



Natural Gas:

Fueling British Columbia's Growth

An **Outlook 2020** Topic Paper prepared by OnPoint Consulting Inc. for the
Business Council of British Columbia

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Executive Summary

Since 2001, British Columbia's natural gas sector has experienced nothing short of phenomenal growth. Industry investment in exploration and development activities grew from \$1.1 billion in 1999, to \$7.9 billion in 2008. The natural gas sector has become one of the leading drivers of the provincial economy, an important employer and the largest direct source of natural resource revenue for the provincial government.

The impact of British Columbia's petroleum industry on the provincial economy is significant. Recent research by the Canadian Energy Research Institute (CERI) indicates that the gross domestic product (GDP) impact from petroleum investment is approximately \$361 billion. Including the economic impacts in British Columbia from investments made in other provinces results in a total GDP impact of \$461 billion.

Being located primarily in northeast British Columbia, the natural gas sector is a major source of employment in that part of the province. IHS Global Insight recently calculated the employment impacts of the natural gas sector in British Columbia. This study found more than 44,000 British Columbians directly employed by the natural gas sector, and an additional 67,000 indirectly employed by the sector.

This growth has been a prelude to a more significant natural gas development opportunity in British Columbia. British Columbia has world-class unconventional natural gas resources in the northeast that are potentially five to ten times larger than the province's conventional natural gas resources. Until recently, the technology has not been available to economically develop these resources. However, over the past decade, North America's natural gas sector has developed new technologies to economically develop these unconventional natural gas resources.

There are potentially numerous development scenarios for British Columbia's unconventional natural gas resources. The National Energy Board's recent Update to Short-term Canadian Natural Gas Deliverability 2010-2011 forecasts natural gas production in British Columbia to increase from approximately 2.65 billion cubic feet/day (Bcf/d) in 2008, to 3.2 Bcf/d by 2011, a more than 20% increase in production.

Looking further to 2020, Spectra Energy has forecasted that British Columbia's natural gas production will increase to approximately 5.0 Bcf/d, or roughly double today's level. To put this forecast into perspective, Alberta currently produces approximately 13 Bcf/d, and this is forecasted to decline to approximately 12 Bcf/d by 2020.

Development of British Columbia's unconventional natural gas resources will have significant implications for British Columbia policy makers. The development of British Columbia's unconventional resources is at the very early stages, and there is an opportunity to ensure that these resources are developed in a way that is consistent with British Columbia's values and goals. In order to attract the investment required to develop unconventional resources, the provincial government will be required to focus on creating a competitive investment climate while balancing other priorities including

protecting the environment, realizing objectives for First Nations and realizing local values.

It is difficult to accurately predict the exact number of wells, roads and pipelines that will be needed or constructed, and the potential impacts. However, there are some general patterns that should evolve, including:

- Concentration of Activity – While obvious, unconventional natural gas development will be concentrated in northeast BC, which is physically and temporally far from where most British Columbian's live.
- BC Climate Change Objectives – British Columbia's aggressive climate action objectives are a significant issue for the natural gas sector. Growing British Columbia's natural gas sector while reducing emissions from the sector will be a major challenge for government and industry.
- Activity on the Land Base – Unconventional natural gas development will result in greater activity on the land base. This will include new activity taking place in areas that have not been subject to natural gas development in the past, but also actively developed areas having more intensive natural gas activities.
- Concerns About Development – Increased unconventional natural gas activity levels will result in greater concerns from communities, First Nations and environmental organizations about the pace and impacts of development.
- Local Pressures – Like Fort McMurray, Alberta, local communities in northeast British Columbia will experience new pressures from swelling populations and greater demands on their physical and social infrastructure.
- Local Service Sector – British Columbia's local service companies will be under intense competition from Alberta-based service companies as producers look to manage costs as tightly as possible.
- Employment Opportunities – Increased natural gas activities will create new employment opportunities for British Columbians. However, most of these jobs require specific training that is generally not available in the province.
- Regulatory Regime – Increasing natural gas activity will put more demands on British Columbia's Oil and Gas Commission, the provincial regulator of oil and gas activities. The changing nature and technology used in the natural gas industry will also impact how the Oil and Gas Commission approaches regulation.
- New Infrastructure Requirements – With the development of unconventional natural gas resources, there will be increasing pressure for new infrastructure supporting the natural gas sector.

The provincial government has been working to address the issues arising as a result of unconventional natural gas development. The key issues that will require focus and attention include:

Leadership

At the most fundamental level, the development of British Columbia's unconventional natural gas resources will require leadership by all of the players involved in the natural gas sector: government, industry, local communities and First Nations will all need to be leaders in their respective areas, and to trust and support the leadership from the others.

With the appropriate leadership, a deliberate approach to unconventional natural gas development can take place. A deliberate approach to development will mean that British Columbia's move to unconventional natural gas development will be an evolution – not a revolution. It also means that, for some areas, there will be clear and transparent decisions where and when unconventional natural gas can happen.

Social License to Operate

Social license to operate is the acquisition of free, prior and informed consent for local development activities from First Nations and local communities through mutual agreements. Without a social license to operate, unconventional natural gas development will face a very rough and challenging road in British Columbia.

There are many players involved in achieving social license to operate. At the centre, the natural gas sector must work collaboratively throughout northeast British Columbia to continue to advance relationships and dialogue. The provincial government also plays a key role acting as a facilitator to bring key parties together, promote discussion and, where needed, put in place requirements that will support social license to operate.

A recent successful example is the creation of the Living Together – Working Together program in northeast British Columbia. This is a voluntary, community-based initiative that will address local area concerns such as traffic safety, speed control and dust. Several natural gas companies operating in the Montney have made a public commitment to adhere to the Living Together – Working Together guiding principles.

In addition, the Horn River Basin Producer's Group is an excellent example of how industry can collaborate to address resource development issues. This approach would be worthwhile in other areas of the province, particularly the Montney. As other areas develop, such as the Liard Basin and Cordova Ebasment, the provincial government will need to work proactively to create synergies similar to the Horn River Producer's Groups.

Local Communities

With expanding unconventional development, local communities will face increasing pressures on local infrastructure and social services as populations, both permanent and temporary, grow. British Columbia need only look to Fort McMurray, Alberta to see the challenges that smaller communities face from rapidly expanding resource development.

The provincial agreement with municipalities in the Peace River Regional District provides provincial local infrastructure funding that is tied to activity levels. While funding may be adequate to fund infrastructure development, communities will need support in managing for growth. It will be critical for the provincial government to recognize growing needs within these communities for provincially supported services, such as health and education, and respond to this demand.

The Fort Nelson Regional Municipality, with the rapidly developing Horn River Basin, has no such agreement with the provincial government for infrastructure funding. Although it has broad property taxing abilities, funding infrastructure solely out of the local tax base will create significant property tax inflation. The regional municipality, provincial government and industry will be required to jointly develop a long-term strategy to ensure that infrastructure development is supported without creating impediments to development.

First Nations

The evolving development of unconventional natural gas resources will create new opportunities for economic development for First Nations, but it also will pose create significant challenges around development on traditional lands and the associated influences on traditional practices.

The provincial government, through the Oil and Gas Commission and Treaty 8 First Nations, has Consultation Protocol Agreements that set out requirements for First Nations consultation. These agreements are set to expire over the next year. It is critical that the provincial government and First Nations negotiate new agreements that will enable the continued orderly development of unconventional resources. In addition, the provincial government has negotiated several Economic Benefits Agreements with a number of individual Treaty 8 First Nations. Completing Economic Benefit Agreements to support unconventional natural gas development will be critical for both First Nations and the provincial government in order to realize opportunities from unconventional natural gas development.

British Columbia Service Sector

British Columbia's local natural gas service sector has been working through its association, Energy Services BC, to promote the growth and development of its members throughout northeast British Columbia.

With continued growth in development of unconventional resources, the local service sector will be challenged to provide services to natural gas producers. This will require continuously upgrading both the skills and equipment used to support the natural gas sector. Locally-based service companies will also be competing against Alberta-based service companies that are increasingly looking toward unconventional natural gas development for their own business opportunities.

In order for local service companies to thrive, there is a critical need for highly skilled people to work in the natural gas sector. This requires education and training programs. The recent creation of the oil and gas training Centre of Excellence at Northern Lights College is an important foundation from which to grow training programs throughout BC's colleges and universities. In addition, the local service sector will need to replace a significant portion of its equipment so that it has an up to date capital stock.

The provincial government has partnered with Energy Services BC to assist the development of the local service sector. This relationship must continue to be strengthened and focused unconventional natural gas development.

Infrastructure

Infrastructure development is one of the key factors affecting the development of British Columbia's unconventional natural gas resources. When natural gas producers are required to invest in new infrastructure, they are directing available capital from the drill bit. The provincial government has been a strong supporter of the development of new road infrastructure to enable resource development. British Columbia's infrastructure royalty programs and investments in road infrastructure have been a key reason for the province's success since 2001.

With potentially significant increases in natural gas production will come significantly higher royalty revenue. It is important that the provincial government continues to invest a portion of this royalty revenue back into supporting road infrastructure and local communities that service the natural gas sector.

With growing natural gas production, the need for producer area storage will increase. Greater availability of producer area storage will create significant benefits for natural gas producers, processors and shippers, along with higher provincial royalties. British Columbia requires an updated storage policy that is consistent with other jurisdictions and encourages investment in new storage infrastructure.

Climate Change Policy

British Columbia's climate change policies will have a significant influence on the development of the province's unconventional natural gas resources. Requirements to cap emissions will require more costly technology to capture and store GHGs. The cost to achieve CCS technologies will ultimately be borne by natural gas producers, which will negatively affect the return on investment.

In order to achieve its Climate Change objectives while minimizing negative impacts on the development on unconventional natural gas development, British Columbia must be supportive and flexible with the natural gas sector. This does not suggest that the natural gas sector should not do its part to achieve the province's goals. However, British Columbia must be aware of the trade-offs that it is making.

Regulating the Natural Gas Sector

Through the Oil and Gas Commission, British Columbia has an effective and efficient regulatory framework that protects the health and safety of people working in the industry and residents in local communities. Growing activity levels from unconventional natural gas development will create new demands on the Oil and Gas Commission. It is important that British Columbia's regulatory framework evolves with the situation and needs of the industry.

British Columbia recently passed a new Oil and Gas Activities Act that will replace and modernize the patchwork of older legislative tools. Regulations under the new legislation are currently under development and will likely be implemented in 2010. It is important that these new regulations reflect the unique aspects of unconventional natural gas development.

Over the past decade, British Columbia's natural gas sector has become one of the most important parts of the provincial economy. It is a major source of capital investment, employment and government revenues. This has been accomplished by constructing a policy environment that has created a highly competitive environment to attract investment.

With the development of unconventional natural gas resources, British Columbia has the potential to substantially increase the value of the natural gas sector. However, the provincial government faces a number of key challenges that must be addressed in order to realize this potential.

