

mix, such as atomic energy and the projected automotive fuel cell. However, it is difficult to foresee how such diversions could take place soon enough to affect materially the seventeen million daily barrels of demand in 1980 or how they would be likely to reduce that demand thereafter. Finally, there is always the alternative of conservation of domestic reserves by attempts to rely increasingly on foreign sources of supply. Yet, the uncertainties of economic cost and even of availability which are unavoidably entailed in reliance upon non-domestic sources have recently been emphasized by the sad events in the Middle East. We are not today, and are not likely to become again, truly petroleum independent. For reasons of supply as well as of trade and other external policies, nondomestic production will continue to play a role in satisfying domestic demand. But, deliberate increases in such reliance must take into account the resulting unavoidable insecurity.

It was recently suggested that it is "possible that there will never be a need" for shale oil. Anything, of course, may be possible. But, it is difficult to believe that the petroleum policy of the United States will be planned on the basis of what is *possible* rather than what all of our germane experience shows to be *probable*.

The experience of recent years does not indicate that we will fail as a nation to meet our domestic petroleum needs. It indicates, instead, that our inventiveness and capital must, as they have often in the past in the cases of other needs, be devoted to rendering the unconventional useful.

MAXIMUM DAILY SHALE OIL PRODUCTION

However, it would be wrong to suggest that the oil that can and will be produced from the oil shale deposits of Western Colorado, Utah and Wyoming is likely to supply the whole answer to domestic needs. I would like to examine with you briefly what the contribution of shale oil to domestic production seems to us likely to be.

It has often been remarked that the tri-State oil shale deposits contain in the neighborhood of two trillion barrels of oil. While the statement is probably correct, it is, for planning purposes, unhappily irrelevant. The reserves of principal economic interest today lie mainly in Western Colorado. The Oil Shale Corporation has estimated that there are approximately four hundred and eighty billion barrels of oil in place of economically attractive grade in the Colorado reserves. However, even that number can be misleading if it is carelessly extrapolated into probable rates of production. Much of the oil in high grade ore is found as much as two thousand feet below the surface and in horizons in some areas of the Basin as thick as fourteen hundred feet. Such a distribution of reserves combined with the resulting limitations of access and the severe limitations of terrain make it most unlikely, in our view, that the Colorado reserves will yield at any time a daily production of more than 2.5 million barrels.

Nor is that production likely to arise swiftly. If the first 50,000 daily barrels of shale oil production comes onstream in 1970, and 100,000 daily barrels is added every year thereafter through 1980, shale oil will, in 1980, be supplying less than 6% of the conservatively estimated seventeen million daily barrels of 1980 demand, and only about 20% of the *increase* in demand which is expected to occur between now and 1980. Moreover as to the rate of build-up of production, it should be recognized that with present technology the development of one million daily barrels of production from high quality reserves requires an investment of approximately \$2 billion in production facilities alone, exclusive of pre-refining treatment of the oil.

These facts, we think, make it plain that two comments often voiced in recent months are without any substantial foundation. I refer to the expressions of concern that shale oil will inundate markets; and to the more sweeping suggestion that the value of the reserves could retire the national debt, and pay a substantial cash bonus to all of us who are citizens and would be delighted to receive it. Shale oil, even if production is rapidly developed, will supply at most a portion of the incremental future demand; and at any conceivable royalty rate for the reserves and any conceivable evaluation of the final crude oil product, the revenues from the full 2.5 million daily barrels of production would not suffice to pay even the interest on the national debt.

We began with the question whether the commencement of shale oil production is desirable. The answer is yes. Shale oil is needed and will be useful and significant supplement to waning domestic supplies. But, it is also apparent that from