

sources. Even then, our energy needs will far exceed available domestic supplies. But the gap between domestic supply and demand must be narrowed, and increased coal production offers the country one of its best opportunities.

The Present State of Coal

Estimated current annual productive capacity of the coal industry is about 700 million tons. In addition, some 535 million tons of new capacity is planned and could be in production by 1985. It is possible then that productive capacity will measure more than one billion tons by 1985.

Still, there is no guarantee that actual production will be able to match productive capacity. For instance, coal production in the United States increased by only six percent in 1975 over 1974—from 603 million tons to 640 million tons. Another 51 million tons of productive capacity had been expected to come onstream. There were just too many problems.

Some of the problems have to do with the type of mining used in the production of coal. Basically, there are two kinds: surface mining and underground or deep mining. Each method accounts for about half of the coal produced in the United States.

Surface mining is on an average three times more productive than deep mining—some of these mines actually extract 10-15 times as much coal per man-hour as deep mines. But, there are problems.

- *The Cost.* Most new surface mines are located in the western part of the country. By the time the coal produced in these mines is shipped to customers in the East, transportation costs can boost the base price of the coal substantially. And even though most western coal is low in sulfur content, most of it is also low-energy sub-bituminous coal. A ton of it has only three-fourths as many British thermal units (BTU's) as eastern coal.
- *Delays.* Surface mining has encountered many environmental delays. In addition, the Federal government has withheld coal land from lease sales for the past five years or so. Since nearly 80 percent of all western coal is located on Federal lands, these delays have had a significant impact on production.

Deep mining, which is the principal coal mining method used in the eastern part of the country, also has problems—both environmental and technological.

- *Sulfur Content.* Most of the high BTU coal in the East is also high in sulfur content. The Clean Air Act of 1970 imposes rigid sulfur emission standards. Stack-gas scrubbing, a technique for reducing sulfur emissions, is costly and creates its own environmental problems.
- *Longwall Mining.* This method mechanically shears a coal seam several hundred feet on a side, while the operator is protected by a thick steel canopy. It can remove more than 80 percent of the coal in a mine. However, the method requires a great deal of investment for machinery that might sit idle half of the time, since setting up a longwall operation can take weeks. Moreover, the strata overlying American coal seams do not always lend themselves to such operations.
- *Continuous Mining Machines.* This mechanical borer can churn out nearly 4,000 tons of coal per shift, if it operates without interruption. But the shuttle cars used to transport coal to the surface can convey only two to three tons per minute. Thus, the machine can sit idle 80 percent of the time waiting for other operations to catch up.

Some of these problems are being resolved through the application of technologies developed by petroleum companies. For instance, Consolidation Coal, an affiliate of Continental Oil Company, devised a system using techniques developed in the petroleum industry whereby coal from the continuous miner is fed to a crusher. The crusher breaks the coal into chunks small enough to be flushed with water through a 10-inch pipe and moved to the surface. This hydraulic system can pump coal at 10 tons a minute, or as fast as the coal is cut.

Oil companies are also applying their oil drilling know-how and technology to improve safety and to reduce environmental problems associated with the production and use of coal.

The utilization of technology perfected by petroleum companies as well as the infusion of capital which oil companies can bring to the coal industry have had a favorable impact on energy production. Three of the four coal companies acquired by four different oil companies during the 1960's experienced substantial increases in production for the five-year period immediately following the date of acquisition, compared to the five years prior to their acquisition.

This pattern of growth in underground coal mines has been slowed somewhat by coal strikes, by new