

**A scoping review on the community impacts of unconventional natural gas
development for northern BC**

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Key Messages

- The development of unconventional natural gas sources is a growing international industry as a result of improved drilling and export technologies. British Columbia is home to the largest reserve of natural gas in Canada and significant speculation exists in developing liquefied natural gas processing facilities to ship this resource around the globe.
- UNG development can yield significant impacts for communities, and those impacts differ depending on where in the supply chain a community is located.
- This scoping review presents findings from a review of 343 articles that were identified by asking: How are communities impacted by UNG development, and how do those impacts vary for 'upstream' gas producing regions, 'midstream' gas transporting corridors, and downstream gas exporting communities?
- We found four broad categories of impact (environmental, infrastructure and social service delivery, socioeconomic, and policy/regulatory responses) comprised of 28 unique sub-themes.
- The UNG literature expanded rapidly beginning in 2011 before peaking in 2014.
- A large body of literature documents and describes community impacts at the point of extraction. These 'upstream' impacts are typically expressed in terms of environmental contamination of soil, air and water, with subsequent impacts on community health and wellness. However, limited literature addresses community impacts resulting from the construction and operation of natural gas pipelines and LNG facilities.
- Midstream and downstream impacts are primarily focused on industrial and community safety resulting from spills or potential explosions. There is limited scholarly evidence on the boom and bust associated with the construction of large UNG projects and associated short term impacts on communities.
- There are numerous policy mechanisms that exist to enable local decision-making, regulation, and advocacy, and a key part of this is to ensure public participation in key decision-making processes through the engagement of diverse stakeholders (e.g. industry, First Nations, concerned citizens).
- Significant knowledge gaps exist in the scholarly literature addressing community impacts of UNG development. Examples of gaps include: a lack of equity-focused analyses of UNG impacts to understand how vulnerable populations may be impacted by booms and busts in resource development; limited understanding of the community impacts of UNG development in midstream and downstream supply chain locations; few published articles on changing population dynamics associated with the construction and operation of UNG developments across the supply chain.

Executive Summary

Background

The advent of hydraulic fracturing technology and directional drilling has increased the accessibility of gas reserves, resulting in a global boom for so-called unconventional natural gas (UNG) development. Alongside market demand in Asia, this has led to a flurry of investment proposals and a strong focus from the provincial government for natural gas extraction and export to drive job creation and revenue generation. British Columbia holds roughly half of Canada's known natural gas reserves, and the pace and scale at which liquefied natural gas (LNG) projects have been proposed in BC presents challenges for local governments, First Nations and the public in addressing potential impacts associated with UNG development. Our research responds to calls for a more constructive engagement with the socio-economic and cultural impacts of resource development by asking: How are communities impacted by UNG development, and how do those impacts vary for 'upstream' gas producing regions, 'midstream' gas transporting corridors, and downstream gas exporting communities? This report provides a summary of the methods, results and analysis of a scoping review on the community impacts of UNG development across the supply chain. While a full review of all identified impacts is beyond the scope of this report, we present a targeted analysis of policy and regulatory responses to UNG development.

Methods

Scoping reviews are a form of knowledge synthesis that aim to examine the extent and nature of research activity on a given topic by mapping key concepts, themes, and main sources and types of evidence available for a particular field of knowledge. Our scoping review methodology followed a phased process that included: (a) identifying a research question, (b) identifying relevant studies, (c) study selection, (d) data charting, (e) synthesizing and reporting results, and (f) planning for knowledge translation.

Results

We identified and reviewed 25 342 titles and abstracts for articles published between 2005-2016 that were returned through a search of seven academic databases. Of the retrieved articles, 343 met our inclusion criteria for full review. These articles were reviewed and 'tagged' according to their core focus. The tagging process sought to capture the date of publication, the geographic focus (including the supply chain focus of 'upstream', 'midstream' and 'downstream'), research methods, and identified community impacts. Tagging counts were used to 'chart' the data and identify emergent themes; to map the existing literature on community impacts of UNG across the supply chain and understand what topics existing research have addressed, and what knowledge gaps remain. Emergent themes were subsequently analyzed using a narrative review method to generalize key trends within nascent bodies of literature.

We found that the number of published scholarly articles rose dramatically in 2011 before peaking in 2014-2015. The geographic focus of articles was predominantly centered on the United States which comprised 69% of all articles, and was largely driven by a well-established body of research on impacts of Pennsylvania's Marcellus Shale play (only 7% of included articles focused on Canada, and only 2% of articles focused explicitly on the context of British Columbia). A look at the supply chain focus of the articles revealed that the majority of studies (69%) analyzed community impacts at the 'upstream' point of extraction. Fewer articles (18%) focused on 'midstream' gas

transportation impacts (e.g. impacts of pipeline development) and even fewer (9%) focused on the community impacts of 'downstream' processing, liquefaction and shipping.

