

N79-27615 ^{D18}

SYNTHETIC NATURAL GAS IN CALIFORNIA: WHEN AND WHY

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ABSTRACT

Western Gasification Company (WESCO) proposes to build and operate a coal gasification plant in northwestern New Mexico. The project would utilize coal to produce 257 MMCFD of pipeline quality gas (SNG) using the German Lurgi process. The SNG will be commingled with natural gas in existing pipelines for delivery to southern California and the Midwest. Cost of the plant is figured at more than \$1.4 billion in January 1978 dollars with a current inflation rate of \$255,000 for each day of delay. Plant start-up is now scheduled for 1984.

TEXT

Thank you for asking me to speak here today at this Department of Energy and California Energy Commission sponsored conference on coal use for California. The subject assigned me is "Synthetic Natural Gas in California: When and Why." Let me hasten to tell you that the "why" is an easier topic to deal with than the "when." The reason for the development of a synthetic fuel industry such as the proposed coal gasification plant in northwest New Mexico to supply synthetic gas (SNG) to southern California and the Midwest is threefold. Need. Technology is available. And economics.

As to need, I am quite sure everyone of you knows that there has been a decline since 1970 in the supplies of natural gas for southern California. Today we have about 75% of the gas supply that we had in 1970 for our 3.4 million customers in southern and central California. Yet we have a dependence on natural gas that is unmatched virtually anywhere else in the country. Nearly half of our non-transportation energy needs are met by natural gas, compared with only about a third for the rest of the country. Over 90% of our home heating and water heating is done with gas. And a full 40% of the commercial and industrial energy needs of California are met with gas.

The reasons for the decline in gas supply are falling production from California sources and declining mid-continent supplies with federal curtailments of the Gas Company's two major out-of-state sup-

pliers, El Paso Natural Gas Company and Transwestern Natural Gas Company.

Without additional primary supplies, curtailments could reach our Priority 1 customers who are homeowners and small businesses in 1984 in a cold year or 1986 in a year with average temperatures. Lowest priority customers who are the power plants and largest industrial users can expect little in the way of natural gas supply after this year lacking additional primary supplies. And between now and the mid-80s our remaining commercial and industrial customers who have standby fuel capability--usually oil--will experience increasing curtailments.

SNG from coal is one of the additional primary sources of supply we are now pursuing. Subsidiaries of Southern California Gas Company's parent company, Pacific Lighting Corporation, and Texas Eastern Corporation of Houston, Texas, have formed a joint venture, Western Gasification Company or WESCO, to build and operate a plant designed to chemically convert nearly ten million tons of coal per year into 250 million cubic feet per day of substitute natural gas, or SNG. The plant would be located in northwest New Mexico on the Navajo Reservation and would have cost more than 1.4 billion dollars, including financing costs, as of January 1, 1978.

The joint venturers have contracted with Utah International for the coal required for the first plant, with an option on coal for one additional plant. At the same time, Utah International will assign its existing water rights to WESCO for the water necessary to the gasification process.

The process to be used in the chemical conversion is one developed in Europe--the Lurgi process. The first section of the gasification process is the commercially proven Lurgi gas producer. The gas is produced by the reaction of coal and oxygen in the presence of excess steam at a pressure of 400 to 450 psig. The oxygen supplies the heat of reaction by combustion of the char which has not been gasified, while the steam is the essential source of hydrogen. The WESCO plant will have 24 gasifiers. The coal enters the gasifier through a coal

lock hopper in a batch sequence. A rotating grate distributes the fresh coal uniformly over the coal bed. As the coal moves down the reactor, it is successively preheated, dried, devolatilized, gasified and combusted. The resultant crude gas is then cooled and scrubbed to remove impurities.

At this point, the crude gas enters a shift conversion unit. In this step, carbon monoxide is catalytically converted to carbon dioxide and additional hydrogen is produced. The gas stream is now in the proper chemical balance for methanation.

