# Structured Decision Making as a Tool for Facilitating Stakeholder Engagement in Non-Renewable Resource Management: Using the Case Study of Hydraulic Fracturing in the Green Point Shale Formation in Western Newfoundland

By

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# ABSTRACT

This thesis examines the importance of effective stakeholder engagement that complies with the doctrines of social justice in non-renewable resources management decision-making. It uses hydraulic fracturing in the Green Point Shale Formation in Western

Newfoundland as a case study. The thesis uses as theoretical background John Rawls' and David Miller' theory of social justice, and identifies the social justice principles, which are relevant to stakeholder engagement. The thesis compares the method of stakeholder engagement employed by the Newfoundland and Labrador Hydraulic Fracturing Review Panel (NLHFRP), with the stakeholder engagement techniques recommended by the Structured Decision Making (SDM) model, as applied to a simulated case study involving hydraulic fracturing in the Green Point Shale Formation. Using the already identified social justice principles, the thesis then developed a framework to measure the level of compliance of both stakeholder engagement techniques with social justice principles. The main finding of the thesis is that the engagement techniques prescribed by the SDM model comply more closely with the doctrines of social justice than the engagement techniques applied by the NLHFRP. The thesis concludes by recommending that the SDM model be more widely used in non- renewable resource management decision making in order to ensure that all stakeholders' concerns are effectively heard, understood and transparently incorporated in the nonrenewable resource policies to make them consistent with local priorities and goals, and with the social justice norms and institutions.

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## LIST OF ABBREVIATIONS

| | |
|---|---|
| Mtoe | Million Tons of Oil Equivalent |
| IEA | International Energy Agency |
| SDM | Structured Decision Making |
| NLHFRP | Newfoundland and Labrador Hydraulic Fracturing Review Panel |
| CAPP | Canadian Association of Petroleum Producers |
| NL | Newfoundland and Labrador |
| GPSF | Green Point Shale Formation |
| UNESCO | United Nations Educational, Scientific, and Cultural Organization |
| CBC | Canadian Broadcasting Corporation |
| IER | Institute for Energy Research |
| CNA | Canadian Nurses Association |
| ILO | International Labour Organization |
| CERN | Code of Ethics for Registered Nurses |
| CCSD | Canadian Council on Social Development |
| ISRM | International Society for Rock Mechanics |
| SPE | Society of Petroleum Engineers |
| PM | Performance Measures |

# CHAPTER 1: INTRODUCTION

## 1.1 BACKGROUND TO THE STUDY

Following the rise of industrialization, human societies have evolved to rely heavily on energy for daily activities. The International Energy Agency (2014) estimates that, in 2013, total world energy consumption was 13,541 Mtoe, or 5.67 × 1020 joules, equal to an average power consumption of 18.0 terawatts (The International Energy Agency, 2014). By 2035, global demand for energy is expected to rise by 33% as economies in both developed and emerging countries continue to grow and as the standard of living improves in the developing world (International Energy Agency, 2014). To meet this increased demand for energy, it will be necessary to maximize the production and management of natural resources (Gerber et al., 2008). Though there is a growing movement for the development of renewable sources of energy, a large proportion of consumers and governments prefer to rely on non- renewable energy sources like oil and gas. Non-renewable resources are often viewed as being more accessible and economically viable because of existing technologies and processes, also many of the alternatives require major service and infrastructure to allow delivery. North America is one of the largest consumers of oil and gas in the world. According to the Canadian Association of Petroleum Producers (CAPP), crude oil accounts for 40% of Canada's energy demand while natural gas accounts for approximately 30%. In the United States about 40% of the energy consumed comes from oil (Birol, 2010). With about 5% of the world's population, the United States alone is responsible for 25% of the world's oil consumption (Birol, 2010). In a bid to harness these non-renewable resources, humans inadvertently leave footprints that can be harmful to the environment. One of the biggest challenges facing

governments today is finding a balance between the need for more energy resources and the need to protect the environment from the effects of harnessing of these resources. The challenges surrounding non-renewable resource management are problematic, as they are multifaceted, inter-jurisdictional, and often involve a diverse group of stakeholders. Multiple competing objectives associated with highly contentious resource extraction activities, like hydraulic fracturing, combined with multiple uncertainties, pose real challenges for decision maker.

Policy formulation and decision making in non-renewable resource management is evolving rapidly, a result of the increasing complexity of the problems facing decision- makers today. The majority of problems in non-renewable resource management tackled by governments can be classified as 'wicked problems' due to the difficulties faced in arriving at a consensus over their exploitation, distribution and use. A wicked problem is one for which each attempt to create a solution changes the understanding of the problem (Rittel, 1969). Wicked problems cannot be solved in a traditional linear fashion because the problem definition evolves as new possible solutions are considered and/or implemented (Rittel, 1969). The issues surrounding deliberations on whether or not to engage in hydraulic fracturing in the Green Point Shale Formation in Newfoundland and Labrador (NL), for example, particularly the difficulties of defining stakeholders and successfully engaging them so their issues are identified and factored into the decision making process, are examples of wicked problems. Identifying and objectively reviewing the core issues within the controversies in hydraulic fracturing to enable decision makers identify the best possible s solution has proved difficult the opinions of many of the weaker stakeholders are often drowned out by their more powerful counterparts. It seems

to date that decisions on hydraulic fracturing have been limited to a series of misguided attempts at consensus building in the absence of relevant metrics, policies and stakeholders. Although consensus building is an important factor in effective decision making, the consensus should be reached after all the values that are important to the various stakeholders have been included in the decision context. Effective policy development for resource extraction, moving forward, must be responsive to multiple objectives (Burton et al. 2002), particularly in resource developments where socioeconomic and environmental systems are intricately linked and where there are numerous experts and stakeholders with diverse or competing interests. The 1987 report of the World Commission for Environment and Development (WCED) defined sustainable development as, "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987). In its most simplistic sense, sustainable development is the process of increasing energy and material efficiencies while decreasing environmental damages (Lafferty, 1996). Policies designed to ensure sustainable development may not be practical and may not be successful if key local actors and institutions are not involved and playing a significant role in decision making (Kemp et al., 2005). The development of alternatives will be more successful if they are identified and developed by local actors because they are more likely to be consistent with local priorities, goals, norms, and institutions (Ogden et a., 2009). Conversely, development alternatives that fail to consult local communities or government institutions are far less likely to be implemented (Newton et al. 2005). It is therefore imperative for decision makers to develop and adopt a method for engaging stakeholders in a non-confrontational atmosphere where each stakeholder can share their views and knowledge and also learn from other stakeholders so that well informed decisions can be reached. In this study, experts are defined

as anyone who has relevant professional experience in one or more of the various aspects of unconventional gas-well development and other affected fields. Stakeholders are defined as people who will be directly affected by the hydraulic fracturing activities in the Green Point Shale Formation (GPSF), either because they live or work in the area or as a result of identity based attachments or any other form of connection to the Green Point Shale Formation that will lead to their being affected by the fracking policies.

Due to the controversy and polarization shrouding the issue of hydraulic fracturing in Newfoundland, decision makers have faced difficulties with stakeholder engagement as attempts at engagement usually devolve into emotionally charged environments which make it difficult for the core issues to be identified and properly considered. The argument has been largely dominated by the extreme poles, those in favor stressing the economic value of the process, arguing that the Green Point Formation has been favorably compared with the Eagle Ford Shale in South Texas; Eagle Ford is considered one of the most significant oil discoveries in the United States in the past 40 years (Shoal Point Energy, 2013). They argue that the Green Point Shale Formation may produce similar and significant economic impacts for Western Newfoundland as the Eagle Ford Shale did in South Texas, citing the Institute for Energy (2012) that describes the economic impacts of the Eagle Ford formation as extraordinary: creating over $25 billion dollars in economic development, and supporting over 47,000 local full-time jobs. Those against fracking have raised serious alarms about groundwater pollution and other negative environmental risks of hydraulic fracturing. Gros Morne National Park is a world heritage site located on the west coast of Newfoundland. At 1,805 km2 (697 sq. mi), it is the second largest national park in Atlantic Canada. Of particular concern to stakeholders against

fracking is the fact that the United Nations Educational, Scientific, and Cultural Organization (UNESCO) could reconsider Gros Morne's world heritage status if decision makers do not take steps to protect the park's natural beauty and unique geology (CBC News, 2013), this they believe can seriously damage the huge tourism industry in the region. Also concerns have been raised that fracking near the park could disrupt scientifically-important natural rock formations, and could have serious environmental impacts above ground (CBC News, 2014). As a result of ongoing debate and controversy, the government in 2014 established a province wide moratorium on hydraulic fracturing that affected the Green Point Shale Formation. After increased pressure from the public, an independent Panel called the Newfoundland and Labrador Hydraulic

Fracturing Review Panel (NLHFRP) was appointed by the Minister of Natural Resources to find out the public view of fracturing in Western Newfoundland. The NLHFR was mandated with making recommendations on whether or not hydraulic fracturing should be undertaken in Western Newfoundland. The panel is responsible for engaging stakeholders on the issue, and - in response to this - has implemented a series of open consultations to collect information and opinions from stakeholders. The panel has been criticized for its lack of diversity and narrow scope of expertise (Fusco, 2015). Its members, all white men, bring significant knowledge only from the areas of engineering, economics and biochemistry (Fusco, 2015). Other areas of expertise, such as medicine and social science, key to studying socio- economic impacts, especially the impact of fracking on human health, are largely absent from the skills list on the panel and leaves out the voices of women, Indigenous people and people living in the affected areas (Fusco, 2015). This study will analyze the methods used by the panel with regards to their review of the

potential costs and benefits of hydraulic fracturing in Western Newfoundland. Beginning with how the panel defined stakeholders, this study will assess how experts' and stakeholders' opinions and knowledge were collected, how this information has been incorporated into their decision making process and how transparent the process was as a whole. The study will also offer a framework to measure the level of compliance of stakeholder engagement techniques with social justice principles. According to Gregory et al. (2012), Structured Decision Making (SDM) can be defined as the collaborative and facilitative application of multiple objective decision making and group deliberation methods to environmental management and public policy problems. In order to define potential decisions, a method has to be devised to incorporate these views and create alternatives. The primary goals of this process include: successfully eliminating extreme positions on the issue, encouraging parties to make compromises and trade-offs, and developing a suite of decisions which consider and respond to all stakeholders in the most efficient way possible. This is the very essence of the structured decision making process.

Further, the SDM approach employs an array of analytical methods including: decision analysis, applied ecology, human judgment studies, cognitive psychology, group dynamics studies, and negotiation theory (Gregory et al., 2012). SDM aids in the creation of a framework and network of decision making processes that can be applied to diverse situations. It is an excellent option in complex situations as it makes allowances for uncertainties and also creates a series of alternatives within which stakeholders can negotiate and trade-off toward a common ground, while ensuring a substantial portion of their interests have been adequately represented. Gregory et al. (2012) further asserts that SDM is especially suited for solving environmental issues because it helps in understanding complex problems,

generating and evaluating creative alternatives and is designed to accommodate diverse groups and interests. The method pays special attention to the challenges and pitfalls that confront people working together on emotionally charged and technically intensive problems, which are key attributes of wicked problems. The process encourages consistency, transparency and defensibility, particularly in the face of technical and value-based controversy. The steps of SDM provide a process for decision-making that clarifies objectives in a meaningful, inclusive, and manageable way. This is because decisions are broken down into interdependent parts that help identify roles for a consensus decision. Stakeholders articulate objectives and goals, experts knowledge is used to create model consequences and quantify uncertainties of various management alternatives in an open forum so as to ensure that both agree to an acceptable decision that incorporates all their values and concerns. The SDM framework helps improve Stakeholder understanding of the uncertainties involved in decisions, and the transparent process can open lines of communication to repair Relationships, build trust, and reduce conf7lict (McDaniels et al. 1999).

The study will run a simulation involving the application of the SDM tools to the issue of hydraulic fracturing in Newfoundland. The simulation of the SDM process will involve taking the issue of hydraulic fracturing in Newfoundland and running it through a series of stakeholder engagement exercises in which important stakeholders are simulated by the researchers who attempt to represent the interests of the actual stakeholders. Assumptions are made as to the opinions of these stakeholders on key issues in the decision making process. The positions are in no way to be accepted as the actual opinions of these stakeholders as no

attempts will be made to verify that the positions simulated are the actual positions held by these stakeholders.

Social justice will serve as the lens under which the methods of stakeholder engagement considered in this study will be analyzed. Social justice can be defined as a situation existing when all people share a common humanity and therefore have a right to equitable treatment, support for their human rights, and a fair allocation of Community resources (Robinson, 2010). Social justice can only exist when people are not discriminated against, nor their welfare and well-being constrained or prejudiced on the basis of gender, sexuality, religion, political affiliations,

Age, race, belief, disability, location, social class, socioeconomic circumstances, or other characteristic of background or group membership (Robinson, 2010). Social justice stresses the importance of protecting not just the economy and the environment, but also protecting the individual rights of citizens from the negative consequences and effects of natural resource Policies, by promoting justice and fairness, ensuring fair participation and fostering social equity (Gary C. Bryner, 2002). By implication, for social justice to be achieved in non-renewable resource management context, decision makers must implement a system where individuals' and groups of individuals' perspectives and opinions can be effectively heard, understood and transparently incorporated in the non-renewable resource policy so as to make them consistent with local priorities, goals, norms, and institutions. These ideals have made social justice a useful tool for the evaluation of policies, as they ensure that even the weakest members of the society are protected from being overlooked in the decision making process. In sum, this study will discuss stakeholders' engagement from the social justice perspective. It will

use the Green Point Shale Formation as a case study to assess the best way stakeholders' engagement can be designed by comparing methods employed by the NLHFRP and the SDM approach.

## 1.2 PURPOSE THE STUDY

The issues surrounding non-renewable resource management, especially pertaining to hydraulic fracturing in NL have proved to be particularly highly controversial "wicked" problems. A number of attempts have been made to engage stakeholders in Newfoundland and Labrador so as to create an avenue for them to table their opinions and views. An example of this was the public forum titled 'Can Fracking be done in a sustainable way?' organized by the Harris Centre and the Environmental Policy Institute Memorial University of Newfoundland (MUN) on February 11, 2015. Regrettably, many public forums often quickly devolve into heated debates with both sides of the debate battling for supremacy. One of the major purposes of this study is to determine the factors that foster successful stakeholder engagements.

The study will then use these factors as a basis of comparison for the current method used by the NLHFRP and the methods employed in SDM. To achieve this purpose, the study will have to fulfill the following objectives:

To identify social justice as a theoretical background of stakeholders' engagement, and using its precepts develop a checklist of qualities that should be present in effective stakeholder engagement.

- To describe the stakeholder engagement process as prescribed by SDM.
- To describe the case study site: Green Point Shale Formation.
- To use the Green Point Shale Formation as a case study to simulate the stakeholder engagement processes prescribed by SDM.
- To describe, analyze and discuss the stakeholder engagement process as employed by the NLHFRP.
- To contrast and compare the two processes.
- To determine using the identified tenets of social justice which process aligns more closely and why?
- To create guidelines for stakeholder engagement that can be applied to other non-renewable resource management cases that will ensure the tenets of social justice are upheld.

## 1.3 THESIS STATEMENT AND QUESTIONS

This research will show that the methods of stakeholders' engagement prescribed by Structured Decision Making are more aligned with the tenets of social justice than the methods currently employed by the NLHFRP.

To achieve this aim, the study will have to find answers to the following questions:

- What principles of social justice are relevant to stakeholders' engagement?
- How effective is the method of stakeholders' engagement used by the NLHFRP?

- What is the method of stakeholder engagement proposed under the SDM?
- Which of the methods best complies with the tenets of social justice?
- What principles should be considered when conducting stakeholder engagement?

## 1.4 SIGNIFICANCE OF STUDY

This research will have both academic and policy contributions. The research will contribute to the theoretical discussion about decision making in the exploration, exploitation and use of non-renewable resources. It also has the potential to contribute to the improvement of the decision-making process in the province of Newfoundland and Labrador (NL) on the issue of non-renewable resource management. Findings from this work may provide suggestions which the provincial government may use in making a decision on whether to lift the moratorium on unconventional gas-well development in the province. By objectively analyzing the current techniques for stakeholder engagement and comparing them with the techniques under the Structured Decision Making (SDM) model, the research will determine what method best conforms to the ideals of social justice and effectively represents the interests of all stakeholders.

The research also will utilize existing SDM guidelines by applying them to the issue of hydraulic fracturing in Newfoundland. This simulation involving the application of the SDM tools to the issue of hydraulic fracturing in the Green Point Shale Formation can be used as a scenario based framework that can be applied in diverse non-renewable resource management issues to find solutions that encompass the objectives of each stakeholder. Decisions made using the SDM method will enhance the legitimacy of the policies as they would emanate from the

stakeholders as each of them would have been given the opportunity to express their opinions and beliefs and have these opinions and beliefs represented in the designed/developed alternatives. This framework will give stakeholders an opportunity to measure how their core objectives will be affected by the various alternative solutions to the debate. This will be achieved by the development of performance measures which will be used to measure the impacts of each of the alternative solutions would have on the stakeholder's objectives and values.

SDM is already used in solving environmental issues, as it is demonstrated in studies like Using Expert Judgments to Explore Robust Alternatives for Forest Management under Climate Change (McDaniels et al., 2012), and Application of Structured Decision Making to an Assessment of Climate Change Vulnerabilities and Adaptation Options for Sustainable Forest Management (Ogden and Innes, 2009). SDM is applied in these studies to use expert opinions to determine alternative Forest policies to mitigate the effects of the mountain pine beetle in BC, and to use Expert judgments to rate possible forest management strategies to adapt to climate Change in the Yukon. Very little work has, however, been done in the application of SDM to solve the issues associated with hydraulic fracturing. This is a gap the study will fill, by creating a framework that can be effectively utilized in other regions challenged with similar issues.

## 1.5 LIMITATIONS AND ASSUMPTIONS

The major limitation of this study is a lack of adequate resources to run the SDM case study to its full capacity. As a result of this limitation, the study resorted to a simulation in which members of a team wore stakeholder hats and attempted to represent the interests of various

stakeholders in the decision context. However, as a result of limitations in man power not every potential stakeholder was represented and this may result in gaps in the results. This limitation has also resulted in the team members making assumptions concerning what they believed were the major objectives of the various stakeholders they were representing.

The study seeks to examine the role of stakeholder engagement in the decision making process in the hydraulic fracturing debate going on in the province. However a major limitation to the scope of this study is the difficulty in getting information on how stakeholder opinions are valued by the decision makers. It is also difficult to determine exactly how these opinions are incorporated in the government decision making process. A better insight into government decision making is therefore required to fully understand how any new framework might be incorporated into existing DM protocols.

The study also assumes that social justice is a good basis for comparison of the two methods of stakeholder engagement considered herein. This assumption is based on the fact that social justice promotes a just society by challenging injustice and valuing diversity. It exists when all people share a common humanity and therefore have a right to equitable treatment, support for their human rights, and a fair allocation of community resources (Bonnycastle, 2011). The theory is broad with various schools of thought that have been applied to a variety of topics including health care and human rights. The ideals have been adapted to various societal institutions and have enjoyed great success in ensuring the protection of individuals as societies evolve. It is therefore reasonable to assume that it will enjoy a similar amount of successes when applied to stakeholder engagement.

In the case study included in this research, an assumption is made as to the economic potential of Green Point Shale Formation. A comparison is made between the Green Shale Point Formation and the Eagle Ford Shale in South Texas. Eagle Ford is considered one of the most significant oil discoveries in the United States in the past 40 years (Shoal Point Energy, 2013) and due to similarities between the sites it can be reasonably assumed that their economic potentials will be similar. Projections for 2021 estimate the creation of over 116,000 full-time jobs, and $62.3 billion in economic development (IER, 2012). According to Shoal Point Energy, analysis of data by independent consultants indicates that resource numbers (in-place hydrocarbons) for the Green Point are much higher than for comparable basins like the Eagle Ford (Shoal Point Energy).

The thesis is organized as follows: Chapter two presents the theoretical foundations of the study, examining the principles of social justice as propounded by John Rawls and David Miller. The study then presents an analysis on how these theories can be applied to decision making. Chapter three examines the issue of hydraulic fracturing in Newfoundland. It describes the process of hydraulic fracturing and the controversies that surround it. Chapter three also presents a background to the issue of hydraulic fracturing in the Green Point Shale Formation and the NLHFRP examining its processes and the criticisms suffered by the panel. Chapter four describes the SDM process and runs a simulation in which the SDM tools are applied to the issue of hydraulic fracturing in Green Point Shale Formation. In Chapter five a framework using the relevant rules of social justice is developed and applied to comparing the technique applied by the NLHFRP and those prescribed by SDM. Chapter six recommends principles that can facilitate effective stakeholder engagement in non-renewable resource management, and concludes the study.

# CHAPTER 2: SOCIAL JUSTICE

## 2.1 OVERVIEW OF SOCIAL JUSTICE

The first writer to use the term social justice was an Italian priest, Taparelli D'Azeglio, in his book *Natural Rights from a Historical Standpoint* (1883) on the debates over the beginnings of the Risorgimento's effort to unify the Italian peninsula politically. In ancient Western philosophies, social justice conversations usually revolved around interactions within and with the community. Plato was concerned with members of communities being assigned to classes they were best suited for (Bloom, 1991). Aristotle posited that the worth of individuals was important in determining how they are to be treated (Nielsen, 1984). These views are a reflection of the time when slavery and subjugation of women were commonplace. The ideas of social justice evolved in the middle ages, with scholars like Thomas Aquinas broadening the scope of social justice, but ultimately linking being a good citizen to the purpose of serving God. The end of the Renaissance and Reformation ushered in the modern concepts of social justice. The focus of social justice began to shift towards the development of human potential. Thomas Paine posited in his book The Rights of man, that genius should be given a fair and universal chance by society (Paine 1792). John Stuart Mill argued that "Society should treat all equally well who have deserved equally well of it, that is, who have deserved equally well absolutely. This means that every individual is to be given an equal opportunity to prove themselves worthy of advancement. This is the highest abstract standard of social justice, towards which all institutions, and the efforts of all virtuous citizens, should be made in the utmost degree to converge" (Mill 1861).The evolution of social justice continued through the 19th and early 20th centuries becoming increasingly popular through the works of authors like John Dewey, Roscoe Pound and Louis Brandeis. The founding document of the International Labour

Organization (ILO) which was created in 1919, as part of the Treaty of Versailles that ended World War I stated in its preamble that peace can be established only if it is based on social justice. Though the theory has had more than its first share of criticism it has made its way into mainstream legal and academic discourse.

