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Petroleum Research Centers

In terms of resource potential for liquid fuels, the United States is extremely well endowed. It has huge reserves of coal that could be liquefied and vast deposits of oil shale. The estimated resource of petroleum is 625 billion barrels, which far exceeds the present reserves of Saudi Arabia. However, the tasks of converting U.S. resources into reserves involve large expenditures and long delays. In general, the costs far exceed the $18 per barrel price established by the Organization of Petroleum Exporting Countries. Because of this low price, the major oil companies have downgraded the coterminous 48 states as an area for exploration. Instead they are emphasizing offshore, frontier areas and foreign prospects.

There are good reasons to believe that targeted R&D could go far to reduce costs of converting an important fraction of the 625-billion-barrel resource to producible reserves. However, the small independent companies who will drill for and find most of the oil that is discovered do not have research competence. The major companies have dispersed much of their research staffs. The federal government retains the outdated policy that the majors will do what is needed. Consequently, only tiny federal support has been available for improving the efficiency of petroleum exploration and practically nothing for advancing the technology of obtaining synthetic fuels from coal or shale. This year $43 billion for imports; small change for liquid fuel research.

It has long been known that only about a third of the oil that has been discovered has been produced. During the period from 1979 to 1985, it became evident that a larger fraction could be extracted. Earlier, wells were spaced as much as a mile apart. It was assumed that reservoir strata were sufficiently porous and uniform that the mobile oil in place would flow to the wells either under existing pressure or as a result of a water drive. To take advantage of the high prices existing in the early 1980s additional so-called infill wells were drilled in existing fields. Many of these were good producers, thus showing that reservoir rocks are often heterogeneous and compartmentalized. On average, the successes were such that it was profitable to drill when oil was $30 per barrel, but not $18.

Improvements in the knowledge of what to expect in heterogeneous reservoirs could enhance the success rate for drilling and thus lower costs. It would also improve the effectiveness of technologies for enhanced oil recovery based on carbon dioxide or on detergents. If such an opportunity exists, why have the major companies not exploited it? The answer seems to be that the large companies have emphasized discovery and production from giant fields. Their R&D has been aimed chiefly at improved discovery of large deposits.

A recent report of the Energy Research Advisory Board (ERAB) urges studies that address the problems of reservoir heterogeneity.* It calls for enhanced integration of sedimentology, geophysics, geochemistry, hydrogeology, petroleum and chemical engineering, and geostatistics to define the origin and distribution of heterogeneities within petroleum reservoirs. The information available to address this problem includes drilling cores, logs, and seismic and engineering data. This would be supplemented by seismic tomography, three-dimensional reflection seismology, and measurements of variations in shear or *S* waves. This and other information would be incorporated in models relating geologic measurements to engineering factors. The objective would be to understand enough about heterogeneities to provide a scientific basis for predicting well spacing and enhanced oil recovery potential.

To implement such an effort the ERAB report recommends the creation of oil and gas research centers within each of the six major oil and gas provinces of the United States. These centers would conduct and coordinate the necessary interdisciplinary problem-oriented research. Some of the work would be conducted in university-based centers.

William Fisher of the University of Texas has stated that with greater efficiency of discovery of oil, as much as 80 billion barrels of oil could be produced for less than $25 per barrel. In view of the sums of money we will be spending on imports, the effort to attain greater efficiency should be supported.—PHILIP H. ABELSON

*Energy Research Advisory Board, *Geoscience Research for Energy Security* (U.S. Department of Energy, Washington, DC, February 1987).