



Examining unconventional gas-well
development in Green Point Shale
formation through the lens of
structured decision making

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Background

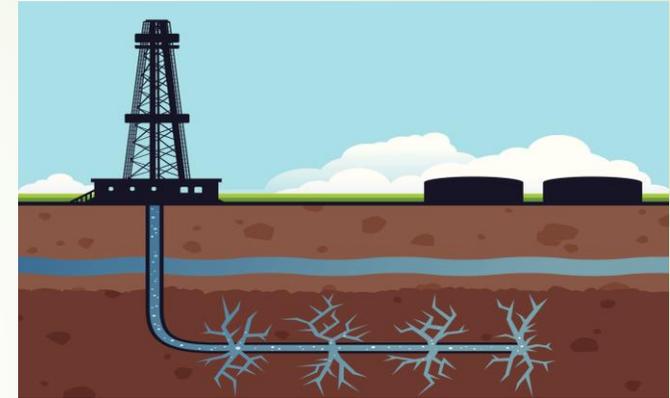


- ▶ Development of unconventional natural gas reserves in North America has been rife with controversy, leading to a polarized stalemate.
- ▶ Opponents raise concerns about environmental safety, health risks, pollution risks and over dependence on fossil fuel.
- ▶ Proponents insist on the safety of the process and stress economic, energy security and social benefits of the process.
- ▶ Resulted in uneven development, development going on unimpeded in some areas, while it has been stalled or halted by activists and policies in others.
- ▶ Although both sides of this debate have experienced success in limited political spheres, the contradictory nature has prevented any one ideological camp from taking precedence on the issue.

Key Terms

- **Unconventional Gas Well Development**
- A means of removing large volumes of hydrocarbons from highly dispersed reservoirs (Rahm, 2011)

- **Sustainable Development**
- Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. (WCED, 1987)
- The process of increasing energy and material efficiencies while decreasing environmental and social damages. (Lafferty, 1996)



Structured Decision Making (SDM)

