



FutureGen's Promise

CENTER PROMOTES RESEARCH

BY KEN SILVERSTEIN

» **THE POWER INDUSTRY** supplies a commodity that is integral to people's lives. Traditionally conservative, when it takes risks, the industry typically partners with the government for funding and technical expertise. When the government is willing to allow researchers to reach beyond their limits for innovative solutions, such partnerships become fruitful.

The U.S. Department of Energy has its hands in many endeavors. For coal, its go-to division is the National Energy Technology Laboratory (NETL), with main offices in Pittsburgh and Morgantown, W.Va. The cornerstone of NETL's current undertakings is the FutureGen, a DOE program to design and build a large-scale prototype plant to produce electricity and hydrogen from coal with no carbon or other emissions.

NETL has smaller offices in Alaska, Oklahoma and Oregon, and many partners in industry. Its main ally, the FutureGen Alliance, is made up of large utilities such as American Electric Power, Southern Company and E.ON, as well as big coal companies that include Peabody and Console Energy. Various contractors are assigned to bits and pieces of the deal, all in conjunction with the agency.

NETL also works with many universities. For example, the University of Pittsburgh and West Virginia University review the fundamentals and theories for each technology. They develop ideas from a theoretical stage into a computational science.

"FutureGen incorporates many of the advanced technological developments we are working on," said Tom Sarkus, FutureGen project director for NETL in Pittsburgh. "It is the culmination of a number of our research and development initiatives. We really want to influence and to push for technological advancement. Industry wants to advance the technology, but not to the degree of those in government. It knows how to design, construct and run the plants. The government also provides financial assistance to advance the technologies to a level that industry cannot do on its own."

The FutureGen zero-emission coal-fired power plant could also capture and sequester carbon dioxide emissions. It is a nearly \$1 billion undertaking. Of that, the coal industry will pony up \$250 million, and foreign governments – China, India and Korea are all involved – will contribute \$80 million. The U.S. government will cover the roughly \$700 million balance. The initial plant would generate 275 megawatts of electricity. If the design is successful, it could be replicated throughout the country.

THE ELEMENTS

FutureGen began in 2000 and officially launched in 2004. The goal is to have the plant up and running by year-end 2012. The project's three basic elements are:

- » The capacity to gasify coal so that it would be cleansed of all the impurities before it leaves the smokestack.
- » The ability to develop hydrogen.
- » The ability to capture and bury CO₂.

These objectives address the global warming issue. If hydrogen can be separated, it could be used to power everything from vehicles to electric generators. And, if carbon could be sequestered and bottled up, that would put a shine to coal's future. Pilot projects show that each feature is doable. The challenge lies in integrating each attribute into one generation facility.

The project's importance is obvious. According to DOE, the United States mines more than 2.8 million tons of coal each day and if it did not, the nation would have to double its natural gas production. Coal remains cheap and plentiful, with 250 years' worth of reserves. It comprises 51 percent of the electricity generation.

Coal's prominence, however, is threatened by the strong emphasis on minimizing the release of heat-trapping emissions. According to the Congressional Research Service, coal

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HYDROGEN STUDY

The U.S. Department of Energy has earmarked \$11.2 million to support 13 projects to solve the challenges involved in the production, storage and use of hydrogen.

Dr. Raymond L. Orbach, DOE under-secretary for science, said, "This funding will support transformational scientific research addressing major issues underpinning the hydrogen economy..."

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A \$1 billion research effort is expected to result in FutureGen, the world's first zero emissions fossil fuel plant.
DRAWING COURTESY OF FOSSIL ENERGY.

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CHINA TO TOUGHEN POLICIES

Chinese Premier Wen Jiabao wants his country's biggest energy-using industries to get more energy efficient and less polluting as his country's economy continues to surge.

"We are left with no choice but to develop in an economical, clean and safe way," the premier recently said, according to *Xinhua*.

Stricter environmental and land use standards are coming for power, steel, oil refinery, chemicals, construction materials, and metals industries that account for 70 percent of industries' power needs, he said.

is responsible for about a third of all CO₂ emissions. It also releases double the other pollutants regulated by the Clean Air Act, including sulfur dioxide and nitrogen oxide.

