Maximizing Local Benefits: Natural Gas Development in Northeast British Columbia

Report prepared at the request of Industry Canada in partial fulfillment of University of British Columbia, Geography 419: Research in Environmental Geography, for Dr. David Brownstein.

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EXECUTIVE SUMMARY

BC’s natural gas (‘NG’) industry has grown significantly over the past decade and emerged as one of the province’s strategic sectors. Given the key role it plays in BC’s economy, this study builds on the Department of Industry’s (‘Industry Canada’) interest in understanding to what extent communities in Northeast BC (‘NEBC’) are maximizing economic benefits through NG development. The study arrives at the following findings:

- Northeast BC’s NG industry drives GDP, high-paying employment opportunities, business development, and revenues for particular municipalities;
- Although industries are expanding upstream opportunities outside of the conventional natural gas development value chain, economic benefits are not maximized to the full extent as reflected by employment leakages and weak downstream initiatives; and
- NG industry’s social and environmental impacts undermine the industry’s long-term development, community growth and ability to maximize benefits.

To help communities optimize NG’s potential, this study recommends:

- Support existing initiatives on local skills development to help bridge existing labour supply with industry needs;
- Facilitate regional initiatives to bring together NG businesses across the supply chain to network, access resources and showcase industry’s capabilities to NG producers;
- Nurture local capacity in value-added activities in NG;
- Identify strategies to manage the industry’s social impact and improve liveability in order to support a prosperous and long-term settlement by permanent residents; and
- Promote better communication, transparency and accountability of the industry’s environmental conduct.
The study aims to present a snapshot on the local NG industry in BC through examining:

1. General economic contributions of natural gas to the Northeast region;
2. Key economic activities taking place at the local level;
3. Challenges associated with “unmaximized” benefits and leaked opportunities; and
4. Other barriers to long-term local development.
This research relied on secondary literatures of diverse natures. Primary sources, including media reports, government publications and industry communication materials, were used to gain baseline knowledge. Public statistical datasets were acquired to illustrate economic trends. This study also benefited from semi-structured interviews and informal conversations with scholars and local stakeholders to help fill in information gaps and gain local perspectives.

The study area is limited to BC’s only NG producing region – NEBC, which intersects the petroleum-rich Western Canada Sedimentary Basin. Home to the Peace River and Northern Rockies regional districts, NEBC has less than 2% of BC’s workforce but 17% of the provincial employment in natural resource (BC Stats, 2011). The region sees a low unemployment rate and high income level (ibid). To help illustrate NG’s impact at the local level, this study will draw examples from Dawson Creek, an active participant in the industry.

<table>
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<tr>
<th>Table 1: Regional &amp; Community Profile in 2011</th>
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<tr>
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<tr>
<td>Population</td>
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<tr>
<td>Employment</td>
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<td>Unemployment</td>
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<td>Medium Income$^1$</td>
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(BC Stats, 2011; Census Canada, 2011)

**ECONOMIC IMPACTS$^2$**

With the support of new drilling and fracturing technology, infrastructure, provincial policies and improved regulatory processes, the industry is now able to unlock the economic potential of unconventional resources in NEBC (OnPoint, 2010). Between 1999 and 2008, the oil and gas

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$^1$ Based on most recent data from 2009

$^2$ The data pertaining to the following indicators are sourced at the provincial level – the smallest spatial unit available – and are aggregated with the oil extraction industry. However, given that NEBC is the only gas-producing region and that BC has a relatively insignificant oil extraction industry, the trends shown in this section may be largely indicative of the current landscape in Northeast BC (Oil and Gas Commission, 2013).
industry expenditures rose substantially from $1.7B to more than $9B while production of NG increased from 0.86 Trillion cubic feet (Tcf) to 1.25 Tcf (Adams, 2011). This growth is partially reflected by the recent economic trends shown below.