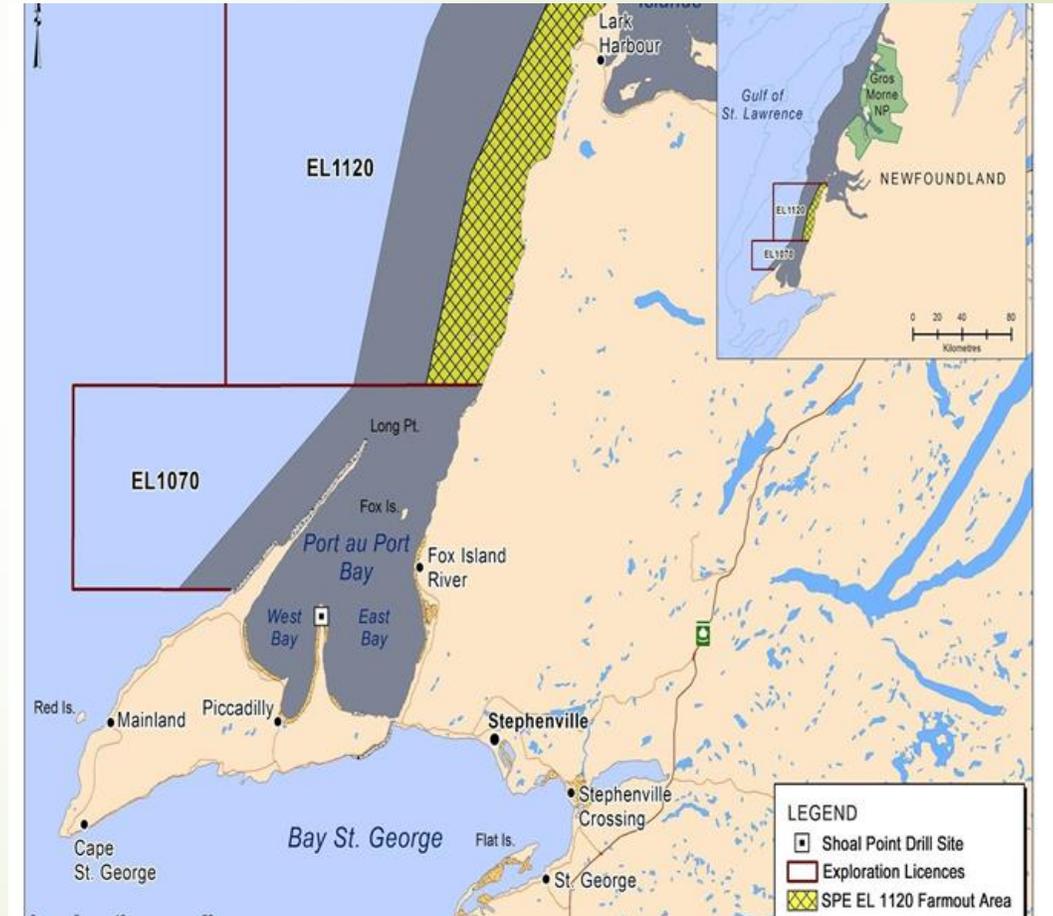


- SDM can be defined as the collaborative and facilitated application of multiple objective decision making and group deliberation methods to environmental management and public policy problems
- Stages Of SDM
 - Defining the problem (creating the framework)
 - Specifying the Objectives and Measures
 - Creating Imaginative Alternatives
 - Identifying the Uncertainties
 - Identifying the consequences
 - Clarifying the tradeoffs
 - Implementation



Green Point Shale Formation

- North America's next big oil find: ~23 bn barrels, ~969 mn recoverable
- Shoal Point Energy: biggest player, 280,000 hectares
- Will require the use of hydraulic fracturing
- Huge economic potential like Eagle Ford Shale Play in Texas
- 2021: 116,000 full-time jobs, \$62.3 bn economic development



Controversy



- Drilling near Gros Morne NP: serious alarms
- NL-Fracking Awareness Network (FAN): arisen in opposition
 - 17 member organizations, over 100 individuals
 - homeowners associations, tourism promoters, business representatives, ENGOs, community activists, politicians
- UN World Heritage Site Status
 - UNESCO: Published report, lost status, role of buffers.
- Damage to tourism industry
- Scientifically important natural rock-formations
- Above ground environmental impacts

Decision Sketch



Fundamental Objectives	Attributes	Units
Minimize human health impacts	Noise pollution	Sound level meter (dB)
	Quality of drinking water	Temperature, pH, dissolved oxygen, oxygen reduction potential (ORP), etc.
	Seismic activity	Richter scale
	Air pollution	WHO standard/ AQI
Minimize tourism impacts	# of tourists visiting area	# of visitors
	Retain UNESCO designation	Binary
	Damage to tourist attractions	(see environmental impacts)
Minimize environmental impacts	Methane combustion & leakage	Atmospheric CH ₄ testing
	Seismic activity	See health impacts
	Water table contamination	See health impacts
	Biodiversity degradation	Species richness
	Transportation risks	Previous precedent
	Green chemical optimization	Collateral chemical effects
	Bioaccumulation (marine/ terrestrial)	Baseline tests
Maximize economic benefits	Maximize job creation	Employment rates
	Maximize capital investment	\$
	Strengthen rural communities	See other factors
	Stabilize power rates	\$
	Increase industry presence	See other factors
	Maximize royalties: Minimize inflation	\$

Alternatives



- 1st phase produced 7 alternatives:
 1. Ban hydraulic fracturing
 2. Moratorium on hydraulic fracturing (with activity)
 3. Command and control regulated development onshore only with designated buffer zones
 4. Command and control regulated development offshore only with buffer zones
 5. Command and control regulated development onshore and offshore with designated buffer zones
 6. Full development with government incentives (subsidies, tax-breaks, employment programs to encourage industry, etc.)
 7. Full development (no new regulations, free market approach)

Alternatives



- ▶ 2nd phase produced 4 alternatives:
 1. Ban fracking
 2. Moratorium on fracking (no activity)
 - ▶ Until policy development
 3. Moratorium (with activity)
 - ▶ exploratory drilling during policy development
 4. Command and control regulated development onshore and offshore

Stakeholder Role-play



- Alternatives put into a consequence table to then be evaluated by stakeholders
- Stakeholder hats were:
 - Conservation biologist
 - Oil and gas geologist
 - Local non-governmental (NGO) or civil society member
 - Economist
 - Government



