Oil and Gas: Exploration and Risk

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Introduction

Risk analyses entail a multi-dimensional matrix that considers scalable political, economic, social, technical, environmental, and safety factors. Risk is the probability of an event occurring multiplied by the magnitude of its adverse consequences. The risk of offshore exploration is addressed through development and implementation of mandatory safety management systems (sms) vetted by regulatory bodies and third-party certifying agencies. Risk management processes within the sms are employed throughout all stages in exploration projects, from the conceptual planning stage down to each work shift on deck. This essay considers risks to frontier and offshore oil and gas exploration, as opposed to the risks of oil and gas exploration. The issue is considered in a Canadian context.

Meaningful commentary on exploration risk requires an outlook on global energy demand and socio-economic trends. Today, there is uncertainty as most major energy players are looking inward, re-assessing and adjusting their business models and re-baselining their market projections in response to the steep market downturn. The risks to conducting oil and gas exploration programs are always dynamic, but particularly complex under depressed market conditions.

Global Energy Outlook

According to a United Nations report, the current world population of 7.3 billion is expected to reach 9.7 billion in 2050. Projected gains in global

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1 United Nations, Department of Economic and Social Affairs, Population Division, World Population Prospects: The 2015 Revision, Key Findings and Advance Tables, Working Paper No. ESA/P/WP.241 (New York: United Nations, 29 July 2015), http://www.un.org/en/development/desa/news/population/2015-report.html.
productivity will lead to increasing prosperity and rising standards of living, with more than two billion people lifted from low incomes.\(^2\) Nearly two-thirds of the increase in global energy consumption will be for power generation.\(^3\) Although there is an ongoing, gradual, and steady transition from combustible fuels to ‘clean’ energy sources, fossil fuels account for over 75 percent of present energy demand. The fuel mix transition will continue with growth in renewables, nuclear, and hydroelectric power, together accounting for half the growth in energy supply over the forecast; however, oil, gas and coal will remain the dominant sources of energy, especially in developing nations where fossil fuels are more affordable than renewables. According to Enerdata, virtually all growth in world energy demand will come from emerging economies, with China and India accounting for over half the increase.\(^4\)

Under this demand forecast, one would expect businesses involved in exploring for hydrocarbons and exporting them to developing economy states to do well. Conservative estimates of global ‘proved’ oil reserves have more than doubled over the past thirty-five years. Thus, for every barrel of oil consumed, more than two new barrels have been discovered. The abundance of known oil resources today dwarves the world’s likely consumption of oil out to 2050 and beyond.\(^5\) Cumulative global oil demand amounts to less than half of today’s technically recoverable oil resources.\(^6\)

This abundance of hydrocarbon reserves, combined with the prospect of slowing oil demand, has prompted competitive change in global oil supply. Low-cost producers are leveraging their competitive advantage to increase market share. Although costs vary significantly within resource categories (i.e., coal, oil, and gas), the majority of low extraction-cost reserves are located in large, conventional onshore oilfields, particularly in the Middle East and Russia, followed by tight oil prospects in the United States. The extent to which supplier behavior changes is a key source of uncertainty.\(^7\) Behavioral change

\(^2\) Id.
\(^3\) “World Energy Outlook 2017,” International Energy Agency (IEA), 14 November 2017, http://www.iea.org/weo2017.
\(^4\) “2020 Global Energy Forecasts,” Enerdata, 1 April 2007, https://www.enerdata.net/publications/reports-presentations/2020-global-energy-forecasts.html.
\(^5\) “BP Energy Outlook 2035: Focus on North America,” BP plc, March 2015, https://www.bp.com/content/dam/bp/pdf/energy-economics/energy-outlook-2016/energy-outlook-2015-focus-on-north-america.pdf.
\(^6\) “BP Energy Outlook: 2017 Edition,” BP plc, 2017, https://www.bp.com/content/dam/bp/pdf/energy-economics/energy-outlook-2017/bp-energy-outlook-2017.pdf.
\(^7\) Statoil, Energy Perspectives 2017: Long-term Macro and Market Outlook (Stavanger: Statoil ASA, 31 May 2017), https://www.statoil.com/content/dam/statoil/documents/energy-perspectives/energy-perspectives-2017-v2.pdf.
will depend on (1) the ability of low-cost producers to increase their supply, (2) the extent to which prices respond to increased supply, and (3) the ability of higher-cost producers (e.g., oil sands and offshore production) to compete by varying their tax and royalty regimes.\(^8\)