**Gross Domestic Product (GDP)**

The GDP contribution of the oil and gas extraction industry shows a positive growth of 176% overall between 2002 and 2008. After GDP peaked in 2005 — corresponding to peak drilling levels in that year — the trend has declined for two years as a result of the reduced demand from the US, a global commodity price drop, and the global financial downturn (Institute of Chartered Accountants of BC, 2009). Noticeably, the oil and gas GDP figure in BC shows a volatile trend that is reflective of the industry’s cyclical nature. Since then, the industry’s GDP contribution has gradually recovered.
Employment & Earnings

Similar to GDP, employment in oil and gas extraction has seen slowdown beginning in 2005, but nevertheless, an overall positive growth. The figure increased by around 70% between 2002 and 2012 and continues to grow at a rapid pace with recovering drilling activities. The growing demand for workers has also driven up earnings levels, which continue to grow at a higher rate than the total goods sector.

Municipal Revenue

In BC, municipal governments earn resource-related revenue through property tax. As 95% of the natural gas activities occurs outside of municipality boundaries, tax revenue for the municipality is modest (Arnesnault, 2012, 22), with the exception of the Peace River Region. Under the *Fair Share Agreement*, the province allocates a tax transfer to Peace River Region’s municipalities, as a compensation for hosting natural resource projects, the majority of which are NG-based3 (Markey et al., 2011). Dawson Creek’s revenue has increased significantly as a result of the Fair Share Agreement (City of Dawson Creek, 2003). In 2001, the City received

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3 The grant considers the population, equalized per capita taxation and industrial tax agreements.
a total of $3,906,000, roughly 15% of total revenue (ibid). In 2008 and 2009, the figure rose to 25% (Markey et al., 2011). The transfer has put Dawson Creek among the top recipients of provincial transfers (Ministry of Community, Sport and Cultural Development, 2005-2011).

**Other Economic and Business Impacts in Dawson Creek**

Qualitative and anecdotal findings from Dawson Creek suggest that the positive economic growth has been felt locally. Between 2001 and 2006, employment in the mining, oil and gas extraction industries alone in Dawson Creek has increased by 33% (Census Canada, 2001 & 2006). The city Mayor, Mike Bernier, has also observed that NG industry contributes to an average of 100 businesses per year over the last four years; approximately 80% of which are of suppliers and services that support NG activities (Bernier, 2013).

Business development, as well as training provided by operating companies, has fostered entrepreneurship, technical and professional skills for local residents, all of which are valuable transferable attributes in developing local capacity (Connolly, 2013). Operating companies have also been active in investing in community infrastructure, including the EnCana Events Centre, the Shell Wastewater Treatment Plant as well as BP Energy’s donation of solar panels for the Northern Lights College (Lawrence, 2012).

While this study focuses on direct impacts, local stakeholders suggest that the large influx of industry presence has induced spill-over effects on the service economy in areas such as Dawson Creek (Bernier, 2013). This study recommends further research on the multiplier effects of the NG industry.
TRENDS IN DAWSON CREEK

The Natural Gas Supply Chain

Upon purchasing land rights, NG companies normally subcontract operations to businesses
either from the local community or elsewhere depending on the stage of development (Bernier,
2013). The different stages in an NG project include: the upstream exploration and production
of NG; the midstream processing; and the downstream distribution and manufacturing
(OnPoint, 2010, 25). Through exploring case studies on natural resource communities in North
America and consulting stakeholders, the following section outlines the key generic phases for
an NG development that takes place in NEBC and Dawson Creek4 (Bernier, 2013; Jacquet, 2011;
Seydor et al., 2011).

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4 The supply chain is simplified and tailored to describe the key activities in NEBC communities, and as a result,
excludes some corporate affairs and service type activities since they generally do not take place within the
community.
Expanding the Supply Chain

Besides the generic activities in NG development, there have been ongoing and proposed efforts by companies in and around Dawson Creek to expand opportunities beyond the standard supply chain phases. These efforts have increased employment opportunities as well as local capacity to diversify the industry outside of primary extraction.