Value Scale



- 12 performance measures to assess
- 5 stakeholders
- Maximum and minimum range of the scale
- + 120 – (-120)

Value scale	
-2	High negative impact
-1	Low negative impact
0	No impact
1	Low positive impact
2	High positive impact

Risk and Uncertainty



1. Indeterminacy, underspecificity & subjective judgment
 - ▶ “standard of living”- synonymous with wealth, comfort, material goods and necessities available to a certain geographic class, did not narrowly define the important factors; social and cultural values
2. Ambiguity, sources of linguistic uncertainty, vagueness amongst fundamental objectives
 - ▶ New titles for FOs included measurable terms: Ensure, Minimize, Maximize
3. Natural Variation in sub-objectives
 - ▶ Fracking’s Contribution to Climate Change
 - ▶ Impact on Renewable Resource Development
 - ▶ Impact of pollutants on health
4. Measurement errors
 - ▶ Difficult to separating effects of one industry to another.
 - ▶ Constructed measure for locals to measure impacts
 - ▶ Advance prediction of effects on tourism

Alternative 1 “Ban on Fracking”

Performance Measures (PMs)	Conservation Biologist	Oil & Gas Geologist	Local NGO (Civil Society)	Economist	Government
Tourism Revenue (\$)	2	1	2	0	0
# of tourists	2	1	0	0	0
Perceived Impacts	2	0	1	-1	0
# of sick days	2	0	0	-1	0
Species richness	2	2	0	0	0
Groundwater contamination	2	2	0	-1	0
Air emissions	2	2	0	-1	0
noise (dB)	2	2	0	-1	0
# of jobs (direct)	0	-1	0	-2	0
# of jobs (indirect)	0	-1	0	-2	0
Oil and gas revenues	0	-2	0	-2	0
Capital Investment	0	-2	2	-2	0
TOTAL (SUM)	16	4	5	-13	0

Total value of 12 = medium positivity rating

- Conservation biologist
High positive values overall.
- Oil and gas geologist
Low positivity due to negative values in economic sector

- Local NGO, civil society
Overall little to no impact for all sectors
- Economist
Medium level negativity
- Government
No impact in any sector.

Alternative 2 "Moratorium (no activity)"					
Performance Measures (PMs)	Conservation Biologist	Oil & Gas Geologist	Local NGO (Civil Society)	Economist	Government
Tourism Revenue (\$)	2	1	1	0	0
# of tourists	2	1	0	0	0
Perceived Impacts	2	0	0	0	-1
# of sick days	2	0	0	0	0
species richness	2	2	0	0	0
Groundwater contamination	2	2	0	0	0
air emissions	2	2	0	0	0
noise (dB)	2	2	0	0	0
# of jobs (direct)	0	-1	0	-1	0
# of jobs (indirect)	0	-1	0	-2	0
Oil and gas revenues	0	-2	0	-2	0
Capital Investment	0	-2	1	-2	0
TOTAL (SUM)	16	4	2	-7	-1

Total value of 14 = high positivity rating

- Conservation biologist
High positive values overall.
- Oil and gas geologist
Low positivity

- Local NGO, civil society
Little to no positive impact
- Economist
Low negative to no impact
- Government
Little to no impact in any sector.

Alternative 3 “Moratorium (with activity)”

Performance Measures (PMs)	Conservation Biologist	Oil & Gas Geologist	Local NGO (Civil Society)	Economist	Government
Tourism Revenue (\$)	-1	0	-1	0	-1
# of tourists	-1	0	-1	0	-1
Perceived Impacts	-2	0	0	-1	1
# of sick days	-1	0	0	0	-1
species richness	-2	-1	-1	0	-1
Groundwater contamination	-1	-2	-2	-1	0
air emissions	-2	-2	-2	-1	-1
noise (dB)	-2	-1	-1	-1	-1
# of jobs (direct)	1	1	1	1	1
# of jobs (indirect)	0	1	-1	1	1
Oil and gas revenues	1	1	0	1	1
Capital Investment	1	1	0	1	1
TOTAL (SUM)	-9	-2	-8	0	-1

Total value of -20 = highest negative rating

Conservation biologist

- Low negative value.

