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EDITORIAL

Improved Fossil Energy Technology

New technologies are having significant effects on the exploration and discovery of crude oil and natural gas, as well as on the costs of their production. Geophysical and geochemical techniques are enhancing our knowledge about subsurface geology on land and undersea. The most important of these techniques is three-dimensional seismology (3D seismic). Its expanded use has greatly improved geological interpretations and has led to a much higher rate of successful wildcat drilling. In 3D seismic, a precisely located set of vibration-detecting geophones records the results of a series of experimental seismic disturbances. In one recent onshore survey involving 49 square kilometers, 725,000 geophone traces were recorded in connection with 1700 seismic disturbances. The tests were conducted and the data analyzed in 12 days. This exercise resulted in a substantial increase in estimated local reserves and led to greater production of oil and natural gas.

Exploration is also being facilitated by other seismological technologies. In cross-well seismic, a powerful source of wide-spectrum sound is activated at different levels in one well and vibrations are received in one or more other wells. The character of the sound received indicates much about the intervening terrain. Nuclear magnetic resonance is increasingly being used downhole in petroleum exploration and can differentiate between hydrogens bound to clay, hydrogens in water, and hydrogens in hydrocarbons.

Horizontal drilling has been used for about a decade. Before its advent, a well was usually drilled straight down and tapped a limited volume of hydrocarbons. A better approach has been to angle off the vertical and drill a path that follows the producing formation. So-called horizontal holes are now producing at rates three to five times those of vertical wells. In one instance, a well with an extended reach of more than 5 kilometers was successful in tapping the petroleum present along its length. In some instances, costs of production are being halved. Horizontal drilling and 3D seismic have been crucial to dramatic developments in fossil energy production in the region of the Gulf of Mexico adjacent to Louisiana and Texas. In that region, beneath waters 500 to 3000 meters deep, are world-class reserves of oil and natural gas that exceed those found at Prudhoe Bay, Alaska. New production technologies are facilitating the exploitation of these hydrocarbons. They include platforms with capabilities for drilling and completing wells and for subsequently producing and processing oil and gases. An underwater infrastructure of pipelines is being expanded to convey products to shore.

The contiguous 48 states were originally explored with what are now regarded as primitive methods. The spacing of wells was based on assumptions about the underlying geology that were often erroneous. The large reservoirs were discovered but production from them was incomplete, and smaller reservoirs often went undiscovered. Today's new exploration technologies are finding additional reserves, and a vast infrastructure of pipelines and processing plants is available to minimize the costs of the final products resulting from these discoveries.

Applied research sponsored in part by the Gas Research Institute has been effective in decreasing the costs and increasing the potential reserves of natural gas. One result has been a doubling of the estimate of ultimately recoverable quantities of natural gas in the United States. Prospects for the production of crude oil have also improved over those previously projected. The improved technologies are halting declines in the production of domestic oil and aiding in the discovery of additional reserves in other countries.

The positive news stemming from developments in petroleum technology should not cause us to forget some troubling realities. The United States will continue to import about half of its supplies of liquid hydrocarbons. The cost of this fuel will contribute to a huge trade deficit that has made the United States the world's largest international debtor. This reliance on imported fuel also makes the United States vulnerable to deleterious political developments in countries on which we depend for fossil energy production. Such developments can happen overnight, in contrast to the 10 or more years required to construct production facilities. The United States has the technological ability needed to foster conservation and to create cost-competitive sources of transportation fuels. Efforts have already led to substantial decreases in the costs of renewable energy sources, but additional innovative programs should be devised and implemented.

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