Methanation is the step that catalytically converts the gas into essentially pure methane, or CH₄. Extensive laboratory and pilot plant testing of methanation has been completed by Lurgi and other companies including the joint venturers to WESCO. Although methanation has not been used in a commercial-size plant, it has been tested and proven in pilot plants. In fact, methanated gas produced in a demonstration plant in Westfield, Scotland, was introduced into the Scottish gas grid system for use in homes in and around the city of Fife. Lurgi and others are now ready to guarantee a commercial-size methanation unit.

After methanation, the gas undergoes dehydration and final CO₂ removal. The product SNG consists of 97% methane, with a heating value of 980 Btu's per standard cubic foot. The SNG is compressed to 1,000 psig and sent to market by existing pipeline systems. It is completely interchangeable and can be commingled with natural gas.

Other phases of the Lurgi process are designed to purify the SNG by removing by-products and to clean up plant emissions.

The chemical conversion of coal into synthetic gas offers several significant benefits. The gasification process provides a high efficiency of energy conversion. The thermal efficiency of the WESCO plant will be approximately 70%. The overall energy efficiency--from mine through ultimate residential user--is approximately 40% which by way of comparison is 1-1/4 times that of converting coal to electricity in a conventional power plant through the ultimate user. The SNG will move to market through existing pipelines, which provide one of the most efficient means of transporting energy now known. The recent decreases in the gas supply coming from traditional sources have resulted in existing pipeline systems not being utilized at maximum capacity. The WESCO plant output will augment such declining supplies and will flow through these under-utilized pipeline systems.

Reduced pollution is another advantage. In production of equivalent amounts of energy, pollutant emissions are significantly lower from the coal gasification process than from the combustion of coal. In the WESCO coal gasification plant about 15% of the coal will be burned to produce process steam, while the remaining 85% will be reacted chemically in closed pressurized vessels. In the generation of electricity, 100% of the coal is burned!

Finally, coal gasification offers a major new source of domestic energy, reducing reliance on foreign supplies, and causes no adverse impact on the U.S. balance of payments.

The second reason for the "why" of a synthetic fuel industry is, as I mentioned earlier, that commercial technology is available now. I am quite sure most of you are aware that there is considerable ongoing R and D for second generation coal gas technology. We, in fact, participate through the American Gas Association in that activity. The Lurgi process, however, is a commercially proven technology which has advanced through several stages of development since the early 1930s. Plants using Lurgi technology have been installed worldwide in Germany, England, South Africa, Korea, Pakistan and Australia. In fact, a new generation of gasifiers which are quite similar to those selected for the WESCO project are installed in the new Sasol II complex now under testing in South Africa. Although new technology promises greater cost benefits, possibly as much as 15% in another decade, from 15 to 17 years from now may be required to reach full commercialization and there is no way in view of today's inflationary and escalation rates that such plants can be cost competitive with a first generation plant which could be on line in 1984.

The third reason for the "why" that I mentioned is economics. Over the years, the natural gas consumer has had an economic advantage over consumers using other energy forms to meet heat energy needs. This advantage is expected to continue as synthetic gas from coal is introduced, particularly in those areas of the country where the only feasible alternative energy for residential, commercial, and small industrial customers is electricity. A coal-fired electric generating plant, together with necessary transmission and distribution facilities, requires from two to six times the capital investment required for a coal gasification plant delivering an equivalent energy output. The residential customer will have to pay at least twice as much for electrical energy produced by coal-fired steam electric generation as he would for gas energy produced by coal gasification. This cost differential is due to the

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lower thermal efficiency of electric generating plants, more expensive transmission and distribution facilities, and the high cost of meeting electric peak demands.

In California--and this is according to a published analysis made by the California Public Utilities Commission staff--the 1976 cost of energy delivered to the point of use from new nuclear or coal-fired electric generating facilities was over \$12 per million Btu's. By comparison, the cost of gas from the WESCO coal gasification project, using existing pipeline facilities for delivery to the point of use, was figured at about \$3 per million Btu's. That cost has escalated to \$4.16 in terms of January 1978 dollars. Costs related to coal-fired electric generation have experienced similar escalation. Even assuming the worst in terms of further delays and cost escalation, the cost of energy resulting from coal gasification should continue to have a substantial cost advantage, by comparison with the electric alternative, for the southern California gas consumers.