While a number of important focus areas are outlined in this report, the most fundamental requirement will be leadership from government, the natural gas sector, local communities and First Nations to ensure that the province's unconventional natural gas resources are developed responsibly and in a way that maximizes benefits for all British Columbians.

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Introduction

This report was prepared by OnPoint Consulting Inc. as a Topic Paper for the Business Council's **Outlook 2020** Project. The objective of **Outlook 2020** is to help shape a positive vision and agenda for British Columbia's economic future. One important focus of the project is how to strengthen British Columbia's export base – the industries and other economic activities that generate flow of income into the province. This Topic Paper covers British Columbia's natural gas sector¹.

Since 2001, British Columbia's natural gas sector has experienced nothing short of phenomenal growth. Industry investment in exploration and development activities grew from \$1.1 billion in 1999, to \$7.9 billion in 2008². The natural gas sector has become one of the leading drivers of the provincial economy, an important employer and the largest direct source of natural resource revenue for the provincial government.

This growth has been a prelude to a more significant natural gas development opportunity in British Columbia. British Columbia has world-class unconventional natural gas resources in the northeast that are potentially five to ten times larger than the province's conventional natural gas resources. Until recently, the technology has not been available to economically develop these resources. However, over the past decade, North America's natural gas sector has developed new technologies to economically develop these unconventional natural gas resources.

Natural gas producers are making significant investments in northeast British Columbia to unlock the province's unconventional natural gas resources. Over the next decade, these investments will have a profound impact on the province's economy, creating significant opportunities for new businesses, employment, community development, First Nations opportunities, royalties and tax revenue.

Realizing the full potential of northeast British Columbia's unconventional natural gas resources will require the provincial government to focus on policies and actions that balance resource development with protecting the environment, recognizing First Nations' aspirations, and supporting local values.

¹ The natural gas sector is commonly divided into three sub-sectors. Companies in the **upstream sector** are involved in the exploration and production of natural gas. The **midstream sector** refers to companies involved in the processing, storage, marketing and transportation of natural gas. Companies that distribute and sell natural gas to final consumers, or process natural gas into other products such as plastics and fertilizers, are referred to as the **downstream sector**. For the purposes of this paper, the British Columbia natural gas sector will refer to the combined upstream and midstream sectors. Specific references to sub-sectors will be made where appropriate

² Canadian Association of Petroleum Producers. Statistical Handbook. Net Cash Expenditures of the Petroleum Industry. <http://membernet.capp.ca/SHB/Sheet.asp?SectionID=4&SheetID=190>

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British Columbia's Petroleum Resources

The following section provides an overview of British Columbia's petroleum resources (oil and natural gas) to put the province's petroleum opportunities into context. While British Columbia has potentially significant petroleum resources distributed throughout the province, it will be shown that the unconventional natural gas resources in northeast BC are both the most immediate and important opportunity for British Columbia.

Petroleum resources are found in sedimentary basins, which are geologically depressed areas that have been filled over long periods of time with many layers of sedimentary material. British Columbia has a number of sedimentary basins distributed throughout the province. (Figure 1)

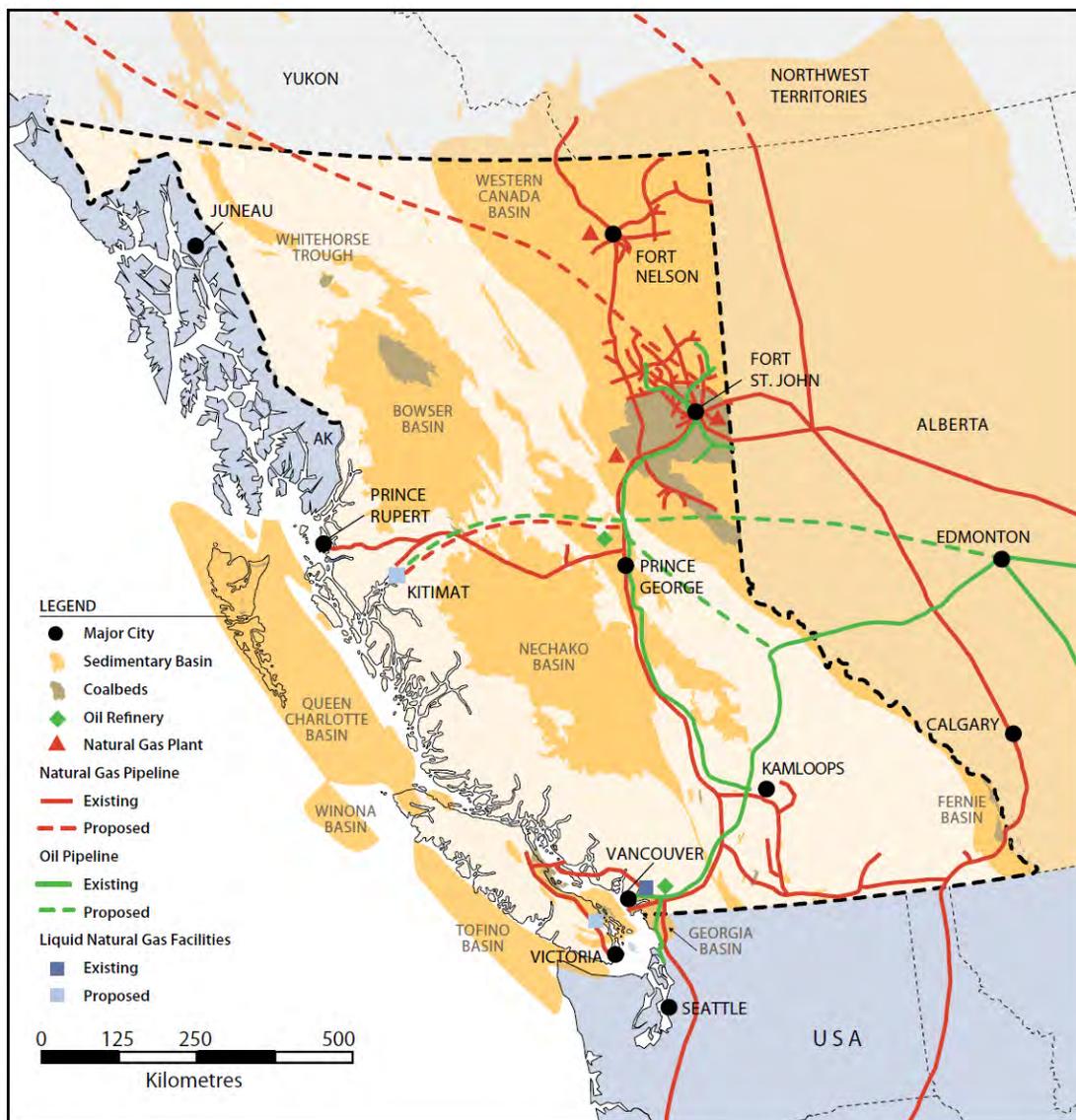


Figure 1: British Columbia Sedimentary Basins
Source: Ministry of Energy, Mines and Petroleum Resources

Interior Basins, the Offshore and Coalbed Methane

Outside of the Western Sedimentary Basin in northeast British Columbia, the province's other sedimentary basins and coalfields are largely unexplored and poorly understood from a petroleum geology perspective. Published petroleum resource estimates for these other basins are therefore highly speculative and can only be verified through additional exploration and drilling programs.

Interior Basins

While British Columbia has a number of interior basins (Figure 1), only the Bowser and Nechako Basins likely have sufficient resources close to infrastructure to potentially support commercial petroleum development.

The Geological Survey of Canada (GSC) estimates that the Bowser Basin has 6.5 trillion cubic feet of natural gas (Tcf) and 2.5 billion barrels of oil (Bbbls) of oil. The area that is most prospective for petroleum development is in the northern part of the basin. However, a significant portion of this area is covered by the Spatsizi Plateau Wilderness Park, which precludes oil and gas development. It is therefore unlikely that the Bowser Basin will see petroleum exploration (with the exception of coalbed methane resources discussed below) over the next decade.

The Nechako Basin is in the central interior of the province, an area severely affected by the Mountain Pine Beetle. The provincial government has expressed considerable interest in developing petroleum resources in the Nechako Basin as a strategy to offset the economic impacts of the Mountain Pine Beetle. The GSC estimates that the Nechako Basin contains 9.5 Tcf of natural gas and 5.1 Bbbls of oil. The Nechako Basin has been the subject of recent geological research by the federal and provincial governments and Geoscience BC³. Geoscience BC recently undertook more than 330 kilometres of seismic surveys in the Nechako Basin. In July 2009, Geoscience BC publicly released the results of the seismic surveys in the hope of encouraging industry interest in the Nechako Basin.

While still very poorly understood, a picture is emerging that the Nechako Basin has a complex petroleum geology setting that will take considerably more research to better understand. The provincial government can encourage petroleum industry interest in the Nechako Basin through continued investment in geoscience research to provide a clearer picture about the oil and natural gas potential in the basin.

The Offshore

The GSC estimates approximately 42 Tcf of natural gas and 9.8 Bbbls of crude oil in British Columbia's three offshore basins. (Figure 1) The most recent offshore petroleum

³ Geoscience BC is an industry-led non-profit geoscience organization funded by the provincial government and other partners. Additional information about Geoscience BC can be found at GeoscienceBC.com

activity was in the late 1960's, when fourteen wells were drilled in the Queen Charlotte Basin, all without commercial success. Although there have been a number of academic research programs to investigate the geology of British Columbia's offshore regions, the petroleum potential for these basins is still poorly understood.

Although oil and gas leases granted to petroleum companies cover most of British Columbia's offshore basins, offshore exploration came to a standstill in 1972 when the federal government put a moratorium on offshore exploration and development. In 1989, British Columbia announced a provincial moratorium on offshore exploration in provincial waters for at least five years. The federal government subsequently announced it will not consider offshore exploration or development until requested to do so by British Columbia. The existing offshore petroleum leases will remain frozen until the federal and provincial governments remove the moratoriums.

Since 2001, the provincial government has undertaken a number of reviews of the science and policy issues surrounding offshore exploration and development, and has examined how other jurisdictions have responsibly developed their offshore petroleum resources. In addition, the provincial government has engaged in discussions with First Nations and local communities to explore concerns surrounding offshore petroleum development.

In the 2003 Throne Speech, the British Columbia government stated that, *"by 2010, your Government wants to have an offshore oil and gas industry that is up and running, environmentally sound and booming with job creation."* The 2007 Energy Plan reaffirmed the provincial government's commitment to offshore oil and gas exploration and development, noted its request to the Government of Canada to lift the federal moratorium and reiterated that the 1989 provincial moratorium will be lifted at the same time.

Similar to the Nechako Basin, development of an offshore petroleum industry in British Columbia is realistically a number of years off. If the moratoriums were lifted today, it would take time for the provincial government to put into place a functioning offshore regulatory structure and for industry to turn their attention back to the British Columbia offshore.