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**A Simplified Natural Gas Supply Chain in Northeast BC**

<table>
<thead>
<tr>
<th>Upstream</th>
<th>Midstream</th>
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<tr>
<td><strong>Exploration &amp; Regulatory</strong> describes a pre-development stage where scientific and field studies and legal and environmental assessments are conducted (Seydor et al., 2012).</td>
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<tr>
<td><strong>Construction/Drilling</strong> of the gas well and transportation infrastructure is labour-intensive in nature and accounts for at least 80% of the on-site workforce due to its labour-intensive nature (Jacquet, 2011, 4).</td>
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<tr>
<td><strong>Extraction &amp; Production</strong> is the long-term production of NG and operation of the plant and infrastructure. This phase involves fewer but long-term and semi-skilled employees (Jacquet, 2011).</td>
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<tr>
<th>Midstream</th>
<th>Downstream</th>
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<tr>
<td><strong>Processing</strong> refines the NG by removing impurities from the raw gas stream. Processing is already common to the Northeast and continues to expand to meet the market demands (OnPoint, 2010).</td>
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<tr>
<td><strong>Transportation/Distribution</strong> occurs when the marketable gas is distributed through pipeline systems to the end-user within the province, in Alberta or the US (OnPoint, 2010).</td>
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Figure 3: Simplified Natural Gas Industry Supply Chain in NEBC
**Waste Water Treatment**

As a result of the hydraulic-fracturing process⁵, NG companies are heavy consumers of water. Frequent droughts and water shortage have forced companies in Dawson Creek to cease operations for months (Hume, 2010). The City responded by working with Shell Canada on establishing a $12M Dawson Creek Reclaimed Water Plant, which recycles the City’s wastewater to standards that could be used for industrial and municipal services (Shell, 2012). Shell Canada now draws water directly from the plant, and the City is able to sell the rest (ibid).

**Chemical Supply**

As a result of the shale activities, companies have established liquid nitrogen facilities close to their industrial customers in Dawson Creek. Liquid nitrogen facilities take in ambient air from surroundings, and separate the gas elements before condensing the nitrogen to liquid form (Bains, 2012b). NG drillers use liquid nitrogen to enable fracturing and help decrease water consumption (ibid). The Calgary-based energy service company, Ferus Incorporated, launched BC’s first liquid nitrogen facility in Dawson Creek in 2011 (Ferus, 2011). In 2012, Air Liquide Canada has also announced plans for a Nitrogen Facility in Dawson Creek (Air Liquide, 2012).

**Process Innovation**

Local stakeholders indicate that NG companies in Dawson Creek and NEBC have pioneered technologies in the current upstream process of NG development. Examples include EnCana drawing saline water from deep wells for fracturing and NG service providers developing technologies that could be used under harsh environments in Northern BC (Connolly, 2013).

⁵ See Environmental Considerations.
Various innovations are currently undergoing commercialization process and are potentially exportable (ibid).

Natural gas liquids extraction

Companies in Dawson Creek are also seeking to produce natural gas liquids (NGLs), which are hydrocarbons (e.g., ethane, propane and butane) carried in raw NG (Seydor et al., 2012). NGLs are key ingredients in the manufacturing of petrochemicals and plastics and can be marketed at an even greater value than natural gas itself (ibid). In 2012, Spectra Energy has proposed the Dawson Liquids Extraction Project to leverage on the rich NG feedstock and pursue this value-added capacity and benefit from the rich NG feedstock (Bains, 2012). As Kathleen Connolly of Dawson Creek Chamber of Commerce suggests (2013), economic gains from NGLs could potentially offset effects from the drop in NG prices.

DIRECT CHALLENGES

Employment Leakages

Scholarly sources suggest that NEBC communities do not participate fully in all local development stages, resulting in employment leakages out of the local region (Initiatives Prince George, 2009; Ryser et al., 2008). The majority of the local employees are involved in primary and trades employments during the upstream phases. Common jobs taken on by local residents include machine operators, welders and general construction labour. Opportunities outside of these areas – especially high-valued employment such as accounting and legal services, geophysical field and engineering operations – are leaking out of the local communities to regional headquarters of the operating companies and, or undertaken by temporary workers (Northern Development, 2008; Ryser et al., 2008; Bernier, 2013). According to a North Peace
Economic Commission study, the leakage could be as many as 37,000 service jobs – ranging from environmental consulting to accounting positions – and as much as $1.6B in income (Ryser et al., 2008). BC Energy Services estimates that “55% to 65% of every dollar spent on exploration and production in BC goes to out of the province service providers” (Northern Development, 2008).

