Underground Treasure

COAL GASIFICATION REVISITED

BY SALVATORE SALAMONE

CHANGING ECONOMIC CONDITIONS and concerns over emissions are reviving interest in underground coal gasification.

The technology burns coal in place in the ground creating a mix of gases including hydrogen, methane, carbon monoxide and carbon dioxide. This mix is called synthesis gas, or syngas. At the surface, these gases can be recovered – and if need be, cleaned – and used to produce energy by driving turbines designed for combined-cycle power plants. The gases may also be converted to low-sulfur liquid fuels. Additionally, the gases might be used to generate hydrogen for use in fuel cells.

The idea is not new. The former Soviet Union developed and ran plants using the technology throughout most of the last century. However, interest waned over time due to the abundance of low-priced natural gas and the emergence of other, cheaper alternatives.

Interestingly enough, one of the drawbacks to using the technique in the old days was that it produced a lot of hydrogen – something that is viewed as a plus in today's energy marketplace.

Now, as demand for energy grows, the price for existing energy sources rises and pressure to reduce emissions escalates, underground coal gasification is getting more attention. Commercial and pilot programs have started in Australia, China, South Africa and the United States.

At the heart of the technique is the ability to extract energy from coal without removing it from the ground.

Typically, this is done by drilling a vertical borehole into a coal seam, injecting air or a mix of oxygen and steam into the hole, and igniting the coal in the ground. The burning produces gases that are extracted through a second vertical borehole, which is linked to the injection well.

The potential for the technology is enormous. Australia, China, India, Russia, the United States and other countries have large reserves of coal. But only about 5 percent of all coal reserves are economically viable for extraction.

With such potential, a new U.S. program is underway to assess the viability and economics of developing a commercial plant. GasTech is undertaking the program, and it is focusing on the Powder River Basin coal reserves in Wyoming. BP is a partner in the effort.

So why focus on the Powder River Basin? The region has 510 billion tons of coal, according to the U. S. Geological Survey. "About 60 percent of that is at a depth suitable for underground coal gasification," said Stephen Morzenti, president of GasTech.

Morzenti notes that the location of the coal seams is well known from geological surveys. With this and other information, the company used about a dozen criteria to select areas with the best potential. Criteria included the thickness of a coal seam, its continuity and its depth.

Also factored in are the coal's ash content and geological characteristics such as faults in the region, hydrological conditions and what lies between the surface and the coal seam. These factors can make a great difference in determining if a site is suitable for a plant. For example, water is a necessary part of an underground coal gasification effort. But excessive water lowers the BTU value of the coal.

Underground coal gasification offers a number of ways to address carbon emissions. As the coal burns, an empty cavern is created underground. This space could be used as part of a carbon sequestration operation. The aboveground plant could include a carbon-capture capability. And emissions can be reduced if the plant uses the syngas in an integrated-gasification combined-cycle (IGCC) operation.

GasTech studies estimate that the capital costs to build an underground facility are 25 percent lower and the operating costs are 50 percent lower than a comparable surface IGCC plant.

The two main points critics raise are the possibility of contamination of underground water supplies and incidents of subsidence, which is the collapse or sinking of the land once a cavity forms when the coal is burned.

But proponents point out that worldwide pilot and operational programs have yielded a very small number of contaminations, and that subsidence incidences can be minimized by proper site selection.

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