"Let's face it, we are going to use coal," says Richard Bajura, director of West Virginia University's National Research Center for Coal and Energy. "I do think coal can be carbon neutral."

To build FutureGen and to particularly sequester CO₂, "we must know what the technical risks are and how to finance them and what it will all cost," added Ken Humphreys, director of carbon management at Columbus, Ohio-based Battelle, one of the leading private enterprises at work on the project. "We are on an aggressive path to move it from a pilot scale to a fully integrated scale. I don't see it as far off."

Those two experts agree that the immediate goal is to perfect the gasification technologies – the ones that convert coal to fuel gases before the sulfur, mercury and CO₂ would be removed. Right now that process is expensive and fraught with obstacles. But, if it can be proven, then the CO₂ would be more concentrated and therefore much easier to capture and store.

Four such coal-gasification plants are now operating: two in the United States and two in Europe. Currently, more than 30 projects are on the drawing board, although no one expects more than a handful to reach fruition. American Electric Power, Duke and Southern are among utilities pursuing the technology, all with huge coal fleets.

GETTING RESULTS

Xcel Energy has another project in mind. It wants to construct a coal-gasification plant with the ability to capture and store carbon, and to begin the process by 2010. It is conducting feasibility studies and acquiring partners for a 350-megawatt plant that would cost as much as \$1 billion. The company said it expects the coal-gasification elements to add 10 percent to 20 percent more to the typical price tag while the carbon-sequestration features would contribute another 35 percent to 45 percent.

Southern California Edison, meanwhile, is studying several clean-coal technologies with an eye toward making all the ideas commercial. Besides wanting to construct a plant that limits CO₂ emissions, it also seeks the ability to burn hydrogen in a highly efficient, combined-cycle generating system. It foresees using those technologies in a full-scale, 600-megawatt commercial generating facility.

The utility is asking regulators for permission to commit \$52 million of revenues it collects from customer rates during a two-year period to study this effort. If approved, this allocation would represent less than a quarter of one percent of current customer rates, the company said.

"Edison believes that if California and the nation are to significantly reduce greenhouse gas emissions and other pollutants while

increasing power supplies using domestic fuels, companies like ours must take the lead exploring the feasibility of these advanced technologies," said Edison International Chairman John Bryson, in a public statement.

While many in the environmental community champion technological progress that includes FutureGen and coal gasification, greenies are skeptical. Any progress would be mitigated, they say, if CO₂ capture were not included. And the ultimate answer is to increase the reliance on sustainable energy forms such as wind and solar while slowly withdrawing from the fossil-fuel addiction, they say.

The U.S. government is heavily involved in renewable projects. Even the fossil-fuel energy-research arm, NETL, has its tentacles in those enterprises. But the position of the Bush administration and many others is that coal will be used for the foreseeable future, and the goal is therefore to make it environmentally acceptable. Toward that end, most of the clean coal projects rely on government support to get off the ground.

As for FutureGen, it is on target to meet its 2012 operational time line. The FutureGen Alliance will make its final site selection this year, with four places located in Texas and Illinois in contention. Soon thereafter, it will make its technology choices. In addition to lending money and its scientific brainpower, NETL will also try to ensure the selection process is done fairly through a series of audits.

The research arm is quick to point out that with any breakthrough technology there will be a learning curve, noting that some of the ideas will work better than others. In the end, though, it said that industry would be poised to commercialize those products and services that are proven effective.

"The project and the time line are very realistic, but challenging," said Mike Mudd, chief executive of the FutureGen Alliance in Columbus. "It is critical we meet our deadlines. The alliance and the Energy Department must work together to ensure these dates are met. It would be very easy on the part of either party to not act quickly enough so as to cause delays. But, we always try to identify and resolve situations that might cause delays. If we can maintain that perspective, we will be on line in 2012."

The alliance and the technology lab are determined to make FutureGen a success. If the plan works as advertised, not only would it be the ultimate energy-driven public-private partnership, but it would also lead to the subsequent development of other ultra-clean coal projects. That's something the average guy can understand.