The high proportion of primary workers is partly related to the majority of projects concentrating in upstream stages (Bernier, 2013). Yet, it is also recognized that NEBC’s labour force lacks the skills and training to conduct specialized services required by the industry (Initiatives Prince George, 2008; Ryser et al., 2008; Markey et al., 2011). For one reason, NEBC’s population lags slightly behind the province in education attainment. Secondly, the region has had few industry-related training programs only until recently (Bernier, 2013). Stakeholders have also attributed skills shortages to the low population growth in the area, which is a barrier to supplying qualified talents (Bernier, 2013; Connolly, 2013).

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<thead>
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<th>Northeast BC</th>
<th>BC Average</th>
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<tr>
<td>Below High School Diploma</td>
<td>11%</td>
<td>13%</td>
</tr>
<tr>
<td>College Diploma and Trade Certificates</td>
<td>35%</td>
<td>32%</td>
</tr>
<tr>
<td>University Degree</td>
<td>13%</td>
<td>24%</td>
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Table 1: Education Attainment between ages 24 and 64 in NEBC and BC (Statistics Canada, 2006).

Energy Services BC adds that the economic benefits of service industry employment flow out of the province due to a lack of connection with NG developers, most of which are based in Alberta. Albertan developers habitually subcontract Alberta-based companies to provide services and supplies for BC Operations (Northern Development, 2008). The Association suggests that this is the result of a lack of relationship building between BC industry and Alberta producers, which may prevent the former to successfully bid contracts (ibid). BC’s NG service sector is still new to the game for unconventional gas, and many businesses are small-sized
(ibid). In other words, they have a limited capacity to engage with producers in Calgary, while at the same time, compete for contracts with their experienced Alberta counterparts (ibid).

Options & Needs:
To help local residents capture the specialized services opportunities in the industry, discussion outcomes from the Regional Workforce Table held in the Northeast suggests a critical need to upskill the existing labour force by building on existing initiatives (Ministry of Jobs, Tourism and Skills Training, 2012; OnPoint, 2010). Local communities, industry, provincial government and the community college, Northern Lights College, are helping the current labour pool to meet industry demands by holding workforce forums, investing in local education and scholarship programs as well as training infrastructure (ibid).

Energy Services BC also suggests that more leadership and collaboration between companies and the government is required to help BC industry players engage with stakeholders and NG developers. Relationship building with large producers is critical for the local community in capturing business and procurement opportunities (Northern Development, nd). Active organizations currently involved in this area are Energy Services BC and Northern Development.

Underexplored Downstream Opportunities
There is also a general consensus among scholars and stakeholders that BC’s strategy for the natural gas industry is more focused on exporting the gas, supporting few opportunities to explore downstream activities in the NG industry (Initiatives Prince George, 2011; Ryser et al., 2009; Caroll et al., 2011; Bains, 2012). Unlike the oil sands industry, “which has the option to conduct refinement and upgrade to create value-added jobs, there are currently few potential
value-added activities beyond natural gas liquidation in BC’s industry”, not to mention that liquidation would occur in Northwest BC (Caroll et al., 2011, 172). For the local communities in NEBC, little can to be done to optimize the economic benefits once the gas is processed and transported to end users.

This does not imply that natural gas has no value-added potential. Besides carrying extractable NGLs, natural gas is a critical ingredient for the production of chemicals, fertilizers and plastics. The downstream challenge for NEBC not only stems from the skills gap, but also the absence of government leadership, an established and specialized manufacturing base and infrastructure that can support the production of these commodities (Bernier, 2013).

**Options & Needs:**

Having already proposed plans in NGL extraction, communities such as Dawson Creek may be in a strategic position to explore further downstream activities with appropriate policy and program guidance. Lessons can be taken from Edmonton’s successful petrochemical cluster, which produces chemical products through benefitting from an abundant NG feedstock (City of Edmonton, nd). Besides having access to trained university graduates and a technology infrastructure, companies are also incentivized to produce high-valued NGLs through royalty programs such as the Incremental Ethane Extraction Program (ibid).
SOCIAL CONSIDERATIONS

Besides addressing the direct economic challenges, the industry is creating social impacts that could limit the long-term economic growth of both itself and the communities. Case studies from Dawson Creek, Fort McMurray and Wyoming suggest that sudden NG booms put planning uncertainty and fiscal pressure on local communities (Markey et al, 2011; Jacquet, 2009; Tracey, 2005). Although the Fair Share Transfer has supported operations and infrastructure development, Markey et al. (2011) and OnPoint (2010) observed that this transfer addresses the short-term needs. In fact, social issues – community service shortages and inflation, to name a few – remain.