What does this mean for oil and gas exploration in Canada? Market adjustments and environmental concerns have already led to short-term postponement or outright cancellation of infrastructure, exploration, and low-efficiency production projects. An estimated 185,000 direct and indirect jobs were lost in Canadian oil sands production over the past few years.\(^9\)

**Policy and Social License**

Before hydrocarbon exploration can begin, the proponent must obtain social license to conduct offshore activities. Getting and sustaining social acceptability is fundamental to a project’s approval process. The loss of social license or community trust by one offshore operator typically has ramifications for other exploration firms, even for other ocean sector users. The rise in public consciousness to the socio-economic and environmental implications of exploration projects, Indigenous rights to lands and resources and the global social justice movement are factors impacting the approval of exploration permits. This is exemplified by the recent cancellation of the Canadian Energy East pipeline project. There are moratoria against hydrocarbon exploration on Canada’s Georges Bank and the Beaufort Sea, and against hydraulic fracturing in New Brunswick and Nova Scotia.

Part of the challenge to proponents is the evolving policy framework, including international, federal, provincial, and territorial jurisdictions. The Canadian federal government recognized that to achieve high standards for risk and safety management, effective environmental protection, industry investment, and economic development, a more efficient regulatory regime would have to be developed and aligned with existing international standards, such as in Norway.\(^{10}\) However, the Frontier and Offshore Regulatory Review

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8. IEA, *supra* note 3.
9. T. McMillan, “McMillan: Grow the energy industry, don’t just tax it,” Commentary to *Calgary Herald*, Canadian Association of Petroleum Producers, 10 July 2015, http://www.capp.ca/media/commentary/grow-the-energy-industry-do-not-just-tax-it.
10. Canada Senate, Standing Committee on Energy, the Environment and Natural Resources, *Facts Do Not Justify Banning Canada’s Current Offshore Drilling Operations: A Senate Review in the Wake of BP’s Deepwater Horizon Incident*, August 2010, https://sencanada.ca/content/sen/Committee/403/enrg/rep/rep08aug10-e.pdf.
Initiative has stalled, with little meaningful progress since the Canada Oil and Gas Drilling and Production Regulations were completed in 2009.\(^\text{11}\) Issues include the following: regulatory boards have yet to resolve gaps in areas of environmental risk, mitigation and response; coordination between federal, provincial, and territorial agencies has been ineffective; transition from prescriptive to performance-based regulation is incomplete; and the unsatisfactory use of strategic environmental assessments to identify concerns.\(^\text{12}\) As a result, social pressure has deterred resource development prospects in British Columbia, Quebec, Nova Scotia, Newfoundland and Labrador, and Nunavut.

**Seismic: Not a Four-Letter Word**

Seismic exploration is the first phase in the search for oil and gas reservoirs. A total of 401,651 km of two-dimensional seismic data and 48,864 km\(^2\) of three-dimensional seismic data has been acquired offshore Nova Scotia.\(^\text{13}\) To date, environmental monitoring programs conducted on seismic sound effects have not found dead cetaceans, sea turtles, or fish as a direct result of seismic exploration. Nonetheless, due to knowledge gaps and variability in research findings, speculation remains, and risk perception is heightened. Suspicion and mistrust sustain the impression that geophysical operations pose a high risk to marine mammals, crustaceans, sea turtles, and fisheries. Meanwhile, over the last four years on the Canadian east coast, there has been considerable scientific and public concern and media coverage attributing deaths of numerous large cetaceans to dense sea ice, entanglement with fishing gear, and alleged ship collisions. A New England Aquarium study by Kraus et al. in the Bay of Fundy found that between 2010 and 2015, 85 percent of North Atlantic right whale deaths were due to fishing gear entanglement.\(^\text{14}\) Ship strikes have decreased with mitigation measures to relocate shipping lanes and reduce

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\(^{11}\) A.L. Hanson, “Offshore Drilling in the United States and Norway: A Comparison of Prescriptive and Performance Approaches to Safety and Environmental Regulation,” *Georgetown International Law Review* 23, no. 4 (2011): 555–576.

\(^{12}\) G. Caron, “National Energy Board on the Latest Developments in Northern Oil and Gas Regulation,” Speech to the 14th Annual Arctic Oil and Gas Symposium, 11 March 2014, https://www.neb-one.gc.ca/bts/nws/spch/2014/nrthnlgsrgltn/index-eng.html.

\(^{13}\) “Geoscience Overview, Data Compilations, Seismic Offshore NS,” Canada-Nova Scotia Offshore Petroleum Board, last updated 2004, https://www.cnsohp.ns.ca/sites/default/files/pdfs/seismic_offshore_ns.pdf, pers. comm., updated to 2017.