Oil and gas geologist

- Low positive to no impact overall

- Local NGO, civil society
 - Low negative
- Economist
 - Low negative to no impact
- Government
 - Low negative and positive values.

Alternative 4 "Regulated Development"

Performance Measures (PMs)	Conservation Biologist	Oil & Gas Geologist	Local NGO (Civil Society)	Economist	Government
Tourism Revenue (\$)	-2	0	-2	0	-1
# of tourists	-2	0	-2	0	-1
Perceived Impacts	-2	-1	-1	-1	2
# of sick days	-2	0	-2	0	-1
species richness	-2	-1	-1	-1	-1
Groundwater contamination	-2	-2	-2	-1	0
air emissions	-2	-2	-2	-1	-1
noise (dB)	-2	-1	-2	-1	-1
# of jobs (direct)	1	2	2	2	2
# of jobs (indirect)	1	2	-2	2	2
Oil and gas revenues	1	2	2	2	2
Capital Investment	-1	2	-1	2	2
TOTAL (SUM)	-14	1	-13	3	4

Total value of -19 = high negative rating

Conservation biologist

- High negative value.

Oil and gas geologist

- High positive value economically goes against environmental values

- Local NGO, civil society
 - High negative overall
- Economist
 - High positive to no impact
- Government
 - High positive economically low negative socially

Creating of New Alternative



- Addressed the most important values of the stakeholders and the values the stakeholders felt would be most affected
- Moratorium on high volume fracturing with controlled activity
- Only controlled exploration and testing permitted until development of policy is accepted and put into legislation
- Exploration must strictly following UNESCO guidelines
- buffer zones must be set out prior to exploration that does not allow testing and exploration to take place within the boundaries, ensuring the protection of sensitive ecological and cultural areas

Alternative 5 "Revised Moratorium"					
Performance Measures (PMs)	Conservation Biologist	Oil & Gas Geologist	Local NGO (Civil Society)	Economist	Government
Tourism Revenue (\$)	0	0	0	0	1
# of tourists	0	0	0	0	1
Perceived Impacts	0	0	-1	-1	2
# of sick days	-1	0	0	0	0
species richness	-1	0	0	-1	-1
Groundwater contamination	-1	-1	-1	-1	0
air emissions	-1	-1	-1	-1	-1
noise (dB)	-1	-1	-1	-1	-1
# of jobs (direct)	1	2	1	2	2
# of jobs (indirect)	0	1	-1	2	2
Oil and gas revenues	1	2	0	2	2
Capital Investment	-1	-1	-1	2	2
TOTAL (SUM)	-4	1	-5	3	9

Total value of 4= low positive rating

Conservation biologist

- lowest negative value.

Oil and gas geologist

- low positive to no impact

Local NGO, civil society

- Low negative to no impact

Economist

- low positive impact

Government

- High positive impact

Key Findings



- ▶ Ban Fracking: highly polarized with conservationists very much in support and economists against
- ▶ Moratorium without activity: though positive, the polarization on this issue points to a need to develop more robust and inclusive alternatives
- ▶ Moratorium with Activity: though often pursued by governments, findings suggest it is not the best place to start
- ▶ Regulated Development: Strong polarization and opposition points to a lack of trust in Government and Industry.
- ▶ Revised Alternative: Major trade-offs which speak to the stakeholders and address polarization, further extrapolation on potential policies would improve civil societies support.

Summary



- ▶ Hydraulic Fracturing in and of itself, is an extremely polarized issue with the potential to impact a wide array of stakeholders.
- ▶ Ensuring that the Hydraulic Fracturing is taking place in a manner consistent with the tenets of Sustainable Development further compounds the issue.
- ▶ Structured Decision Making provides the necessary framework to approach this problem in a constructive objective based manner, whilst including and responding to all necessary experts, stakeholders, and decision makers.

Summary



- ▶ It is important for Stakeholders to analyze the value systems and their interpretations, they must be both, defined clearly, and discussed at length, prior to engagement in the consequence valuation process
- ▶ Uncertainties must be identified and either resolved or factored into the decision making process
- ▶ Future impacts of activities must be taken into account and a regular review of the activities is imperative.
- ▶ Presents an opportunities for trading off so every interest can be objectively analyzed in terms of its impact on the big picture and aids the reaching of agreements and compromise