Stress on Municipality

The industry has brought many temporary workers into NEBC, which heavily draw on local services and infrastructure, especially in welfare and social services (Markey et al., 2011). About 1,000 people have moved in and around Dawson Creek each year since 2006, many of whom are temporary NG workers who reside in work camps, hotels or rental apartments (Lawrence, 2012). Non-resident employees are not part of the local tax base but are significant users of the municipal resources. Agencies such as the South Peace Community Resources Society have noted the financial struggle to keep up with the increasing population’s needs (ibid).

Affordability

Another social by-product to the NG boom is the decreasing affordability where the high-paying and labour-demanding NG industry drives up the wage and commodity price in the community, creating labour, service and housing shortages (Jacquet, 2009; Markey et al., 2011; Tracy, 2005). Induced by the labour shortage, businesses in Dawson Creek constantly compete to offer high
wages to attract employees. The hourly wage for an average sales and service position in NEBC is approximately 17% higher than the BC average (BC Stats, 2009). Even so, as many employees have fled to the higher-paying gas industry, labour shortage is common in other industries (Jacquet, 2009; Lawrence, 2012). Of the surveyed employers, 16% experience hiring difficulties and 62% experience vacancies of more than four months (BC Stats, 2009). Some services in fact struggle to maintain service quality and availability as a result of this shortage. Retail stores are often short in staples and are forced to reduce work hours while social agencies are unable to hire enough workers for child and youth care programs (Social Planning and Research Council of BC, 2008; Connolly, 2013).

The influx of high-paying transient workers has also induced a housing shortage where “renters outnumber units and homebuyers outnumber properties” (Tracy, 2005, 9; Jacquet, 2009; Bernier, 2013). In Dawson Creek, there is a close to zero vacancy rate in hotels and rental dwellings (Lawrence, 2012). New housing is stalled by high labour cost and shortage, reducing housing affordability and availability for the community (ibid). The South Peace Community Resources Society states that NG employees can easily afford the inflated housing prices, while single parents, young families or those who make a minimum wage experience difficulties (ibid).

Besides issues relating to the municipality’s fiscal imbalance and affordability, this study suggests further research on the long-standing ill relationship between some community members and the industry. The EnCana Bombings in 2008 and 2009 is one of the many examples where companies and residents in Dawson Creek had failed to arrive at a consensus in environmental conduct and land treatment. While less applicable to Dawson Creek, NG activities in and around Fort Nelson has spurred debate on whether the First Nations have been
meaningfully consulted. Consequently, further study should also be dedicated to Aboriginal relations.

These industry-induced impacts not only challenge social sustainability, they are also barriers for future economic and industry growth (Bernier, 2013; Connolly, 2013). These social effects have undermined community liveability, thereby affecting the region’s ability to entice long-term residency (ibid). Ultimately, this may interfere with the attraction and retention of permanent labour to support industry development – already an ongoing economic problem for NEBC communities.

Options & Needs:
Interviewees and stakeholders have emphasized the importance of enhancing the liveability in NEBC to ensure sustainable labour needs. Further attention is needed to explore strategies in encouraging permanent settlement by families and industry employees. Common examples include relocation tax credits and investment in local urban planning and community services and infrastructure (Bernier, 2013; Connolly, 2013).
ENVIRONMENTAL CONSIDERATIONS

There have been long-standing concerns in NEBC regarding the industry’s environmental risks, such as gas leakages, fragmentation of the landscape and impacts to the ecosystem (Campbell et al., 2011). The most alarming concern for communities is the impact on water. Given that the majority of the NG activities in the Peace River are shale-based, the extraction relies on hydraulic fracturing, otherwise known as fracking. This method, as depicted in Figure 7, involves injecting a mixture of water, chemical additives and sand, down the well to create fractures and release the gas (ibid). This practice not only poses controversy in the high water consumption and risks for water contamination, but also industry’s water supply certainty and social license.