## 2.2 SOCIAL JUSTICE AS A TOOL FOR POLICY ANALYSIS

Social justice promotes a just society by challenging injustice and valuing diversity. It exists when all people share a common humanity and therefore have a right to equitable treatment, support for their human rights, and a fair allocation of community resources (Robinson, 2014). Social justice insists that all people be treated equally and given equal opportunities within which they can advance themselves based on merit.

This research examined two studies in which social justice was adopted to analyze public policy. The first study examined Assessing Criminal Justice Practice Using Social Justice Theory, the methods and techniques utilized in applying the tenets of social justice to criminal justice was analyzed. The methods utilized for applying social justice as a basis for comparison between SDM and the NLHFRP is adapted from the method used in this paper. The second study examined is titled Social Justice in Practice published by the Canadian Nurses Association (CNA); it identifies achievements of social justice in nursing.

Social justice was applied in analyzing the criminal justice system by Matthew Robinson in Assessing Criminal Justice Practice Using Social Justice Theory. The study examines the criticisms brought by scholars against criminal Justice agencies (Robinson 2010).

Criminal justice agencies have been accused of being ineffective in meeting their goals of achieving justice (Robinson 2010), criminal justice system has also been accused of curtailing the rights of certain segments of the population in order to serve the ideological interests of the powerful (Reiman, 2003; Shelden, 2003). The general consensus is that there are major inconsistencies between criminal justice practice and efforts to bring about social justice (Arrigo 1998). The main aim of the study is to show how the problems of criminal justice threaten the realization of social justice as characterized by John Rawls and David Miller (Robinson 2010). The study achieved this aim by examining the theories of social justice as propounded by John Rawls in A Theory of Justice (1971) and David Miller in Principles of Social Justice (1999) and identifying principles relevant to criminal justice. From the principles of John Rawls' (Rawls, 2003) the following assertions were taken to be applicable to the criminal justice system:

- Every person should have the same liberties. According to the Stanford Journal of Civil Rights and Civil Liberties civil rights are legal actions that the government takes to create equal conditions for all people while civil liberties are protections against government actions (Stanford Journal of Civil Rights and Civil Liberties 2013).

- Inequalities are acceptable if every person has the same opportunity for success.

- Inequalities are acceptable if they are arranged to the greatest benefit of the least-advantaged members of society. The least advantaged people are usually the people with limited access to resources or power.

From David Miller's philosophies (Miller 2003), the following assertions were taken as principles relevant to the criminal justice system;

- Every person's basic needs should be met and not hindered.
- Every person should enjoy benefits and carry burdens to the degree he or she deserves them. That is to the degree of which he utilizes the equal opportunities afforded to him.
- Each person should be treated equally. That is each person should be given equal opportunities for advancement in the society.

The study was able to identify areas of similarities and overlap in both theories. These overlaps in the theories result from the fact that both theories are founded on like principles and based on previously posited theories for significant historical philosophers. Some of these areas of overlap are as follows:

- Rawls' equal liberties principle is similar to Miller's principle of equalities (Robinson 2010). Both studies assert that every citizen deserves the same basic liberties and no societal practices should interfere with these rights (Robinson 2010).
- Rawls' difference principle is also compared with Miller's principle of need (Robinson 2010). The study posits that the similarity is in the fact both principles are stressing the need for arrangements in society that take care of the basic needs

Of all the people in the society and no other societal practice should interfere with these needs (Robinson 2010).

- Rawls' equal opportunity principle is seen as similar to Miller's principle of desert (Robinson 2010). The similarity here is that both principles opine that every citizen should have the same opportunities to compete for rewards, based on their performance and societal practices should be established to ensure this outcome (Robinson 2010).

The study then identified the scope of these principles and identified where each of them best fit in the analysis of the societal institution to determine how compliant they are with the principles of social justice as propounded by John Rawls and David Miller.

Examples of some of these principles and their scopes are as follows:

- Rawls principle of equal liberties applies to the establishment of "constitutional essentials" (Rawls 2003). This means this principle can be used to assess if citizens enjoy equal liberties according to the law (Robinson 2010).

- Rawls' other principles are seen as being applicable to the main institutions of society, which include the law, the police, courts and corrections (Rawls 2003). This is taken by the study to mean that the equal opportunity and difference principles apply to the interpretation and application of the law by the important societal institutions like the police, the courts and corrections.

Miller's principles of equality are applicable to matters of citizenship (Miller 2003). According to the study, this principle implies that as citizens of a nation (United States in the study) everybody ought to be treated equally in the eyes of the law and its application by agencies of criminal justice (Robinson 2010).

- Miller's principle of need is relevant to solidaristic communities like families (Miller 2003). This principle was extended to cover relationships governing citizenship in the study, and the study gives three reasons for this extension. The first reason is that all citizens to some degree see themselves as members of an extended family (Robinson 2013). Secondly, the study argues that the principle of need is relevant to the degree that criminality is driven by efforts to satisfy basic needs and punishing people for doing this can amount to interfering with their ability to satisfy their basic needs (Little & Steinberg, 2006). Thirdly, criminal justice can interfere with the basic needs of citizens directly, especially for minorities and the poor (Lurigio & Loose, 2008).

- Miller's principle of desert is relevant for instrumental associations such as work (Miller 2003). The study posited this principle can be adapted to criminal justice for three reasons (Robinson 2010). First, the fact that many criminology theories assert that crime is driven by a desire to seek monetary gain (Baumer & Gustafson, 2007). Second, if people are unable to obtain wealth through legal means, some will turn to criminality (Merton, 1938), which can serve as mitigating factors in the criminal justice system (Ashworth, 1994). Third, it is widely held by legal scholars that punishment is aimed at satisfying desert, by giving offenders what they deserve (Ristroph 2006). It is based on these identified principles, that the principles of John Rawls and David Miller were applied to assess the performance of criminal justice

agencies, like the law, policing, courts and corrections. The institutions, processes and outcomes in the criminal justice system that do not comport with Rawls' or Millers' principles of social justice are concluded as not being consistent with social justice (Robinson 2010). Each of the American criminal justice agencies are thoroughly analyzed using the principles of social justice according to John Rawls and David Miller, identifying the ways each of these agencies help realize as well as interfere with achieving social justice (Robinson 2010). This study was able to discover that the ideals of the American criminal justice systems are consistent with social justice, while many of the actual practices of the criminal justice agencies make the achievement of social justice impossible (Robinson 2010). Based on this discovery, the study makes recommendations that since the people hold values consistent with social justice, the criminal justice systems under which they are bound should help achieve social justice (Robinson 2010). The study concludes by stressing that if criminal justice policies are defined behind a ''veil of ignorance'' and are blind to personal preferences, then the problems seen in criminal justice practice today would not be present because they threaten social justice values, as laid out in criminal justice ideals (Robinson 2010).

The 2008 revision of the Canadian Nurses Association (CNA) Code of Ethics for Registered Nurses reflect Canadians nurses' interest and involvement in social justice (CNA, 2008). The code is presented in two parts, each reflecting dimensions of social justice (CNA, 2008). Part I sets out seven primary values and ethical responsibilities, all drawn from social justice values, which Canadian nurses are expected to uphold (CNA, 2008). Part II contains thirteen statements describing ethical endeavors that nurses in Canada may undertake to address social inequities affecting health and well-being (CNA, 2008). The study was carried out to enlighten nurses who have little familiarity with the concept of social justice on the relevance of the part II of the code to their own practice (CNA, 2008). As the code states, "Although these endeavors are not part of nurses' core ethical responsibilities, they are part of ethical practice and serve as a helpful motivational and educational tool for all nurses" (CNA, 2008). The study explains the concept of social justice and its importance to nursing. The study employs three case studies to show how the social justice ideas translate into concrete nursing actions (CNA, 2008). Social justice is defined "as the fair distribution of resources and responsibilities among the members of a population, with a focus on the relative position of one social group in relationship to others in society as well as on the root causes of disparities and what can be done to eliminate them" (CNA, 2006). The study posits that when social justice is applied to health and health care the term resources is taken to mean not just direct services but also other aspects of human life that can positively affect health like housing, food security, gainful employment, social inclusion etc. ( World Health Organization, 2008). These factors are collectively referred to as the social determinants of health (CNA, 2008). Applying social justice to health and health services involves attempting to reduce system wide differences that disadvantage

certain groups and prevent equal access to determinants of health and health care services (CNA, 2008). This is to be achieved by preventing oppressive practices such as discrimination against individuals on the basis of gender, sexual orientation, age or any other social factor that affects health and well-being (McGibbon et al., 2008). These studies posit that social justice is important in Canada because Canada has its share of unequal social relationships. The Canadian Council on Social Development reports that as of 2004 about 3.5 million Canadians were living in poverty, including 865,000 children under the age of 18 (CCSD, n.d). Social justice is of particular interest to nurses as they practice at the intersection of public policy and personal lives, they are therefore perfectly situated and morally obligated to include sociopolitical advocacy in their practice (Falk-Rafael 2005). The study is of the opinion that the tenets of social justice should be translated into the daily practice of nurses, by striving to overcome oppression and discrimination wherever they are encountered in the health-care system (Varcoe, 2004). These values have been codified in the Code of Ethics for Registered Nurses where the values of "providing safe, compassionate competent and ethical care", "promoting health and wellbeing" and "preserving dignity" are outlined. The study shows that the focus of the Canadian health care is shifting back from individualism and institutionalized illness to population health and social justice (CNA, 2008). The reports of the Commission on the Future of Health Care in Canada (CFHCC, 2002) and the Premier's Advisory Council on Health in Alberta (2002) (PACH, 2002) recognized that the current emphasis placed on technology and illness care is not necessarily increasing the overall health of the population, and call for more emphasis be placed on the social determinants of health (CFHCC, 2002; PACH, 2002). As a result, health care reform is now paying more attention to social justice issues (ButlerJones, 2004). Nursing education, research and education

are also paying more attention to the influence of oppression, marginalization and social exclusion on health and well-being (Fitzpatrick, 2003). Nurse scholars have suggested that nurses should be more actively involved in seeking solutions to social justice problems because their knowledge and numbers make them ideally suited for both individual and collective action (Davidson et al. 2003; Falk-Rafael, 2005). CNA's publication states that social justice is a means to an end as well as an end in itself (CNA, 2006). It is a means to an end because social justice is necessary for individual health, population health and the health-care system as a whole, while it is an end in itself because a just society is a better society (CNA, 2006). Part II of the CNA 2008 which relates to ethical endeavors, suggests aspects of nursing that relate to the need for change in systems and societal structures in order to facilitate greater equity for all" (CNA 2008). As a practical expression of the ideals of social justice now represented in the Code of Ethics for Registered Nurses (CERN) three scenarios are presented to serve as case studies. Each scenario is followed by reflections on how the nurse might respond using the tenets of social justice codified in the CERN. This paper is a clear example in which the tenets of social justice have been put to practical use.

## 2.3 JOHN RAWLS: "A THEORY OF JUSTICE"

John Rawls propounded a theory of justice that is popularly called "justice as fairness" (Rawls, 2003). Rawls considers justice to be the "first virtue of social institutions" (Rawls, 2003). Rawls explores social justice as a quality of society, its institutions, constitution and laws; he also stretches the theory to include the quality of persons (Hoffe, 2013). Rawls bases his theory on the idea that society is a cooperative venture for mutual benefit (Rawls, 2003). Rawls posits that conflicts arise in societies because each person seeks the greatest

advantage for themselves while shirking the burdens that arise in the society; it is therefore up to justice to distribute the benefits and burdens of the mutual effort (Rawls, 2003). To Rawls, after subtracting the burdens of society, the remaining benefits should be equally at everyone's disposal (Rawls, 2003). He further posits that however efficient or stabilizing a societal institution may be, if they are unjust they must be corrected (Rawls, 2003). This position comes from his belief in every person's inviolability that is founded in justice and cannot be overridden, not even for the welfare of society as a whole (Rawls, 2003).

Rawls maintains that the precept of social justice is connected to society's fundamental legal institutions, economic conditions and social relations which he refers to as society's basic structure (Rawls, 2003). These basic structures have decisive influences on the general rights, duties, societal expectations and economic prospects of a society's members (Rawls, 2003). Moreover, these basic structures regulate the distribution of the elementary goods and services which are available as a result of mutual cooperation. These goods and services are highly sought after by members of the society as they are integral for individual's chances in life (Rawls, 2003). Rawls refers to these goods as social primary goods and they form the subject of social justice (Rawls, 2003). These goods comprise people's basic rights and liberties, social positions of power and opportunities, economic prospects and social bases of selfrespect (Rawls, 2003). To Rawls, the basic question social justice seeks to answer is what mode of dividing the primary goods would rational people agree to under the conditions of the original position (Koller, 2013). To understand the original position we are to imagine ourselves in the position of free and equal persons who jointly agree upon and commit themselves to principles of social and political justice.

The main distinguishing feature of the original position is "the veil of ignorance". To ensure that judgement is impartial, the parties in the imagination are deprived of all knowledge of their personal characteristics and social and historical circumstances. They do know of certain fundamental interests they all have, plus general facts about psychology, economics, biology, and other social and natural sciences. The parties in the original position are presented with a list of the main conceptions of justice drawn from the tradition of social and political philosophy, and are assigned the task of choosing from among these alternatives the concept of justice that best advances their interests in establishing conditions that enable them to effectively pursue their final ends and fundamental interests (Freeman, 1996). The first step to Rawls' answer to this question involves a thought experiment (Rawls, 1982). Supposing social life had the total amount of all social primary goods constant, the parties in the original position will agree on a strictly equal distribution of the primary goods, so as to ensure that each individual gets the largest possible share (Rawls, 1982). This assumption can however not stand as it does not comply with social realities (Koller, 2013). This leads to the second step, which starts from the idea that the supply of primary goods is not constant but variable, and the extent of the supply is determined by how social cooperation is arranged. It might eventually lead to a situation where efficient social division of labour can only be possible if some level of inequality is allowed, for example, to create an incentive for higher performance (Rawls, 1987). This position results in a general conception of justice that states that all social values i.e. liberty and opportunity, income and wealth, and the social bases of self-respect, are to be distributed equally unless an unequal distribution of these values is to everyone's advantage (Rawls, 2003). However, even this step is incomplete to Rawls, as it does not take into account the unequal weight and importance of wants and needs. If left at this step, there is the possibility that basic

interests and liberties of people will be curbed or unequally distributed in the interest of social wellbeing, this should not occur as Rawls believes that rights and liberties have more weight than social and economic advantages (Rawls, 1987). This leads to the creation of the third step, which splits the general concept of justice into two principles, which relate to the different classes of social goods. The principles developed from this scenario are as followed;

- Each person is to have an equal right to the most extensive scheme of equal basic liberties, compatible with a similar scheme of liberties for others.

- Social and economic inequalities are to be arranged so that they are both reasonably expected to be to everyone's advantage and attached to positions and offices open to all (Rawls, 1987).

The first principle deals with the political system of a society, and it affects the distribution of rights and basic liberties (Koller, 2013). These rights include the democratic rights of participation, freedom of speech and assembly, liberty of conscience, freedom of thought, integrity of the person, the right to hold personal property and the right to a fair procedure (Rawls, 1987). These rights must always be equal for all members of society so that they are within the reach of all. The second principle on the other hand deals with the society's socio-economic system. It affects the distribution of social and economic primary goods, which includes the power invested competences and privileges connected with professional positions, income and possessions and the social bases of people's sense of self-respect (Rawls, 1987). These goods have to be equally divided too, unless the unequal distribution is to the benefit of everyone in the society (Rawls, 1987). In situations where the principles conflict, Rawls

introduces the priority where the first principle has absolute priority over the second rule (Rawls, 1987). Interpreting if the unequal distribution of social and economic goods is to everyone's advantage can either be in the sense of the principle of efficiency or through what he termed the difference principle (Rawls, 1987). The principle of efficiency states that a distribution is efficient if it is impossible to raise the position of one individual without making that of another worse (Rawls, 1987). This is called the Pareto efficiency. The difference principle states that social inequalities are only acceptable if they are needed to improve the plights of the least advantaged members of the society to the greatest possible extent (Rawls, 1987). Rawls defines the least advantaged as those who lack "primary goods" (Rawls, 2003). Primary goods include ''things needed and required by persons seen in the light of the political conception of persons, as citizens who are fully cooperating members of society, and not merely as human beings apart from any normative conception. These goods are things citizens need as free and equal persons living a complete life; they are not things it is simply rational to want or desire, or to prefer or even to crave'' (Rawls, 2003, p. 58). Such goods include:

- The basic rights and liberties: freedom of thought and liberty of conscience, and the rest;

- Freedom of movement and free choice of occupation against a background of diverse opportunities, which opportunities allow the pursuit of a variety of ends and give effect to decisions to revise and alter them;

- Powers and prerogatives of office and position of authority and responsibility;

- Income and wealth, understood as all-purpose means (having an exchange value) generally needed to achieve a wide range of ends whatever they may be;

- The social bases of self-respect, understood as those aspects of basic institutions normally essential if citizens are to have a lively sense of their worth as persons and to be able to advance their ends with self-confidence (Rawls, 2003, p. 58–59).

Rawls conception of social justice revolves around the idea of social contract, he believes that rational free people will agree to play by the rules if the conditions are fair (Rawls, 2003). He posits that the agreement of the people is necessary for the attainment of social justice (Rawls, 2003). He stresses the importance of human rights saying that a just world order is best seen as a society of peoples, with each person maintaining a well- ordered and decent political regime that fully respects basic human rights (Rawls, 2003).

## 2.4 DAVID MILLER: "PRINCIPLES OF SOCIAL JUSTICE"

Miller posits that social justice deals with the distributions of goods (advantages) and bad (disadvantages) in the society (Miller, 2003). To him, social justice deals with how these resources are allocated to people by social institutions (Miller, 2003). Some of the advantages in society identified by David Miller include money, property, jobs, education, medical care, child care, care for the elderly, honours and prizes, personal security, housing, transportation and opportunities for leisure. He identified military service, dangerous work, and other forms of hardship as the disadvantages to be distributed in the society (Miller, 2003). Miller's theories apply to both public goods and private commodities. The propriety of the distribution of the

advantages and disadvantages is what determines whether a thing is just or unjust. Miller posits that when a policy is tagged as socially unjust, people are claiming that a person or group of people enjoy fewer advantages than that person or group ought to enjoy or that they are bearing more of the burdens in the society than they ought to bear, especially when compared to other members of the society in question (Miller, 2003). For social justice to be attained, people must be viewed and treated as equals in the society. Miller argues that determining whether a policy is just or unjust should transcend selfish or personal interests. He posits that justice should be about assigning benefits whose values are established by their worth to the relevant population taken as a whole, he insists that it must be blind to personal interests (Miller, 2003). He argues that we should see justice as what people would agree to in advance of knowing their own stake in the decision to be reached (Miller, 2003). Both David Miller and John Rawls agree on some points including the fact that social justice efforts can not merely be motivated by self-interest (Robinson, 2010). Miller argues that social justice is a social virtue that encompasses both what you are owed and what you owe others (Miller, 2003). Miller's theory focuses on concepts of need, desert and equality. Miller defines the needs in his theory as intrinsic needs like food, clothing and shelter, and not merely instrumental needs. Claims can only be based on need if one is lacking in basic necessities or is either being or harmed or in danger of being harmed or if one's capacity to function is being impeded (Miller, 2003). Desert is a claim that one deserves rewards as a result of superior performance and not just talent; it is a claim that superior performance merits superior reward (Miller, 2003). Equality refers to the ideal that all members of a society be treated as equals and benefits of rights should be evenly distributed (Miller, 2003).

Miller argues that the modes of human relationship being considered is what determines whether need, desert or equality takes precedence. Modes of relationship refer to the different kinds of relationships that people have with each other (Miller, 2003).

Miller identifies three modes of human relationships which are solidaristic community, instrumental associations and citizenship. Solidaristic communities exist when people share a common identity as members of a stable group with a common ethos like family relations (Miller, 2003). This mode of relationship is related most closely with the principle of distribution according to need. Under this mode, every member of the community is expected to contribute to catering to the needs of others in proportion to their ability; the extent of liability however varies depending on how close the ties are in the community (Miller, 2003). Needs are understood in terms of the culture of the community, as each community has its different set of standards that have been accepted either implicitly or explicitly as the standard that an adequate human life must meet (Miller, 2003). It is based on these standards that needs are differentiated from mere wants within the community. Miller stresses the importance of differentiating needs from wants and preferences, needs are community specific rather than individual specific and they vary from pace to place (Miller, 2003). Instrumental associations on the other hand exist when people relate with each other for utilitarian purposes, as each has individual aims and purposes that can be best achieved by cooperating with others; an example of this are economic relations (Miller, 2003). This mode of human relationship is most closely linked with the principle of distribution according to desert (Miller, 2003). The members of the association each comes in as a free agent with a set of skills and talents which he applies to advance both his and the society's goals (Miller, 2003). To Miller, justice is achieved in this form of association when he receives rewards that are equivalent to the contribution he makes. Under this association, a

person's deserts are fixed by their aims and purposes, and these serve as the measuring rod in terms of which relative contributions can be judged (Miller, 2003). Miller stresses that desert is measured by actual performance and not just efforts or attributes; it assumes that superior performance not superior talents should attract superior reward (Miller, 2003). Finally, Miller posits that citizenship refers to members of a political society in modern liberal democracies who are related not just through their communities and their instrumental associations, but are also related as fellow citizens (Miller, 2003). Full citizenship according to Miller embodies a set of rights and obligations which are inalienable from the citizens (Miller, 2003). Under the citizenship mode of human relationships, the principle of distribution according to equality is most relevant, because everybody in the society is equal in terms of certain rights and obligations (Miller, 2003). Miller stresses the importance of human rights in his theory of social justice, as his key point under citizenship is that every citizen deserves equal rights, which includes rights to various concrete liberties such as freedom of movement and freedom of speech (Miller, 2003). Miller builds an extensive sphere of basic liberty into his theory of social justice (Miller, 2003).

## 2.5 APPLICATION OF THE THEORIES

To successfully apply these theories to the analysis of the stakeholder engagement techniques adopted by the NLHFRP and under the SDM, it is important to first identify the relevant sections of these theories. Both John Rawls' and David Millers' theories can be summarized into three major principles (Robinson, 2013). John Rawls' principles argue three major points:

- Every person should have equal liberties.

- Inequalities are acceptable if every person has the same opportunities for success.
- Inequalities are acceptable if they are arranged to the greatest benefit of the least advantaged members of the society (Rawls, 2003).

David Miller's theories can also be summarised as the following three points;

- Every person's basic needs should be met and not hindered.
- Every person should enjoy benefits and carry burdens to the degree he or she deserves them.
- Each person should be treated equally (Miller, 2003).

