

Petroleum Potential of the Arctic Offshore of Alaska

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Kirk W. Sherwood
*Minerals Management Service
Alaska OCS Region, Anchorage*

The Chukchi and Beaufort Sea Planning Areas are the offshore continental shelf extensions of the prolific (onshore) northern Alaska petroleum province, the latter with an approximate recoverable hydrocarbon endowment of 71.3 Bboe consisting of 42.5 Bboe (60%) risked mean undiscovered resources and 28.8 Bboe (40%) discovered EUR (Houseknecht, pers. comm., 2006 & State AK DOG, 2004). The offshore areas are only sparsely explored and have seen very little development, yet are forecast to offer an endowment of 45.7 Bboe consisting of 42.1 Bboe (92%) risked mean undiscovered resources and 3.6 Bboe (8%) discovered EUR. By this accounting, the offshore thus contains 39% of the total resources of the greater "Arctic Alaska" petroleum province (117 Bboe).

The principal driver for the perception of high potential in these offshore areas is the observation that they share many of the key geological elements that contributed to the creation of the large accumulations near Prudhoe Bay. Key source and reservoir formations extend directly offshore and are found in settings favorable for generating and capturing petroleum. MMS seismic mapping has identified many structural and stratigraphic-wedge prospects, of which a small fraction have closure areas that surpass the productive areas of the Prudhoe Bay (13,700 Mmbo) and Kuparuk (2,900 Mmbo) oil fields. Offshore exploration wells have discovered pooled petroleum at

Hammerhead, Kuvlum, Northstar, Liberty, Burger, Klondike, Popcorn, and (possibly) Crackerjack wells. Burger prospect in the Chukchi Sea has 190,000 acres within closure and discovered resources (median fill case) estimated at 14 Tcf gas and 724 Mmb condensate.

MMS resource assessments rely on an inventory of prospects that were mapped through the years using two-dimensional CDP seismic data gathered by industry since the mid-1970's. The MMS assessment method is essentially a summation of hypothetical petroleum pools which originate from this inventory of mapped prospects. However, the prospects are analyzed for resource volumes in groups rather than individually. The prospects are grouped into genetic families called "plays." For each play, probability distributions (used to reflect uncertainty) are developed for prospect area, fill fraction, pool area, pay thickness, and commodity yields (recoverable quantities per unit reservoir volume). The assessment computer model aggregates these probability distributions to create a lognormal probability distribution for pool size. Estimates for the numbers of pools in plays are developed by combining prospect count and risk models. Aggregations of these probability models for pool size range and pool count produce ranged estimates for pool sizes and play resources.

Economic assessments of plays test thousands of “model simulation” pools by constructing hypothetical development infrastructures (platforms, wells, pipelines, shipping tariffs, etc.) and then comparing the hypothetical production stream revenues to costs using a standard business model. Economic results are aggregated to play, basin, and higher levels.

Beaufort Sea oil and gas first become economic (average case) at \$22/bbl and \$3.33/Mcf at U.S. West Coast and U.S. Midwest markets, respectively. At \$46/bbl and \$6.96/Mcf, 4,120 Mmbo and 8.74 Tcfg (mean, risked) may be economically recoverable from the Beaufort Sea. Chukchi Sea oil and gas first become economic at the same markets at comparatively higher prices of \$30/bbl and \$4.54/Mcf. At \$46/bbl and

\$6.96/Mcf, 2,370 Mmbo and 7.91 Tcfg may be economically recoverable from the Chukchi Sea. At very high prices, the higher economic hurdles of the Chukchi Sea become less important, and at \$80/bbl, the economic potential of the Chukchi Sea (21.7 Bboe) is twice that of the Beaufort Sea (10.5 Bboe).

[The Power Point presentation \(21,135 kb\) of this talk is available on the MMS web.](#)

For more information about the assessment of the Alaska offshore, see the MMS web site posting of “2006 Assessment, Undiscovered Resources, Alaska Federal Offshore” at <http://www.mms.gov/alaska/re/reports/rereport.htm>.