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Missouri Coal in Perspective

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ABSTRACT

Missouri's coal resource base of 49 billion tons is part of the 132 billion ton coal resource base of the Western Interior Coal Region of Missouri, Iowa, Kansas, Arkansas and Oklahoma. The energy content of this coal resource base is 2,600 quadrillion Btu, more than the amount of energy contained in all the petroleum produced to date in the United States.

This large energy resource cannot remain ignored in a time of energy crisis such as the present. It is recommended that research efforts be stepped up that will permit recovery of energy from the thin, high sulfur seams of the Western Interior Region.

It is recommended that research focus on (1) developing desulfurization and coal conversion technology to allow the use of high sulfur coal in compliance with environmental standards (2) lowering production costs (3) developing technology which will allow the mining of thin seams and deep coal and (4) improving reclamation methods. Conversion of coal to low-Btu gas or solvent-refined coal and in-situ gasification of coal are considered to be especially important research areas.

Research facilities should be located in the Western Region to facilitate application of the results to mining conditions and coal characteristics prevailing in the region.

Missouri, with the greater share of the Region's coal, is a likely candidate for research facilities to be established in the region.

INTRODUCTION

The current energy crisis has brought into focus the potential importance of coal in providing needed energy to meet the nation's growing demands. For although oil and gas now supply 78 percent of the nation's energy requirements and coal only 17 percent, reserves of coal represent 80 percent of the nation's conventional energy reserve and 85 percent of the nation's fossil fuel reserve.

Despite energy conservation programs the demand for energy continues to increase. The demand for fossil fuels is expected to double by the year 2000 (only 26 years hence). Should nuclear power fail to materialize as expected the demand for fossil fuels will be even greater.

Domestic supplies of crude oil and natural gas cannot keep pace with future demand, and increasingly heavy reliance on foreign imports is unthinkable for obvious reasons. Only coal is available in large enough quantities with existing technology to meet the nation's energy needs in the next several decades.

Under the President's energy self-sufficiency program coal will be called upon not only to perform its present function as a fuel for electric power generation, but also to fill the energy gap being created by dwindling supplies of oil and gas. If coal is to fill this gap, great amounts of coal will be mined in the decades ahead and deposits now thought uneconomical to mine will become economical. Production will be needed from every known coal field.

The Western Interior Coal Region of Missouri, Iowa, Kansas, Arkansas and Oklahoma contains a coal resource base of 132 billion tons. The energy content of this coal resource base is 2,600 quadrillion Btu, more than the amount of energy contained in all the petroleum produced to date in the United States. This large energy resource cannot be ignored in a time of energy crisis such as the present. It is the purpose of this paper to recommend that research and development programs that will facilitate development of this significant energy resource be pursued.

Missouri's coal resource base is greater than that of any other state in the Western Interior Region. In fact, Missouri ranks 10th nationally among the 27 states containing reserves of bituminous coal. Over 6 billion tons of Missouri's 49 billion tons resource base is technically recoverable. This represents more than 132 quadrillion Btu of technically recoverable energy. Much of the remaining 43 billion tons which is now considered unrecoverable could be converted to a recoverable reserve by a combination of technological research and continued exploration.

Therefore, Missouri, with the greater share of the Region's coal, is a likely candidate for research facilities which should be established in the Western Interior Region to facilitate application of the results to mining conditions and physical and chemical characteristics of the Region's coal.

The coal beds of the Western Interior Region are beset by common problems. The two most serious problems are (1) a tendency of the beds to be thin and (2) high sulfur content. The thin nature of the beds makes underground mining difficult and costly and the high sulfur content precludes the use of these coals for direct combustion without costly (and thus far ineffective) desulfurization. The fact that much coal in the Western Interior Region is strippable has in the past allowed it to be mined competitively. Strip mining continues to be the primary mining method, and this creates environmental problems which require solution.

Future expansion of coal production in Missouri and other states of the Western Interior Region will be contingent upon several factors. Production costs must be kept at a minimum to allow economic competition with other coal producing regions. Economic methods of producing low-sulfur fuels from the Region's high-sulfur coals must be developed. Improved methods of mined land reclamation must be developed to allow strip mining with minimum environmental

damage and lower reclamation costs. Research must be oriented toward solution of these problems.

The states of the Western Region have not been neglectful of their coal resources. The Iowa Geological Survey is conducting a drilling program with the evaluation of reserve tonnage, coal quality and stratigraphic relationships as objectives. Iowa also is planning an experimental strip mine to study mining, coal beneficiation and reclamation methods. The Kansas Geological Survey is presently re-evaluating that state's reserves and evaluating alternate coal-mining methods for thin seam coal. The Kansas Survey has also been active in mined-land reclamation research.

In Oklahoma, a recent feasibility study has demonstrated that it is economically workable to construct a coal gasification plant in eastern Oklahoma. For the past several years the Missouri Geological Survey has been mapping and re-evaluating Missouri's coal resources. Core-drilling and coal sampling, with accompanying analysis, were conducted as part of this program. The Missouri Survey is currently developing plans for a study of the alternate roles that the future development of coal in Missouri might take. The Survey's objective will be to attempt the identification of the most probable modes of utilization of these coal resources, their short and long-term benefits with respect to the state's economy, as well as the costs that various modes of development might impose on our environment and upon our other natural resources.

Future research on Missouri coal should focus on four areas: (1) Developing methods which will allow the use of high sulfur coal in compliance with environmental standards (2) lowering production costs (3) developing technology which will allow the development of thin seams and deep coal and (4) improving reclamation methods.