There are some areas of overlap in both theories, an example of this is that Rawls' principle of equal liberties is similar to Millers principle of equality, as they both posit that every citizen deserves the same basic liberties and no societal practices should interfere with these rights (Robinson, 2013). Another example of overlap in the two theories of social justice can be seen in the similarities between Rawls' equal opportunities principle and Miller's principle of desert, they both posit that arrangements in society should take care of the basic needs of all people in the society and no social practices should supersede these needs (Robinson, 2013). Rawls' equal opportunity principle is comparable to Miller's principle of desert as they both posit that every citizen should have the same opportunity to compete for rewards based on performance and societal practices should be set up to assure this outcome (Robinson, 2013). The overlaps in

these theories have been attributed to the fact that both principles are founded on like principles that were propounded by significant historical philosophers (Robinson, 2013).

Each of the principles also have their unique scope, an example of these can be seen in Rawls' principle of equal liberties, which applies to the establishment of constitutional essentials (Rawls, 2003). The equal liberties principle can be used to assess if citizens are afforded equal rights and opportunities according to the law (Robinson, 2013). This principle applies to the interpretation and application of the law by the main institutions of society, including the decision makers, the law, the police, the courts etc. (Robinson, 2013). In a similar vein, Miller also stresses that in matters of citizenship the principle of equality is most important, which is to say that all citizens should be treated equally in the eyes of the law and in its application by governmental agencies (Robinson, 2013). The principle of need which is posited to be most relevant for solidaristic communities like families is also relevant in the scope of this study. One of the reasons for relevance is that citizens view themselves as one large extended family where all the members are seen as being "in this together", this makes need very important in their relations with each other. Another reason for its relevance is that governmental policies on issues like hydraulic fracturing directly affect the livelihoods of many members of the society especially minorities and the poor since they less access to more options and this situation can interfere with their ability to satisfy their basic needs, this brings to the fore the importance of the needs principle. The importance of this principle has been brought to the fore with the agitation by citizens in Newfoundland to be included in the decision on whether or not to engage in hydraulic fracturing, because citizens are getting increasingly conscious of the consequences of governmental decisions on the environment.

The principle of desert is most relevant for instrumental associations such as work (Miller, 2003). The policies developed to govern hydraulic fracturing will both directly and indirectly affect the ability of many of the citizens to work and earn a living.

For the above reasons, the theories of John Rawls and David Miller are appropriate to use to assess the methods of stakeholder engagement adopted by the NLHFRP and those prescribed under the SDM. John Rawls' justice as fairness can be used to determine whether the techniques adopted are consistent with social justice. If the technique is found to interfere with the person's undeniable claims to basic liberties as is found in Rawls principle of equal liberties; or if the inequalities in the techniques are not attached to positions open to all under conditions of fair equality of opportunity as is proposed in Rawls' equal opportunities principle or if inequalities in society are not arranged to the greatest benefit of the least-advantaged members of the society as is recommended under the difference principle, then the technique can be said to be inconsistent with the theories of social justice as propounded by John Rawls. Similarly, David Miller's principles can be used to determine whether or not these techniques comport with the doctrines of social justice. If the technique interferes with peoples basic needs or if it hurts their capacity to function, if it interferes with claims based on desert or if it affects equal opportunity or treatment, then the technique can be said to be inconsistent with the doctrines of social justice as propounded by David Miller.

# CHAPTER 3: HYDRAULIC FRACTURING IN NEWFOUNDLAND AND LABRADOR

## 3.1 BACKGROUND OF HYDRAULIC FRACTURING: PROCESS AND CONTROVERSY

Unconventional gas well development is a resource extraction method that has been popularized by the oil and gas industry as a means of removing large volumes of hydrocarbons from highly dispersed reservoirs (Rahm, 2011; Smith & Ferguson, 2013). Extracting unconventional hydrocarbons was not considered economically viable until the early 2000s, when technological improvements and the rapidly rising cost of fossil fuels made the per unit energy cost of "fracked" hydrocarbons' market competitive (Boudet et al, 2014).

The practice known as hydraulic fracturing is a multistep exercise that is both technologically advanced and energy intensive. The process begins by vertical drilling down to the region of the earth's substrate containing hydrocarbons; this primary wellbore can extend anywhere from fifteen hundred to four thousand meters below the earth's surface; the vertical wellbore is used as a sort of stem to facilitate horizontal drilling (King, 2012; Rahm, 2011). Horizontal drilling occurs in the pay zone – hydrocarbon rich area – to increase each well's production by maximizing the sheer extent of substrate penetrated and thus mined (King, 2012; Pless, 2012). Each horizontal wellbore can extend hundreds of meters into the formation, which means a small drilling platform on the surface can effectively extract resources from an expansive underground region (Pless, 2012). After the wellbores are drilled, the vertical wellbore is reinforced with a series of steel casings and cement designed to protect aquifers and other valued ecosystem components (King, 2012).

The second step in the process involves fracturing the substrate to facilitate the extraction of shale gas. This is the only period wherein actual 'hydraulic fracturing' takes place (Pless, 2012; King 2012; Smith & Ferguson 2013). Fracturing is induced by hydraulic pressure, which builds up as millions of gallons of hydraulic fluid are pumped into the wellbore (Gregory, Vidic, & Dzombak, 2011). The built up pressure eventually exceeds the fracture pressure of the targeted rock formations, creating small cracks in the formation. These fractures extend as far as two hundred and fifty meters perpendicularly from the horizontal wellbore, though theoretically should not continue beyond the gas containing formation (Peduzzi & Harding, 2013).

Additionally, it is important to note that hydraulic pressure is not exerted on the rock formations surrounding the vertical wellbore as it is encased in steel and cement. Instead, the built up pressure is forced to escape through the rock exposed in the horizontal wellbores (Rahm, 2011). The network of fractures created by this process increases the permeability of the formation thereby increasing access to shale gas trapped throughout the shale. In many cases, fracturing is induced at intervals of one to two hundred meters throughout the horizontal wellbores (Peduzzi & Harding, 2014).

Hydraulic fracturing occurs for periods ranging from twenty minutes to four hours (King, 2012). Directly after pressure subsides, flow back of frack fluid begins (Boudet et al, 2014). Much of the fluid is lost in the rock formation, meaning five to eighty percent of the spent fluid returns to surface on average (Rahm, 2011). In addition to spent fluid, hydrocarbons unlocked by the fracturing procedure also travels along the horizontal wellbores and up the vertical wellbore to the surface (Gregory et al., 2011). This process occurs at a rapid

pace of several barrels a minute immediately following the flow back of fracking fluid, and continues at a gradually decreasing rate for several weeks until the well no longer produces (King, 2012). The hydraulic fracturing fluid used in this process is a compound mixture, which often includes two main components. The first is a solution containing water and chemicals. The chemicals included in the solution reduce friction, thicken the fluid, control microbes in the wellbore, prevent mineral scaling inside equipment, induce fracturing at lower pressures and prevent corrosion (King, 2012). The second component of the fluid is the proppant. Proppant are small incompressible sand or ceramic particles (King, 2012). These particles are integral to the hydraulic fracturing process because they flow into the fractures and prevent them from sealing after the pressure is released (Rahm, 2011). A high volume of fresh water is used in this process most of which cannot be reused, this is one of the main concerns of many parties against the process.

Development of unconventional natural gas reserves throughout North America has a great deal of controversy, pitting stakeholders against each other in a polarized stalemate. Opponents of unconventional gas extraction raise a variety of concerns regarding both human and environmental welfare (Boudet et al., 2014). Recent studies suggest that the process of unconventional well development can result in considerable greenhouse gas emissions, soil and water contamination, noise pollution, land clearance, and species depletion negative impacts of fracking Peduzzi, & Harding, 2014; Osborn, Vengosh, Warner, & Jackson, 2011; Lustgarten, & Kuznetz, 2011; Roach, 2013; Rosen, 2014). Proponents of unconventional well development firmly assert that the process is environmentally sound, and brings with it many economic and social benefits in the way of

employment, reduced energy costs, and secure domestic energy supplies (Smith & Ferguson, 2013; King, 2012; Pless, 2012; Warpinski, Wolhart & Wright, 2004). The confrontational nature of the debate has resulted in apparent victories for both sides throughout North America (Boudet et al, 2014). In some regions, development has gone forward unimpeded by activists, regulation, or public opinion in general, while in others, the anti-development movement has succeeded in preventing any development whatsoever through outright bans and moratoriums. 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.

## 3.2 GREEN POINT SHALE FORMATION: OVERVIEW, ECONOMIC POTENTIAL AND CONTROVERSY

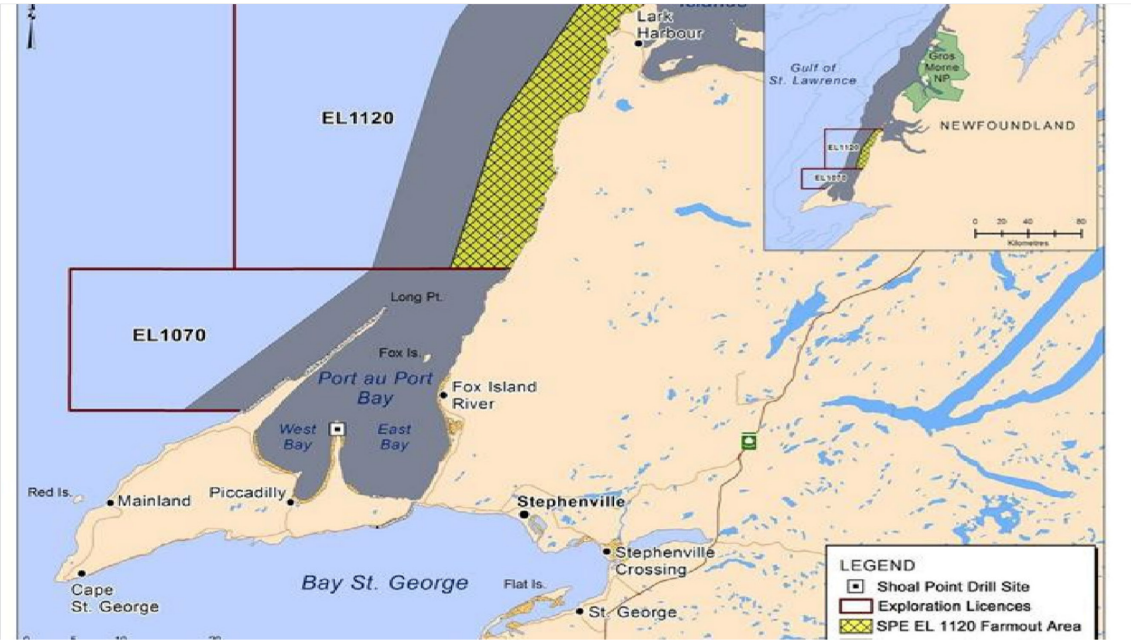


*Figure 1 Map of Green Point Shale Formation*

The Green Point Shale Formation, located in the Port au Port Bay area on the west coast of Newfoundland, has been coveted as North America's next big oil discovery (Huffington Post, 2013). The Green Point shale formation has been studied extensively; consultant reports give best estimates of approximately 23 billion barrels of oil (Shoal Point Energy, 2013). Of this total resource, 969 million barrels are considered prospective or technically and economically feasible to extract under current conditions (Shoal Point Energy, 2013). Shoal Point Energy is the biggest landowner in the Green Point formation, amassing more than 280,000 acres across three separate licensing blocks. Shoal Point Energy owns 100% of two blocks, and 80% of a third. Shoal Point Energy's activity to date has been concentrated along the south edge of the formation, which stretches north along the coast, a considerable distance from Gros Morne National Park (Huffington Post, 2013). Similar to other shale formations throughout North America, extracting oil and gas from the Green Point formation will require the use of hydraulic fracturing.

The Green Point shale formation has many attractive features from the prospective of oil and gas development. The formation can be developed entirely by land- based drilling. The location of the formation is along an accessible coastline, consisting of highways, deep year-round ports, and an abundance of space for infrastructure development (Shoal Point Energy, 2013). The Green Point Shale formation compares favorably to other significant oil-in-shale deposits globally. As already stated, proponents of this project cite the Eagle Ford Shale which is considered one of the most significant oil discoveries in the United States in the past 40 years (Shoal Point Energy, 2013). Since the development of the Eagle Ford Shale

first began in 2008, the formation has become one of the most active drilling sites in the world (IER, 2012). As of April 2012, the formation produced 2 billion cubic feet of natural gas, as well as 500,000 barrels of oil daily (IER, 2012). The Institute for Energy (2012) describes the economic impacts of the Eagle Ford formation as extraordinary: creating over $25 billion dollars in economic development, and supporting over 47,000 local full-time jobs. In 2011, the Eagle Ford formation produced $257 million in local government revenues, as well as $388 million in state government revenues (IER, 2012). Projections for 2021 estimate the creation of over 116,000 full-time jobs, and $62.3 billion in economic development (IER, 2012). Proponents state that the Green Point shale formation may produce similar and significant economic impacts for Western Newfoundland (Cooper et al, 2001).

The prospect of drilling in Green Point shale near the picturesque Gros Morne National Park has raised serious alarms about groundwater pollution and other negative environmental risks of hydraulic fracturing. The Newfoundland and Labrador Fracking Awareness Network (NL-FAN) has originated as a response to the potential development of the Green Point formation. NL-FAN is a network of organizations and individuals who have concerns about the potential risks of hydraulic fracturing used in oil and gas exploration and development in Newfoundland (NL-FAN, n.d.). The organization currently consists of 17 member organizations and hundreds of individuals: notable examples include homeowners associations, tourism promoters, environmental NGOs, and major civil society organizations (NL-FAN, n.d.). Members include community activists, provincial politicians, and business owners (NL-FAN, n.d.). Of particular concern is the threat of Gros Morne National Park losing its World Heritage Site designation received in 1987, as a result of oil and gas development

near the park. The United Nations Educational, Scientific, and Cultural Organization (UNESCO) could reconsider Gros Morne's world heritage status if decision-makers do not take steps to protect the park's natural beauty and unique geology (CBC News, 2013). UNESCO has recently recommended that Canada setup buffer zones around the park to prevent fracking activities from coming too close and causing harm (CBC News, 2014). Canada's tourism industry may be damaged by changes to Gros Morne's world heritage status; fracking near the park could disrupt scientifically- important natural rock formations, and could have serious environmental impacts above ground (CBC News, 2014).

## 3.3 NLHFRP: BACKGROUND AND OVERVIEW

Due to public concern, despite the moratorium already placed on hydraulic fracturing, the government of Newfoundland has seen that it is important to evaluate whether hydraulic fracturing is an appropriate activity for oil and gas development in Western Newfoundland and whether it should be banned or approved with appropriate risk management and use of best industry practices (NLHRP, 2016). Incidental to this, an independent Panel was appointed by the Minister of Natural Resources, Government of Newfoundland and Labrador, in October 2014 to conduct a public review of the socio- economic and environmental implications of hydraulic fracturing in Western Newfoundland. The Minister of Natural Resources was responsible for appointing members to the Panel, including the chairperson. The Panel is comprised of five members who are academics and scientists chosen from outside the public service who have knowledge or experience relevant to hydraulic fracturing operations and/or the potential impacts. The members of the panel are as follows:

Dr. Ray Gosine is the chair of the panel. Dr. Ray Gosine has an undergraduate degree in electrical engineering from Memorial University and a Doctoral degree in robotics from Cambridge University England. He has held teaching and research positions at Cambridge University, University of British Columbia and Memorial University. Dr. Gosine is a professor and J.I. Clark Chair in the Faculty of Engineering and Applied Science at Memorial, and through his administrative responsibilities as associate vice-president (research) at Memorial he is working closely with other academic leaders on the implementation of the Research Strategy Framework and other strategic research priorities for Memorial. His research is in the areas of telerobotics, machine vision and pattern recognition for applications in the resource industries (i.e. mining, oil and gas, aquaculture and fisheries, and forestry). From August 2002 until September 2003, Dr. Gosine was the interim associate dean (Graduate Studies and Research) in the Faculty of

Engineering and Applied Science at Memorial and became dean of engineering in October 2003, serving in this capacity until March 2008. In March 2008, he was appointed acting associate vice-president (research) and he was appointed associate vice-president (research) in May 2011. He served as vice-president (research) pro tempore, from October 2008 to August 2010 and from September 2014-March 2015. Dr. Gosine serves on the Board of Directors for the provincial

Health Research Ethics Authority and was formerly the Chair of the Board of Directors of the Professional Engineers and Geoscientists of Newfoundland and Labrador. He is a Fellow of the Canadian Academy of Engineering and a Fellow of Engineers Canada in recognition of his contributions to the field of engineering and to the engineering profession.

- Dr. Graham Gagnon is another member of the panel. Dr. Graham Gagnon is a professor in the Department of Civil and Resource Engineering at Dalhousie University. Dr. Gagnon is also the NSERC (Natural Sciences and Engineering Research Council of Canada) Industrial Research Chair in water quality and treatment and the director of the Centre for Water Resources Studies. Dr. Gagnon's professional and research interests focus on the management of water quality and treatment for natural and engineered systems. He has taught courses

on water quality, water treatment plant design and solid waste management. Throughout his career, he has worked on applied water research projects for communities in Atlantic Canada and abroad. In recognition of his technical and leadership skills, Dr. Gagnon has provided technical advice to several government agencies on matters concerning water quality and water management. He has contributed to an assessment of drinking water policy in Alberta, a review of water concerns associated with onshore oil and gas in Nova Scotia and a long- term project regarding wastewater management in Nunavut. In 2014, Dr. Gagnon was awarded the George Fuller award from the American Water Works Association in recognition of his engineering leadership and contributions to water quality.

- Dr. Maurice Dusseault carries out research in coupled problems in geomechanics including thermal and non-thermal oil production, wellbore integrity, deep disposal technologies for solid and liquid wastes, hydraulic fracture mechanics, CO2 sequestration in saline aquifers, shale gas and shale oil mechanics, and compressed air energy storage in salt caverns. He holds 10 patents and has co- authored two textbooks with John Franklin (former International Society for Rock Mechanics (ISRM) President, deceased in 2012) as well as 520 full text conference and journal articles. Dr. Dusseault works with governments and industry as an advisor and professional instructor in petroleum geomechanics. He was a Society of

Petroleum Engineers (SPE) Distinguished Lecturer in 2002-2003, visiting 19 countries and 28 separate SPE sections, speaking on New Oil Production Technologies. He has taught a number of professional short

courses in subjects such as production approaches, petroleum geomechanics, waste disposal, and sand control, presented in over 20 different countries in the last 12 years. Current projects are focused in these areas: Hydraulic fracturing of naturally fractured rock masses in differential stress states, Work, energy and stress-strain responses of deep stressed rock masses (reservoirs, mines), Rock-cement-casing interaction and gas seepage along oil and gas wells, thermo-hydro-mechanical (THM) coupling in naturally fractured rock masses, Monitoring deformation in rock masses using surface and subsurface methods, Storage of energy from stochastic renewable sources as compressed air in dissolved salt caverns.

- Dr. Leonard Wade Locke is a full professor of economics at Memorial University of Newfoundland and is currently the academic head for the Department of Economics, Memorial University. He specializes in the Newfoundland and Labrador economy, resource economics, public finance, public policy, innovation indicators, productivity, economic impact assessment and cost-benefit analysis.

He has published extensively in a variety of public policy fields. In addition, Dr. Locke has provided his professional services to all three levels of government, to foreign governments and to national, local, regional and international businesses. He has served as an expert commentator and analyst to the local, national and international media. His research has had a major impact on public policy, particularly on the public finance of the Province of Newfoundland and Labrador and the development of its oil and gas resources. He returned to the Newfoundland

and Labrador in 1984 and accepted an appointment in economics at Memorial. Dr. Locke is a past president of the Atlantic Canada Economics Association. In 2007, he was appointed as an honorary lifetime member of the Atlantic Canada Economics Association. In 2008, Dr. Locke was awarded Memorial University of Newfoundland's President's Award for Exemplary

Community Service. He was appointed to the Board of Governors, Law Foundation of Newfoundland and Labrador (2011-2015). For the 2013 budget cycle, he served as senior policy advisor to the Minister of Finance, Government of Newfoundland and Labrador. In 2012-13, Dr. Locke was appointed to the Council of Canadian Academies' Expert Panel on Canadian Industry's Competitiveness in Terms of Energy Use. Dr. Locke's formal training consists of a doctoral degree in economics, a graduate degree in economics from McMaster University and undergraduate degrees in economics and science (biology) from Memorial University. He also has a certificate in applied petroleum economics from Van Meurs Associates through the Centre for Management Development (Memorial). Dr. Locke was awarded the Queen Elizabeth Diamond Jubilee Medal in 2012. He was also a gold medal winner in economics at Memorial University and won Social Sciences and Humanities Research Council (SSHRC) doctoral fellowship and several university scholarships at McMaster University.

• Dr. Kevin Keough received his doctoral degree from the University of Toronto in 1971. He is past president and chief executive officer of the Alberta Heritage Foundation for Medical Research and currently operates Kevin Keough Consulting Inc. Prior to his role with Alberta Heritage Foundation for Medical Research he was chief scientist at Health Canada. Past roles have included vice- president (research and international relations), and head of biochemistry at Memorial University of Newfoundland where he was a professor of

biochemistry in its Biochemistry and Pediatrics departments. Dr. Keough maintained an active research laboratory for over 32 years. He is currently an adjunct professor of Biochemistry at Memorial University. His research interests include molecular organization and function in lung surfactant and membranes, and liposomes as carriers for vaccines and drugs. Dr. Keough is a Fellow of the Canadian Academy of Health Science, and was member of its inaugural council, and he was a member of its predecessor organization, the Canadian Institute of Academic Medicine. Dr. Keough was a member and deputy chair of the Council of Science and Technology Advisors, an external national expert advisory council that provided guidance on federal science and technology issues to the cabinet of Government of Canada. As a former executive member of the Medical Research Council, he was instrumental in the creation of Canadian Institutes of Health Research, and was a member of its first governing council. He was a member of an independent panel of experts advising the President of the Treasury Board of the Government of Canada on the transfer of federal laboratories to the academic and private sector. Dr. Keough was a founding member of the board of directors of Genome Canada, and has also been a board member of Genome Atlantic and Genome Alberta. He was the Canadian co-chair of the Canadian-European Union of Science and Technology Agreement. He was also a member of the boards of directors of the Genesis Group Inc., the Canadian Centre for Fisheries Innovation, the Canadian Centre for Marine Communications, the Centre for Cold Ocean Resources Engineering, Operation ONLINE, and the Newfoundland and Labrador Science Centre. He was a member of the University Advisory Group of Industry

Canada. Dr. Keough is a past-president of the Canadian Federation of Biological Societies, the Canadian Society of Biochemistry and Molecular and Cellular Biology and the Canadian

Association of University Research Administrators. He is also the founder of NovaLipids Incorporated.