Coalbed Methane

Coalbed methane (CBM) is natural gas that occurs naturally in coal seams. Coalbed methane is the same as the natural gas that is used to heat homes and run factories. British Columbia's coal beds are spread throughout the province. The province's total CBM resource is estimated at 84 Tcf. If developed responsibly, CBM holds the promise to support economic development in numerous communities across British Columbia.

Alberta has seen significant CBM development and has forecasted that annual CBM production should reach 0.6 Tcf by 2015 (British Columbia's current total annual natural gas production is about 1.1 Tcf). British Columbia has only a handful of CBM projects in

the very early stages of development. The province's first CBM sales gas began flowing in December 2008 from the Hudson's Hope Gas project near Fort St. John. Other key CBM projects in development in British Columbia include:

- Canadian Spirit Resources has partnered with Shell Canada to advance its Farrell Creek Project, located north of Hudson's Hope, which is also pursuing development of the Gething Formation.
- In 2004, Shell Canada acquired tenure from the provincial government to explore for CBM in the Klappan Coalfield, located in the northern part of the Bowser Basin. The Klappan Coalfield is a high-rank anthracite coal deposit that may contain significant commercial volumes of CBM. High-ranking deeper coals tend to have higher CBM concentrations and better production characteristics. To date, Shell Canada has drilled three exploratory wells, but it requires several years of exploratory work to determine if a viable project is possible. In December 2008, the provincial government specified no activity on the project for two years to facilitate Shell Canada having discussions with First Nations and local communities about the project.
- In December 2008, BP Canada was awarded with tenure in the Crow's Nest Coalfield in southwest British Columbia to evaluate and potentially develop the Mist Mountain CBM project. BP Canada is currently in the midst of a \$100 million five-year appraisal process to assess the viability of the resource. This work includes continued public consultation, environmental base-line data gathering, technical appraisal and designing a potential development.
- Smaller coalfields on Vancouver Island, the Elk Valley and Princeton have attracted varying levels of interest from industry – these projects are all in very early stages of concept development or evaluation.

British Columbia's CBM resources are generally more remote and more complex to develop than those in Alberta. This has a significant effect on the rate of exploration and development. In addition, concerns within some communities about the potential impacts of CBM have slowed development in certain areas. To date, less than 100 CBM wells have been drilled in British Columbia.

Coal seams can hold vast quantities of often nearly pure methane gas because of the unique physical properties of coal. In addition to methane being present within pore spaces (like conventional reservoirs), the methane is also adsorbed to the microscopic sponge-like surface of the coal. The adsorbed methane is held in place to the coal face by naturally occurring water pressure within the coal seam. There is a general correlation between water volume and the amount of methane gas within the coal; however, there are some dry coals that contain significant volumes of methane, such as Alberta's Horseshoe Canyon coals, the largest producing source of CBM in Canada.

The adsorbed methane is released by pumping water out of the coal seam to reduce the pressure on coal face. CBM wells initially produce mostly water, with only small

quantities of methane. Over time, water production falls, and methane production increases. The quality of the water pumped from the coal seam is often fresh, but can contain salts or other impurities depending on the location. Depending on water quality and treatability, the water is either disposed or used for other non-potable purposes. In some areas, produced water is piped to ranches for cattle watering or used for industrial purposes.

British Columbia has put in place a number of policies, programs and targeted royalty initiatives to support development of CBM resources across the province. In addition, British Columbia's Energy Plan introduced a suite of policies to provide British Columbia with the best CBM practices in North America, requiring companies to:

- Fully engage communities and First Nations;
- Use the most advanced technology and practices that are commercially viable
- No surface discharge of CBM produced water; and
- Any re-injected produced water must be injected well below useable aquifers.

The technology exists for the responsible development of the province's CBM resources, while protecting environmental values and supporting economic development. In some areas such as Vancouver Island, CBM can be used as an energy source for local industry and households. CBM production can also be used to de-gas coal seams prior to mining operations to reduce the release of methane gas during mining. Technology is also being developed to inject CO₂ into coal seams to enhance methane production and store CO₂.

CBM development brings long-term economic benefits to local communities from direct employment, contracting and the use of local suppliers and services such as hotels. In addition, CBM development would produce significant royalties and taxes for the provincial government. There are also opportunities for First Nations to participate directly or indirectly in projects within their traditional territories.

Northeast British Columbia's Petroleum Resources

British Columbia's conventional natural gas resources are located in the northeast corner of the province, on the northwestern edge of the Western Canadian Sedimentary Basin (WCSB). (Figure 2) The WCSB extends from the Rocky Mountains across western Canada to the Canadian Shield in Manitoba. The WCSB is one of the world's largest reserves of oil and natural gas, and supplies a significant portion of North American oil and natural gas needs.

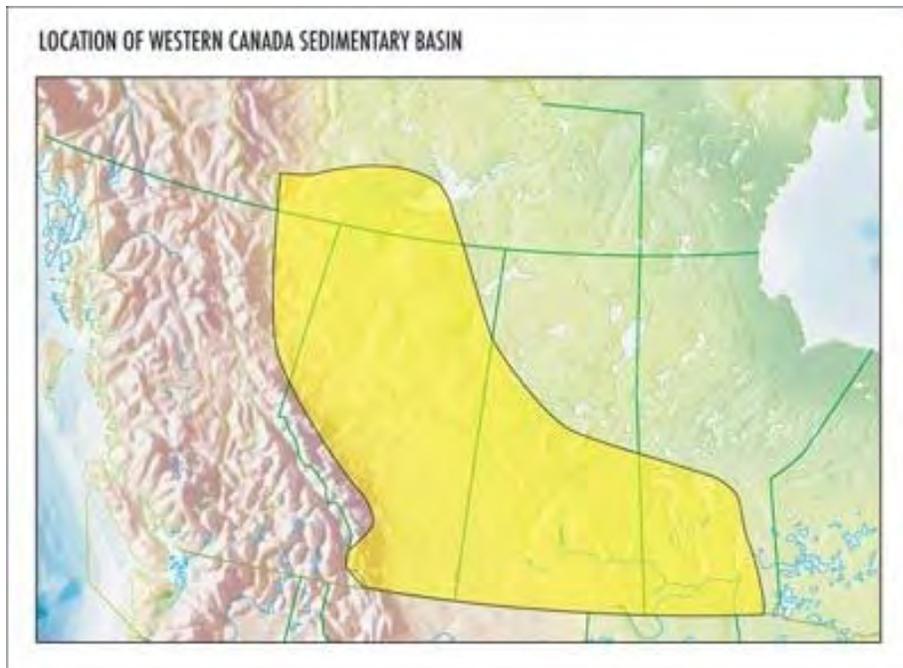


Figure 2: Western Canadian Sedimentary Basin
Source: National Energy Board

As a result of the geological processes that formed the WCSB, British Columbia's portion of the WCSB is highly natural gas prone – accumulations of oil are small compared to other parts of the WCSB. The oil potential in northeast British Columbia is 944 million barrels (Mmbls), compared to more than 175 billion barrels (Bbbls) of oil in Alberta's oil sands. British Columbia produces only about 8.4 (Mmbls) per year, and this figure is dropping as producers focus on natural gas opportunities.

Conventional natural gas resources are spread throughout northeast British Columbia and have been the focus of development over the past 50 years. British Columbia's ultimate conventional natural gas resource (the amount of natural gas that has ever been present) is estimated at 51.9 trillion cubic feet (Tcf)⁴. Approximately 20 Tcf of that total resource have already been produced, and 14 Tcf have been booked as reserves. This leaves approximately 18.5 Tcf of remaining potential supply. By comparison, Alberta's conventional natural gas ultimate resource is estimated at 376 Tcf, with 168 Tcf remaining potential supply⁵.

⁴ British Columbia Ministry of Energy, Mines and Petroleum Resources and the National Energy Board, *Northeast British Columbia's Ultimate Potential for Conventional Natural Gas*. 2006

⁵ Alberta Energy Utilities Board and National Energy Board, *Alberta's Ultimate Potential for Conventional Natural Gas*. 2005

Topic Box: Conventional vs. Unconventional Natural Gas

Natural gas is formed over thousands of years by the combination of pressure and heat on organic material trapped in sedimentary rock. After natural gas is formed, the earth's pressure often pushes the gas upward through small holes and cracks in rock until it reaches a layer of impermeable rock, where the gas becomes trapped. It sits there in a concentrated "pool" until it is released from the ground by drilling into the pool, and then flows freely under its own pressure through the well bore to the surface. This is what is called conventional natural gas. Missing a pool with a well bore results in a "dry hole". Depending on the play, there may be a very high risk of hitting "dry holes".

However, not all natural gas is found in pools. There are a number of forms of unconventional natural gas that were created in formations without the permeability necessary to allow gas migration.

These include:

- Tight Sands Gas – formed in sandstone or carbonate (called tight gas sands) with low permeability that prevents the gas from flowing naturally.
- Shale Gas – formed in fine-grained shale rock (called gas shales) with low permeability in which gas has been adsorbed by clay particles or is held within minute pores and microfractures.
- Coalbed Methane (CBM) – formed in coal deposits and adsorbed by coal particles.

The natural gas located in these formations does not pool, but is found fairly evenly distributed throughout the rock in the formation. While unconventional reservoirs may have lower density of natural gas resources within an equivalent volume of conventional reservoir, unconventional reservoirs tend to be both thicker and cover larger areas. The adsorbing characteristic of shale and coalbed gas can result in significant natural gas volumes within an equivalent reservoir volume. (Figure 3)

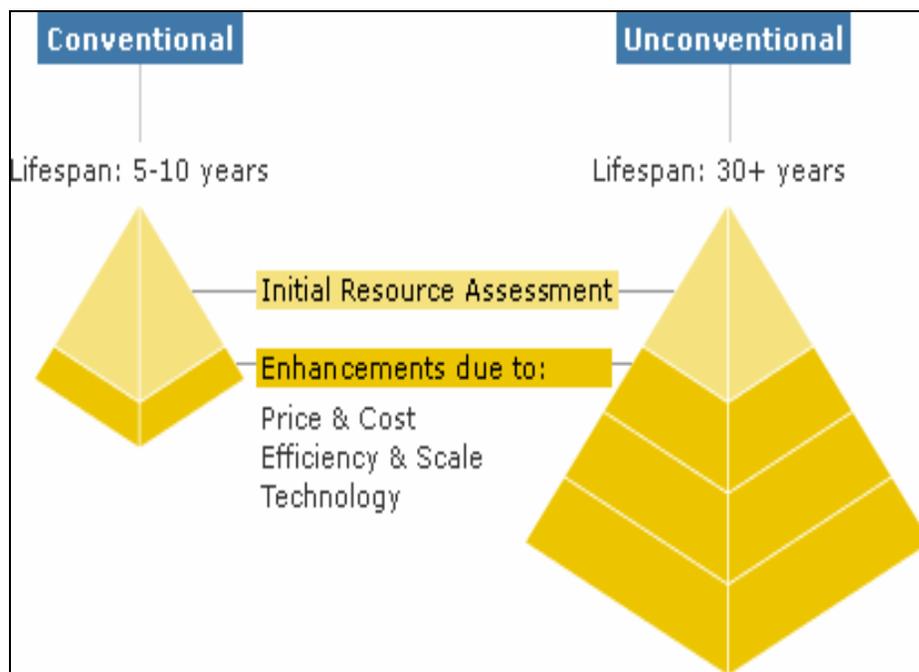


Figure 3: Conventional vs. Unconventional Resources
Source: EnCana

Topic Box: Conventional vs. Unconventional Natural Gas (Con't)

With unconventional reservoirs, the majority of the geological risk has been eliminated from the resource development process. Instead, unconventional natural gas producers face the technological challenge of extracting natural gas from reservoirs with pore spaces so small that the gas cannot move freely to a well bore. Over the past several decades, producers have developed new technologies to drill wells horizontally through unconventional reservoirs to maximize well bore exposure through the unconventional reservoir. In addition, producers have developed technology to create extensive fractures within the reservoirs to act as channels for the trapped gas to move to the well bore. These fractures are created by pumping highly pressurized fluid into the well bore to shatter and break-up the formation to allow gas to move freely to the well bore.

