OIL SHALE AND TRANSPORTATION

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It is certain that as we look at additional energy resources we can identify many new transportation problems. Your meeting is therefore timely and your initiative is to be commended.

Before we discuss transportation problems for oil shale, I want to justify that oil shale is the transportation alternative. The present energy shortage is in reality a shortage of cheap conventional forms of energy and in particular a shortage of liquid fuels for transportation. It is no accident that petroleum has become the mainstay fuel for transportation.

The liquids prepared from petroleum have that unique combination of energy per unit volume and energy per unit weight, combined with safe handling properties that have made them ideal for mobile equipment. Oil shale offers the cheapest large scale alternative to petroleum for the production of liquid fuels having these properties.

Without going into detailed discussion of cost estimates, let me just say that the subsidy we need now for oil shale is about five dollars a barrel. You can make your own comparison with the amount of subsidy being requested for the other alternatives for producing liquid fuels. In addition to the advantage of cost, oil shale offers some other important advantages as a transportation fuel. It has an improved yield of middle distillate fuels even over petroleum. We note a trend in studies toward increased use of diesel fuel. Oil shale has an advantage in safety in that it has low aromatic content providing a particularly high yield of kero base jet fuel. This makes it particularly attractive to the aviation industry. It may actually be possible that as we produce more and more shale oil, we will reduce the amount of aromatic material in commercial jet fuel and thereby increase the safety of aviation operations. Probably the most important advantage of oil shale is that it is compatible with the existing refinery and distribution system serving the transportation industry in this country. Even if we were to find a perfect alternative that was plentiful, if it could not use the existing distribution system, there would be many years of effort and enormous dollar expense associated with establishing a new fuel distribution system for the country.

Thus, oil shale may be viewed as a timely alternative even though we are faced with some enormous problems to bring production on stream at the rate the President would like.

With regard to timeliness, let us consider briefly just what is involved in commercializing a new natural resource such as oil shale. This is not to say that oil shale is new. The existence of the mass of oil shale deposits has been known since the pioneers first traveled in this area and made the first transportation use of oil shale making axle grease for their wagons. What is new is the national conviction that we must use it for an alternative to imported petroleum. In any case, in addressing the question of commercializing any natural resource, three basic elements are examined.

One, is there sufficient resource to justify a commercial operation?

Two, is there an economical extraction technology?

Three, is there a market for the product of the operation?

Regarding these three elements, the nation has two trillion barrels of shale oil in the rich deposit in the Green River Formation in the West and twenty-six trillion barrels in the leaner deposits throughout the Nation. This can meet our transportation needs for thousands of years.

Control of the resource by the private sector in the West has been a problem because eighty percent of the resource is on public lands.

This is an issue that is receiving careful attention as we plan for the growth in shale oil production to meet the President's goals. It may be that we will have to consider producing possibly somewhat more expensive shale oil from the Devonian deposits to meet the more ambitious national goals.

The socioeconomic impact and strain on the environment and water supplies in the West may be too great to manage if we try to produce all of the shale oil in that part of the country. In any case, there is in the twenty-eight trillion barrels of shale oil in the continental United States an adequate resource for thousands of commercial shale oil operations.

The extraction technology is somewhat uncertain because commercial operations in shale oil have never been carried out on the scale that must now occur in the United States. In general, we believe that surface technology is ready to scale up to commercial operations. More work is required to prove the reliability of the in situ technologies. The economics of these technologies is such that we have proposed a three dollar per barrel tax credit which will shelter between five and six dollars per barrel of income for a company producing shale oil.

The capital investment associated with this technology is enormous - on the order of a billion dollars per fifty thousand barrels per day plant.

We are, therefore, supporting legislation that would provide some protection from catastrophic loss in the event of an unforseen change in world oil price. Under these conditions, the market for shale oil will be barrel for barrel replacement of imported petroleum. The raw shale oil produced directly from the retort does have to be upgraded to be compatible with existing refineries. It is uncertain whether this upgrading will take place at the oil shale plant or at existing refineries. Regardless of where upgrading occurs, synthetic fuel prepared from shale oil will be a premium refinery feedstock, an excellent source of middle distillate fuel, and an excellent blend material to prepare broad range refinery feedstock from the heavy oils which are predominating new petroleum discoveries. Thus, oil shale meets the test of the basic three elements for commercializing a natural resource. For those of us who have worked in oil shale for a number of years, we note with promise that the President's energy plan now contains all the support necessary for such commercialization to occur.

Regarding the transportation of shale oil, it is our opinion that in the long run transportation questions will not pose a very serious threat to the development of a healthy and prosperous shale oil industry. The marketing research firm of Purvin and Gertz, in a recent transportation analysis performed under contract to Occidental Petroleum, has concluded that sufficient existing pipeline capacity (through the Amoco and Platte pipelines) should be available to move more than the projected two hundred thousand barrels per day from Occidental Colorado-based production to midwestern and north central states refineries by the early 1980's, when production is expected to reach that level. On the other hand, in the near term - over the next several years - important transportation problems must be overcome.