The mandate of the Panel is to make recommendations on whether or not hydraulic fracturing should be undertaken in Newfoundland. The Terms of Reference for the Panel were issued by the Minister of Natural Resources, in consultation with the Department of Environment and Conservation and the Canada Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB), along with research completed during the Provincial Government's internal review (NLHFRP, 2016). An external organization called MQO Research was contracted to undertake a province wide survey which resulted in over 800 Newfoundland & Labrador residents participating in a detailed survey regarding Hydraulic Fracturing. A website (www.nlhfrp.ca) was created by the Panel to provide a mechanism for members of the public and other stakeholder groups to make submissions to the Panel, or to request to meet with or make a presentation to the Panel and to review Documents under

Consideration by the Panel and also to create an avenue to publish the Panel's final report after its completion (NLHFRP, 2016). In the interest of ensuring that the public has access to all information at its disposal, the website also contains information to the general public on times and locations of meetings and workshops, and to documents that were applied in the Panel's report. The mandate of the Panel is to conduct a public review and advise the Minister of Natural Resources on the socio-economic and environmental implications of the hydraulic fracturing process with respect to the possible exploration and development of the petroleum resources of Western Newfoundland. This is particularly important in November 2013, the Minister of Natural Resources announced that no applications for onshore and onshore-to-offshore petroleum exploration using hydraulic fracturing would be accepted until

government has undertaken a balanced review of regulations, rules and guidelines in other jurisdictions; completed the technical work necessary to fully assess the geological impact in Western Newfoundland; and following this process, undertake public consultations to ensure that residents can comment and are fully informed before any decisions relating to hydraulic fracturing are made. The work of the Panel involves the gathering of relevant information using the following methods:

- Public consultations in Western Newfoundland, including community meetings;
- Internet/web-based consultations and written submissions;
- Stakeholder consultations, including meetings and written submissions;
- A review of regulatory processes related to hydraulic fracturing in other jurisdictions;
- An identification of environmental risks to water, land and communities respecting hydraulic fracturing operations;
- An identification of current best industry practices and procedures respecting hydraulic fracturing operations; and,
- A review of current regulatory process in Newfoundland and Labrador respecting hydraulic fracturing operations and identifying needed changes consistent with other jurisdictions and best practices.

During the review, the panel will also be mindful of existing provisions within the Environmental Protection Act that state that the purpose of environmental assessment is to

"protect the environment and quality of life of the people of the province; and facilitate the wise management of the natural resources of the province (NLHFRP, 2016). It requires anyone who plans a project that could have a significant effect on the natural, social or economic environment to present the project for examination, including dissemination of project information for public comment (NLHFRP, 2016).

This review is focused on the potential impacts of hydraulic fracturing in oil and gas operations in Western Newfoundland only and is not a review of the onshore oil and gas sector. The Panel sought submissions from members of the general public and stakeholder groups on only the 14 topics under its consideration, these topics are listed below. As such, the Panel's focus is strictly on gathering public input on the following topic areas regarding hydraulic fracturing in oil and gas operations in Western Newfoundland and provide specific responses in the areas stated below:

- Protecting and Monitoring Water Quality- The risk of water contamination, particularly groundwater, is one of the biggest concerns raised by the public with respect to hydraulic fracturing. Two key areas to address are the potential effects of hydraulic fracturing on groundwater and on surface water. The Panel will assess the short and long-term risks to groundwater and water wells. This may include such activities as water acquisition, additives mixing, well injection, flow back/produced water and wastewater management. The Panel will also assess the use of surface water for hydraulic fracturing operations. This assessment will include an assessment of the quantity of water required for exploration and operations, and the effect on water sources in the areas where exploration and development activities could take

place. The Panel will also assess the sourcing of fresh water alternatives and recycling of water for use in hydraulic fracturing operations. The Panel should also assess the potential impact of surface water use on other users.

- Protecting Communities and the Environment- While there is no recommendation at this time to allow hydraulic fracturing operations to occur in the province, it is useful to review, and, where appropriate, recommend improvements to existing environmental and technical standards to ensure our communities and the environment are protected. The Panel will assess the challenges that hydraulic fracturing activities may represent for social and physical environments. This should include assessing opportunities for minimizing/mitigating surface infrastructure development and associated impacts such as footprint, linear disturbances, vehicular traffic, dust, emissions, odours, noise and environmental impacts such as pollution, waste management and geological risks.

Impacts on Land- The panel will assess the potential impacts on land as a result of hydraulic fracturing operations. This should include an assessment of potential risk for soil contamination from site development and from the storage and handling of additives, wastes and petroleum products. The panel will also review impacts to land from site development and transportation of chemicals to and from the site.

- Waste Management- The Panel will assess the potential risks to the environment of current and available waste management technologies for treating fluids used in hydraulic fracturing and the associated outcomes. This assessment will include, but is not limited to, issues such as storage areas, deep well injection, and solid wastes.

- Seismicity and Geological Risks- The Panel will assess the potential geological risk associated with hydraulic fracturing operations, including induced seismicity. This may include wellbore placement and drilling design, procedures to monitor for induced seismicity and procedures to mitigate and respond to induced seismicity.

- Regulatory Oversight and Responsibility- The Panel will assess the regulatory oversight requirements for hydraulic fracturing operations. This would include regulations regarding how wells are drilled, completed, stimulated, produced, suspended and abandoned in a manner that assures wellbore integrity, considers the risks imposed by the unique reservoir characteristics of the play and the technologies being used (such as inter-wellbore communication). This review will also include the application and approval process, filing requirements and design of hydraulic fracturing operations, including the chemicals used.

- Wellbore Integrity- The Panel will assess the requisite regulatory requirements and best practices to ensure wells are drilled, completed, stimulated, produced, suspended and abandoned in a manner that assures wellbore integrity, considering the risks imposed by the unique reservoir characteristics of the play and the technologies being employed, such as inter-wellbore communications.

- Site Restoration- The Panel will assess final site restoration requirements for hydraulic fracturing operations. This may include well decommissioning, removal of infrastructure, soil assessment, soil remediation, long-term monitoring and holding tank decommissioning. Under the Site Restoration topic area the Panel will consider restoration beyond the immediate well site. This will include access roads (e.g. potential erosion in the

future), local treatment facilities, pipelines, pipeline terminals and tank farms for transshipment, and other associated surface infrastructure and facilities. It is recognized that some of the infrastructure (e.g. roads) may have residual value to the local communities.

- Management of Additives- The Panel will assess the potential risks of additives used in hydraulic fracturing fluids, including the use of additives, potential environmental impacts, and the storage and handling of these additives.

- Financial Security and Insurance- Various financial securities and insurances are required throughout the different phases of resource development. The Panel will assess the financial security requirements for hydraulic fracturing operations to ensure that they address the potential risks associated with hydraulic fracturing activities.

- Air Emissions- The Panel will assess the potential risks to air quality from hydraulic fracturing operations. This may include setting emissions limits, monitoring emissions from hydraulic fracturing operations and planning for emission reductions.

- Public Safety and Emergency Planning- The Panel will assess potential risks to public safety from hydraulic fracturing operations and associated emergency response planning needs.

- Community Engagement- The Panel will assess how to inform and involve the local communities and other stakeholders throughout the full life cycle of a project, from early exploration through to abandonment, to determine which issues are of particular concern and how they might be addressed.

Socio-Economic Impacts- Technology such as hydraulic fracturing has made it possible for many communities to benefit from economic gains due to the production of oil and gas, including employment opportunities, supply and service contracts and local infrastructure development. In addition to recognizing the economic benefits for local communities, care must be taken to minimize disruption during operations and consider social and environmental responsibilities to individuals and communities.

- Definition of Hydraulic Fracturing: For the purpose of the work of the Panel, the term "hydraulic fracturing" is an all-inclusive term that includes exploration (e.g. seismic, magnetic, drilling of exploratory wells), infrastructure development (e.g. access roads, drill pads), transportation and storage (pipelines and tankage at ports), drilling and well development, well completion and stimulation using hydraulic fracturing technology, production and re-stimulation, and well decommissioning and site restoration.

- Public Health: The Terms of Reference are clear in mandating the Panel to consider how "our communities and environment are protected". For further clarity, the Panel has added the topic of Public Health to its scope of consideration. The Panel will assess the potential impacts on public health from hydraulic fracturing operations. This may include identifying likely effects of hydraulic fracturing on the health of individuals and communities. The Panel will identify ways in which public health risks might be mitigated.

The Panel also compiled a list of potential questions that they believe are pertinent to the various stakeholders in the hydraulic fracturing issue (NLHFRP, 2016). The questions are as follows:

- What are the sources of water and volumes required for hydraulic fracturing activities?

- What are the potential risks to surface water sources and other users of these water sources?

- Are there adequate sources of water in Western Newfoundland regions where hydraulic fracturing activities may take place?

- What actions/regulations/best practices can be applied to hydraulic fracturing activities to reduce risks to surface water?

- What are the activities associated with hydraulic fracturing that can impact soil and land?
- What are the potential risks to soil and land from these activities?
- What actions/regulations/best practices can be applied to reduce the impact of hydraulic fracturing on soil and land?

- What types of fluids are used in modern hydraulic fracturing operations?
- What are the potential risks from using these types of fluids?
- How are these fluids treated after use and where can they be stored?
- What actions/regulations/best practices can be applied to manage fluids used in hydraulic fracturing operations?

- What types of fluid additives are used in modern hydraulic fracturing operations?
- What are the potential risks from using these types of fluid additives?
- How are these fluid additives treated after use and where can they be stored?
- What actions/regulations/best practices can be applied to manage fluid additives used in hydraulic fracturing operations?

- What are the current regulatory requirements for well drilling and completion in Western Newfoundland?

- Are these regulations consistent with those in other Canadian jurisdictions?

- Is the geology of Western Newfoundland distinct from other areas where

hydraulic fracturing operations are currently taking place to require different well drilling and completion rules?

- What actions, regulations and/or best practices can be applied to ensure wellbore integrity?
- Do hydraulic fracturing activities cause measurable seismic events that can impact communities?
- Is the geology of Western Newfoundland distinct from other areas with respect to the impact of hydraulic fracturing on seismicity?
- What actions/regulations/best practices can be applied to hydraulic fracturing activities to minimize seismicity and geological risks?
- What are the regulatory oversight mechanisms in other Canadian jurisdictions where hydraulic fracturing operations occur?
- How does the current framework in Newfoundland and Labrador compare?

- What are the best practices to ensure appropriate oversight for hydraulic fracturing operations?
- Should there be ongoing environmental monitoring during and after hydraulic fracturing operations?
- What actions/regulations/best practices will ensure appropriate regulatory oversight and responsibility?

- What are the risks to soil and water from completed hydraulic fracturing sites?

- What are the best practices to ensure that companies properly close their sites upon abandonment?

- What actions/regulations/best practices can be applied to hydraulic fracturing activities to ensure sites are properly restored?

- What type of activities and risks should be covered under financial security and insurance?

- What are the long-term risks and how should they be mitigated or monitored?

- What are the long terms costs of environmental risks associated with hydraulic fracturing operations?

- What actions/regulations/best practices can be applied to hydraulic fracturing activities to ensure companies post the appropriate financial security and insurance?

- What are the potential risks to air quality resulting from hydraulic fracturing operations?

- What limits on air emissions from hydraulic fracturing operations are imposed by other Canadian jurisdictions?

- What actions, regulations and/or best practices can be applied to hydraulic fracturing activities to reduce air emissions?

- What are the public safety risks to communities from hydraulic fracturing operations?
- Is the emergency response infrastructure in Western Newfoundland sufficient to address the public safety risk from hydraulic fracturing operations?
- What actions, regulations and/or best practices can be applied to hydraulic fracturing activities to ensure public safety?
- What best practices can be applied to ensure appropriate community engagement should hydraulic fracturing occur?

- What is the potential socio-economic impact from unconventional petroleum development involving hydraulic fracturing operations in Western Newfoundland?
- What are the possible short-term and long-term risks to groundwater and water wells resulting from hydraulic fracturing activities?
- What actions/regulations/best practices can be applied to hydraulic fracturing activities to reduce potential risks?
- What are the risks to public health that might occur through hydraulic fracturing and well operations such as release of toxic substances into ground and surface water or effects on air quality from airborne substances released during the activities?
- What are the risks to public health that might result from the short-term phase of development and fracturing such as fluid spills, air contamination, vehicular traffic, injuries, noise, infectious disease and other factors that might occur during the development phase of this industry?

- What benefits might accrue to the health of individuals and communities through increases in incomes and in wealth generated as a result of fracturing and subsequent well operations?

- What actions/regulations/best practices can be applied to hydraulic fracturing activities to understand and/or mitigate against risks to public health?

- Wellbore Integrity: Under the Wellbore Integrity topic area the Panel will also consider the question "How will energy wells be permanently decommissioned so as to reduce the probability of slow gas migration developing in the future?"

The public will have an opportunity to provide written comments related to the topic areas covered by the scope as well as attend public review sessions. The Panel will go through the following processes so as to gather the opinions of the stakeholders:

- Release the Terms of Reference and other related research documents completed.

- Have the Panel provide an email address and standard mail address for general public responses and submissions. The Panel will also provide a feedback form. All the submissions received by the panel are available for viewing on the website, at http://nlhfrp.ca/wp-content/uploads/2016/06/NLHFRP-Master-List- May-16-v5.pdf.

- Have the Panel issue a news release that outlines the review process and announces a series of public review sessions held in Western Newfoundland. The Panel may request public

comment on the scope and topic areas to determine whether additional information should be provided before convening the public sessions.

- Following the news release, the Panel will provide 90 day notice of the detailed schedule of the public review sessions.

- After the review, recommendations will be submitted to the Provincial Government via the Panel's report.

Prior to participating in various Public Consultation Sessions, the Panel actively solicited input and information from a variety of sources to assist the Panel in delivering on its mandate. Some of the activities carried out to before the Public Consultation sessions are as followed:

- Received in excess of 600 submissions from the public which have been posted to the web site. Contracted MQO Research, an external organization to undertake a province wide survey which resulted in over 800 Newfoundland & Labrador residents participating in a detailed survey regarding Hydraulic Fracturing. Results of the survey have been posted on the web site (http://nlhfrp.ca/wp- content/uploads/2015/01/MQO-Fracking-Report.pdf).

- Worked with key stakeholders in Western Newfoundland to determine the most appropriate locations and timing for the Public Consultation Sessions. The Panel will be holding these sessions with groups and individuals who have made submissions to the Panel and who have requested to present the key points of their written submission orally to the Panel. Members of the public are invited to attend these sessions. Priority for presenting at a public consultation session will be given to individuals/groups that have made written submission to

the Panel and who requested to present orally to the Panel. Others will be accommodated on a first come, first-served basis as time permits.

The sessions were held at several locations across the province with presenters, all of whom were contacted by the Panel before the sessions, to ensure that the Review Panel had their most recent and updated written submission. Each presenter was given up to 10 minutes to highlight the key and salient points in their submissions and the Panel took up to 10 minutes to ask clarifying questions. Depending on time constraints in each session, members of the public who attended these sessions and who wished to present to the Panel (walk-in presenters) were given up to 5 minutes for their presentation and the panel took up to 5 minutes to ask clarifying questions. These walk-in presentations took place following the confirmed presentation and were in the order of registration. Individuals who wished to do walk-in presentations were asked to come to the session at 3:30pm on the day of the session to register their interest. The Public Consultations were held in four different cities in the province. On October 13th, 2015 the consultation was held in Rocky Harbour at the Fisherman's Landing Inn, on October 14th, 2015 the session was held in Stephenville at the Day's Inn, on October 15th, 2015 the session was held in Port au Port East at the Maria Regina Parish, the final session was held on October 16th, 2015 in Corner Brook at the Glynmill Inn. In addition to the Public Consultation Sessions, a number of Groups and Individuals requested to meet the Panel in face-to-face to meetings. Using the information gathered from the processes noted above, the Panel shall prepare a report[1] at the end of the review which will include a description of the Panel review

[1] The report has already been completed and published on the website at http://nlhfrp.ca/final-report/. However, this thesis was already completed before the report was released, therefore the findings from the report could not been included in the thesis. .

process, the rationale, conclusions and recommendations of the Panel. The report will also provide a summary and analysis of comments from the public, stakeholders and communities. Formal submissions to the Panel will be made available for public review. The Panel shall also provide conclusions on the environmental and socio-economic significance of hydraulic fracturing in oil and gas operations (exploration and production) in Western Newfoundland. In addition, the Panel report may provide recommendations relating to the appropriate practices and procedures regarding potential hydraulic fracturing operations in the province should the Panel recommend proceeding with hydraulic fracturing. Once completed, the Panel report will be submitted to the Minister of Natural Resources and will be made available to the public.

## 3.4 CRITIQUE OF NLHFRP ENGAGEMENT METHODS

The NLHFRP has faced criticism particularly from opponents of hydraulic fracturing. The Telegram published an article on the 25th of May, 2015 titled " Too little, not too late, say N.L. fracking opponents". This article chronicles the misgivings groups of NL fracking opponents have for the NLHFRP, laid out at a joint press conference titled the Public Forum on the Gulf of St. Lawrence, Oil and Fracking. The conference was a public forum sponsored by the Social Justice Cooperative of NL and the NL chapter of Save Our Seas and Shores. The conference was comprised of representatives of 12 environmental and social justice groups: Citizens against CETA, Coalition for Alternatives to Pesticides and Toxic Substances, Divest MUN, East Coast Fracking Awareness Group, NL Fracking Awareness Network, Port au Port Bay Fishery Committee, Port au Port/Bay St. George Fracking Awareness Group, Research Exchange Group at MUN, Sandy Pond Alliance, Save Our Seas and Shores Coalition, Sierra Club Atlantic, Social Justice Co-op NL, Council of Canadians, St. John's chapter, Whaleback Nordic for a Clean

and Health Environment (The telegram, 2015). The groups called for the disbanding of the NLHFRP, barring this they suggested that some changes be made to the Panel (The Telegram, 2015). They suggested that the Panel's work needs to be expanded to include public consultations throughout the province and not just in two stops as was initially suggested before the stops were included to four stops. They believed that the two venues will not be enough to present an accurate representation of Newfoundlanders' views on Hydraulic Fracturing. The NLHFRP was also compared unfavourably with the process employed in the making of the Wheeler Report in Nova Scotia. According to the group, the Wheeler Report was compiled by an eleven member panel with a broad set of expertise and experience including an aboriginal representative (The Telegram, 2015).

The panel that compiled the Wheeler report also had province-wide consultation, which they believed helped them get a more accurate opinion of people affected by Hydraulic Fracturing within the province (Telegram, 2015). Also fears about long-term environmental effects of fracking and uncertainties not covered under the mandate of the NLHRP were raised in the press conference, and they suggested that more baseline environmental and health information be provided before fracking can be considered (The Telegram, 2015).

An article published in Rabble.ca on the 2nd of March, 2015, further expanded on the criticisms raised at the conference (Fusco, 2015). The article focused mainly on the criticisms on the lack of diversity of the panel. According to the article, the fact that the Panel is comprised entirely of white males with a narrow scope of expertise is a huge cause of criticism (Fusco, 2015). The members of the Panel mostly bring knowledge from the areas of engineering, economics and biochemistry, which does not cover the wide-range of issues

like medicine, the environment and socio-economic impacts that surround the issue of fracking in the region (Fusco 2015). As a result of this, many critics like Graham Oliver of the Port au Port-Bay St. George Fracking Awareness Group, believe that the review panel will not adequately address the issues of concern to the members of the communities and as such will be unable to make a valid recommendation on fracking (Fusco, 2015). Minority groups like women, indigenous people and people living in the affected areas are particularly concerned that the white male academic members of the Panel will be unable to effectively understand or represent their needs, views and opinions (Fusco, 2015). Paula Graham a board member of the Social Justice Co-op went as far as to posit that the Panel does not represent the province or the people of Newfoundland (Fusco, 2015). The narrowing of the scope of the review panel to only the potential topics and issues identified on the website limits the stakeholders' ability to share their opinions and concerns, particularly when they fall outside these potential questions.

# CHAPTER 4: STRUCTURED DECISION MAKING (SDM)

## 4.1 INTRODUCTION TO SDM

Decision making can be a very difficult process as it is filled with stakeholders representing various groups, opinions, and societal sectors whose opinions and interests should be factored into the decision making process. The situation becomes increasingly complicated when said views and opinions are polarized and fraught with controversy as they appear in the issue of hydraulic fracturing in the Green Point Shale Formation. In order to define potential decisions, a method has to be devised to incorporate these diverse views and create alternatives. Structured Decision Making is an organized process for engaging multiple parties in a productive decision-oriented dialogue that considers both facts and values (Failings et al., 2007). It relies on the principles and tools of decision analysis, the core elements of which include defining objectives and measures of performance, identifying and evaluating alternatives, and making choices based on a clear understanding of uncertainties and trade-offs (a). The primary goals of the Structured Decision Making process include:

- Successfully eliminating extreme positions on issues.
- Encouraging parties to make compromises and trade-offs.
- Developing a suite of decisions which consider and respond to all stakeholders in the most efficient way possible.
- Create an avenue for even the weakest and most disadvantaged stakeholders that can have their interests represented in the decision making process.

These goals are the very essence of the Structured Decision Making process.

According to Gregory et al. (2012), SDM can be defined as, "the collaborative and facilitative application of multiple objective decision making and group deliberation methods to environmental management and public policy problems". Further, they posit that it employs an array of analytical methods including: decision analysis, applied ecology, human judgment studies, cognitive psychology, group dynamics studies, and negotiation theory (Gregory et al., 2012).

Structured Decision Making aids in the creation of a framework and network of decision making processes that can be applied to diverse situations. It is an excellent option in complex situations such as solving wicked problems, it makes allowances for uncertainties and also creates a series of alternatives within which stakeholders can negotiate and trade-off toward a common ground, while ensuring a substantial portion of their interests have been adequately represented. Participants begin by structuring the problem in terms of a small set of relevant issues and interests (Keeney, 1992). These are defined in terms of explicit objectives or endpoints of concern, and performance measures are identified for each. Performance measures (also termed performance criteria, indicators or attributes) are the specific metrics used to track the extent to which objectives are satisfied by the alternatives (Failings et al., 2007). Based on the objectives, participants then identify alternatives, or potential management actions (Gregory and Keeney, 1994). Each alternative is evaluated based on predictions of how it will affect the performance measures. Predicting these consequences involves the development of hypotheses about the response of key variables to the management action. Competing hypotheses may originate from different knowledge sources, or within a given knowledge source. Uncertainty surrounding the

hypotheses may result in the use of expert judgment, modeling and data collection, or further studies prior to the decision to aid the evaluation process (Failings et al, 2007). The best preferred alternative will then be selected after a series of trade-offs. The trade-off should include sessions where stakeholders are allowed to state their preferences based on good fact based or technical information about the range of potential consequences (Failings et al., 2007). These preferences should transcend purely personal concerns; rather they should be guided by societal concerns such as distribution of economic returns, long term environmental effects, and cultural implications and most importantly to this study, social justice (Failings et al., 2007). Under SDM, the stakeholders are engaged by a facilitator that ensures though stakeholders make recommendations based on their own perspectives, they are in the public interest and they reflect and take into account information learned in the deliberative process from the other stakeholders and experts (Failings et al., 2007).

