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Decision on oil and gas exploration in an Arctic area: Case study from the Norwegian Barents Sea

Jon Rytter Hasle [a,*], Urban Kjellén [b], Ole Haugerud [a]

[a] StatoilHydro, N-0246 Oslo, Norway
[b] Norwegian University of Science and Technology (NTNU), N-7491 Trondheim, Norway

A B S T R A C T

This paper addresses how risks to the environment in the Arctic are handled in decisions regarding the exploration for petroleum resources. An exploration well in the Norwegian Barents Sea is used as a case to demonstrate how environmental risks are assessed together with technical and economic considerations in the Oil Company's decisions to enter into a new area and drill a well. The paper outlines environmental challenges in petroleum activities in the Arctic, the different roles of the Authorities and Oil Companies in decisions about petroleum activities, and the Oil Company's tools and decision criteria used in addressing risks in the decision making.

It is concluded that environmental and associated reputation risks are not a major issue at the strategic level in the Oil Company, since the most controversial areas in the Norwegian Arctic offshore have already been kept out of the exploration acreage by the authorities. Risks and uncertainties penetrate every aspect of the exploration of petroleum resources, and environmental risks are not unique in this sense. The Oil Company has established technical and economic tools and decision criteria to address them, and the mitigation of environmental risks becomes an element in the technical and economic analyses that affect detailed design and operational procedures. Mitigation measures such as the minimization of discharges to the sea (the so-called "zero-discharge" policy) and oil spill contingency planning are dimensioned to meet authority requirements and expectations rather than on strict risk acceptance considerations. A significant concern is to avoid delays in the permit granting process.

1. Introduction

1.1. Exploring new frontiers in the search for oil and gas resources

Since the start of the petroleum activities in Norway at the end of the 1960s, Norwegian industry has developed considerable resources and competence to explore, develop and produce oil and gas fields. Today, the Norwegian Continental Shelf is by and large a mature petroleum area. In 2006, only about 12% of the produced petroleum reserves were replaced by new findings (Norwegian Petroleum Directorate, 2007). The oil production peaked in year 2000 and has declined by 25% between 2000 and 2006. The gas production continues to increase.

This development will in the future have large impact on employment and value creation in the Norwegian oil industry. Both the Norwegian oil companies and the supplier industry have at an early stage identified this trend and are seeking business opportunities in new areas. Internationally, the Norwegian oil industry is facing significant challenges. World wide, the finding of new petroleum reserves does not match the increasing demand, not the least from developing nations such as China and India. The Independent Oil Companies (IOCs) are seriously limited in their possibilities to operate in many countries due to privileged National Oil Companies (NOCs) or political insecurity. There is an ever-increasing competition for the limited new petroleum resources that in practice are available to the IOCs.

The US Geological Survey (USGS) expects 24% of the World's remaining undiscovered petroleum resources to be located in the Arctic (USGS, 2000). Petroleum activities in this area have, however, for decades been hampered by a high cost level and significant public resistance (USGS, 2000). This situation is about to change. The high oil prices during the last years and the increasing competition for new petroleum resources have evoked the IOCs' interest for especially the Arctic offshore. It has been a natural step for the Norwegian oil industry to expand into the Arctic offshore, as 30% of the undiscovered Norwegian petroleum resources are expected to be in the Barents Sea. The country's advanced offshore oil industry and location in the "High North" are also expected to be competition advantages internationally.

* Corresponding author.
E-mail addresses: JRHAS@statoilhydro.com (J.R. Hasle), urban.kjellen@iot.ntnu.no (U. Kjellén), OLHAUGE@statoilhydro.com (O. Haugerud).

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1.2. Environmental and safety challenges

Oil and gas development in the offshore Arctic is controversial. The area is in the public perception an icon for clean and undisturbed nature, and the "last wilderness". Fisheries and hunting of marine mammals are of great economic importance for the Arctic population, which includes indigenous people such as the Nenets in the Kara Sea and the Eskimos in Chukchi and Beaufort Seas. Environmental non-governmental organisations (NGO) challenge oil and gas development in the offshore Arctic, based on a claim that the Arctic is so valuable and vulnerable that it should not be put at risk.

