

generators. One such plant at The Geysers in northern California is now producing over 56,000 kilowatts and the developers say that this site has a potential of producing over one million kilowatts.

The Geological Survey estimates that 5 to 10 percent of the world's geothermal energy resources are in the United States and that there is enough heat stored in rocks in the upper six miles of the crust beneath the U.S. to equal the heat content of 900 trillion tons of coal.

The Departmental program is aimed at providing the basic geologic, geophysical, and geochemical knowledge necessary for effective exploration and development of geothermal energy and at locating areas of potential geothermal energy. Information will be developed to provide the background knowledge necessary for the efficient administration of the geothermal resources on Federal lands.

The Department has also received a proposal to participate in the development of an electric power generating unit that utilizes ocean thermal gradients to drive a propane gas generator. Such a unit is known to be theoretically operable, but its need, practicality, and economic feasibility are unknown. The proposal has received mixed reactions by Departmental specialists.

OIL SHALE

Demand for liquid fuels in the U.S. for the period 1969 to 1980 is expected to be equal to the total consumption of these products since the discovery of oil in the U.S. Oil-shale deposits in the U.S. contain one of the largest potential sources of energy available from fossil fuels and will inevitably be a future source of hydrocarbons. Production of petroleum products from oil shale is approaching commercial feasibility. R and D on reduced mining costs, in situ combustion, improved methods of retorting, and processing of products could significantly advance the development of a full-scale industry. Although petroleum refining practices can be used to upgrade shale oil, lower cost methods to treat a high nitrogen content shale oil must be found.

The expected increase in crude oil reserves from now through 1980 will show a deficit of 6 billion barrels if the rate of adding reserves is not increased. One way to meet this need is to develop an economical capacity for shale oil production from the 50 billion barrels equivalent of known oil shale resources that are amenable to conventional methods of mining, retorting, and refining. The program includes research that could lower production costs and that could allow industry to develop a shale oil production capacity of 1 million barrels of shale oil per day by 1980.

A 10-year program has been proposed by the Department to perform both basic and applied engineering research on: (1) The physical and chemical properties of oil shale and kerogen (the solid organic material in oil shale from which shale oil is derived by heat treatment) as related to occurrence in the deposit and how the properties vary with geologic conditions; (2) composition of shale oil, shale-oil components, and shale-oil fractions with particular reference to heavy hydrocarbon fractions; (3) application of basic data on the properties of oil shale to improve processing methods; (4) fundamentals of catalytic, thermal, and chemical treatment of shale oil; (5) effects of retorting temperature variables; (6) effect of physical properties of oil shale on efficiency of crushing; (7) methods for retorting oil-shale fines; (8) techniques for utilizing spent (retorted) shale; and (9) spent-shale disposal problems.

MINERALS

HEAVY METALS

Situation and outlook

Gold and certain other heavy metals including silver, platinum metals, mercury, tin, antimony, bismuth, nickel, and tantalum are being consumed at a rate far exceeding domestic production. To satisfy our needs we are relying heavily on imports and, for gold and silver, on sales from Treasury stocks. The situation for gold is particularly critical because, in addition to the monetary demands for this metal, consumption by industry and the arts has risen markedly in the past few years while domestic production has remained relatively constant. As a result, we now use more than three times the volume of gold we obtain from domestic mines. Unless the net gold balance is altered favorably, Treasury stocks are expected to reach a critical point by 1977.