Gregory et al. (2012) further asserts that SDM is especially suited for solving environmental issues as it helps in understanding complex problems, generating and evaluating creative alternatives and is designed to accommodate diverse groups and interests, it pays special attention to the challenges and pitfalls that can trap people working together on emotionally charged and technically intensive problems, which are key attributes of environmental issues. The process encourages consistency, transparency and defensibility, particularly in the face of technical and value-based controversy.

According to Industry Canada (2011), SDM can be divided into five steps:

- Defining the problem- this involves identifying the exact problem that requires the decision and also identifying the stakeholders that would need to be involved in the process for the development of a viable solution to this problem. Also the policy makers would need to determine at this stage the scope of the problem, the possible angles the problem can be approached from, the type of solution that will best solve the problem, the key assumptions and constraints for the parties that should be involved in the process and the extent of their involvement.

- Specifying the Objectives and Measures- this involves identifying the objectives and goals of the decision that is to be reached and identifying ways of measuring the impacts the alternatives developed would have on the objectives identified. This would help the decision makers focus and prioritize information and make the risk and uncertainty of each alternative both explicit and comparable.

- Creating Imaginative Alternatives- At this phase, more alternatives are developed to cover as many of the stakeholders interests as possible so that each stakeholder can expressly identify how his/her interest is represented and impacted in the various alternatives.
- Identifying the consequences- this involves creating a table to identify the sets of consequences created by each alternative. This helps the decision maker narrow the objectives to those where critical trade-offs lie and can aid in the attainment of a general consensus.

- Clarifying the trade-offs- This involves the decision maker making explicit choices on the best possible alternative to solve the problem. The decision maker therefore has to consider each trade off, carefully comparing what will be lost or gained by each option, once these have been achieved and the benefits and losses identified, the decision can be easily made.

Gregory et al. (2012) posited that the application of the SDM approach usually requires that the following questions are addressed:

i. What is the context for (scope and bounds of) the decision?

ii. What objectives and performance measures will be used to identify and evaluate the alternatives?

iii. What are the alternative actions or strategies under consideration?

iv. What are the expected consequences of these actions or strategies?

v. What are the important uncertainties and how do they affect management choices?

vi. What are the trade-offs among the potential consequences?

vii. How can the decisions be implemented in a way that promotes learning over time and provides opportunities to revise management actions based on what is learned

## 4.2 APPLICATION OF SDM TOOLS TO THE HYDRAULIC FRACTURING CASE STUDY

As the world population increases, more emphasis has been directed towards using both renewable and non-renewable resources in a more sustainable fashion. In this chapter, the study aims to create a framework for successful stakeholder engagement using the SDM tool in the decision pertaining to hydraulic fracturing in the Green Shale Formation. To create this framework a team of researchers simulate the decision making process using the SDM by representing various stakeholders in the decision context. It is important to note that the views represented in the framework are in no way true representations of the actual stakeholders represented by the teams of researchers, as no steps were taken by this study to verify these positions or to engage the actual stakeholders. The main objective of this chapter is to create a framework that shows the various processes for stakeholder engagement as prescribed by the

SDM. The study will show how selected tools and approaches could be applied at various stages of the process. The study will discuss its contribution to the goal of integrating diverse knowledge meaningfully into decision making, with emphasis on its role in ensuring a fair integration of both fact-based and value-based knowledge into the decision making process. Methods are discussed for communicating and evaluating values and technical information across participants and cultures in ways that are both methodologically rigorous and that encourage different sources of credible knowledge to be considered on equal footing. Specifically, the study discusses approaches to clarifying and framing "what matters" (using the 'decision sketch'), exploring competing hypotheses (using influence diagrams and performance measures), clarifying uncertainties (through expert judgment and local knowledge elicitations), identifying and comparing alternatives (using consequence tables), making value-based choices (using structured values elicitations), and fostering on-going learning (through a commitment to adaptive management).

The wealth of polarized views on hydraulic fracturing in the Green Point has made structured decision making (SDM) a great fit for this case study. The study determined that the best way to assess this highly debated topic is to develop a structure that would help make a decision that takes all the stakeholders objectives into consideration to create several alternative solutions before a best preferred solution is decided upon. This is one of the key advantages of SDM. To successfully apply SDM to this case study, stakeholders were simulated by a team of four students. Each of the different members of the team represented a stakeholder and tried to represent what the stakeholder considered to be of priority in the decision making process. Though the team of researchers was only able to simulate a small section of the possible

stakeholders and their views are not a holistic representation of the stakeholders on the issue, the simulation was able to suggest how the SDM can be applied to the fracking issue. In the first decision sketch, the stakeholders determined that if fracking is to occur at all, it must be carried out in a sustainable way, and for sustainable fracking to be achievable three fundamental objectives must be met;

- Maximize social sustainability
- Maximize environmental sustainability
- Maximize economic benefits.

**Decision Sketching**

A "decision sketch" is the first step in creating a structured decision making model. Sketching out the issue in broad strokes frames the problem as one requiring a multidimensional decision; thereby facilitating an approach that is defined by objectives and alternative choices (Gregory, 2012). Framing the project as a series of decisions, as opposed to a singular problem, transformed the debate surrounding Hydraulic Fracturing into a focused problem-solving exercise, this was designed to create a suite of best possible alternatives. Developing a decision sketch involves three pertinent stages intended to focus and scope the project moving forward.

- Frame the Decision- In a preliminary discussion, individuals considered the type of decision this issue warranted, the individual or groups that would be making the final decision and the specific deliverables that would be required from the decision process. In answering the aforementioned questions, the group concluded that a single preferred alternative must be made by the Province of Newfoundland based on a set of deliverables in Table 1 below. The objectives shown in Table 1 below are the original objectives developed by the stakeholders before they were further refined into the final objectives applied in the final trade- offs.

*Table 1 Decision Sketch Framework*

| **Fundamental Objectives** | **Attributes** | **Units** |
|---|---|---|
| Minimize human health impacts | Noise pollution | Sound level meter (dB) |
| | Quality of drinking water | temperature, pH, dissolved oxygen, conductivity, oxygen reduction potential (ORP), turbidity, and secchi disk depth |
| | 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 energy and electricity rates | $ |
| | Increase industry presence | See other factors |
| | Maximize royalties | $ |
| | Maximize governmental tax revenue | $ |

- Develop a Sketch- Brainstorming activities designed to simulate stakeholder debates on the issue of hydraulic fracturing were useful tools to develop a framework that identified a range of objectives and alternatives. The framework is conveyed through the flowchart in Figure 2 below. The flowchart also facilitated a discussion about known facts to the issue as well as knowledge gaps and allowed participants to visually identify where trade-offs, uncertainties, and multi-stakeholder issues may arise.

- Plan Consultation and Analysis- An exhaustive list of relevant stakeholders and experts was compiled. Due to limitations in man power and other resources the research team was only able to represent five of the relevant stakeholder groups in the simulation. Tools to facilitate measured and effective consultations with these stakeholders were also compiled.

**Objectives-Setting**

Objectives are concise statements designed to frame the project around important facets of the larger policy decision. Gregory et al. (2012) asserts that useful objectives focus on what

matters in the context of the policy decision and relevant stakeholder groups. To be useful, the compilation of objectives must create a holistic representation of the issue with minimal individual objectives. Objectives must be sensitive to alternatives, understandable to all those involved in the process, and capable of contributing independently to an understanding of the overall performance of an alternative (Martin, Runge, Nichols, Lubow, & Kendall, 2009).

In the decision sketch phase, several preliminary iterations of objectives were raised by the various stakeholders, however these objectives were refined through the review and application of relevant literature. Stakeholder-based brainstorming sessions improved both the categorization and independence of each individual objective. The session resulted in a refined version of the flowchart in Figure 2. The flowchart is an exceptional visual tool that simplifies the goal of understanding objectives, while simultaneously serving as a hierarchical display of objectives. The flowchart in Figure 3 shows a refined list of sub-objectives.

Means-ends diagrams were created for every sub-objective as a method of deconstructing each issue (see Figure 4). Means-ends diagrams are easily digested pieces of information, which highlight the important factors of every objective while simultaneously bringing important facets of the step-by-step process to the fore.

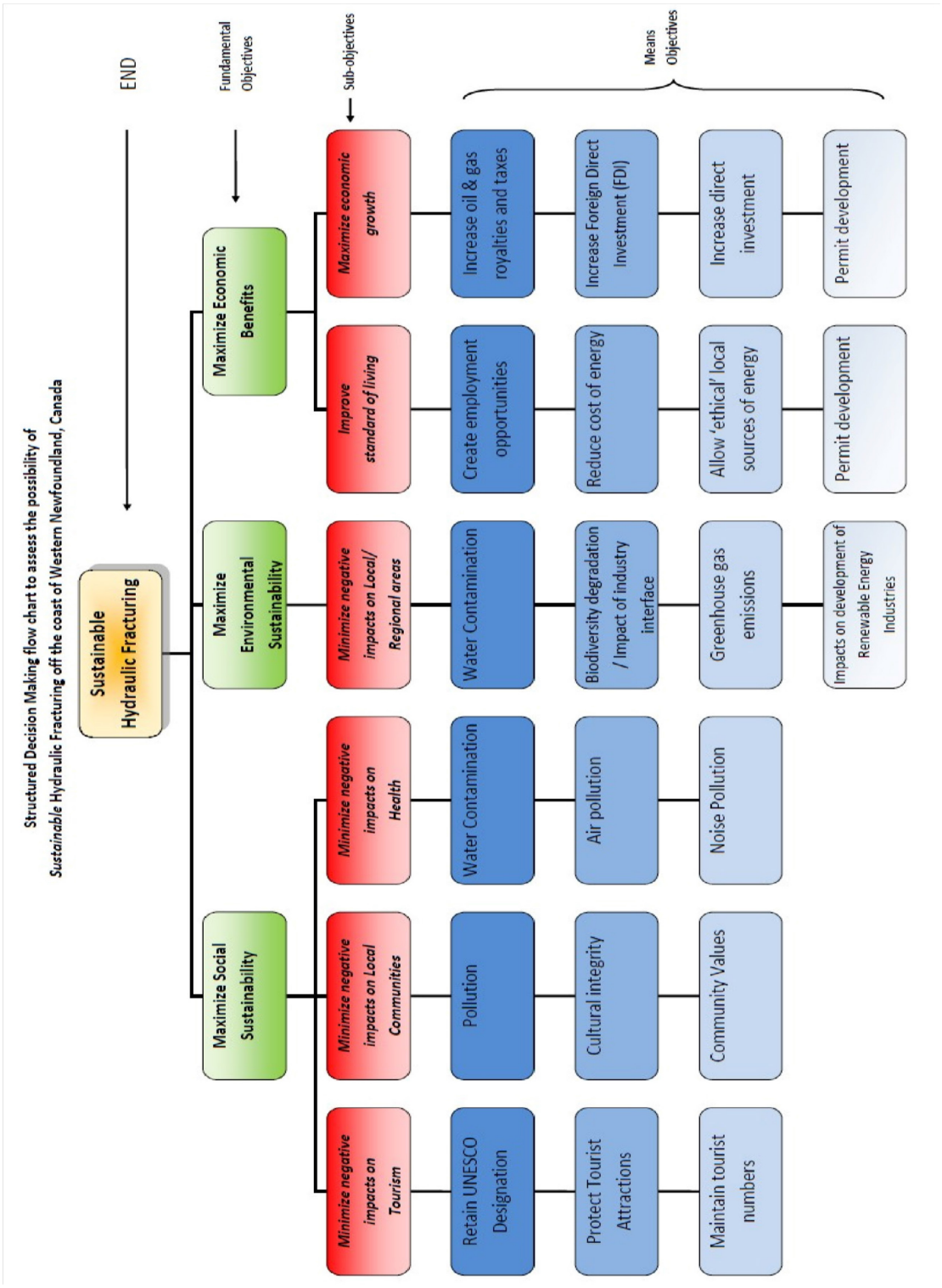



*Figure 2 Objectives Flow Chart*

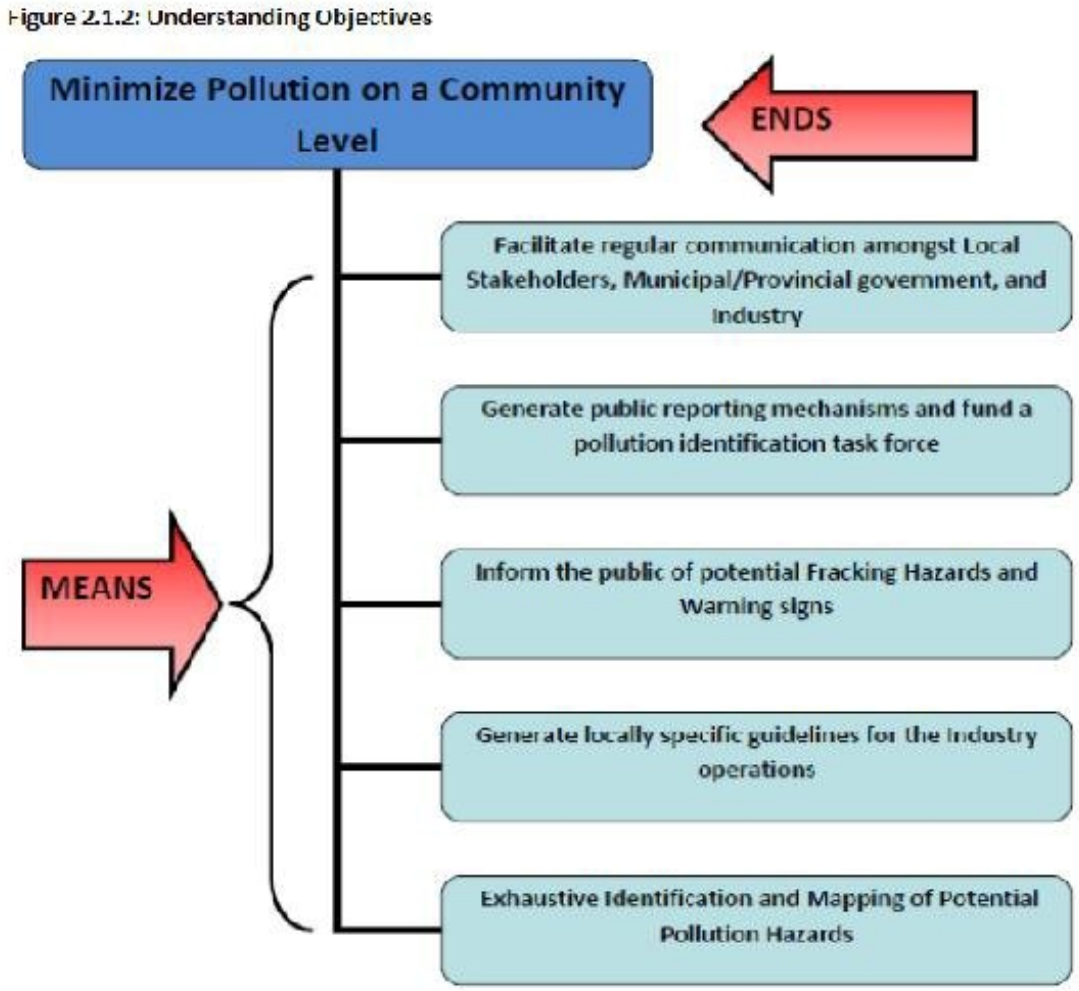


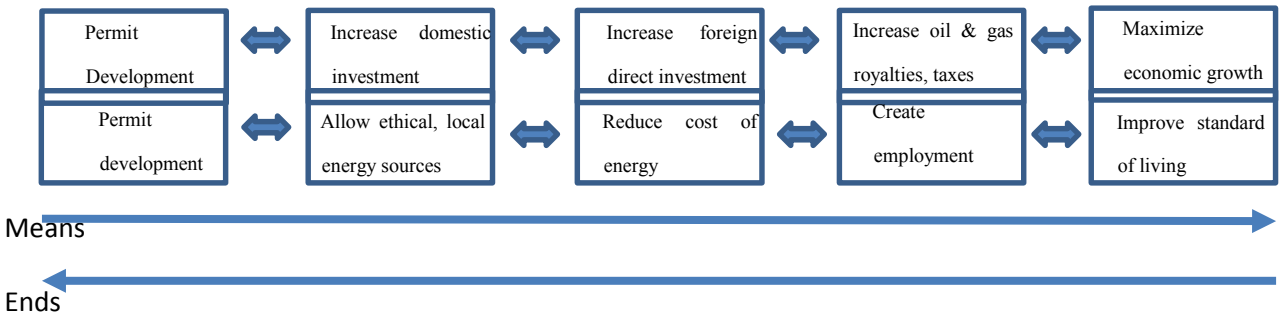

*Figure 3 Objectives means-end diagram*

**Performance Measures**

Gregory et al. (2012) describe performance measures as specific metrics used to consistently estimate and report expected consequences of a management alternative with respect to a particular objective. Performance measures define how an objective is interpreted and evaluated for the purpose of a decision. These metrics provide the ability to determine the relative degree of impact across alternatives, either quantitatively or qualitatively; this provides

decision-makers a consistent and appropriate method for comparing alternatives. The consideration of performance measure within this project was an iterative process consisting of four main stages as outlined by Gregory et al. (2012).

- The Brainstorming of Candidate Measures: In a simulated stakeholder process consisting of the team of researchers simulating representatives from the environment, public health, the government and tourism, an original set of potential performance measures was created for each fundamental objective (Table 1). Listed in the table is a preliminary suite of objectives, and/or attributes, as well as specific measurable units for each attribute.
- The Development of Influence Diagrams: Influence diagrams are structuring/modeling tools that graphically represent different concerns and relationships important to understanding a decision (Gregory et al., 2012). In the study, simulated multi-stakeholder groups developed impact-pathways for each sub-objective to produce these diagrams (Figure 4).




To move from means to ends, ask, 'why is this important?' To move from ends to means, ask, 'how might we achieve that? *Figure 4 Maximize Economic Benefits Means-ends diagram*

• Identifying Different Sources of Information for Estimating Measures: For this stage, the simulated multi-stakeholder group explored multiple ways to assess performance measures. The simulated multi-stakeholder group considered if natural, proxy, or constructed performance measures were most suitable for each sub-objective (See Tables 2 and 3 for examples).

*Table 2 Performance Measures for minimizing negative health impacts objective*

| **Sub-objective: Minimize negative impacts on health attribute: determination of pollution based on the following measures** | |
|---|---|
| **Natural Measures** | Number of fatalaties/ year |
| | Number of respiratory cases/ year (number of patients) |
| | Number of water poisoning cases/ year |
| | Number of noise pollution related cases/ year |
| | Average decibels of sound created/ year |
| | Number of motor vechicles driven/ year |
| **Proxy** | Emissions test |
| | Water quality test |
| **Constructed Measures** | Measure of impacts of fracking activities on the health of members of society (scale1-5)<br>1= no impact<br>2= very little impact<br>3= average impact<br>4= high impact<br>5= very high impact |

*Table 3 Performance Measures for minimizing contribution to climate change sub-obj*

| | *Quantitative binary threshold (2)* | |
|---|---|---|
| | *1. Carbon footprint (metric tons of C2)* | *2. Methane off gasing (% of production)* |
| **Natural PMs** | *a.* Consider impact of industry extraction methods, flaring methods, transp ortation techniques, and carbon emissions from fossil fuel power generations | a. Determine the total percentage of methane leakage as a percentile of the total methane extracted. |
| | | b. Independent science demonstrates methane escapes as high as 7.9% of the total production of a well (reference). |

- Evaluating and Selecting Most Useful Measures: Good performance measures are determined by whether or not they are useful when making choices among alternatives. The simulated multi-stakeholder group reviewed performance measures to ensure experts could report consequences in a technically accurate and defensible manner, and would allow decision-makers to make key value- based trade-offs. The following list of performances measures was produced (see Table 4)

***Table 4 Refined PM***

| Fundamental Objectives | Sub-objectives | Performance Measures |
|---|---|---|
| Minimize Negative Social Impacts | Minimize Negative Impacts on Tourism | Tourist Revenue ($) |
| | | Number of Tourists |
| | | Risk of Take (1-5 Scale) |
| | Minimize Negative Impacts on Local Communities | Number of Opportunties |
| | | Risk of Take (1-5 Scale) |
| | Minimize Negative Impacts on Health | High/Low Pollution |
| | | Risk of Take (1-5 Scale) |
| Minimize Negative Environmental Impacts | Minimize Negative Impacts on Local/ Regional Areas | High/Low Biodiversity |
| | | High/Low Contamination |
| | | High/Low % of GHG Emissions |
| | | Risk of Take (1-5 Scale) |
| Maximize Economic Benefits | Improve Standard of Living | Number of Jobs |
| | | Percentage Value |
| | Maximize Economic Growth | Oil and Gas Revenues ($) |
| | | Capital Investment ($) |

NATURAL

CONSTRUCTED

PROXY

**Uncertainty**

Gregory et al. (2012) describe uncertainty as situations or outcomes for which we lack information that we would like to have. They identified ten sources and types of uncertainties; natural variation, measurement error, systematic error, model uncertainty, subjective judgment, vagueness, ambiguity, context dependence, underspecificity, indeterminacy. In the study, findings were tested using these ten sources and in doing so identified several key sources of uncertainties. Below are a few examples found in this study:

- Ambiguity: According to the Oxford dictionary, ambiguity can be defined as the quality of being open to more than one interpretation (OED, 2006). Ambiguity can be described as an attribute of any concept, statement or claim whose meaning cannot be definitely resolved according to a rule or process consisting of a finite number of steps.

- Measurement Errors: The major uncertainty was the inability to measure the exact impact of hydraulic fracturing on several factors in the societies/ communities that would be affected by the industrial activities.

- Natural Variation: Gregory et al. (2012) define 'natural variation' as outcomes that vary naturally with respect to time, space or other variables and can be difficult to predict. Fracking as a process is prone to this form of uncertainty, both geologically and technologically.