Highways: Almost all of the areas where oil shale will be mined and retorted are in remote areas of Colorado, Utah and Wyoming. Comprehensive transportation systems to support commercial-scale oil shale operations do not now exist there, and a battle is certain to be waged between pro and anti-development forces before such systems can be developed. Although major all weather highways exist in the general area now destined for oil shale development, the highway situation within immediate project areas is not always adequate. Dirt roads in and out of mining areas still are prevalent. A general upgrading is also required for major support roads linking mine and retorting facilities with major railway trunk lines, as well as for roads serving as conduits for shipment of supplies and large pieces of equipment from trunk lines to the mine and retorting areas. Finally, shale oil competes for many of the larger highway systems with coal and other mineral resources. Shale oil shipment will only thus add to the need for increased highway upgrading and highway maintenance of large intra- and interstate roads.

Railroads: Only two railway systems serve the general geographical area - to the South, the Denver and Rio Grande Western Railway; to the North, the Union Pacific. If agreements for laying additional rail spurs or other railway system support cannot be made with one of these two companies, a developer is simply out of luck. Also, Denver and Rio Grande Western and Union Pacific trunk lines do not directly intersect present and planned shale oil development projects. A one hundred mile rail spur to link up with the main Denver and Rio Grande Western trunk line in Colorado has been talked about by the railroad, but no specific action has yet been taken. Due to rugged, mountainous terrain and pristine environmental conditions, construction of a rail spur line might prove prohibitively costly.

Whether a commercial scale shale oil industry can ever be adequately supported by a transportation system of roads linked to major trunk lines is rather doubtful. The railroads certainly have the freight car capacity, especially with unit car systems. The problem is with the highway tanker truck link.

Pipelines: Pipeline systems from mine and retorting sites linking up with interstate pipeline systems and thence to major refineries offer the best, and probably the most economically feasible, means of transporting shale oil in the future. Purvin and Gertz, in their study for Occidental Petroleum, have determined that shale oil can be transported by pipeline to midwestern and north central refineries at a per barrel rate less than domestic crude oil from the north slope of Alaska, or imported oil from Indonesia or Saudi Arabia, and they feel fairly sure that capacity will remain available.

A feeder line would have to be built from northwestern Colorado to Casper, Wyoming, to feed the Amoco and Platte lines. The Northern Pipeline Company has shown interest in constructing such a line. There is presently some small spare capacity in the Amoco pipeline which now runs between Rangely, Colorado, and Wamsutter, Wyoming. Yet Amoco is not enthusiastic about using this spare capacity for shale oil. They feel that a new, more direct route between northwestern Colorado and Casper could be more economical in the long run.

Several other alternative routes for the transport by pipeline of shale oil out of the Rocky Mountain area have been discussed. One is to construct a pipeline between the Uinta Basin area of Utah and Casper. However, the decline in Wyoming crude production and skepticism regarding the prospects for appreciable new production in the area have temporarily put a halt to such an idea. Another proposal is to build a southern tie to the Pure Company pipeline at Lisbon, Utah (either from Utah or northwestern Colorado) or to the Four Corners area of Utah, Colorado, New Mexico, and Arizona to link up with the Texas-New Mexico pipeline and thence to Gulf Coast refineries. The problem with this idea is that the Texas-New Mexico pipeline is used primarily to hook up with the petrochemical refineries of the Gulf Coast. Also, the Texas-New Mexico pipeline is in very poor condition. Still another alternative is to reverse certain Wyoming pipelines to supply northern tier refineries with shale oil crude. This would have to assume that a northern tier pipeline linking Alaskan oil with the northern tier would not be constructed. Purvin and Gertz feel that even in the unlikely circumstances that some new source of crude is found to absorb the spare capacity of the Amoco and Platte lines, it may still be possible to move crude shale oil by these pipelines. They are common carrier pipelines and as such have limited rights to deny movement of crude through their systems.

Although in the long run it seems possible that pipeline systems will be the chief means by which shale oil will be transported from mine to refinery, in the short term there are some sticky pipeline problems which need to be resolved. For example, a large feeder pipeline from shale oil areas to interstate pipelines will involve enormous capital expenditures, and environmental and socio-

economic impacts of pipeline construction can be serious. Although it will be easier to construct a feeder pipeline than a railway spur in the rugged, mountainous oil shale areas, significant impacts and regulatory problems can be expected. In addition, the physical design of the pipeline itself may prove a problem. A large feeder pipeline will probably involve a joint venture by several companies - it would be environmentally unsound and economically wasteful to construct industrial pipelines for various company projects. Yet as of now no design work for a feeder pipeline has been completed. There will be a need for intra-industry negotiation on the exact design and the exact placement of such a feeder pipeline before such a project can get underway.

Finally, there may be special pipeline design problems because of the nature of shale oil and the particular climate of the area through which it will traverse - for example, it might be found that the pipeline will have to be heated or that because of its weight, numerous pumping stations will have to be built along the way, or that because of its nitrogen content, shale oil will have to be segregated on intrastate pipeline runs - all exacerbating the cost and environmental problems already mentioned.

In conclusion, I think it can be said that in shale oil we have a resource with great potential impact for alleviating some of this nation's burden regarding our lack of adequate domestic liquid fuel supplies. Not only is oil shale abundant, its products are particularly useful as a transportation fuel, having distillate yields which meet needed diesel and jet fuel requirements, as well as providing an excellent refinery feedstock for gasoline. Regarding transport of shale oil, in the near term a truck-rail transportation system will suffice to bring the initial production from mine area to refinery. However, once commercial levels of shale oil are produced - fifty thousand barrels of oil per day and more - the only economical and environmentally feasible means of transport will be by feeder pipeline system linking up with major interstate pipeline systems and thence to refineries for processing.