With the new drilling and fracturing technologies, unconventional natural gas wells have high rates of initial production as the “free” gas drains quickly through the fractures. As this gas drains, production drops quickly, then levels off at a lower stable rate as both the gas in the pore space and the adsorbed gas (in the case of shales and coalbed methane) is slowly released. Whereas the producing lifetime for conventional wells typically last seven to twelve years, unconventional wells will produce for twenty, or more, years. However, because unconventional natural gas wells produce over a longer period, the producer is also exposed to greater business risks from changing commodity prices, interest rates, currency, and changing government policy.

In early unconventional gas developments in the United States, producers would drill many wells close together to ensure that production from the reservoir was maximized. Today, producers have developed technologies to drill up to twenty individual well bores from a single drilling pad, and set up to twenty individual fractures in each of the well bores. In many respects, these drilling pads resemble offshore drilling pads, but are onshore. This allows producers to concentrate their activities in a very small area, which reduces the amount of land required to be cleared and roads and pipelines to be constructed.

A significant issue with unconventional natural gas development is how much of the natural gas is ultimately produced from an unconventional formation. Prior to the development of horizontal drilling and fracturing technologies, the anticipated recovery rate was approximately ten percent. This compares very poorly to the sixty percent expected recovery rate for conventional wells. However, with the application of new technology, recovery rates of forty percent or greater for unconventional formations are anticipated. In time, continued technology development should bring recovery rates for unconventional formations on par with conventional formations.

With this new technology, natural gas producers have fundamentally changed their business models. With the geological uncertainty largely eliminated, natural gas producers now focus on effectively managing costs – natural gas producers have become manufacturers instead of explorers.

The changing technology for unconventional natural gas has created a major shift within the natural gas sector. Conventional natural gas resources used to provide the highest returns to producers; it is now the unconventional resources that provide the highest return. Recent research by Tristone Capital¹ indicates that British Columbia's Montney play in particular is one of the best shale plays in North America, while the Horn River Basin is also more competitive than conventional natural gas plays.

The result has been a major shift of natural gas producers to focus on unconventional plays. One of the most significant examples of this is Talisman Energy completely reversing its British Columbia strategy to focus on unconventional resources. Talisman was one of the few companies that focused on exploring for highly complex deep resources along the Rocky Mountain Foothills. Over the past two years, Talisman has reorganized its efforts to become a top-tier unconventional natural gas company, with considerable focus on British Columbia. Other companies, such as EnCana, made the strategic decision to focus on unconventional natural gas a number of years ago and have become experts on unconventional natural gas in British Columbia.

Although British Columbia's remaining conventional natural gas is not considered large, these resources are an attractive investment opportunity. Compared to Alberta, British Columbia's conventional natural gas resources are significantly less developed, and less mature. Figure 4 below shows drilling densities for British Columbia and Alberta for shallow (< 1500 metres) and deep wells (>1500 metres).

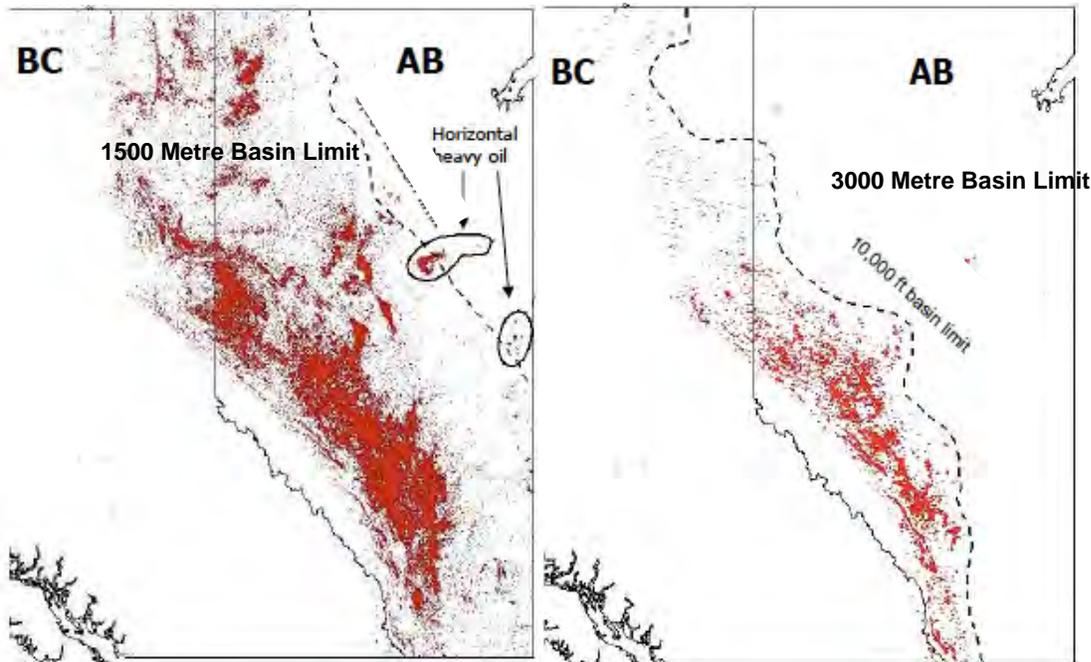


Figure 4: British Columbia and Alberta Drilling Densities
Source: Ministry of Energy, Mines and Petroleum Resources

Having less mature conventional resources, British Columbia's conventional natural gas pools tend to be larger, with higher initial flow rates and lower decline rates. While there may be less overall resource available compared to Alberta, what is available is much earlier in the development cycle, which provides better returns for producers.

In particular, British Columbia has significant deep (> 3000 metres) natural gas resource opportunities. As seen on Figure 4, British Columbia's deep conventional natural gas resources are significantly less developed than Alberta's deep conventional resources. Almost half of British Columbia's conventional natural gas is located in deep zones along the Rocky Mountain Foothills. Deep resources along the foothills are attractive targets for the natural gas sector because of the larger pool sizes and higher rates of production. However, deep wells are considerably more expensive to develop, and have significantly lower success rates due to technical challenges.

The province's conventional resources have been the backbone of British Columbia's natural gas development over the past fifty years. Considerable conventional resources remain available for development; however, as will be shown, British Columbia's unconventional resources are now replacing conventional natural gas resources as the primary driver for British Columbia's natural gas sector.

Northeast British Columbia's Unconventional Resources

While it has long been known that British Columbia has significant unconventional shale and tight gas reservoirs, their size, gas content and other characteristics were largely unknown. This is mainly because the technology to economically produce these resources was not available.

Recent geological studies conducted by the Ministry of Energy, Mines and Petroleum Resources and the province's academia community suggest that northeast British Columbia has significant unconventional gas resource potential, including:

- 300 Tcf of tight gas
- 250 Tcf of shale gas

With additional geological research and drilling results, it is expected that these resource estimates could significantly increase. In fact, there is a growing community of petroleum geologists who believe the total unconventional resource could be more than 1,000 Tcf.

Tight Gas

Significant accumulations of tight gas are found in the Greater Sierra area near Fort Nelson, the Rocky Mountain Foothills and the Deep Basin, located near Dawson Creek. (Figure 5) EnCana's \$418 million expenditure for natural gas exploration rights in the Deep Basin in 2004 was one of the first signals of British Columbia's unconventional natural gas opportunity.

Natural gas producers have drilled and produced tight gas resources for many years. However, many of these wells were only marginally economic. It was only after the development of new technology and provincial policies supporting unconventional natural gas development that production quickly accelerated after 2003. Production from tight gas resources now represents approximately 30 per cent of British Columbia's annual natural gas production.

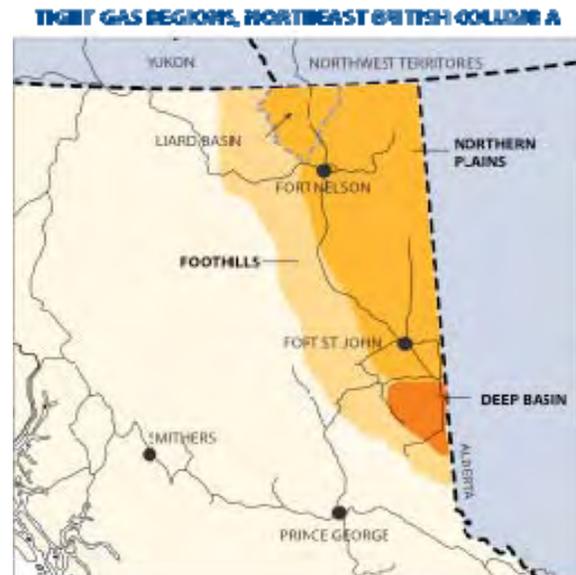


Figure 5: British Columbia Tight Gas Regions
Source: Ministry of Energy, Mines and Petroleum Resources

Shale Gas

Shale zones are spread throughout Northeast British Columbia (Figure 6); however, the majority of interest to date has been targeted toward three areas:

- Devonian shale accumulations, with particular interest in the Horn River Basin, located north of Fort Nelson, also referred to as Muskwa Shales. Interest is also being shown in the Liard Basin and the Cordova Ebyament.
- Triassic shales in the Montney formation located south of Dawson Creek, and trending north of Fort St. John.
- Emerging interest in Cretaceous Buckinghamshale shales located extensively throughout northeast BC.