**Alternatives**

At the most basic level, alternatives are complete solutions to a given problem that can be directly compared by decision-makers (Gregory et al., 2012). Structured decision- making uses

what has been learned about the nature of a project, the context-specific objectives, and explicit performance measures to compare comprehensive sets of management alternatives. Alternatives are important for a number of reasons. First, stakeholders learn by generating and exploring alternatives. Generating alternatives help stakeholders arrive at better solutions for achieving fundamental objectives. Secondly, alternatives allow for value-judgments to be made by those with legitimacy to make them.

Finally, the presence of alternatives provides contexts for stakeholders to evaluate choices (Gregory et al., 2012).

Gregory et al. (2012) describe three basic steps in developing alternatives. In this study, the simulated multi-stakeholder group brainstormed a range of potential management responses, organized them into fully specified alternatives, and iteratively refined the alternatives under consideration.

- Brainstorm a range of potential responses- The simulated multistakeholder group used a value-focused system for the generation of alternatives; working through the list of fundamental objectives and identifying actions that satisfied each concern (see Table 5).

*Table 5 Brainstorming Alternatives*

**Figur**

| Fundamental Objectives: | Maximize Economic Benefits | Minimize Negative Environmental Impacts | Minimize Negative Social Impacts |
|---|---|---|---|
| | | | |
| Potential Alternatives: | | | |
| 1) | Full development, existing regulations | No development (outright ban) | Regulated development |
| 2) | Permit development, buffer zones | Market enviro regulations | Permit development w/ buffers |
| 3) | Gov. subsidies to encourage industry | Marine reserves | Aboriginal employment program |
| 4) | Deragulation of labor, enviro standards | Extend park boundary | Community investment strategies |
| 5) | Gov investment in infrastructure | Regulatory controls (EIA, fines) | Cooperative management |
| 6) | Encourage partnerships with MNCs | No gov intervention (let market decide) | Ban development |
| 7) | Partner with other producing provs | Increased enforcement (w/ development) | Labour and hiring regulations |
| 8) | Educaition and awareness | No marine development | Create monitoring group/fund |
| 9) | | No land development | Increase regional investment |
| 10) | | Improve infrastructure | Facilitate reinvestment to region |
| 11) | | Moratorium (more research) | Improve social support systems |
| 12) | | Education and awareness | Regulatory controls |
| 13) | | Baselines and threshold establishment | |

- Organize Actions into Complete Alternatives- The next step of the simulated multi-stakeholder group was to combine a long list of potential solutions into complete and comparable alternatives. The study created a series of logical combinations of actions so as to develop solution strategies (Figure 5).

**Figure 2.5.2: Developing Strategies**


*Figure 5 Developing strategies*

- Iteratively improve alternatives- The development of alternatives was an iterative process, with new and improved alternatives continuously developed, the result of learning gained from estimating consequences and information exchange facilitated in the stakeholder engagement process. The simulated multi stakeholder group started with a brainstorming session, which led to the generation of a first round of alternatives. The alternatives were analyzed, and then further refined. Every time a new alternative was identified, the group would provide feedback and further analyze the consequences.

**Understanding the Consequences**

Hydraulic fracturing is a process that has been surrounded by huge controversies; these controversies have led to high tensions among the stakeholders, making it difficult to clearly identify the consequences of the processes associated with fracking. Establishing a clear picture of the real consequences means establishing sufficient information on the process, risks surrounding the practice, various stakeholder biases, as well as identifying potential

rewards and consequences of the proposed alternatives. To achieve this end, various stakeholders were simulated including the Provincial Government, oil company representatives, geologists, biologists, environmentalists, civil society representatives, sociologists, and statisticians, presented information and opinions believed to be important to them and this information was included the decision context.

The stakeholder process which involved the refinement of objectives and alternative solutions until a decision is reached is carried out with the assistance of consequence tables. Persons representing the various stakeholders weighed the consequences of each of the refined alternative and assigned a value to each facet of the consequence table. The information was organized into a constructed measure format, with the following values: -2 (high negative impact); -1 (slight negative impact); 0 (no impact); 1(slight positive impact); 2 (high positive impact) (see Table 8 in results).

*Table 6 Initial consequence table*

| Objective | Alternatives | | | | |
|---|---|---|---|---|---|
| | Ban development | Restrict development, exploration and continue moratorium | Onshore development only | Offshore development only | Permit high volume hydraulic fracturing |
| Improve standard of living | | | | | |
| Maximize economic growth | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Minimize negative impacts on local/regional areas | | | | | |
| Minimize negative impacts on tourism | | | | | |
| Minimize negative impacts on local communities | | | | | |
| Minimize negative impacts on health | | | | | |

*Table 7 Unrefined consequence table*

| **Fundamental Objectives** | **Sub-objectives** | **Performance measures** | **Alternatives** | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| Minimize negative social impacts | Minimize negative impacts on tourism | Annual tourism revenue ($) | | | | | | | |
| | | Annual number of tourists | | | | | | | |
| | | Perceived effects (1-5 scale) | | | | | | | |
| | Minimize negative impacts on local communities | Number of new opportunities | | | | | | | |
| | | Perceived effects (scale TBD) | | | | | | | |
| | Minimize negative impacts on health | Level of pollution (high/low) | | | | | | | |
| | | Perceived effects (1-5 scale) | | | | | | | |
| Minimize negative | Minimize negative impacts | Effects on biodiversity (high/ low) | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| environmental impacts | on local/ regional areas | Contamination levels (high/ low) | | | | | | | |
| | | % of GHG emissions (high/low) | | | | | | | |
| | | Perceived effects (1-5 scale) | | | | | | | |
| Maximize economic benefits | Improve standard of living | Number of jobs (more/ less) | | | | | | | |
| | | % value (proxy) | | | | | | | |
| | Maximize economic growth | Annual oil and gas revenue ($) | | | | | | | |
| | | Increase capital investment ($) | | | | | | | |

**Alternatives**

1. Ban development of hydraulic fracturing
2. Moratorium on hydraulic fracturing (exploration and research permitted)
3. Regulated development: onshore only (buffer zones, command and control)
4. Regulated development: offshore only (buffer zones, command and control)
5. Regulated development: onshore and offshore (buffer zones, command and control)
6. Active government approach (subsidies, tax-breaks, employment programs)
7. Full-development (no new regulations, free market approach)

*Table 8 Refined consequence table*

| **Fundamental Objectives** | **Sub-objectives** | **Performance measures** | **Alternatives** | | | |
|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 |
| Minimize negative social impacts | Minimize negative impacts on tourism | Tourist revenue | | | | |
| | | # of tourists | | | | |
| | Minimize negative impacts on local communities | Perceived impacts; risk of take (1-5 scale) | | | | |
| | Minimize negative impacts on health | # of sick days (direct link to fracking) | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Minimize negative environmental impacts | Minimize negative impacts on local/ regional areas | Species richness | | | | |
| | | Groundwater contamination (see table 1) | | | | |
| | | Air emission test | | | | |
| | | Noise generation (Db) | | | | |
| Maximize economic benefits | Improve standard of living | # of jobs (direct) | | | | |
| | | # of jobs (indirect) | | | | |
| | | Oil & gas revenues | | | | |
| | | Capital investment | | | | |
| **Alternatives** | | | | | | |
| 1. Ban development of hydraulic fracturing<br>2. Moratorium on hydraulic fracturing (no activity)<br>3. Moratorium on hydraulic fracturing (with activity)<br>4. Regulated development | | | | | | |

**Trade-offs**

Trading-off involves the stakeholders engaging in a series of compromise facilitating exercises. Each of the stakeholders examines the suite of alternatives and applying the performance measure determines how their objectives will be affected within each of these alternatives. Based on these findings, each stakeholder can make compromises so as to arrive at the solution that best caters to their objectives while also making allowance for the other stakeholders to achieve their goals. Successful trade offs requires stakeholders to have an understanding of the decision scope and context of the case study. The stakeholders must also be able to understand the uncertainties and impact of performance measures in each alternative (Gregory et al., 2012).

The study evaluates the final four alternatives applying performance measures developed using value based systems. The stakeholders evaluated the degree of importance of each of the impacts each alternative had on their objectives in the trading- off process. The suite of alternatives were then refined to ensure that the extreme alternatives that prevented a majority

of stakeholders from achieving their objectives were eliminated. At this study ensured that all the information gaps are filled so as to facilitate compromise and understanding (Gregory et al., 2012).

## 4.3 FINDINGS FROM CASE STUDY

**Objectives and measures**

Throughout this process, many alternatives were discussed that could potentially satisfy the three fundamental objectives. The first attempt at creating a suite of alternatives, produced seven options:

- Ban development of hydraulic fracturing.
- Institute a moratorium on hydraulic fracturing permitting exploration and research.
- Permit command and control regulated development onshore only, with designated buffer zones.
- Permit command and control regulated development offshore only, with buffer zones defined/designated.
- Permit command and control regulated development onshore and offshore with designated buffer zones.
- Full development with government incentives (subsidies, tax-breaks, employment programs to encourage industry, etc.).
- Full development with no new regulations taking a free market approach.

Another deliberation was held which allowed the group of stakeholders to identify ambiguities, compromise, merge and streamline the alternatives until a final number of four main alternatives was reached. They include the following:

- Ban fracking.
- Institute a moratorium on fracking that would not permit exploration or drilling to take place until policy was put into legislation.
- Institute a moratorium and exploratory drilling would be permitted while policy was being developed.
- Permit command and control regulated development onshore and offshore.

The final four alternatives were then compiled into a consequence table that allowed the stakeholders to evaluate the alternatives. Through the process of refinement, the analysts created a value system to properly assess the alternatives in the consequence tables (see Table 10).

| Value system to assess predicted impacts from performance measures (PM) | |
|---|---|
| -2 | High negative impact |
| -1 | Low negative impact |
| 0 | No impact |
| 1 | Low positive impact |
| 2 | High positive impact |

*Figure 6 Value System to assess predicted Impacts*

The chosen value system allows the positive numbers to represent positive impacts, a zero value to represent no impacts and negative numbers to represent negative impacts on performance measures. In total, twelve performance measures were created in relation to the fundamental objectives (Table 7). To evaluate the alternatives on performance measures, five different groups of stakeholders were selected by the study to be simulated by the team of researchers in the simulation. The study believes that these five stakeholders represent major

stakeholders in the issue but due to the limitations in man power and other resources, they are the only stakeholders represented in the simulation. The stakeholders represented by the group are: conservation biologists, oil and gas geologists, local non-governmental organizations (NGO) or civil society members, economists and the provincial government. If the combined stakeholders gave the highest or lowest evaluation on all twelve performance measures, then the maximum and minimum range of the scale designed would go from positive 120 to negative 120 respectively.

**Uncertainty**

Indeterminacy, underspecificity and subjective judgment in social issues were some of the biggest sources of uncertainty in the decision framework. Issues of indeterminacy and underspecificity existed in describing social objectives. This was most apparent in the several connotations of the term "standard of living". Standard of living is synonymous with wealth, comfort, material goods and necessities available to a certain group of people. This sub-objective was intended to encompass all the issues that are socially and culturally important in the affected regions. It was however discovered that the term 'standard of living' was too vague and did not successfully encompass the many social and cultural values important to the various stakeholders and the phrase connoted several different things to the different stakeholders, generating uncertainty. Additionally, subjective judgment is an issue that must be considered in the development of any survey in social science. Without the consent and input of all stakeholders in the development of surveying mechanisms, the tools developed can be biased by the opinions of those creating, observing, and interpreting the data.

Ambiguity, linguistic uncertainty, vagueness amongst the fundamental objectives was another source of uncertainty that was encountered during the stakeholder engagement sessions. Originally the fundamental objectives read "Ensure Environmental Sustainability", "Ensure Social Sustainability", and "Ensure Economic Sustainability". It was discovered that the word "sustainability" is ambiguous. Sustainability means different things to different stakeholders and it is difficult to determine whose definition of sustainability to adopt. This led to a revision of the fundamental objectives. Instead of using the ambiguous term "sustainability", more easily measured terms like "economic benefits", "health impacts", and "environmental impacts" were used. The terms "Ensure

Environmental Sustainability", "Ensure Social Sustainability", and "Ensure Economic Sustainability", were replaced with "Maximize Economic Benefits", "Minimize Health and Environmental Impacts", and "Minimize Negative Impacts on Communities" so as to ensure that the stakeholders had a clear picture of the fundamental objectives.

The occurrence of natural variation in the sub-objectives was another source of uncertainty encountered. Maximizing economic growth through oil and gas revenues is measurable monetarily but it is uncertain how long this will last and to what cost there may be if a spill or leak occurs due to fracking. Ecosystems are always changing thus bringing new species in and out of a variety of habitats. Biodiversity may stay the same but with different species through the evolution of the area. This also happens over a long period of time with many factors both abiotic and biotic influencing its changes so there are some uncertainties in suggesting biodiversity loss is due to fracking alone. Climate change is also influenced by a myriad of factors which makes it difficult to separate the aspects caused by the fracking process. Although

carbon and methane emissions are measurable, the amounts that would actually cause significant changes in climate are still uncertain as it is over a long time frame. The impact fracking has on renewable resource development is also questionable. It is uncertain if, in the future, this will negatively or positively affect the progress of renewable resource development in Newfoundland, specifically the western region. Could both industries co-exist or, if fracking in the short term, could renewable resource development actually benefit from the economic wealth that fracking has enabled the province to gain, giving the province more money to invest in renewable energy development. As the degradation of Green Point and Gros Morne

National Park are uncertain, so are the effects fracking will have on tourism. Finally, uncertainty is considered when assessing if pollutants from fracking would be the major impact to the health of local community members. It is hard to point where fatalities and respiratory issues come from specifically. Although we can measure the amount of pollution in the area over time, we cannot be certain that all health issues are directly because of fracking in Green Point, NL. Measurement errors were also a great source of uncertainty. This was characterized by the inability to measure the exact impact of fracking on several factors in the societies/communities that would be affected by the fracking activities. This uncertainty arose because of the difficulty involved in separating the effects of fracking from the impacts of other impact inducing activities engaged in in these regions. Specific areas this uncertainty manifested itself include the difficulty in measuring the precise number of reported illnesses from these regions that are a result of fracking activities, the difficulty to measure the exact amount of pollution (air, water and noise) that occurs as a result of fracking, also the constructed measure we developed to measure how the locals perceive that the impact of fracking activities is fraught with uncertainties as it is subject to different biases and opinions held by different

individuals, and the difficulty of predicting the exact effect fracking activities would have on the tourism industry at the Gros Morne park. To mitigate these uncertainties experts would have to be consulted.

In Table 9 below "Ban on Fracking" there is a total value from all five stakeholders of twelve, which is a medium to low positive impact rating. Although it shows a positive view overall, some polarization or disagreement was evident (see Figures 7 &8).

*Table 9 Alternative 1 "Ban Fracking"*

**Consequences, risk and trade-offs: Analysis of consequence tables**

| **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 tamination** | 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** |

In Table 10 below, "Moratorium (no activity)" there is a total value from all five stakeholders of 14, which was the highest rating for a positive impact. Although it shows a positive view overall, not all were in agreement and the economist and government gave this alternative a low negative impact value (see Figures 7 &8).

*Table 10 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 tamination** | 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** |

In Table 11, "Moratorium with activity" there is a total value from all five stakeholders of -20 which was the highest rating for a negative impact. This alternative, aside from the economist who placed a no impact value on it, was the one that the majority agreed would be negative overall for the area (see Figures 7 & 8).

In Table 12, "Regulated Development" a total value from all five stakeholders was -19; a high negative impact value. There seems to be a dichotomy between negative and positive variables and it is a highly polarized alternative (see Figures 5 & 6).

*Table 11 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 tamination** | -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** |

*Table 12 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 tamination** | -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** |

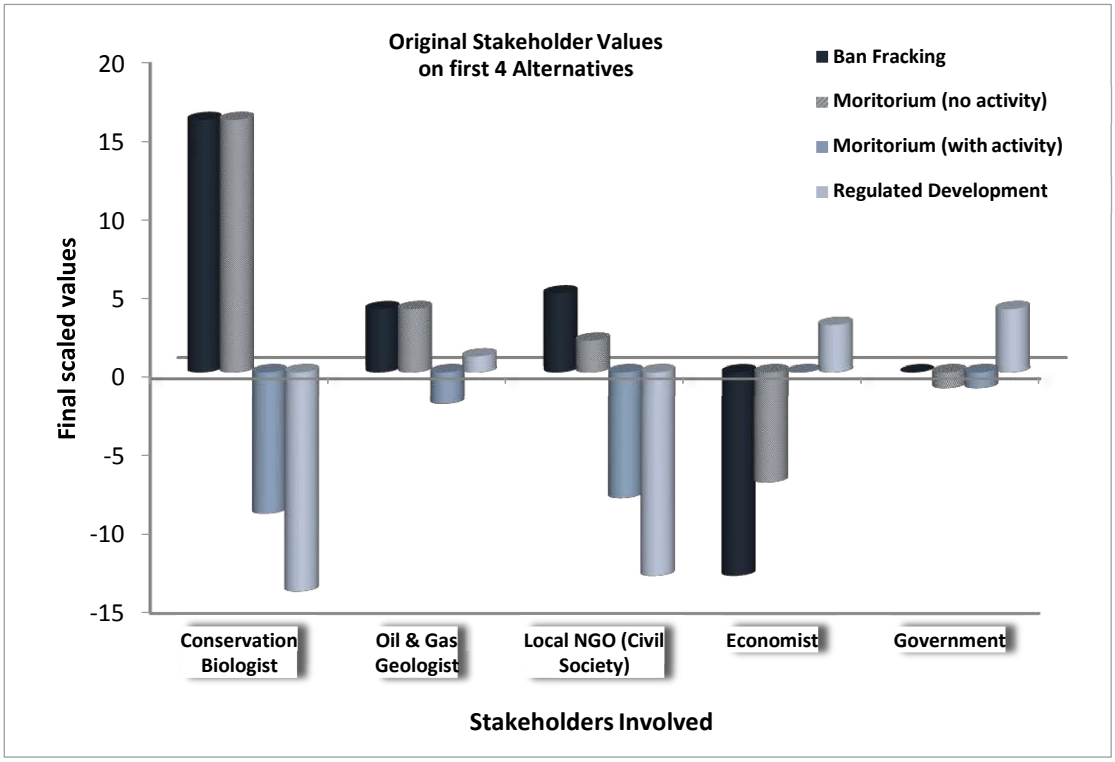



*Figure 7 Stakeholder Values on first 4 Alternatives*

Figures 7 and 8 present a visual aid to show which alternatives are of more value to each stakeholder. They also allow decision makers see the range of opinions held by the

stakeholders, ranging from strongly in support, to strongly opposing. It allows the analysts to understand important steps that should be taken and key trade-offs that need to be made for an effective solution to be reached. While Figure 7 compares the four alternatives against all stakeholders on one graph, Figure 8 displays whether the majority valued each alternative as having a more positive or negative impact overall. Another measurement was also added to Figure 9: the range of agreement, this wide the range of disagreement is among the various stakeholders. A higher range shows more disagreement while a lower range shows more agreement. This was included to show that although the majority might have felt an alternative was positive, there might have been some polarization in the opinions on the alternative. This is important to know as one of the major aims trading-off is to eliminate polarization.

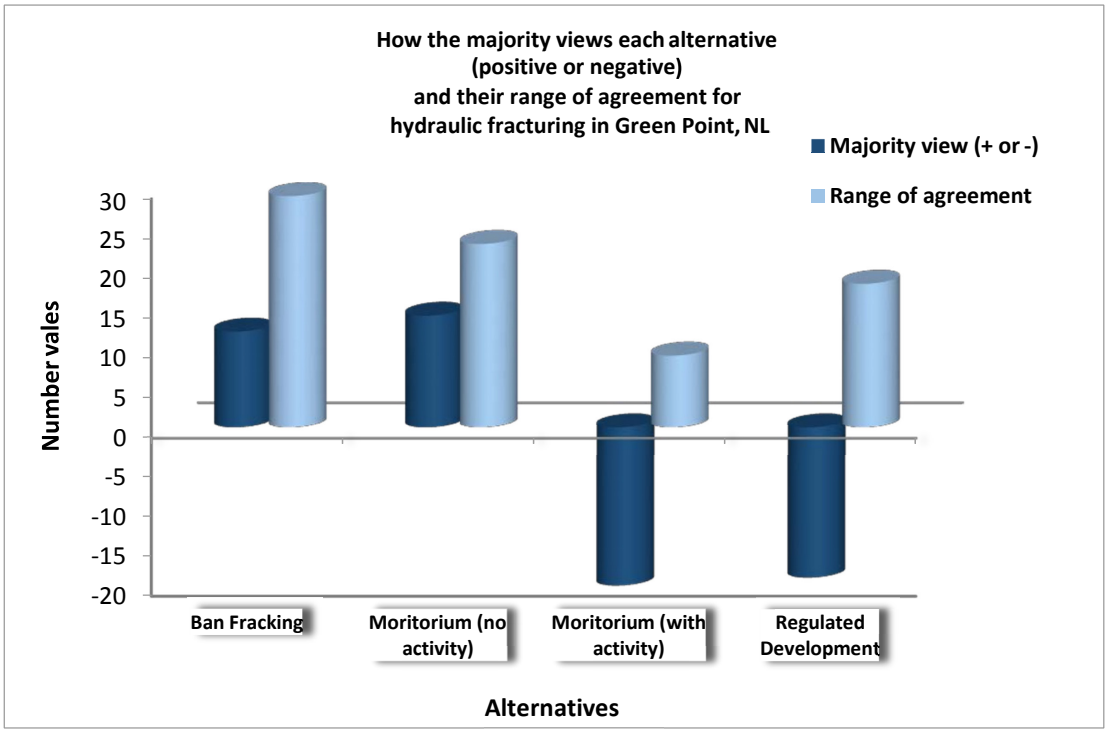



*Figure 8 Extent of polarization among stakeholders*

Agreement differences among all 5 stakeholders and level (high/low negative or positive) of impact they felt alternative would have in Green Point, NL

In Figure 8 the ban on fracking alternative was highly polarized although, overall, most stakeholders felt it would be a positive alternative. The moratorium with no activity was similar to the ban on fracking alternative but the majority felt it would have a more positive impact and there was less disagreement. The majority felt the moratorium with activity would have the most negative impact to all and this surprisingly, majority of the stakeholders agreed that it would be most detrimental to their objectives. Regulated development was also valued as a negative alternative but there was some disagreement amongst stakeholders.

**Final consequence tables and key trade offs**

After a series of negotiations, the simulated stakeholders looked at the evaluation and debated which impacts would be more or less important and what type of trade-offs would be more or less acceptable. From this, a new alternative was developed that addressed the most important values of the stakeholders and the values of those the stakeholders felt would be most affected if hydraulic fracturing in Green Point, NL was to take place; a major trade-off for this case study.

