Petroleum Exploration in the Southern Barents Sea, Norway's Present Arctic Frontier

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Abstract

Norway's oil production peaked in 2001 and is forecast to decrease significantly over the next decade. Although oil exploration success rates remain high in the mature oil provinces of southern Norway, discoveries are small, and forecast production from these pools cannot offset the decline in production from Norway's giant fields. Thus there is significant industrial and political pressure building for the state to open up previously restricted exploration areas in the north.

The resource rich northern frontiers are at the centre of current political and social debates in Norway across a range of issues: fishing versus petroleum exploitation, seismic impact on fishing, sovereignty of disputed areas, and conservation versus industrial development; these issues are familiar to operators active in or considering Canada's northern frontiers. The economics of northern ventures in Norway, however, make them substantially more viable than in Canada, benefitting from strong European commodity prices, competitive allowances for development cost recovery, and the state paying for roughly 78% of the exploration spending which strongly limits capital risk exposure. The viability of Arctic exploration in Norway is in no small part the result of a proactive Norwegian government building a strong partnership with industry to tackle the myriad northern issues.

One such exploration frontier is the Barents Sea which in the main encompasses a broad continental shelf region extending north of Norway and Russia to Svalbard and Franz Josef Land archipelagos in the north, and between the North Atlantic in the west to the Novaya Zemlya in the east. In the Norwegian sector, the southern Barents Sea overlies several promising sedimentary basins, including elongate graben such as the Nordkapp and Hammerfest basins, subbasins arrayed along the western Atlantic margin, and extensive structured platform areas. The operating environment, geological setting, petroleum discoveries and potential of these basins are described and current exploration programs in these basins are highlighted.

Exploration drilling since the 1980's has proven that petroleum is present in several plays beneath the Barents Sea shelf. Large gas resources discovered in Jurassic sandstones in tilted fault block traps in the Hammerfest Basin are being commercialized through the Snøhvhit LNG project. Although these traps are predominantly gas bearing today, early liquids endowment is evident from residual oil saturation and thin oil rims. Significant volumes of oil are hypothesized to have remigrated during Cenozoic

structural inversion, which led to breaching of fault seals, tilting of traps, and reduction of liquid fill through gas expansion. Material oil resources found on the southeast margin of the basin are attributed in part to remigration from the basin centre; industry is actively chasing prospective traps on the other margins. An emerging play for Cretaceous clastic reservoirs shed from local basin highs is also recognized.

Within the Triassic succession, large gas resources have been identified in non-marine clastic reservoirs in structural and combined structural-stratigraphic traps in the platforms, although reservoir quality remains a concern. Oil has recently been found within these older units on the graben margins, which has upgraded the prospects for more oil to be found in the untested parts of the Barents Sea shelf region, especially where the Jurassic source rocks are immature. The thick Triassic shales which have sourced the massive gas resources in the Russian sector of the Barents certainly extend westwards into the Norwegian sector, but drilling in this region will be delayed until territorial disputes are resolved.

The petroleum endowment of the western margin of the Barents Sea remains uncertain as it is largely undrilled. Unknowns include source rock presence and distribution, reservoir rock quality and distribution, charge timing, petroleum phase prediction. Trap definition is poor as it is based largely on sparse 2D seismic grids. Deepwater sandstones within the expanded Cretaceous and Tertiary deposits are primary targets, guided by proven plays along the Norwegian Sea margin. The primary Jurassic and Triassic plays are generally too deep to be played, at least in the southern sector of the margin. Using leading edge exploration techniques, and supportive government policies, industry may yet succeed in proving up hydrocarbon resources along this untested margin in the coming decades. Release of acreage here is anticipated in the coming bid rounds.