
USGS Circum-Arctic Resource Appraisal: Quantifying Undiscovered Oil and Gas North of the Arctic Circle

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ABSTRACT

Although several onshore areas of Arctic Canada, Russia, and Alaska have been successfully explored, most of the Arctic, especially offshore, is essentially untested. One third of the 21 million km² (8.1 million mi²) of the Arctic consists of continental shelves under less than 500 m (1640 ft) of water. These Arctic continental shelves may constitute the geographically largest prospective area for petroleum remaining on earth. In May 2008, the U.S. Geological Survey completed its petroleum assessment of all areas north of the Arctic Circle (66.56083° north latitude).

For the assessment, sedimentary rock volumes were mapped and geologic provinces were defined. Because of the sparse data in most of the Arctic, the usual techniques such as discovery process modeling, prospect delineation, and deposit simulation are not generally applicable. As a result, the Circum-Arctic Resource Appraisal used a probabilistic methodology that combined geological analysis and analog modeling.

Within each province, mappable volumes of rock with common traits (Assessment Units or "AUs") were identified. For each mapped AU, the marginal probability of significant oil or gas accumulations was evaluated based upon the elements of charge (including source rocks and thermal maturity), rocks (including reservoirs, traps, and seals), and timing (including the relative sequences of migration and trap formation, as well as preservation).

In addition to the marginal probability, the number of undiscovered accumulations, their size-frequency distribution, and the likelihood of oil versus gas was assessed for each AU and combined by means of a Monte Carlo simulation. Results of AU assessments were aggregated to province and Arctic-wide volumetric estimates of oil, gas, and natural gas liquids (NGL). The probabilistic results reflect the wide range of uncertainty inherent in frontier geological provinces such as those of the Arctic, but indicate the potential for additions to global reserves from the high northern latitudes.