The fifth alternative was titled a "Revised Moratorium". The alternative suggests putting a moratorium on high volume fracturing with controlled activity. Under this alternative, controlled exploration and testing would be permitted and no further activity would take place until a policy was developed, accepted and put into legislation. The main guideline that is essential to the success of this alternative for all stakeholders is the stipulation that all exploration must strictly comply with the UNESCO guidelines which state that buffer zones

must be set out prior to exploration, ensuring the protection of sensitive ecological and cultural areas.

In table 13, "Revised Moratorium" there is a total value from all five stakeholders of 4 showing a low positive impact. Some stakeholders still show a negative impact value but much less than other alternatives assessed. There is little to no polarization across stakeholder values (see Figures 7 and 8).

*Table 13 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 tamination** | -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** |

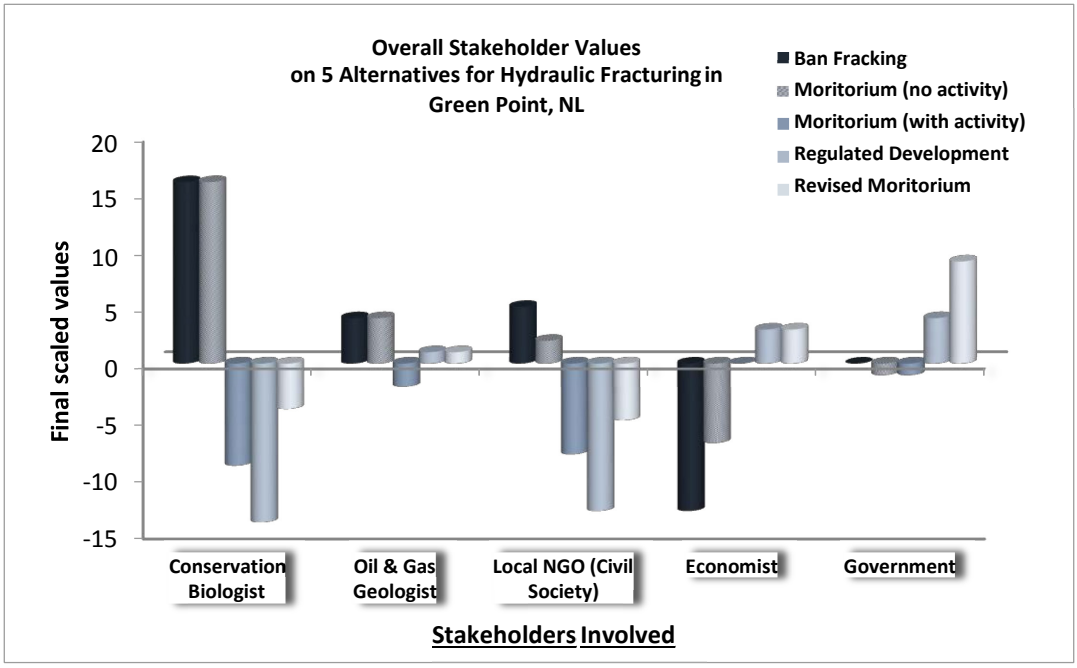



*Figure 9 Final stakeholder trade-off with refined alternative*

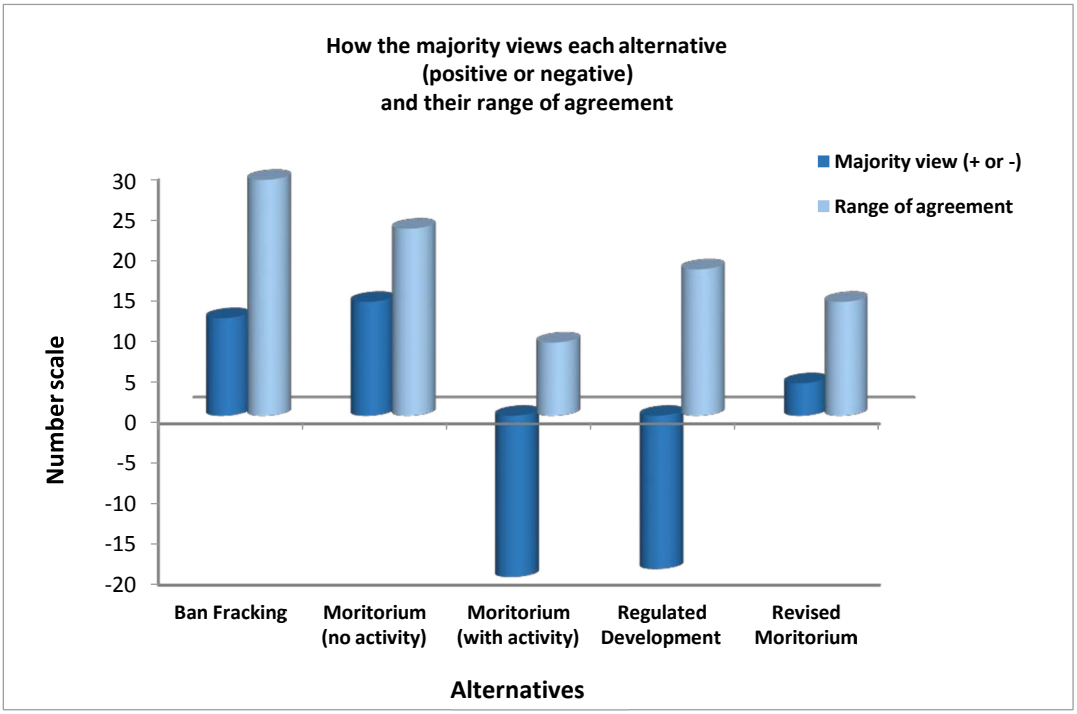



*Figure 10 Comparison of Polarization in refined alternative and previous alternatives*

***Discussion***

The consequence tables and graphs presented in the Results section allow the analysts to observe keys points for each alternative. In Table 9, Ban on Frac king, most stakeholders felt this to be a neutral alternative. The major polarization came from the economist and the conservation biologist. The economist was against the majority on this alternative. Without proper environmental regulations put in place, which would be mandatory for an oil and gas industry, no environmental monitoring would be mandated thus causing a negative impact ecologically. The potential for future environmental protection weighed heavily on the biologist stakeholder, thus suggesting a positive nature of the ban for the environment, but this alternative does not achieve the goal of sustainable unconventional gas well development.

The second alternative (see Table 10), Moratorium without Activity, had the highest overall positive value impact vote but, the polarization on this alternative, points to many information gaps and uncertainties felt by the NGOs and civil society in regards to their view of government and their perception towards hydraulic fracturing. This polarization is what helped the analysts recognize the need to develop a more robust and inclusive alternative.

In Table 11, the fourth alternative, Moratorium with Activity, was considered. This alternative surprisingly scored the lowest, receiving a -20 showing the majority felt it would have negative impacts overall. The potential for negative ecological and health effects as well as lack of guaranteed economic benefits resulted in strong opposition to this alternative, lending too many information gaps. In practice, it should be noted that governments often pursue this alternative and from the findings the analysts suggest, this is the wrong place to start the fourth

alternative (see Table 12), Regulated Development, also scored a high negative impact value (-19). The economic benefits are obvious, but there are many uncertainties especially in the environmental and social arenas. More information or research would have to be conducted to calm the fears of agitated stakeholders. The scores point to a lack of trust in industry and governments by civil society and the conservation biologist stakeholders.

The high polarization seen in many of the above alternatives caused the analysts to discuss the major uncertainties and trade-offs that had to be scored. In doing this, a new alternative was created. In Table 13 the fifth alternative, A Moratorium with Activity (revised), is shown. This alternative took the major uncertainties voiced by the stakeholders and helped fill in the information gaps that were obvious in other alternatives. The stakeholders set out their major values that had to be considered and then trade-offs were put forth. From this came the guidelines that are connected to this revised moratorium. This moratorium would ban high volume fracturing and only controlled exploration would be permitted until policy was accepted and put into legislation. The key point that extinguished the polarization seen earlier was the stipulation that government was to strictly follow UNESCO guidelines that stress the need for buffer zones around sensitive areas before exploration can occur.

From the impact scores of stakeholders (+4), it can be seen that the major trade-offs aided in all stakeholders coming to a middle ground; allowing values by all to be encapsulated in this alternative. It should be noted, however, that there were still some major uncertainties that should be addressed if this alternative was to be put into practice. The lack of policy before exploration still raises concerns for the environment from the geologist, biologist, NGOs and

civil society stakeholders, particularly if the government will hold to this agreement. This decision permits government to take the time to assess the economic impacts of fracking.

**Sources of Error**

During the development of this framework, issues arose that should be taken into consideration if this framework is to be utilized in future SDM models. During the research on sustainable development in unconventional gas well development in Green Point, NL, the analysts had to consider methods of scaling their performance measures; this is something that must be refined. The interpretation by stakeholders of a variety of performance measures is also significant. Problems arise from stakeholders' interpretation of the value system. The value system and corresponding interpretive practices must be both defined clearly and discussed at length, prior to engagement in the consequence valuation process. Clear errors arose from civil stakeholder representatives failing to consider and properly assign values that reflect anticipated impacts on the environment surrounding drill sites. Holistic understanding in valuation is important, as the ultimate goal of this exercise is to facilitate an industry that is sustainable for citizens today, as well for future generations.

## 4.4 CRITIQUE OF SDM

The SDM process is suitable when there are multiple stakeholders that share a common resource (Miller et al., 2010). The SDM process is good for engaging a diverse group of stakeholders because of the following benefits, as seen in the case study:

- The systematic analysis of the issue allows the various stakeholders to review their position in the light of new information from other stakeholders. This review often results in the stakeholders realizing that the optimal decision is different from the initially favoured decision option (Failing et al., 2007).

- The process also helps the stakeholders and decision makers identify and eliminate uncertainties in the decision making process. The series of steps and tools applied in the SDM process help to expose sources of uncertainty that would have otherwise been ignored, so that additional data can be collected and the uncertainties can be reduced.

- The SDM process also includes the creation of performance measures which allow each stakeholder to clearly see how his/her interests are factored into the decision making process. This tool also allows the stakeholders to see how their interests

will be affected by each of the alternative solutions, which invariably helps in consensus building.

- The SDM process also strives to be non-confrontational which aids in trade-off and consensus building. Also the non-confrontational nature of the SDM process allows the weaker, less advantaged stakeholders to ensure that their interests are represented in the decision process and not drowned out by their more powerful counterparts.

- The transparent nature of the SDM process helps in fostering information exchange among the stakeholders. The stakeholders are given the opportunity to not just share their knowledge with the other stakeholders and decision makers; they are also afforded the opportunity to glean information and knowledge from other stakeholders and experts.

- The transparency and engaging nature of the SDM process helps to legitimize the decision reached by the decision makers. The stakeholders can clearly see how their interests are affected by the decision reached, and the fact that they were carried along through the decision making process helps them accept the decision reached more readily.

- SDM also fits well with adaptive resource management (Lyons et al, 2008). After a decision is made, the system is monitored and decision outcomes are compared with predicted outcomes from multiple models. This further reduces uncertainty and helps update the information available to the stakeholders on the issue and also helps ensure that subsequent stakeholder engagements and decision making processes incorporate this new information (Conroy and Peterson, 2013).

- By participating in SDM, decision makers may benefit by reflecting on their values, learning technical information, and identifying decision options that are most likely to meet their objectives (Ferguson et al., 2015).

- Because SDM is participatory, transparently incorporates value-based and technical information, and includes uncertainty, it is an effective way to rigorously evaluate options for decision problems that are controversial or that have incomplete data (Ferguson et al., 2015). It is helping decision makers come to the best possible decision by incorporating views and concerns of the stakeholders.

Despite its many advantages, the SDM process has also suffered some criticism. Some of the shortcomings of the application of the SDM process for stakeholder engagement are as followed:

- For optimum efficiency, it is recommended that researchers and analysts assess each participant's information immediately and throughout the project. This is however difficult to achieve, as a result of researcher-to-participant ratios and time constraints (Failing, Gregory, & Harstone, 2007).

- Adapting scientific information from scientific literature to the SDM decision can be challenging, particularly in situations where expert opinion is the most suitable source of conditional probability (Failing, Gregory, & Harstone, 2007). This situation is more likely to occur in conditions when the scientists involved have

not been trained in the distinction between the proper roles of value- based information and technical information (Failing, Gregory, & Harstone,

2007).

# CHAPTER 5: COMPARISON BETWEEN SDM AND NLHFRP USING SOCIAL JUSTICE

## 5.1 IMPORTANCE OF STAKEHOLDER ENGAGEMENT THAT COMPLIES WITH SOCIAL JUSTICE STANDARDS

Science has long been given extraordinary stature in environmental deliberations and it has undeniably become "the yardstick against which other forms of inquiry are judged and to which they are supposed to aspire" (Fuller, 2002). Yet our conception of what constitutes high quality, credible science is changing. The input of stakeholders with experiential knowledge and value based objectives is becoming increasingly more important. Silvio Funtowicz and Jerome Ravetz described this as post-normal science. They developed the concept as a way to characterise methodology of inquiry that are appropriate for cases where facts are uncertain, values in dispute, stakes high and decisions urgent (Funtowicz and Ravetz, 1991). The theory of post-normal science suggests that there must be an "extended peer community" consisting of all those affected by an issue who should be involved in the decision making process (Funtowicz and Ravetz, 1991). These parties bring their "extended facts", which will include expert opinion, local knowledge and materials not originally intended for publication, such as leaked official information (Funtowicz and Ravetz, 1991). The need for the evolution of stakeholder engagement in decision making change is mostly because though the nature of questions science needs to answer is changing rapidly, the nature of scientific inquiry and its role in the policy making has not kept pace (Failing, Gregory, & Harstone, 2007). As a result of this occurrence, there have been several calls for broadening and upstreaming

public involvement in governmental decision making (National Research Council (NRC), 1996; Canadian Standards Association (CSA), 1997). There have also been calls for the democratization of expertise (CEC, 2001) and the establishment of an "extended peer community" to review "extended facts" (Ravetz, 1999). The importance of integrating diverse participants with knowledge from both science and local knowledge in decision making has grown substantially, particularly in Europe and North America (Fischer, 2000). However, the higher the involvement of these diverse groups in the decision making process the more important it becomes to find innovative ways to integrate them in a defensible decision making process (Failing, Gregory, & Harstone, 2007).

Though there have been many studies on the best types of knowledge to incorporate into the decision making process, like the paper of the American Fisheries Societies that explores the role of local knowledge in the context of defining what constitutes "best available science" (Sullivan et al., 2006), there is very little information on specific methods for successful on the ground multi-stakeholder integration (Oudwater and Martin, 2003). Concerns have been raised about the possibility of stakeholder engagement processes affecting the integrity and importance of science as a guide to risk management (EPA, 2001). Without a proper technique to effectively engage stakeholders to elicit useful information from them, the quality of the decision reached is reduced (Failing et al., 2007). With stakeholder engagement techniques that are too heavily centered in science, local knowledge is often discarded and viewed as not objective enough and not methodical enough in its processes and documentation (Yearley, 2000). On the other hand, some other engagement techniques uncritically accept local knowledge without enough proper scrutiny or research into the knowledge claims (Failing, Gregory, &

Harstone, 2007). Another serious problem that occurs when improper engagement techniques are employed is when uncertainty as to degree or information gaps is not factored into scientific inputs to the environmental decision making process and the scientific data is uncritically accepted (Failing, Gregory, & Harstone, 2007). This not only affects the quality of the decision that is made but also precludes the inclusion of local knowledge that is experience-based and value-laden from the decision process. The opposite can also be the case when stakeholders from the locality are reluctant to accept input of scientific experts regardless of the quality because they believe they are untrustworthy, disrespectful and ignorant of local conditions (Wynne, 1992). For a technique of stakeholder engagement to be deemed successful, it must involve input from both scientific knowledge and local knowledge, so that both sources of knowledge will complement each other and the best possible decision can be reached. This study will adopt the definition of local knowledge as posited by Failing et al. where they define local knowledge as:

" The full variety of insights, observations and beliefs related to a particular decision that do not stem from conventional scientific expertise" (Failing, Gregory, & Harstone, 2007).

This knowledge is usually experience-based and gathered over years, sometimes passed from generation to generation. Examples of this kind of knowledge can be found in long-term residents of the communities, aboriginal communities, experienced hunters and fishermen etc. Involving local knowledge in the decision making process is important as the holders of this knowledge and the inhabitants of the affected communities are usually the ones that bear the brunt of the effects of whatever decision is eventually reached. Also getting the decision

legitimized is easier if all the stakeholders believe that their interests and views are adequately represented in the decision reached.

As a result of these factors, it is important that techniques of stakeholder engagement be developed that seek to create a deliberative process that will support the consideration of diverse knowledge claims in the most equitable way possible (Failing, Gregory, & Harstone, 2007). The technique must be methodologically rigorous and effectively harness the potential of the diverse stakeholders it is engaging (Failing, Gregory, & Harstone, 2007). For environmental risk management, accurate local knowledge is of particular importance particularly those whose authenticity can be verified, especially traditional or indigenous ecological knowledge which has been defined as:

" a cumulative body of knowledge, practices and beliefs concerning the relationship of living beings (including humans) with one another and with their environment (Berkes et al., 2000)."

Local knowledge is agree useful as it relates directly to specific fact-based expertise on local conditions, practices and trends. This can help with the identification of uncertainties and indirect impacts of proposed actions. Local knowledge can also serve as a form of peer review of conventional scientific analysis, especially when it comes to revealing inconsistencies, biases and oversights and redefining analytical boundaries in socially relevant ways and questioning scientific assumptions (Wynne, 1992). Local knowledge places an emphasis on culturally derived values, since it is experience based and can be expressed in more holistic ways, particularly when compared to the more reductionist expressions of western science (Berkes et al., 2002).

There are four critical functions are required to ensure successful stakeholder engagement (Cash et al., 2006). The functions are as follows :

- Convening – the way that stakeholders are brought together to define the goals of the project (Cash et al., 2006).

- Translation – the process by which the results from any research are converted into language that all the parties involved in the process can understand (Cash et al., 2006).

- Collaboration – the process by which the various stakeholders' views are communicated with each other (Cash et al., 2006).

- Mediation – the process defined as how these views are reconciled (Cash et al., 2006).

The ideals of successfully incorporating both expert knowledge and local knowledge into the decision making process are in line with the social justice principles according to John Rawls and David Miller. The principles of social justice that are directly applicable to stakeholder engagement are as follows:

- Rawls' principle of equal liberties and Miller's principle of equality both posit that every citizen deserves the same basic liberties and no societal practices should interfere with these rights (Robinson, 2013).

- Rawls' equal opportunities principle and Miller's principle of desert both posit that arrangements in society should take care of the basic needs of all people in the society and no social practices should supersede these needs (Robinson, 2013).

- Rawls' equal opportunity principle is comparable to Miller's principle of desert as they both posit that every citizen should have the same opportunity to compete for rewards based on performance and societal practices should be set up to assure this outcome (Robinson, 2013).

- Inequalities are acceptable if they are arranged to the greatest benefit of the least advantaged members of the society (Rawls, 2003).

By implication, for a technique of stakeholder engagement to be in line with the principles of social justice it must have the following attributes:

- The stakeholder engagement technique must be open to every stakeholder who is affected by the decision to be made, whether directly or indirectly, and the stakeholders must be given equal access to the decision making process.

- The stakeholders must have equal opportunities to have their opinions and concerns represented in every stage of the policy cycle in the decision making process. To achieve this end, the decision makers have to ensure that each of the stakeholders, whether they possess scientific knowledge or local knowledge, have the same amount of time to present their views, and have equal access to the platforms on which the opinions are presented. Also each of the

stakeholders must be allowed to present his/her opinion and all the concerns and views should be represented in the policy cycle without prejudice.

- The stakeholder engagement technique must not interfere with the liberties and rights of the stakeholders. Each of them must be allowed freedom of expression; to ensure this, the stakeholder engagement techniques must be non-confrontational and there should not be any restrictions to the views and concerns that can be raised by the stakeholders.

The stakeholder engagement technique must take into account the basic needs of the stakeholders and not interfere with their ability to meet these needs. To achieve this end, the engagement techniques must not only allow the stakeholders represent their concerns and needs in every phase of the decision context, they should also be allowed to see how their needs and interests will be affected in the various stages of the decision making process and in the potential decisions that can be reached. Also potential sources of interference to their abilities to provide for their needs should be anticipated and factored into the decision making process.

- The stakeholder engagement technique must be transparent and aid consensus building, so as to ensure that each stakeholder has the same opportunity to have their interests factored in every stage of the decision making process and the final decision.

- The stakeholder engagement technique must be arranged so that the least advantaged stakeholders are given the greatest benefits. This can be achieved by ensuring that the weaker, less advantaged stakeholders (like residents of the affected areas and aboriginal groups) are represented in every step of the decision making process and their opinions are not

drowned out by their more powerful counterparts like the government, NGO's and industry. Also the stakeholder engagement must facilitate information exchange, so that the stakeholders can all be empowered with information, especially the least advantaged stakeholders. This should be done so as to ensure that each of the stakeholders is given the opportunity to make the most enlightened decision on what is best for them.

From the attributes described above, it can be inferred that the most important elements of stakeholder engagement to social justice are as follows:

- All the stages of the engagement process should be open to all interested stakeholders.
- Equal amount of time be allotted to present their opinions.
- Equal access to the stakeholder engagement platforms.
- No restrictions to issues that can be discussed.
- Each stage of the process must be transparent.
- The process must be non-confrontational.
- Development of performance measures.
- Factoring in of uncertainties.
- Least advantaged stakeholders should have representatives on the decision making panel.
- Facilitate information exchange.

- Facilitate compromise and trade-offs.

In this chapter, this study will analyze the different steps of the NLHFRP and the SDM stakeholder engagement methods to discover if they comply with the standards of social justice

## 5.2 ANALYZING NLHFRP AND SDM WITH SOCIAL JUSTICE

Analysis of the stakeholder engagement techniques propounded by the NLHFRP and SDM. The first column lists the social justice principles that are relevant to stakeholder engagement, the other columns show how much the NLHFRP and the SDM stakeholder engagement techniques comply with each principle. To show the degree of compliance, the study has opted to use the terms "High", "Medium", "Low" and "absent". The stakeholder engagement technique will be said to be "High" if the technique effectively complies with the social justice precept at all or most of the stages. It will be "medium" if it complies with the precept only partially or in half or slightly above half of the stages, while it will be "Low" if the technique complies with the precept in less than half of the stages. It will be "Absent" if the technique does not comply with the precept at any stage.