Please believe me it is not my intent here to promote coal gasification at the expense of coal-generated electricity. In fact, meeting our energy needs in southern California requires diligent development of all forms of energy plus, of course, conservation. Unfortunately, the complex benefits of new technologies such as coal gasification are difficult to grasp in the abstract, and comparisons are helpful.

You will recall I mentioned reduced pollution as one of the advantages of coal gasification. Comparisons are particularly striking when comparing the environmental impacts of two energy equivalent projects such as a coal gasification plant and a new power plant with scrubbers. The following data comes from a report prepared by the Radian Corporation for the Council on Environmental Quality and the Federal Energy Administration. In pounds per hour, particulates would be 180 from the coal gas plant and 1,070 from the power plant. SO₂ would be 450 compared to 4,300. NO_x, 1,780 compared to 20,830. CO, 90 compared to 1,200. Solid waste, 1,400 tons/day compared to 5,100. Finally, the water requirements would be 6,300 acre-feet/year compared to 54,300.

This brings me to the second part of my presentation--when can we expect a contribution by a synthetic fuel industry to our energy matrix. The proposed WESCO project is probably the front runner. Technically, it is essentially ready for construction. Major approvals have been received including a certification from the Federal Power Commission--now the Federal Energy Regulatory Commission--and the final environmental statement has been filed with the Council on Environmental

Quality. The State of New Mexico's Environmental Improvement Agency has issued permit authority to build the plant after being satisfied that the plant meets the State's very stringent regulations for emissions from a coal gas plant and that the plant would not exceed the Environmental Protection Agency's ambient air quality standards. Parenthetically, the only emission regulations existing for a coal gasification plant are New Mexico's. The EPA is currently working toward adoption of coal gas emission regulations. New Mexico's Surfacemining Commission has reviewed the mining operator's plan, Utah International, and issued a mining permit after being satisfied that the mining plan will return the mined area to at least equal to the existing grazing capacity as established for that area of the Navajo nation by the Bureau of Indian Affairs. Remaining hurdles to the WESCO project are development of a plan of financing and approval by the Navajo Tribal Council of a business site lease agreement.

The financing aspects of the project were considerably furthered when the President signed into law earlier this year the ERDA Authorization Bill for fiscal '78 which included language providing for a federal loan guarantee program for a coal gasification industry. The need for such a program results because of the large capital investment, coupled with the fact that there are no commercial-size high Btu coal gasification plants in operation. Potential lenders have concerns about a process that has not previously been used to produce the large volumes of SNG contemplated. But they are most concerned about government, regulatory or other force majeure actions which could delay construction, interrupt production or impair the flow of revenues required to pay interest and principal when due. Only the federal government can provide these assurances.

We believe lender protection can best take the form of a loan guarantee. Lacking loan guarantees, the net worth and income of Texas Eastern and ourselves, added together, simply does not provide sufficient credit base to convince lenders the loan would be paid off if we were unable to complete or operate the project.

Also, earlier this year, the Navajo Tribal Council voted down a proposed lease agreement. We are seeking, however, a reconsideration of the lease agreement by the Tribal Council, but that probably will not take place until after the Navajo nation elections which coincide with the federal elections in November.

The "when" then is more difficult to deal with because it remains somewhat nebulous, but the bottom line is that it will probably be 1984 at the earliest before a

coal gas plant is on line. At that time, three-fourths of the WESCO plant output of 250 million cubic feet per day of SNG would be delivered to the Southern California Gas Company and one-fourth to Cities Service Gas Company serving the Midwest. If the WESCO project should fall by the wayside, then one or more of others who follow not too far behind WESCO will likely be built, probably in the plains states of Montana, Wyoming, or the Dakotas.