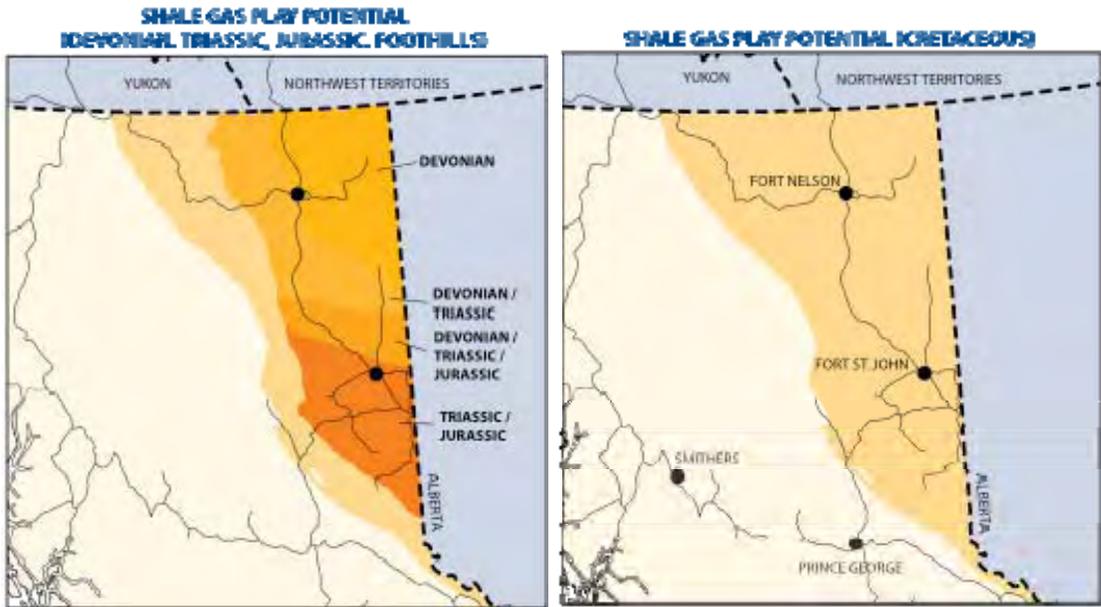


Figure 6: British Columbia Shale Regions
Source: Ministry of Energy, Mines and Petroleum Resources

British Columbia’s shale resources have been the subject of intense tenure acquisition since 2006. Prior to the shale tenure acquisition, the Horn River Basin had almost no exploration and development activity. However, over a period of three years, massive contiguous blocks of natural gas tenure were leased out, making the Horn River Basin a nearly green field development. (Figure 7).

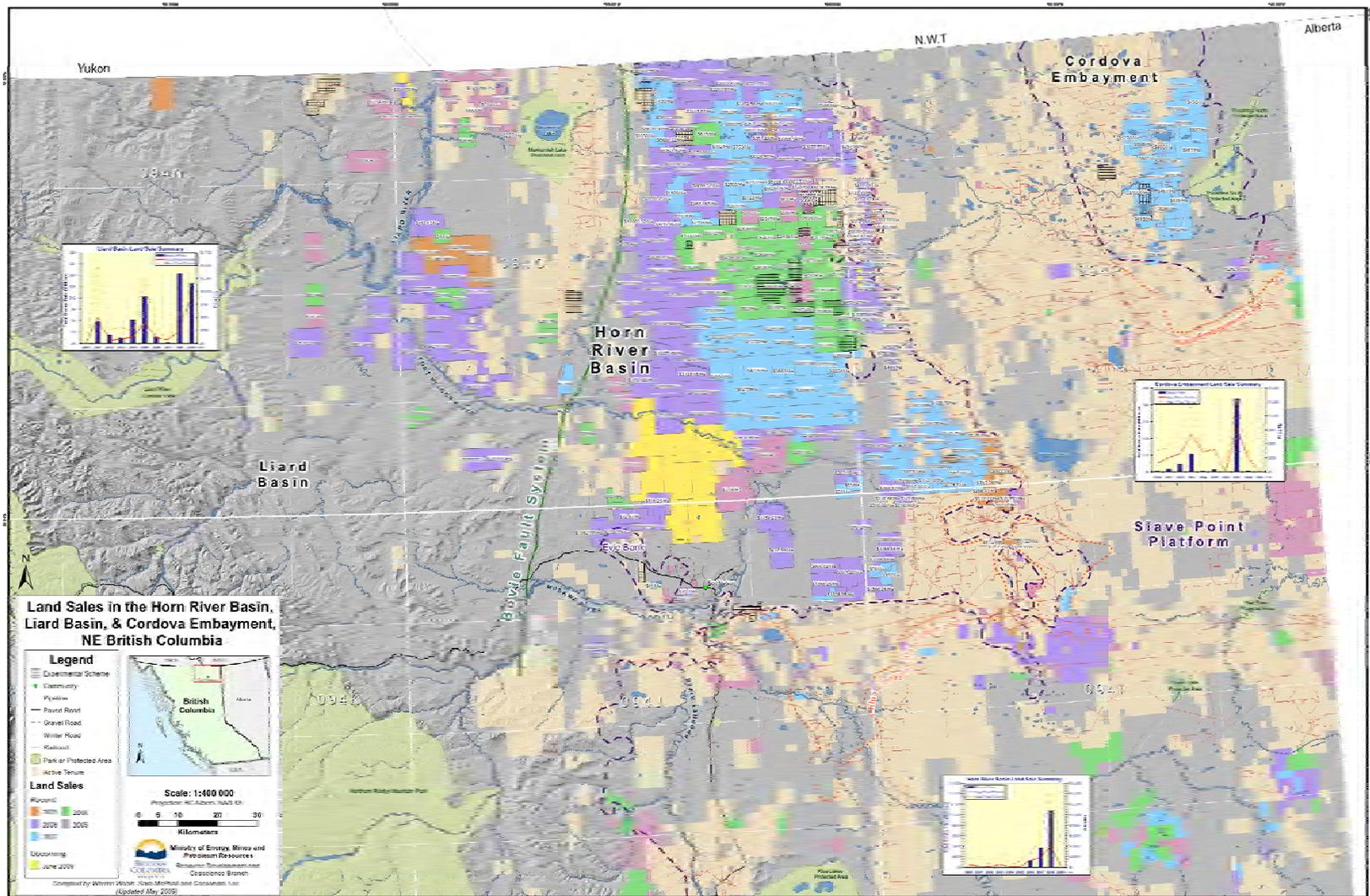


Figure 7: British Columbia Horn River Basin Tenure Acquisition
Source: Ministry of Energy, Mines and Petroleum Resources

The Montney Shale play was also subject to intense tenure acquisition from 2006; however, the tenure situation in the Montney is considerably more complex. (Figure 8) While a handful of producers have assembled large contiguous blocks of tenure, many of the Montney producers have smaller blocks. Many of these smaller blocks are also intermingled with tenure at other depths held by other producers. This will considerably complicate development of the Montney shale resource.

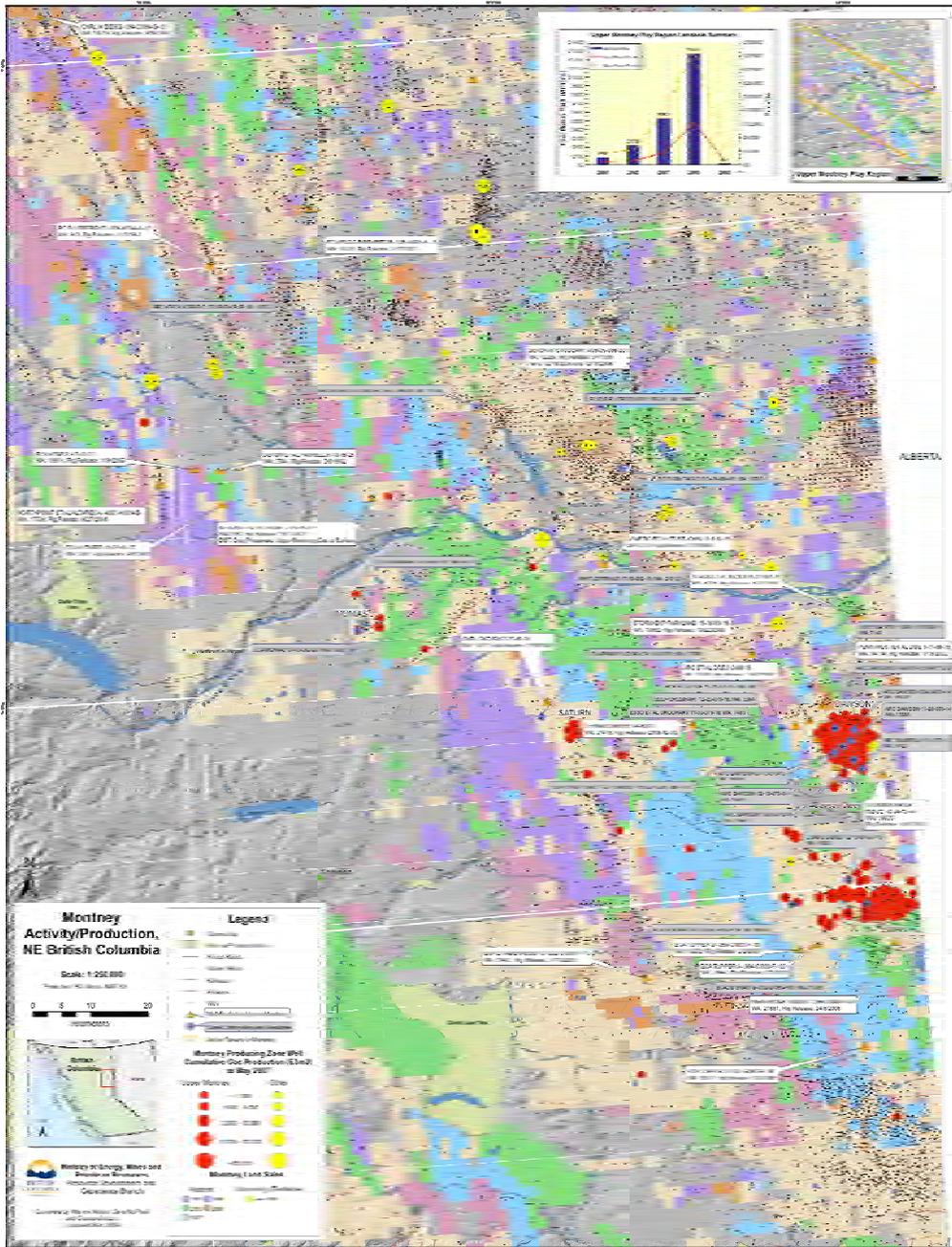


Figure 8: British Columbia Montney Shale Tenure Acquisition
Source: Ministry of Energy, Mines and Petroleum Resources

British Columbia’s unconventional natural gas resources are immense and completely overshadow the province’s other natural gas resources. (Figure 9) These are without question a world class resource that has the potential to fundamentally reshape both British Columbia’s natural gas sector, and the rest of the province.