We also sought to understand unique populations of interest. The majority of articles had a general population focus (78%); that is, any articles that did not specify a certain population category but which documented impacts for specific communities or regions at large. Additionally, 27% of articles were oriented toward policy and government decision makers while only a small number of studies addressed impacts to First Nations, Aboriginal or Indigenous groups (4%), women (2%), children (2%), or the elderly (1%).

The identification of community impacts elicited four over-arching themes: environmental impacts, infrastructure and service delivery impacts, socioeconomic impacts, and policy and regulatory responses. Each of these broad themes are comprised of unique sub-themes or 'tags'. The most frequently occurring tags had a primary focus on water, air quality and resulting health issues at the point of extraction. In midstream and downstream areas, industrial infrastructure was a key focus, highlighting the risk of pipeline failure or explosion at LNG facilities. It is notable that socioeconomic impacts of UNG development are primarily limited to studying health impacts linked to environmental contamination. Far fewer articles focus on the positive or negative consequences for local economic development and labour trends, and demographic changes to communities during construction and operation.

'Upstream' Policy and Regulation Review

Policy and regulatory responses were comprised of four sub-themes: policy/regulation, governance capacity, advocacy and consultation/trust. Our review differentiated these sub-themes across the supply chain. For the upstream supply chain, the policy/regulation and governance capacity sub-themes highlighted differences in the application of local, state and federal law—including an analysis of local government efforts to gain more control of decision making; increasing or improving the role of the public health sector in decision-making for UNG development; and improving consultative processes with Aboriginal or Indigenous groups. Key recommendations from this literature suggest that strengthening regulations that control emissions, mandating emission inventories to track air quality changes over time and improving baseline testing for air and water are paramount. Mandating cumulative impacts assessment for water sources and setting meaningful requirements to assist with reclamation costs is also increasingly seen as industry 'best practice'. However, cumulative impacts assessment or strategic environmental assessment must be adopted at a regional level rather than across a project's footprint to better capture the impacts of upstream development.

Literature on public participation, consultation, trust and advocacy in the upstream supply chain focused on the use of citizen science to address gaps in industry and government monitoring of water and air resources. While there are recognitions in the literature that citizen-science initiatives are rising to fill the void left through the retrenchment of existing regulatory approaches, this is generally viewed as a positive method to engage the public in the identification and co-management of impacts, provided resources can be shared by industrial players or governments to support related activities.

'Midstream' Policy and Regulation Review

The narrative review of policy and regulation themed articles for the midstream supply chain revealed a focus on inconsistent regulations across jurisdictions which create challenges for managing pipeline risks and establishing government oversight. Recommendations from the literature include creating comprehensive management plans over large regions, increasing collaboration across jurisdictions, and restricting pipeline development in parks and near inhabited

areas. At the local government level, recommendations include using zoning/setbacks to restrict and control developments, and for land developers to consult with pipeline owners, although there is broad recognition that local governments often lack the resources to support processes of rapid industrialization and mitigate associated risks.

'Downstream' Policy and Regulation Review

The policy/regulation sub-themes of the downstream supply chain primarily focused on the siting of LNG facilities, noting that the main concern among the public is industrial and community safety. Current siting regulations in some jurisdictions lack safety management systems/plans and risk-based analysis to determine the most appropriate site for facilities. There were no studies focused on LNG facilities in Canada. In Australia, a study of the Kimberly LNG project highlighted Aboriginal participation in site selection which included an 'Indigenous Impacts Report' that assessed the potential economic, social, cultural, archeological and ethnobiological impacts.

Knowledge Gaps

The scoping review process is valuable in identifying where scholarly attention has and has not been directed. We identify several key knowledge gaps that are suitable for further investigation. Relatively few articles highlighted community impacts for midstream transportation corridors and downstream export communities. Given the number of LNG projects that are proposed for construction in BC, it is paramount that more attention be given to communities adjacent to pipeline corridors or possible LNG sites. Further, there are few articles that address the capacity of local governments to address community impacts before, during and after they happen. Longer term planning processes that are guided by adaptive management seem much more likely to be able to address concerns that emerge from the multiple points of intersection between ecological, community and health issues, yet there are few documented examples of this occurring within the literature.

Finally, there were sub-themes within the socio-economic impacts that had few citations. For example, there was limited evidence on population dynamics associated with an influx of workers which can impact waste management, social service provision, crime rates, poaching and sexual violence, and few articles addressing the equity implications of UNG development. A targeted research program that addresses how fairly or justly UNG impacts are distributed, particularly among marginalized populations such as women and Aboriginal peoples, would be a significant contribution to the literature. Nonetheless, our scoping review describes the current state of knowledge on the community impacts of UNG development on (primarily rural and remote) communities across the supply chain. In addressing our research question, this knowledge synthesis contributes to a growing body of research seeking to foster sustainable and resilient communities experiencing unprecedented levels of growth and investment in the UNG industry.

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