The stages of stakeholder engagement to be analyzed under the NLHFRP are the selection of the panel, the decision on the mandate of the panel, the decision sketch and selection of the scope of the panel and potential questions to be discussed, organization of public review sessions, the process for collection of information from stakeholders, the process for review of documents and information in the decision making process, the process for dissemination of information to the stakeholders and general public, the process for incorporation of

stakeholders' concerns and views into the final report and the process for getting and clarifying relevant information from the stakeholders.

. To effectively determine which of the stakeholder engagement techniques discussed in this study complies more closely with social justice, a table with four headings has been developed (Table 14). The first heading is for the social justice principles the stakeholder engagement techniques are supposed to comply with, the second heading shows how closely the NLHFRP complies with the social justice principle, the third represents how well the SDM framework applied in the case study complies with the social justice principle despite the various limitations surrounding it. The final heading represents the SDM framework under ideal situations when not beset or hindered by limitations as to man power and resources.

*Table 14 comparison of SDM and NLHFRP compliance with social justice principles*

| Social Justice Principle | NLHFRP | SDM (Case dy) | SDM (Ideal) |
|---|---|---|---|
| **All stages open to all stakeholders** | Low | High | High |
| **Equal amount of time given to stakeholders to sent opinions** | High | Medium | High |
| **Facilitation of compromise and trade-offs** | Absent | High | High |
| **Facilitation of information exchange** | Medium | High | High |
| **Least advantaged have representatives on the ision making panel** | Absent | Medium | High |
| **Uncertainties are factored into the process** | Low | High | High |
| **Development of performance measures** | Absent | High | High |
| **All stages are non-contentious** | Low | High | High |
| **All stages are transparent** | Medium | High | High |
| **No restrictions to issues that can be discussed** | Low | High | High |
| **Equal access to the stakeholder engagement tforms** | High | Medium | High |

High - the technique effectively complies with the precept at all or most of the stages. Medium – the technique complies with the precept only partially or in half or slightly above half of the stages.

Low – the technique complies with the precept in less than half of the stages Absent – the technique does not comply with the precept at any stage.

## 5.3 DISCUSSION

On the social justice principle requiring that all stages of the engagement process be open to all the stakeholders, the NLHFRP was assigned the "low" grade while the SDM was assigned "high". The reasons for these scores are as follows:

- Under the NLHFRP, the stakeholders are excluded from a number of key steps in the decision making process. The stakeholders' opinions were not considered in the selection of the members of the Panel, neither were they involved in determining the mandate and scope of the Panel. Also, though the NLHFRP claimed to have worked with undisclosed stakeholders in Western Newfoundland to determine the most appropriate locations and timing for the Public Consultation Sessions, the backlash and criticism suffered by the decision to limit the public review sessions to only four locations (Rocky Harbour, Stephenville, Port au Port East and Corner Brook) pointed to the fact that several key stakeholders had been left out of the decision on the locations and venues for the public review sessions (reference).

- In the case study involving the use of SDM, the stakeholders are involved in almost every phase, apart from the selection of experts. In the simulation, allowance was made for the residents of the affected areas to select members of the communities to represent them throughout the SDM process. This situation is true under the ideal SDM situations, the stakeholders are allowed to participate in every step of the SDM process, from the decision sketch to the trade-offs.

On the principle of social justice that posits that all stakeholders should be given equal amount of time to state their opinions, the NLHFRP had a score of "high" while SDM had a score of "medium". These scores were due to the following reasons:

- The NLHFRP had a defined structure to ensure that all interested stakeholders had an equal amount of time to present their views and opinions before the Panel. The Panel provided a forty five day window for interested stakeholders to send in their written submissions, after which the Panel was available for meetings with those who made requests to meet face to face or via teleconference so as to allow them provide a brief review of their written submission. At the sessions, priority was given to those who submitted written submissions to the Panel and they were provided up to 10 minutes to highlight the key and salient points in their submissions and the Panel took up to 10 minutes to ask any clarifying questions. Subject to time constraints, walk in presenters were given up to five minutes each to make their oral presentations, while the Panel took up to five minutes to ask clarifying questions. This structure ensured that all the stakeholders had an equal amount of time to state their opinions.

- In the SDM simulation, however, there was no clear structure to ensure that the stakeholders were given an equal amount of time to express their opinions and concerns. Though the stakeholders were each given as much time as they needed to express themselves, there was no active mechanism in place to ensure that the time allotted to the stakeholders was equal. However, in an ideal SDM application, steps will be taken by the professional facilitator to ensure that all the stakeholders are given equal amount of time to present their views so as to ensure that the least advantaged stakeholders are not drowned out by the more powerful stakeholders.

In the social justice principle that opines that stakeholder engagement techniques should facilitate trade-offs and compromise, the NLHFRP scored "absent" while the SDM stakeholder engagement techniques scored "high". This was due to the following reasons:

- Under the NLHFRP, the impact of each individual stakeholders' concerns and interests is unknown as the Panel did not clearly state how much influence the stakeholders' concerns would have in their report, neither did they state clearly the impact their report would have on the decision that would eventually be made on the issue of hydraulic fracturing in the province. This has made it impossible for the occurrence of trade-offs and compromise.

- Under the SDM, several tools like 'performance measures' are utilized that allow each stakeholder to state his/her concerns clearly and measure the impacts on them across the alternatives. This ensures that each stakeholder's interests are clearly understood, and also helps the stakeholders realize what compromises must be made to ensure that their ideals are met in the final decision that is reached. This facilitates trade-offs and compromise as each stakeholder is brought to a broader understanding of the issues and what must be done to achieve their ends. Also, in the simulation exercise, the facilitators ensured that there was a broad spectrum of stakeholders from across the poles who are involved in every stage of the decision making process. This ensures that each stakeholder is given ample opportunity to share their opinions and learn from other stakeholders. This helps the stakeholders understand the opinions and positions of the other stakeholders which aids in compromise and trade-offs. This situation is the same under the ideal SDM application.

For the social justice principle that posits that stakeholder engagement should facilitate information exchange, NLHFRP was given a score of "medium", while SDM scored "high". These scores are due to the following reasons:

- Though the public forums the NLHFRP organized were public and stakeholders were allowed to air their views and opinions, the Panel did not create an avenue for experts and stakeholders to meet and exchange information so as to improve the knowledge of all the parties and encourage compromise and better decision making. Also, many of the forums were emotionally charged and filled with controversy and strong polarizing emotions. This made it difficult for some stakeholders to get their points across because the louder stakeholders drowning out the less vocal stakeholders. As a result of these factors, though the information from all the various stakeholders were available both on the website and during the public forums, adequate steps were not taken to ensure that the environment was non-confrontational so that each stakeholder would not just know the opinions of the other stakeholders, but also understand their positions.

- Under the SDM, the selected stakeholders are involved in every phase of the decision making process, including the decision sketch; this enables all the stakeholders to have a full understanding. Also, with tools like 'performance measures' each of the stakeholders' concerns are converted from emotionally charged opinions, into measurable items, that can be easily understood by all the stakeholders in the decision sketch. This is the same under the ideal SDM application, and with more resources, man power, and time, information exchange can be even more effectively achieved than was achieved in the simulation exercise.

In the social justice ideal that posits that the least advantaged should have representatives on the decision making panel the NLHFRP scored "absent" while the SDM was scored "medium". These scores were awarded for the following reasons:

- The NLHFRP's Panel is comprised entirely of white males with a narrow scope of expertise. The members of the Panel mostly bring knowledge from the areas of engineering, economics and biochemistry, which do not cover the wide range of issues, like medicine, the environment and socio- economic impacts that surround the issue of fracking in the region. Less advantaged stakeholders, like aboriginals, residents of the affected areas and women, are not represented on the Panel.

- Under the SDM simulation, though the facilitators made a great deal of effort to include as many stakeholder groups like conservation biologists, oil and gas geologists, local NGO's and civil society groups, economists and the government, from across the two poles in the decision making process, they were unable to incorporate the opinions of smaller, less advantaged groups, like residents of affected areas, aboriginal groups and local businesses. Under the ideal situation, the decision makers will have adequate resources to ensure that the least advantaged stakeholders are both identified and mobilized to ensure that they are able to participate in the decision making process.

The social justice ideal that demands that uncertainties be factored into the decision making process saw the NLHFRP score "low" while the SDM scored "high" for the following reasons:

- Though the NLFHRP had a broad scope with an extensive list of potential questions, they were closed to opinions and concerns outside their scope and potential questions. As a result of this, stakeholders would have been unable to raise issues that revolved around sources of potential uncertainties if they fell outside the defined scope of the panel. The narrowing of the topics that could have been raised by stakeholders ensured that new sources of uncertainty could not be unearthed.

- One of the core phases of the SDM process is the uncertainties step, where potential sources of uncertainty are discussed and either resolved or factored into the decision making process. Also, since there is no limit to the subjects and types of opinions and concerns that can be raised by the stakeholders, the possibility of discovering new sources of uncertainty are very high. This is the same under the ideal SDM applications.

Another relevant ideal of social justice is that performance measures should be developed so that stakeholders can clearly see how their concerns and objectives will be affected within all the possible objectives, so they can make the best possible decision and compromise and trade-offs can be encouraged. Under this precept, NLHFRP scored "absent" while the SDM scored "high", for the following reasons:

- The NLHFRP did not expressly show to the stakeholders how their opinions, views and objectives will be incorporated into the decision. Though at the public forums stakeholders were given time to express their views and clarify their positions, and the Panel sometimes took time to ask clarifying questions, the Panel never expressly showed how these views will be

incorporated into the decision sketch and how they will be affected by the various alternative solutions.

Under the SDM, the development of performance measures is an important step. In situations where the objectives are difficult to measure, proxy or constructed measures will be developed to create value-based systems to measure the impacts the alternatives will have on their objectives and values. This is the same under the ideal SDM application, and it can even be better achieved as professional sociologists and folklorists business leaders, economists, community leaders, etc., can be employed to more effectively collect information on the important values of the stakeholders and can aid in developing constructive measures to measure the values that cannot be measured by natural measures or proxy measures. It is also imperative to social justice that all stages are non-contentious so as to ensure that information exchange is fostered and so that least advantaged stakeholders would not be drowned out by the more powerful stakeholders. In this precept, the NLHFRP was scored "low" while the SDM was score "high". This is due to the following reasons:

- Because the NLHFRP allows stakeholders the opportunity to submit written submissions and only those who request for face-to-face meetings and those from whom the Panel requires further clarifications are allowed to speak within an allotted time, the stakeholders are made to feel defensive and they use their allotted time to actively and doggedly defend their positions. This technique can lead to a heightening of passion, debate and contentiousness. This situation can affect information exchange and trade-offs.

- In the SDM process, each stakeholder is given ample time to state their concerns and each of these concerns and objectives are represented clearly within the decision context. This allows each stakeholder to be less confrontational and insecure, as the fear that their objectives will be overshadowed by other stakeholders or forgotten as the process goes along is reduced. This allows the stakeholders to be more receptive to the ideas of the other stakeholders. This is the same under the ideal SDM applications.

For a stakeholder engagement technique to comply with the doctrines of social justice all stages of the decision making process should be transparent. This is to ensure that each stakeholder is carried along and understands how the final decision is reached, so as to improve the legitimacy of the decision. Transparency also helps prevent the occurrence of situations where the more powerful stakeholders influence the final decision and suppress the views and objectives of the less advantaged stakeholders. The NLHFRP was scored "medium" while the SDM scored "high". These scores are due to the following reasons:

- Though the website for the NLHFRP is filled with all the information on the Panel, its scope, processes, dates for the public forums and the documents relied on in their final report, among other information, there is no clear mention of how the various stakeholders concerns would be incorporated into the decision making framework. Also, the influence the final report would have on the final decision to be made by the minister is unknown to the stakeholders. The stakeholders were also not informed as to the procedure for the selection of the members of the panel and the decision on the scope of their duties.

- The SDM is a fully transparent process that allows the various stakeholders to clearly see how all the decisions are reached, and how the concerns of each stakeholder are represented in the decision context. This is the same under the ideal SDM applications.

It is imperative that for social justice to be complied with, there should be no restrictions to issues, objectives and concerns that can be raised and discussed by the stakeholders. Under this principle, the NLHFRP scored "low" while the SDM scored "high", for the following reasons:

- Though the scope of the NLHFRP is very broad and clear efforts were made to include as many questions as possible in the potential questions, the Panel was closed to receiving information and objectives that were outside its scope. This position precluded a lot of stakeholders from presenting their views and concerns.

- Since the stakeholders are involved in every step of the SDM process, including the decision sketch, there is no limit to the topics that can be discussed by the stakeholders relating to the issue of fracking. And as they are exposed to more information and more uncertainties are brought to light, the stakeholders are afforded every opportunity to change their positions or modify their objectives. This is the same under the ideal SDM applications.

Finally, it is imperative for all the stakeholders to have equal access to the stakeholder engagement platforms. This is to ensure that no individual stakeholders or groups of stakeholders with unique interests are excluded from the decision making process. The engagement platforms should be open to all interested stakeholders. Under this head, the

NLHFRP scored “high” while the SDM scored “medium”. The reasons for these scores are as follows:

- The NLHFRP website is open to any interested stakeholder and on the website the stakeholders are instructed on how to make submissions to the panel which would be accepted provided they are within the scope of the mandate of the Panel. This opens the engagement to a diverse group of stakeholders and reduces the chances of any stakeholders being overlooked.

- In the simulation using SDM, though the facilitators attempted to select a wide variety of stakeholder in the decision making process, there are still some less advantaged stakeholders that were left out and as such were unable to participate in the decision making process. Under the ideal situation, the decision makers will have the resources to ensure that every interested stakeholder is given the opportunity to participate in the decision making process and the infrastructure will be available to accommodate all the stakeholders.

In order to score the performance of these stakeholder engagement techniques it is useful to assign number values to their compliance with the various social justice principles that are related to stakeholder engagement.

*Table 15 Compliance score of SDM and NLHFRP*

| **Social Justice Principle** | **NLHFRP** | **SDM (Case dy)** | **SDM (Ideal)** |
|---|---|---|---|
| **All stages open to all stakeholders** | 1 | 3 | 3 |

| | | | |
|---|---|---|---|
| **Equal amount of time given to stakeholders to sent opinions** | 3 | 2 | 3 |
| **Facilitation of compromise and trade-offs** | 0 | 3 | 3 |
| **Facilitation of information exchange** | 2 | 3 | 3 |
| **Least advantaged have representatives on the ision making panel** | 0 | 2 | 3 |
| **Uncertainties are factored into the process** | 1 | 3 | 3 |
| **Development of performance measures** | 0 | 3 | 3 |
| **All stages are non-contentious** | 1 | 3 | 3 |
| **All stages are transparent** | 2 | 3 | 3 |
| **No restrictions to issues that can be discussed** | 1 | 3 | 3 |
| **Equal access to the stakeholder engagement tforms** | 3 | 2 | 3 |
| **Total** | **14** | **30** | **33** |

High – 3; Medium – 2; Low – 1; Absent – 0

As shown in Table 15, SDM complies more closely with the doctrines of social justice than the NLHFRP technique, when the scores in table 14 are converted into numerical scores, with "high" representing a score of 3, "medium" representing a score of 2, "low" a score of 1 and "absent" representing a score of 0. Out of a possible maximum of 33 points in all the social justice precepts, the SDM technique as applied in the case study scored 30 points while the NLHFRP engagement method only scored 14. The areas where the SDM scored "medium" were the result of the limitations faced by the team running the SDM simulation. Some of these limitations were information gaps, limited number of people to help with the simulation, limited amount of time, limited amount of resources to fund a workshop with actual stakeholders. It is the belief of this study that if these limitations are eliminated, the SDM framework would be even more effective in facilitating stakeholder engagement and good decision making and

would comply with all the social justice principles and achieve a score of 33 on this table. It is imperative to note that the current scores awarded to the SDM on the table are a reflection of the simulation and not of the SDM process in its entirety.

# CHAPTER 6: RECOMMENDATIONS AND CONCLUSION

## 6.1 RECOMMENDATIONS FOR THE APPLICATION OF FRAMEWORK TO NON-RENEWABLE RESOURCE MANAGEMENT

The importance of proper stakeholder engagement that conforms with the doctrines of social justice cannot be over emphasized. With the effects of climate change becoming more apparent every day, it is important that stakeholders are allowed to be involved in the decision making regarding issues that affect them. The decisions made can have far reaching effects on the lives of many of the stakeholders, whether economically, socially or environmentally. Sometimes, these decisions interfere with the fundamental rights of the stakeholders, adversely affecting their right to a healthy environment, or a good quality of life. As a result of these huge impacts, proper stakeholder engagement has become much more than a formality. It is the duty of governments around the world to ensure that the rights and liberties of their citizens are protected. This can only be achieved if the citizens are given the opportunity to convey their concerns, values and aspirations. It is a strong recommendation of this study that more research is carried out into entrenching good stakeholder engagement practices as legal rights of citizens. Guidelines should be developed for stakeholder engagement in all decision making processes governing the use and conservation of non-renewable resources.

The blend of different types of knowledge, be it local knowledge or expert knowledge, helps the decision makers reach balanced and better thought-out decisions. It is therefore imperative that representatives from every potential source of impact be present in the engagement sessions. Also, the decision makers must ensure that there is no over reliance on scientific information to the extent that the subjective values of the stakeholders possessing local

knowledge are ignored or seen as less important. Rather, the hard facts from the scientific stakeholders should be adapted to each unique case using the values and objectives of the stakeholders with local knowledge.

The doctrines of social justice have enjoyed a great deal of success in ensuring that the rights and interests of individuals in societies around the world are protected. It is therefore logical to believe that these same principles can be adapted to decision making in resource management. To battle the adverse effects of poor non-renewable resource management decisions, and also ensure that the values of the stakeholders are protected in whatever decisions are made, the stakeholder engagement techniques must be refined, developed and adapted to each unique situation and stakeholder. However, these various adaptations should be made to adhere to the rules of social justice that are relevant to stakeholder engagement. Some of these attributes are as follows:

- The process should be open to all interested stakeholders.
- Each stakeholder should be allowed equal time and opportunity to present their views.
- The various stakeholders should not be limited in the areas of concern that can be raised provided that the concerns are related to the decision in question.
- The concerns and objectives of the stakeholders should be factored into every stage of the decision making process.
- Performance measures should be assigned to ensure that the stakeholders know how their objectives will be affected by the various alternative solutions.
- Information exchange should be facilitated by the decision makers.

- Uncertainties and knowledge gaps should be identified and filled or factored into the decision framework.
- The stakeholders should be given equal time to and access to the engagement platforms.
- The process should be transparent and non-contentious.
- The process should be reiterative so as to monitor the decision's efficacy and also to fix new problems as they arise.
- The least advantaged stakeholders, like Aboriginal groups, residents of affected areas etc., should have representatives on the decision making panel.

The SDM techniques can be used to achieve the above listed goals, if effectively applied. In applying SDM to non-renewable resource management it is important to ensure that stakeholders with both expert knowledge and stakeholders with local knowledge are aptly represented so as to ensure that the decisions reached are not only scientifically sound but also value-laden reflecting each unique decision's context. The importance of compromise and trade-offs cannot be overemphasized as not only do they help to legitimize the final decision reached, they also facilitate information exchange as in the process of trading-off and compromising each stakeholder will have to understand the objectives and concerns of the other stakeholders.

Steps should also be taken to mitigate the occurrence of the limitations faced in the case study. It is imperative that every effort is taken to ensure that the least advantaged stakeholders are well represented in the decision making process. Also, steps should be taken to ensure

stakeholders are given every opportunity to air concerns and ensure that these concerns and objectives are clearly represented in the decision context.

## 6.2 CONCLUSION

It is imperative for stakeholders to be properly engaged before decisions are reached, particularly in high impact sectors like non-renewable resource management. The case study of hydraulic fracturing in the Green Point Shale Formation, Newfoundland and Labrador, is a perfect example of a highly polarized and contentious issue that requires specialized and effective stakeholder engagement. Some stakeholders are of the opinion that the economic potential of the shale gas trapped in the rock formations is worth the environmental risks posed on the environment. Other stakeholders believe that the risks posed to the environment, coupled with the threat by UNICEF to remove the heritage status of the Gros Morne National Park, which would impact the thriving tourism industry in the region, are greater than the economic potential of the park. The controversy resulted in the establishment of the NLHFRP whose mandate was to conduct a public review and advise the Minister of Natural Resources on the socio- economic and environmental implications of the hydraulic fracturing process with respect to the possible exploration and development of the shale petroleum resources of Western Newfoundland. To achieve its mandate, the Panel applied several stakeholder engagement techniques including surveys, public forums and collection of written submissions.

This study analyzed the doctrines of social justice and identified the precepts that were most relevant to effective stakeholder engagement. The study also explored the SDM as a decision making tool, analyzing its methods and tools for stakeholder engagement. Armed with

this information, the study developed a framework to compare the two techniques' compliance with social justice.

To identify the principles of social justice which are relevant to stakeholder engagement, the study conducted an analysis of the principles of social justice as propounded by John Rawls and David Miller. After the analysis, it was determined that Rawls' principles of equal liberties and equal opportunities as well as David Miller's principles of equality and principles of desert are the most relevant to stakeholder engagement. After adapting these principles to stakeholder engagement, the study identified the following elements as imperative to the attainment of social justice in stakeholder engagement:

- All the stages of the engagement should be open to all interested stakeholders.
- Stakeholders should be given equal amount of time to present their opinions.
- Stakeholders should have equal access to the stakeholder engagement platforms.
- There should be no restrictions to relevant issues that can be discussed.
- Each stage of the process must be transparent.
- The process must be non-confrontational.
- Decision makers should facilitate development of performance measures.
- Uncertainties should be factored into the decision context.
- Least advantaged stakeholders should have representatives on the decision making panel.

- The engagement technique should facilitate information exchange.
- The technique should facilitate compromise and trade-offs.

The study critiqued the Panel's engagement techniques, examining the various criticisms levied against the Panel's methods.

The study also analyzed the SDM as a decision making tool, examining each of the tool's stages to describe their purposes and the processes for their application. A simulation was then run applying SDM to the Green Point Shale Formation case study. The various tools for effective stakeholder engagement were then applied albeit with some limitations like limited time, money and man power.

The study then applied the already identified relevant social justice principles to create a framework for the comparison of the NLHFRP stakeholder engagement technique and the procedure recommended by the SDM to see which complies more closely. SDM was shown to conform most closely to these principles, both in the limited state, as applied in the case study, and in its ideal non-inhibited state.

To ensure that decision making in non-renewable resource management conforms to the tenets of social justice, it is recommended that the SDM is applied for stakeholder engagement. It is also imperative that adequate resources are made available to ensure that the least advantaged stakeholders are allowed to participate in the decision making process and that the top experts in the relevant fields are made available so that their knowledge can be incorporated in the decision context.

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