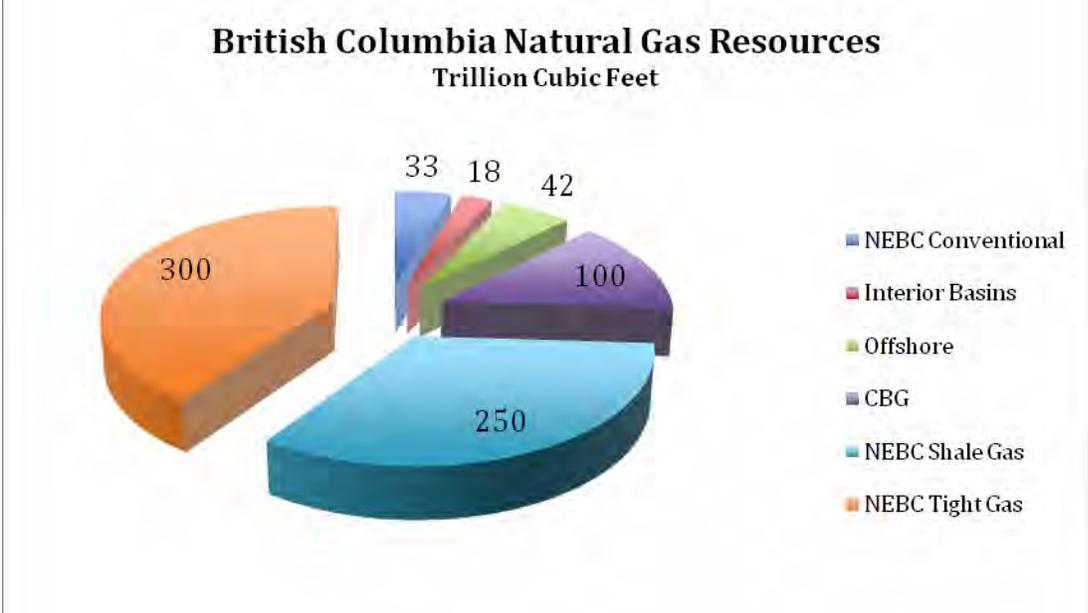


Figure 9: British Columbia Natural Gas Resources
Source: Ministry of Energy, Mines and Petroleum Resources

The development of British Columbia’s unconventional natural gas resources will have significant implications for policy makers. As will be discussed in subsequent sections of this paper, the development of British Columbia’s unconventional resources is at the very early stages, and there is an opportunity to ensure that these resources are developed in a way that is consistent with British Columbians’ values and goals. In order to attract the investment required to develop unconventional resources, the provincial government will be required to focus on creating a competitive investment climate while balancing other priorities including protecting the environment, realizing objectives for First Nations and realizing local values.

State of British Columbia's Natural Gas Industry

While British Columbia has had an active natural gas sector since the 1950's, prior to 2001 the sector was relatively small and faced a number of challenges that restrained growth.

Northeast British Columbia's challenging terrain and climate made the province a higher cost environment to operate compared to many areas in Alberta and other jurisdictions in North America. The road network supporting the natural gas sector was often low-grade and largely impassable during wet periods in the spring and fall. Many roads in the Fort Nelson region and further north were, and still are, accessible only during the winter, when the swampy muskeg has frozen. In addition to road infrastructure constraints, pipeline gathering systems extended only as far as the roads, making orderly expansions of projects expensive and difficult.

Investments by Westcoast Energy (now Spectra Energy) in large natural gas processing and transmission infrastructure greatly helped development in Northeast British Columbia. This infrastructure connected natural gas producers to markets throughout British Columbia and into the Pacific Northwest and California. These investments helped realize economies of scale for natural gas processing and transmission that helped to reduce some of the cost disadvantages of being one of the most distant gas resources from the primary North American gas consuming markets.

As well, the regulatory regime for natural gas activities generally reflected a lack of government interest toward developing the industry. Natural gas producers were required to submit multiple regulatory applications to numerous ministries and agencies; separate applications had to be made to remove trees, construct roads, or build stream crossings. In addition, regulations in British Columbia were often seen as unnecessarily complex and different from those in Alberta, where most natural gas producers had the majority of their activities. For example, producers working in British Columbia were required to have a different kind of first aid kit.

In addition to the noted infrastructure constraints and complicated regulatory processes, many producers simply did not believe that British Columbia held high quality natural gas resources worth pursuing.

British Columbia began to take policy actions in the late-1990's to stimulate the natural gas sector, with the creation of the Oil and Gas Commission (a single window regulator), investments to improve public road infrastructure and royalty reductions. In addition, the provincial government and municipalities in the Peace River Regional District created the Fair Share Agreement to provide municipalities with provincial funding for new infrastructure to support the oil and gas sector.

The 2002 Energy Plan foreshadowed major policy changes for the natural gas sector, indicating that policy initiatives would be developed to increase the province's investment competitiveness. In 2003 British Columbia introduced the Oil and Gas

Development Strategy, a sweeping program that included:

- royalty programs targeting specific resource opportunities (e.g., deep gas, marginal producing wells and summer drilling activity);
- significant investments in public roads and cost sharing initiatives for private oil and gas roads and gathering pipelines;
- streamlined and harmonized regulations with Alberta;
- support to enhance the competitiveness of the local service sector to create economic and employment opportunities for British Columbians.

Three subsequent phases of the Oil and Gas Development Strategy augmented the strategy with additional initiatives to enhance the province's competitiveness. In particular a new royalty program, the net profit royalty, targeted unconventional resources.

At the same time, natural gas commodity prices entered into a more stable, higher price phase. The higher commodity prices provided natural gas producers with cash-flow to finance expanded exploration and development programs. By synchronizing enhancements to British Columbia's competitiveness at the same time that producers were seeking investment opportunities, British Columbia was able to grow the natural gas sector into one of the most important components of the provincial economy.

Topic Box – Commodity Prices, Government Policy and Investment

Investments in natural gas exploration and development are driven by a number of factors, including the geology, technology, expected return on investment, the operating environment.

It has been suggested that higher commodity prices have been the single factor leading to growing oil and gas investment levels in British Columbia. If this were true, it would be expected that the British Columbia's share of western Canadian oil and gas investment would remain relatively unchanged over time.

Based on statistics from the Canadian Association of Petroleum Producers, British Columbia's share of oil and gas investment in western Canada increased from 10 per cent in 1998, to 16 per cent in 2007. During same period, Alberta's share of oil and gas investment fell from 89 per cent, to 82 per cent. Saskatchewan's share of oil and gas investment remained constant around 11 per cent.

This strongly suggests that in addition to commodity prices, other factors have significant influences on investment levels. Oil and gas producers indicate that a particular jurisdiction's competitiveness has a more significant effect on investment rather than commodity prices.

This does not mean that commodity prices are unimportant, but that the investment decision is a complex process that includes a number of inter-related factors.

The 2007 Energy Plan continued to focus on improving British Columbia's competitiveness. In addition, the Plan placed additional emphasis on addressing environmental and socio-economic impacts resulting from natural gas sector activities. More recently, the provincial government announced a stimulus package to further enhance the province's competitiveness and ensure that the natural gas sector continues investing during a time of economic weakness.

Natural gas producers responded to British Columbia's improved competitiveness by substantially increasing investment for tenure acquisition, exploration and development activities. (Figure 10) Oil and gas industry expenditures rose substantially from about \$1.7 billion in 1999, to more than \$9 billion in 2008.

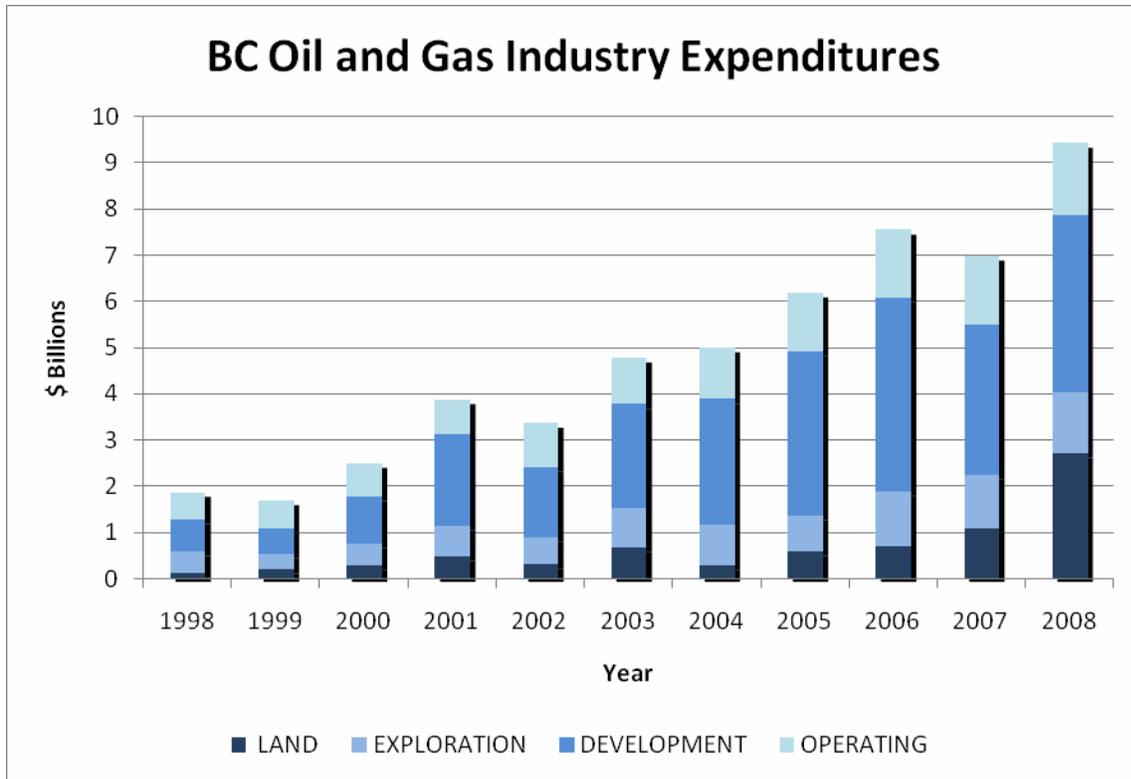


Figure 10: BC Oil and Gas Expenditures 1998 – 2008
Source: Canadian Association of Petroleum Producers.

Natural gas drilling increased from around 400 wells in 1999 to more than 1,200 wells in 2005 and 2006. (Figure 11) However, with declining prices, natural gas producers began to reduce drilling activity. Natural gas drilling activity declined to approximately 950 wells in 2007 and 650 in 2008. British Columbia has not been alone in this experience. The precipitous drop in natural gas and oil commodity prices has resulted in a significant fall off in drilling activity throughout North America.

