

These costs are slightly above those originally projected, principally on account of increases in equipment and related costs since 1964. However, the increases are offset by increased capacity over that originally estimated, as well as by substantially increased product and by-product recoveries and values. In short, the criteria established for the project in 1963 have now been met.

TOSCO's program calls for the first 58,000 daily barrels of production to be onstream in 1970, and we believe that this objective is reasonable and attainable.

The funds already expended by TOSCO and its associates in furtherance of this commercial production venture are some indication of its magnitude. TOSCO has itself expended more than \$21.5 Million. In addition, approximately \$26 Million has been spent by its associates. Of the total approximately \$47.5 Million, approximately \$23.5 Million has been devoted to acquisition of reserves, principally to those susceptible of immediate commercial development and capable of producing more than 200,000 daily barrels for over twenty-five years. The remaining funds have been expended to carry the technology to its present state of readiness.

The mining, retorting and related technologies which have thus been proved and will be commercially applied are, by agreement, under the sole control of TOSCO as exclusive licensor. As licensor, TOSCO has embarked upon a free and open licensing policy under which it will make all or any part of the technology available to bona fide licensees under terms reasonable and customary in the trade. Such a free and open licensing policy is consistent with the widespread practice of the petroleum industry, a practice which experience has shown stimulates competition, production and revenues.

Nor is TOSCO alone in the field of technology. The Committee has had the benefit today of the views of the Union Oil Company of California and is surely aware of Union's sizeable contributions. In addition, there is the work, Bureau of Mines through its various research facilities, and, more recently, of the group of companies associated together under the management of Mobil Oil Company at the former Bureau of Mines facility at Anvil Points in Rifle, Colorado. Some, and perhaps all, of these efforts in above-ground processing technology will undoubtedly prove not only successful but sufficiently attractive to permit industrial application.

The development of technology for processing the material "in place" today, as I have mentioned, has become unclear because of reports of the presence of other minerals as well as because of formidable technical problems. However, as a nation, we have learned to expect that we will develop technology to meet our needs. Suitable methods for in situ processing in at least some of the deposits will likely ultimately be developed.

Status—Reserves

Because of their high quality, the most prominently discussed of the oil shale reserves are those found in Western Colorado. By high quality we mean reserves averaging, in a continuous horizon of at least 100 feet, 25 gallons or more per ton by the modified Fischer assay technique. I would like to concentrate my brief remarks on three aspects of these reserves: (1) their physical distribution in the deposit; (2) the question of ownership; and (3) the relationship between physical distribution of the reserves and the application of existing or future technology.

For purposes of illustration only, it can be said that the Colorado deposit, reportedly the result of deposition in an inland sea, is shaped like a man's inverted hat filled to the brim with oil bearing marlstone. In the brim of the hat, which is the rim of the deposit, the horizon of high quality reserves is relatively thin, and is overlain by a few hundred feet of additional material. But, as one proceeds across the brim of the hat towards its center, the high quality horizon thickens and deepens until near the center, as much as 1400 continuous feet of high quality material has been reported reaching to depths as far as 2200 feet below the irregular surface. By far the overwhelming percentage of the oil found in ore of high quality is found, therefore, towards the center of the hat and not at the brim. (Appendix C).

In general, private ownership of the reserves exists around the rim of the deposit, which was the area in which the oil bearing marlstone of high quality was most readily accessible to the locators who, before the advent of the Mineral Leasing Act in 1920, created under the Mining Laws private rights in the public domain. In general, the deep and far more extensive center of the basin remained in the public domain, with the important exception of homestead rights