Hydraulic Fracturing in Nova Scotia

DALHOUSIE UNIVERSITY
Inspiring Minds

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Basin & Reservoir Lab

1. Hydraulic Fracturing

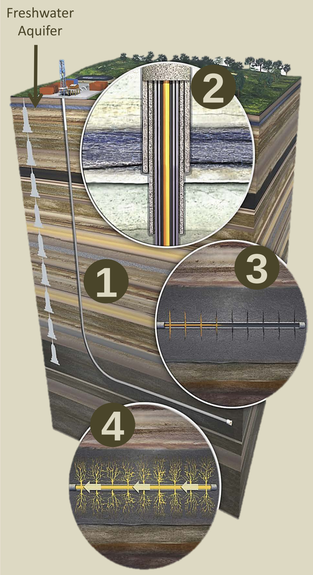

Figure 1: Hydraulic fracturing process (modified from ConocoPhillips, 2011)

Uses:
Primarily used to enhance the extraction of oil and gas from onshore conventional and unconventional resource plays.

The Process (Fig. 1):
Drilling begins vertically until the 'kick-off' point at the zone of interest where horizontal drilling begins (1). Horizontal drilling allows for increased shale area exposure. Three types of casing (conductor, surface, and production) are cemented in place to ensure well integrity (2). A mixture of water, sand, and chemical additives are injected into the wellbore to induce fractures in the shale (3). Isolation of the target zone allows for multistage fracturing, ensuring fracturing precision. The fractures allow for natural gas to flow into the wellbore (4). A single stimulation can allow for 10-30 years of production.

2. Unconventional Resources

Relative to unconventional resources, conventional hydrocarbon resources tend to be found in small volumes (Fig. 2) and are easy and cost effective to extract. Unconventional hydrocarbon resources tend to be found in larger volumes (Fig. 2) but are difficult to develop due to limited permeability of the producing formation (Fig. 3). The combination of technological improvements in both fracturing and directional drilling have made unconventional resources economically feasible to extract. Of these, natural gas – and increasingly oil are target hydrocarbons from shale formations.

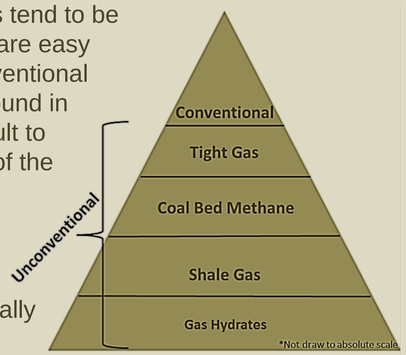

Figure 2: Resource triangle representing the relative volume of hydrocarbon resources (modified from CAPP, 2011)

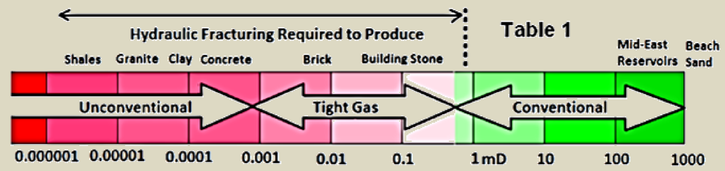

Figure 3: Permeability range of producing formations and where fracturing is needed for extraction (King, 2012)

3. Main Concerns

I. Water Contamination Concerns (Fig. 4)
(A) Well casing failure.
(B) Waste and produced water storage leakage.
(C) Dipping geological strata can cause surface connection.
(D) Unlikely fractures will connect with surface unless natural surface fault occurs.

II. Water Usage
Hydraulic fracturing uses 7 to 20 million liters of fluid per well. Water can be used but alternatives are increasing (eg. liquid propane)

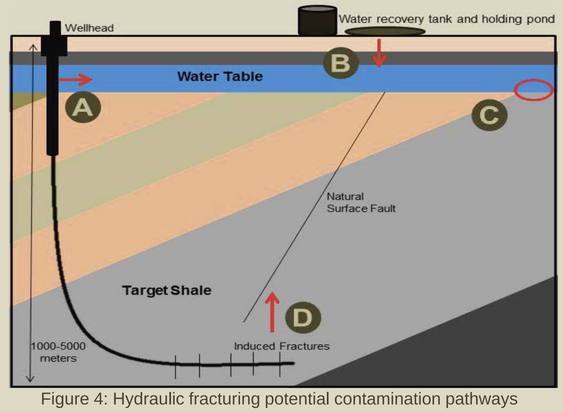

Figure 4: Hydraulic fracturing potential contamination pathways

4. Nova Scotia Context

I. Geological Potential
Although no commercial discoveries have been made to date, the Carboniferous Supergroup shows similar characteristics to New Brunswick geology which has proven hydrocarbon reserves.

II. Infrastructure
Present infrastructure such as the Maritime & Northeast Pipeline (Fig. 5) as well as proposed infrastructure (eg. LNG plant in Goldboro) and innovative infrastructure (eg. salt cavern natural gas storage in Alton) demonstrate Nova Scotia's natural gas supporting infrastructure.

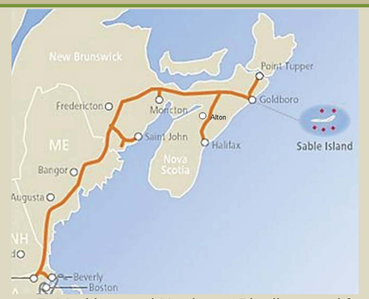

Figure 5: Maritime and Northeast Pipeline used for the transportation of natural gas (SpectraEnergy, 2012)

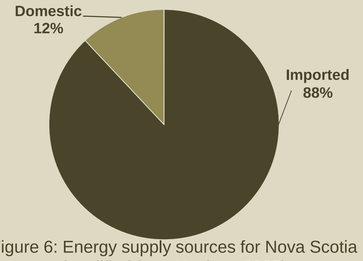

Figure 6: Energy supply sources for Nova Scotia (modified from Hughes, 2007)

III. Government Goals
Natural gas is consistent with the goals laid out in the N.S. Climate Change Action Plan 2009 and N.S.'s 2009 Energy Strategy.

IV. Economic Benefits
Hydraulic fracturing could lead to economic benefits through royalties and the use of locally sourced goods and services as outlined in the *N.S. Petroleum Resource Regulations.*

V: Domestic Energy Supply
Developing onshore hydrocarbons increases supply of domestic energy (Fig. 6).

5. Recommendations for Moving Forward

New Provincial Legislation – *Hydraulic Fracturing Act*
Legislation unique to hydraulic fracturing needs to be outlined before the onset of commercial development. Baseline environmental and health studies need to be included in regulations as well as other industry best practice procedures.

Strategic Environmental Assessment (SEA):
A Strategic Environmental Assessment (SEA) should be completed to understand social, economic and environmental effects of the industry.

Long Term Strategy and Policy
Long-term provincial and federal government policy should encourage innovation with respect to hydraulic fracturing water use alternatives and reuse of produced water. It is also recommended that an Energy Return On (energy) Invested (EROI) minimum value be set to encourage the efficient implementation of this extraction method.

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Acknowledgements

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