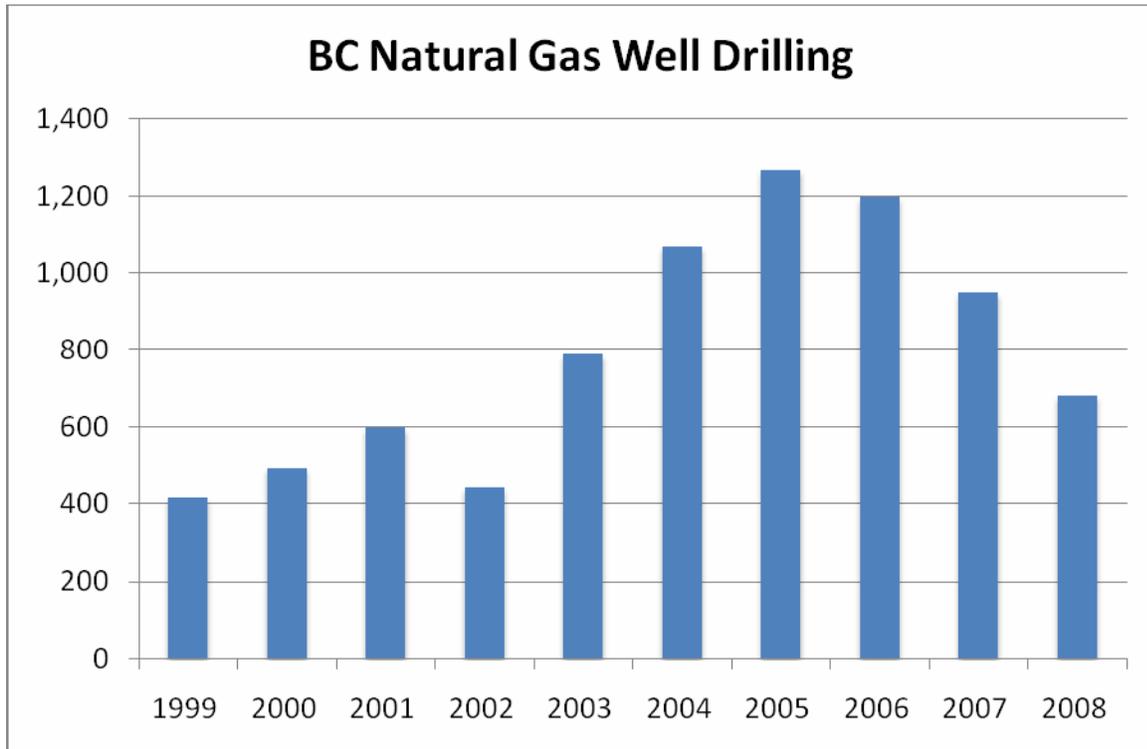


Figure 11: BC Natural Gas Drilling Activity 1999-2008
Source: Oil and Gas Commission

The growth of drilling activity between 1999 and 2006 resulted in an increasing annual production trend throughout most of the last decade. (Figure 12) Production increased from approximately 0.86 Tcf in 1999, to more than 1.25 Tcf in 2006. While drilling activity has tapered since 2006, it is important to note that wells with horizontal completions are making up a larger percentage of wells being drilled. These wells have generally shown to have higher production levels than conventional, vertically completely wells. It is therefore likely that lower drilling activity in 2007 and 2008 will not lead to lower production in 2009 and 2010. Production levels are anticipated to begin increasing once commodity prices recover and unconventional natural gas drilling activity accelerates.

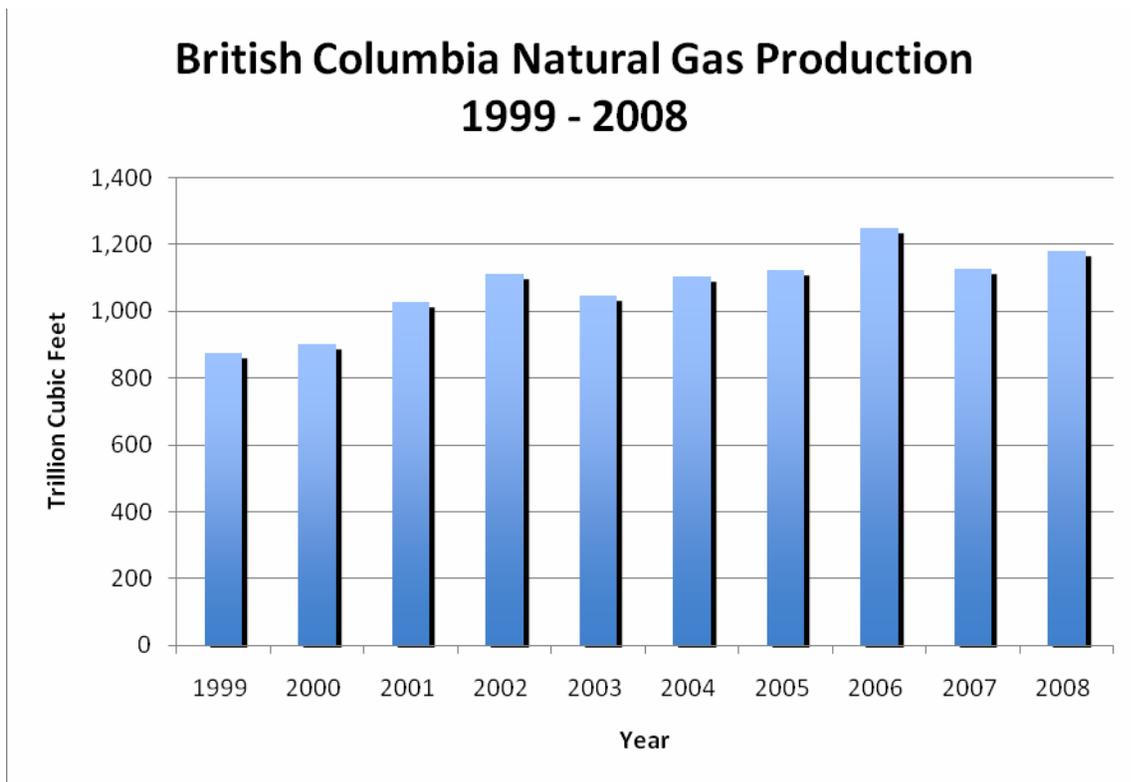


Figure 12: BC Natural Gas Production
Source: Canadian Association of Petroleum Producers

With increased drilling activity, British Columbia's natural gas sector has successfully added to the size of the province's natural gas reserves. (Figure 13) The reserve replacement ratio is a key measure that indicates the level of drilling success. The natural gas reserve replacement ratio is the ratio between natural gas production and incremental additions to reserves. A ratio greater than 100 per cent signals that additions to reserves exceed annual production. With lower drilling activity over 2007 and 2008, there is a high probability that the reserve replacement ratio could dip below 100 per cent in the near term.

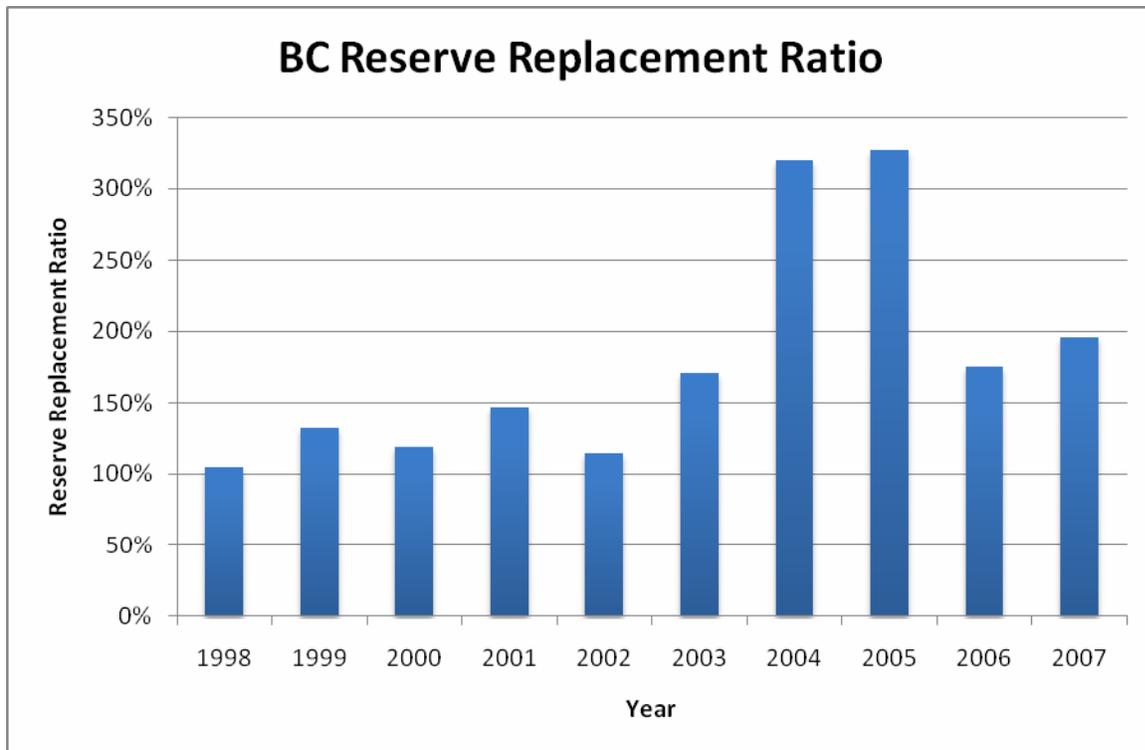


Figure 13: BC Natural Gas Reserve Replacement Ratio 1999 – 2007
Source: Oil and Gas Commission

The natural gas sector has become an important source of revenue for the provincial government. Over time, royalties and tenure bonuses grew substantially to become the largest source of direct provincial natural resource revenues. Provincial revenues have increased from approximately \$0.5 billion in 1999/00, to a record level of more than \$3.8 billion in 2008/09 – triple the 1999/00 level.

Over 2007/08 and 2008/09, tenure bonus bids exploded as producers aggressively bid for exploration rights for unconventional resources in the Horn River Basin and the Montney. (Figure 14) Natural gas producers paid more than \$1.2 billion in 2007/08, and \$2.4 billion in 2008/09. While natural gas producers paid top dollar to acquire land, the actual volume of Crown tenure has decreased from approximately 800,000 hectares in 1999/00 to 650,000 hectares in 2008/09.

However, it should not be assumed that tenure bonus bids will continue along the current trend. Available tenure in the Montney has largely been leased out, as well as significant portions of the Horn River Basin. In addition, with lower natural gas prices, natural gas producers are attempting to maintain cash reserves.