\(^{14}\) S.D. Kraus, et al., “Recent scientific publications cast doubt on North Atlantic right whale future,” *Frontiers in Marine Science* 3, no. 137 (17 August 2016), doi.org/10.3389/fmars.2016.00137.
speed. This study concluded that efforts to reduce cetacean and sea turtle deaths from fishing gear entanglement are largely unsuccessful. Approximately 40 percent of all animals caught in fisheries are discarded as trash.\textsuperscript{15} The risk to cetaceans from harvest fishery practices has not been formally assessed by any government, or debated in the public arena. One may ask why equivalent mitigation and monitoring programs are not consistently applied across all ocean resource industries.

In many countries, including Canada, commercial fisheries practice mass removal of fish to the brink of population decimation. There seems little public opposition to harvest fishing practices, at least to the degree seen against seismic exploration. Fishing communities protest exploration primarily over concern for reduced catches, though there is no evidence that modern seismic methods cause mass death of fish. This year, the Supreme Court of Canada denied seismic exploration in the seas around Baffin Island. Meanwhile, new harvest fishery ventures (e.g., surf clams) face little risk of cancellation, regardless of how disruptive the seabed extraction method may be to the environment.

**Spills, Media, and Fear**

We usually think about accidental oil spills arising from well blowouts, pipeline breaks, derailments, and tanker collisions. With respect to exploration drilling, the direst consequences envisioned are from a blowout and the resultant impact of released hydrocarbons. SINTEF’s offshore blowout database, current to 2014, indicates the risk of blowouts to be very low relative to tens of thousands of wells drilled. Then, only a fraction of blowouts last long enough to cause a significant spill. Canada’s offshore exploration is nascent, with few exploration wells compared to the Gulf of Mexico, North Sea, and other mature jurisdictions. To date, 352 wells have been drilled in offshore Atlantic Canada, so it is necessary to look beyond our borders for a robust assessment of the likelihood of a blowout. ACONA predicted the overall probability for an exploratory well blowout in 1,000 meters of water to be once in every 8,488 wells drilled.\textsuperscript{16} Statistics clearly indicate the risk to be very low.

\textsuperscript{15} “Turtle Threats: Fisheries Bycatch,” see Turtles, last accessed 23 January 2018, http://www.seeturtles.org/fisheries-bycatch.

\textsuperscript{16} ACONA Flow Technology AS, “Technical Report: Blowout Risk Evaluation in the Labrador Sea South-West of Greenland,” last revised 23 March 2012, http://dce.au.dk/fileadmin/dce.au.dk/Udgivelser/Appendix_2_Blowout_risk_in_the_Labrador_Sea.pdf.
The US National Research Council estimated nearly 48 percent of oil entering the oceans is from spills and illegal discharges from ships. Another 21 percent is carried by runoff from urban centers. In all, 18 percent of petroleum products entering the oceans originate from industrial accidents. Of this, hydrocarbon extraction accounted for six percent. So why the disproportionate scrutiny of oil and gas exploration?

We become captivated when a large spill or blowout occurs, partly because they are such rare events. Large oil spills like the *Exxon Valdez* in Alaska and the Macondo blowout in the Gulf of Mexico are considered catastrophes because they fulfill three criteria: a catastrophe must be big; it has to happen all at once; and something about it has to be calamitous, disastrous, and really bad. There is a place in our psyche for fear of big, unlikely catastrophes. Media coverage is undeniably excessive. Major news networks report tragedies because they know the public will pay attention, and that means increased viewership and revenue. It is the unforeseen events close to home, brought daily into our living rooms, as was the Deepwater Horizon incident, that sensitize and make us fearful. Was the ‘No Rigs’ movement born of such fears?

**A Canadian Perspective**

According to the Canadian Association of Petroleum Producers, Canada is among the top ten global oil producers, and the preferred supplier to many nations lacking domestic oil resources. Sustaining that ranking will require continued innovation to improve the efficiency of production and delivery of all forms of energy. It will mean public education programs to ‘de-risk’ seismic exploration, drilling, and pipeline projects to attain informed social approval. Failing that, exploration investment in Canada will remain risky, our energy portfolio will become unbalanced, and our energy forecast will be bleak.

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17 Transportation Research Board and National Research Council, *Oil in the Sea III: Inputs, Fates, and Effects* (Washington, DC: The National Academies Press, 2003), doi.org/10.17226/10388.

18 “Canada’s Petroleum Resources,” Canadian Association of Petroleum Producers, last accessed 23 January 2018, http://www.capp.ca/canadian-oil-and-natural-gas/canadas-petroleum-resources.