In Norway, as for example in Alaska, one of the major controversies has been the risk of large oil spills from blow outs. The Exxon Valdez tanker wrecking in Alaska in 1988 plays a significant role in the public mind as a reminder of the vulnerability of the Arctic environment to petroleum activities. Extreme environmental conditions such as low temperatures, icing and sea ice, and long periods of darkness, as well as insufficient oil spill preparedness resources and long distances to infrastructure, represent operational challenges. Unless compensated for, these are likely to increase the frequency of accidents and their environmental consequences. It is feared that consequences to the environment and subsistence economy activities may be irreversible. It is also claimed that regular discharges from oil installations of produced water and drill cuttings will threaten food chains in the Arctic seas, which are often perceived as more sensitive than those in more temperate areas. Finally, emissions of climate gases from the consumption of extracted oil and gas will contribute to increased global warming and to climate change that is most visible in the Arctic. The NGOs also point to a general lack of knowledge about the ecosystems in the Arctic and their vulnerability to petroleum activities.

The Norwegian oil industry recognises the significance of the issues brought up by the environmental NGOs, but regards them in general as manageable. These issues do, however, represent economic and reputation risks, due to prolonged authority handling, the possibility of a moratorium on petroleum activities in specific areas, increased costs of remedial action, and large reputation impact also of minor incidents. Risk of litigation has so far not been an issue in Norway, but is highly relevant in the US.

Arctic environmental conditions such as sea ice and ice bergs and extreme combinations of low air temperatures and high wind speed (high wind chill effect on the human body) also represent considerable safety, health and emergency preparedness challenges. At present, proven technical solutions do not exist for exploration and production of petroleum resources in the most extreme conditions.

1.3. This paper

This paper is based on the authors' experience through participation in petroleum activities in the Arctic offshore. The decision by a Norwegian Oil Company to apply for permission for exploration and production (production licence) in the Norwegian part of the Barents Sea, with a committed exploration well, and the later preparations for the drilling program, is used as case. It addresses how decisions are made by the Oil Company involving economics and the assessment and handling of risks. The focus is on the environmental risks, since these have been determining for the feasibility of the project and are unique for the geographical area. In particular, the paper addresses the following questions:

1. How have risks and uncertainties in assessments of petroleum reserves, exploration and development costs, environmental and reputation risks, and possibilities and costs of mitigation been made explicit and balanced in the initial decision to enter into the license?
2. How have corresponding risks and uncertainties been handled in decisions on well concept, mitigation measures and costs?
3. To what extent has the decision making been structured in accordance with a pre-defined plan? To what extent have explicit economic and risk acceptance criteria been employed and how have they been balanced?
4. To what extent has the decision making process interacted with a stakeholder dialogue to ensure acceptance among the general public, authorities, politicians and NGOs that the oil and gas industry can operate safely in perceived environmentally sensitive areas?
5. What role have the license partners played in the acceptance of the Operator's decision proposals?
6. What role have the authorities played in the decision to explore and drill, through the public hearing and permission process?

Health and safety risks are not seen as especially challenging in this area, and are managed through recognised technical and organisational measures.

2. Principles for decision making about entering into new areas and drilling exploration wells

2.1. Licensing round application and award

The Norwegian Government regularly invites oil companies to participate in applications for production licenses within a particular geographical area of the Norwegian Continental Shelf. The area in question must have been opened up for petroleum activity by the Norwegian Parliament, which requires an impact assessment of environmental, economic and social effects of such activities, carried out on behalf of the Government. Each company may within a deadline nominate blocks they want included in the licensing round, but the decision on which blocks to include in the licensing round is made by the Ministry of Petroleum and Energy (MPE), after consultation with the Ministries of Environment and Fisheries. The oil companies' nominations are confidential, but there are several known cases where nominated blocks have been initially approved by MPE and then excluded from the licensing round because of potential for conflict with fisheries or being too close to an environmentally vulnerable coastline.

The next step is that the MPE invites oil companies to apply for production licences for specified blocks. The announcement includes conditions related to environmental concerns and fishery interest, some of which are general for all blocks in the licensing round and some block specific. Examples are requirements to map coral reefs within the blocks. "Zero-discharge" to sea requirements have been conditions in the last licensing rounds, see further below.

Oil companies may apply individually or in groups. Applications will include a proposed work obligation, such as seismic surveys covering a specified number of km^2 or a specified number of exploration wells to explore the petroleum potential in the blocks. Based on the applications, the MPE puts together a group of companies for each licence, and appoints an Operator for the partnership who is responsible for the activities under the terms of the licence.

The licence is awarded for a limited period, up to 10 years. It includes the specified work obligations to be carried out during this period (e.g. one exploration well to be drilled into a particular geological formation or to a total depth of 1500 m, or collection and processing of 500 km^2 of 3D seismic). The licence award confirms the conditions relative to environment and fisheries interests that were given already in the announcement of the licensing round.