For high sulfur coal to be made usable under prevailing emission standards, technology must be developed and refined to (1) desulfurize the coal during combustion or the stack gasses after combustion and (2) convert the coal to clean-burning gas or oil. Pilot or demonstration facilities should be erected to facilitate development of these processes.

Direct combustion of coal, without an intervening conversion phase, has the advantage of better energy efficiency. Conversion of a fuel from one form to another (coal to gas or oil) is always accompanied by an energy loss (usually 20 to 30 percent). Therefore, successful use of desulfurization methods would have the effect of conserving energy. In order to be effective in this way, however, the desulfurization process must not be a flagrant consumer of energy. For instance, the quarrying, grinding and transportation of limestone or dolomite for desulfurization consumes an amount of energy that must be taken into account. The development, then, of an energy efficient, economically feasible, effective method of desulfurization should be a primary research goal in regard to utilization of Missouri coal.

Conversion of coal to clean-burning fuels offers another solution to the sulfur problem inherent in Missouri coals. There are many conversion processes under development, but all of them may be grouped under the following categories: (1) gasification, (2) liquefaction, and (3) solvent refining. Missouri coals are high volatile bituminous in rank and most of them are of the caking variety. These factors must be taken into account when designing conversion processes for Missouri coal. Technically, Missouri coals can be converted to liquid, gaseous or sulfur-free solid fuels. Some of the more promising applications are discussed below.

Missouri coals can be converted to either high or low-Btu gas. The caking characteristic of Missouri coals make it necessary to pretreat them for some gasification processes. Production of low-Btu gas for industrial and utilities use may prove particularly applicable to Missouri. Low-Btu gas for industrial use is not a new idea. Early in the present century low-Btu (producer) gas was used for boiler heating, ore roasting and lime and cement manufacturing. Production of gas at large central mine-mouth plants with distribution through pipe systems was proposed. The availability of cheap natural gas soon aborted this concept, but now with natural gas in short supply perhaps the use of low-Btu gas will once again become widespread. Low-Btu gas might prove applicable to the state's industrial needs which are now largely dependent upon natural gas.

A very intriguing concept for the production of gas from Missouri coal is in-situ gasification. Its benefits are obvious. If it proves economically feasible, this method will allow production of a clean gas from coal by burning the coal underground and recovering the gas thus produced through gas wells, thus greatly reducing environmental degradation. In-situ gasification also offers the prospect of recovering coal from seams that are too thin or too deep to mine and therefore would have the effect of actually increasing the state's reserve of recoverable coal. The gas produced by the in-situ process could either be used at or near the production site as a low-Btu gas for electricity generation or for industrial process or it could be upgraded by methanation to a pipeline quality gas.

Missouri coal can be converted to synthetic petroleum by hydrogenation. It can also be converted to a clean-burning, low-sulfur solid fuel by solvent refining.

A critical factor relating to the development of a successful coal conversion industry in Missouri is the problem of acquiring blocks of coal which are large enough and which can be mined cheaply enough to meet the economic requirements of coal conversion. There will be strong competition, especially in the next decade from states possessing greater reserves of thicker and therefore more cheaply mined coal.

Offsetting this negative factor is the comination of adequate supplies of water in close proximity to adequate uncommitted reserves of coal. An abundant water supply is a critical factor in coal conversion, and several states with large reserves of thick coal are severely short on water. The geographic position of Missouri's coal reserves, near some of the nation's more important population and industrial growth centers should prove an important incentive for their development despite inherent technical problems.

There is no doubt that Missouri's coal resources will ultimately be utilized. There are steps that can be taken to hasten the advent of the coal conversion industry in the state. Arrangements should be made to test Missouri coal in pilot facilities where possible. Even more importantly, an effort should be made to erect pilot or demonstration plants in Missouri using Missouri coal. Field mapping and delineation of areas of thick coal or areas where multiple seam stripping is possible would help locate blocks of reserves large enough to feed conversion plants.

Although in comparison to coal beds in the Rocky Mountain states, Missouri coal beds are thin; they are not so thin as to discourage interest. At least two billion tons occur in beds 42 inches or more thick and at least four billion tons occur in beds 36 inches or more thick. It is possible to recover beds of such thickness by underground methods. In addition, areas exist in Missouri where rather large areas of strippable coal, some in miltiple beds, average at least 5 feet in thickness. Additional geologic field work, accompanied by drilling, would most certainly delineate large blocks of economically recoverable coal.

Feasibility studies, taking into account availability of coal and water resources, energy markets and needs, the availability of transportation facilities and economic and environmental factors, should proceed erection of demonstration plants. Detailed mapping and sampling of potential coal reserves should accompany the feasibility studies.

CONCLUSIONS

Coal from the Western Interior Coal Region can be a positive factor in enabling the United States to become energy self-sufficient. Missouri, with a coal resource base of 49 billion tons and a recoverable reserve of over 6 billion tons, is in a particularly good position to greatly expand its coal mining industry.

In order for Missouri coal to make a significant contribution in the near future, the following steps must be taken.

(1) Areas of economically recoverable coal must be delineated by field mapping and drilling.

(2) Research on mining plans that will allow economic recovery of thin seams while minimizing environmental degradation must be encouraged.

(3) Research on improving reclamation methods to lower costs while minimizing environmental degradation must be encouraged.

(4) Effective, economical desulfurization methods must be developed by pilot testing on existing or experimental facilities which use Missouri coal.

(5) Construction of coal conversion facilities in the state must be actively encouraged, beginning with pilot or demonstration facilities.

In addition to the above it is suggested that consideration be given to recovering deep coal by in-situ gasification.

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