmental Protection Agency have taken initiatives in this matter. In view of the importance of the clean use of coal, the current budget of about \$60 million for DOE support of the many efforts seems small. DOE should reexamine its budgetary priorities.

—PHILIP H. ABELSON

*Energy Research and Advisory Board, *Clean Coal Use Technologies* (DOE/S-0036, Department of Energy, Washington, D.C., June 1985), vols. 1 and 2.