Depleting Water Source

In BC, companies generally use fresh surface water in fracking operations and reuse the previously injected water, known as flowback, for a few times (Dunning, 2013). NG operations around Dawson Creek consume water from the municipality source – the Kiskatinaw River – through water purchase and water permits and licences (ibid). With increasing NG activities, bulk water sales from the City to the industry have doubled every year since 2004 (Hume, 2012). In 2008, 340 million litres or 16% of Dawson Creek’s allocated fresh water supply was sold to the
industry, in addition to other sources including water permits, licence and private purchase from other permit holders (Campbell et al., 2011).

Parfitt of the Canadian Centre for Policy Alternatives (2011) argues that the industry’s large water withdrawal is associated with BC’s deregulated water regime. Industries are able to acquire multiple water permits, all of which allow cheap and large withdrawals of water. Under Oil and Gas Commission-issued (OGC) permits, the shale gas industry may withdraw up to 274,956 m³ of surface water daily, which is twice as much as Greater Victoria uses on a daily basis, free of charge (ibid, 32). In addition, there is no requirement for industry to report on water consumption unless it exceeds a high threshold on its use of groundwater and other privately purchased allocations from other users (ibid). This regulatory structure is not likely to encourage conservation. The BC Water Act is currently undergoing a modernization process, which could hopefully incorporate environmental measures to reflect the changing nature of industry’s water use.

**Water contamination**

Most fracturing fluids contain approximately 2% chemical additives and can be highly toxic (Campbell et al., 2011). In addition to existing chemicals in fracturing fluids, the flowback will also pick up high concentrations of radioactive material and contaminants from the geologic formations, becoming highly hazardous (ibid). While the cement and steel casting wells are meant to prevent fracturing fluids’ contact with the surrounding formation, there have been recent incidents in North America where improperly sealed casings has led to gas and fracturing fluids leaking through layers of rock and the drinking water aquifers for local communities (ibid).
There has not been any report of water contamination in BC. Nonetheless, the risks remain uncertain since there is no requirement for companies to disclose the fracking chemicals, limiting the public's understanding of the potential impact on the environment (ibid). Although the BC Government recently announced plans to launch an online registry that allow companies to disclose details about fracturing fluids, there is scepticism of its effectiveness since reports are voluntary, allowing potential loopholes (ibid).

These environmental risks and a lack of information seep beyond ecological issues as they may limit public support for NG projects (OnPoint, 2010; Bernier, 2013). As mentioned earlier, seasonal local hydrology has prevented industrial water intake from the Kiskatinaw River (OGC, 2009; Hume, 2010). This heavy reliance on water, in turn, forced companies to cease operation (ibid).

Options & Needs:
There is an ongoing communication gap between industry practice and public knowledge. The current water regime lacks a requirement to report on water use and fracking chemicals. Encouraging transparency will help the public to better understand industry practices in order to make informed decisions, and will ultimately lead to more certainty in consultation and regulatory process for industry projects. This public surveillance mechanism may also incentivize companies to adopt sustainable practices (Parfitt, 2011, 31).
CONCLUSION

NEBC’s natural gas industry has shown significant growth in the past decade and is contributing to high-paying employment, business development and upstream industry expansion. Nonetheless, it remains unclear whether natural gas will bring significant economic benefits in the long-term, given that communities are not prepared to realize all the employment opportunities and downstream potential for natural gas. Looking beyond business-focused issues, as partly demonstrated by Dawson Creek’s experience, the local community is highly sensitive to industry activities. Such industry-induced impacts on the community and the environment may, in turn, pose an immediate setback for industries and communities to further long-term optimization of the resource.

To promote a more sustainable and maximized growth for both the industry and the community, this study reiterates needs to enhance local capacity through skills and regional network development; explore strategies to encourage local settlement; and finally, promote sound communication between the industry and public on environmental conduct.
REFERENCES

Literatures


Datasets


**Semi-Structured Interviews/Informal Consultation**

BC Stats, Economic Analysis on March 10, 2013

Mike Bernier, Mayor of Dawson Creek on March 5, 2013.

Cathleen Connolly, Director of Chamber of Commerce in Dawson Creek on March 20, 2013.

Sean Markey (PhD), School of Resource and Environmental Management, Simon Fraser University on March 5, 2013

Karena Shaw (PhD), School of Environmental Studies, University of Victoria on March 14, 2013.

**Events**