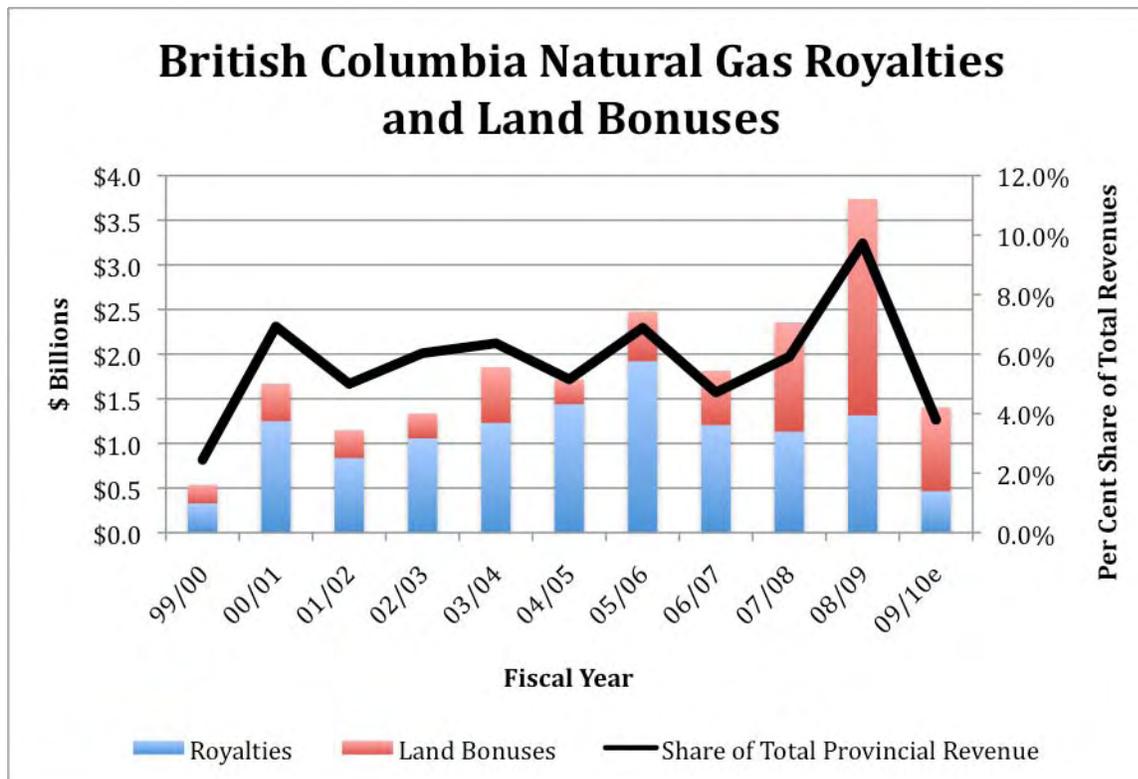


Figure 14: BC Natural Gas Royalties and Land Bonuses 1999/00 – 2009/10
Source: Ministry of Finance, Ministry of Energy, Mines and Petroleum Resources

The impact of the British Columbia’s petroleum industry on the provincial economy is significant. Recent research by the Canadian Energy Research Institute (CERI) indicates that the gross domestic product (GDP) impact from petroleum investment is approximately \$361 billion.⁶ Including the economic impacts in British Columbia from investments made in other provinces results in a total GDP impact of \$461 billion.

Located primarily in northeast British Columbia, the natural gas sector is a major source of employment in that part of the province. IHS Global Insight recently calculated the employment impacts of the natural gas sector in British Columbia.⁷ (Figure 15) This study found more than 44,000 British Columbians directly employed by the natural gas sector, and an additional 67,000 indirectly employed by the sector.

⁶ Canadian Energy Research Institute. Economic Impacts of the Petroleum Industry in Canada. July 2009

⁷ HIS Global Insight (Canada) Ltd. The Contribution of the Natural Gas Industry to the Canadian Nations and Provincial Economies. December 2009

2008 Natural Gas Related Employment	
Employment Category	Employment
Direct Employment:	
Extraction	2,371
Support Services	3,801
Gas Distribution	2,224
Pipeline Operations	1,287
Engineering Construction	34,770
Indirect and Induced	67,290
Total Employment	111,743

Figure 15: British Columbian Oil and Gas Sector Employment
Source: IHS Global Insight

This snapshot view on the status of the natural gas industry shows an industry that has grown from being a relatively minor part of the provincial economy to a leading generator of economic prosperity in the province. It is important to point out that with the expansion of activity comes an increasing presence in communities and on the land base. Communities, First Nations and environmental organizations have expressed concerns about the pace and socio-economic and environmental impacts of natural gas development.

Connecting Natural Gas Resources to the Markets

Having world-class unconventional natural gas resources, and the extraction technology, is of little value if the midstream infrastructure to deliver these resources to markets is not available. Balancing midstream infrastructure development is important for natural gas development. Too little infrastructure and natural gas is shut-in, too much infrastructure and too few customers will have to absorb the cost of under utilized infrastructure. In both scenarios, natural gas producer returns are constrained and new investment in drilling activity is postponed. This is a critical part of the natural gas value chain, and has a significant impact on the pace of development. This section will provide an overview of British Columbia's midstream sector. (Figure 16)

Raw Natural Gas Gathering

British Columbia has an extensive network of raw natural gas gathering pipelines that connect wells to processing facilities. This network has been enhanced since 2004 with royalty credits to support bringing gathering lines into areas that have insufficient infrastructure. With additional development of unconventional resources, this infrastructure will have to be expanded. However, as producers move toward pad drilling, there will be fewer pipelines and less of an environmental impact.

Natural Gas Processing

The majority of natural gas produced in British Columbia is processed within the province. Natural gas is processed at plants that remove impurities, heavier natural gas liquids (propane, ethane, butane, etc.), carbon dioxide and water vapour. British Columbia has forty-seven plants capable of processing approximately 3.0 Bcf/d; however, because of the history of infrastructure development in BC, the majority of raw gas is processed by Spectra Energy, which has capacity to process 2.2 Bcf/d. The remaining processing capacity is held in other smaller third party processors and producer-owned facilities. However, natural gas producers are also planning to increase their own processing capacity. EnCana recently received an environmental licence to construct the Cabin Gas Plant in the Horn River Basin, which will initially provide 0.8 Bcf/d of processing capacity.

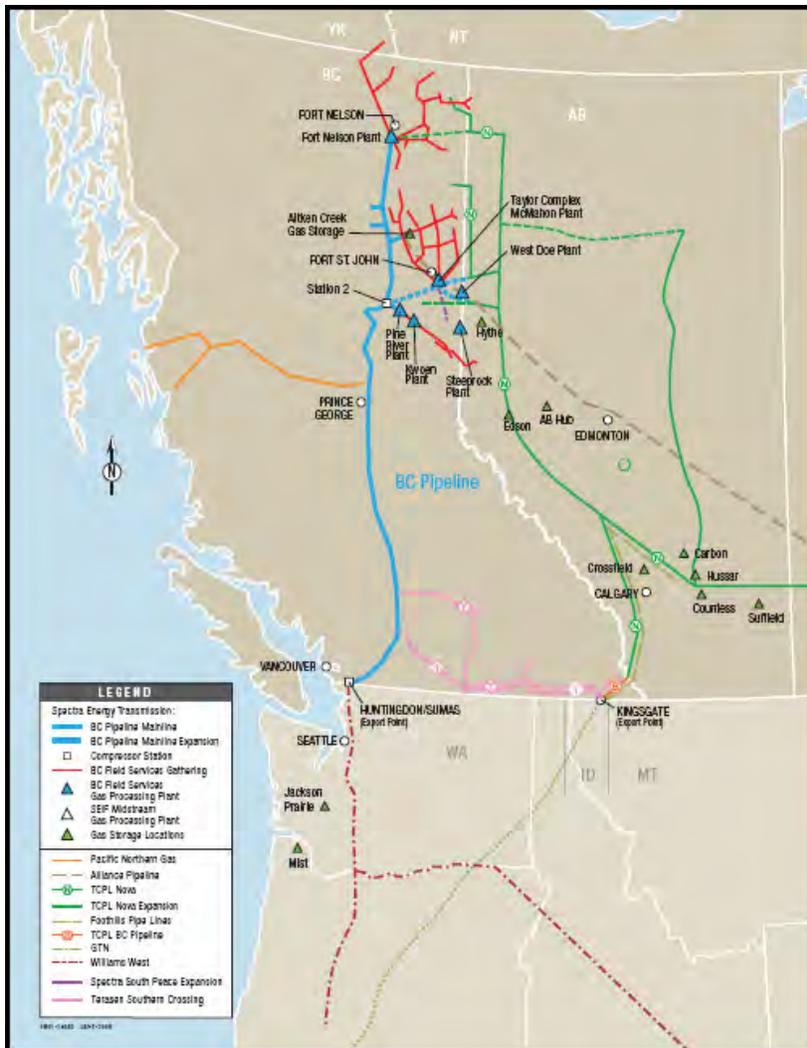


Figure 16: British Columbian Midstream Sector
Source: Canadian Energy Research Institute

A key issue for natural gas producers and processors is how to support the growth of British Columbia's natural gas production in a carbon-constrained environment. British Columbia's Climate Action Plan requires the province to achieve an interim greenhouse gas (GHG) emission reduction target of six per cent below 2007 levels by 2012 and 18 per cent below 2007 levels by 2016. These interim targets are intended to support the province's legislated goal to reduce emissions by 33 per cent by 2020.

Currently in British Columbia, most GHG's stripped from raw natural gas at processing plants are released to the atmosphere. Spectra Energy is leading research into a carbon capture and storage (CCS) feasibility study at the Fort Nelson gas plant, the largest sour gas processing plant in North America. Raw gas in the Fort Nelson area contains high natural levels of CO₂, which is stripped away during processing and is currently vented to the atmosphere. If the project is proven feasible, the CO₂ would be compressed, dehydrated and cooled into a concentrated stream, and then injected into deep saline formations, 2.5 kilometres underground, for permanent sequestration. The

project is designed to demonstrate the technical and economic feasibility of injecting large volumes of sour CO₂ into deep saline formations for permanent storage. If successful, it will lay the groundwork for one of the largest carbon capture and storage projects of its kind in the world.

An initial phase has been completed jointly with the provincial government to evaluate geological, technical and economic feasibility. A second phase of the feasibility study is underway, with the support of the federal government. Spectra Energy has drilled two test wells to determine whether the surrounding geology is suitable for the permanent storage of acid gas. If proven viable, the project has the potential to store approximately one million tonnes of carbon dioxide annually, the equivalent of taking 250,000 cars off the road each year.

Production Area Storage

Production area natural gas storage is an important element of the midstream sector. For producers, production area storage guarantees a market outlet during seasonal demand fluctuations. This helps to maintain stability in natural gas market prices and assists producers in avoiding the costs associated with temporary interruptions of market access that can result in shutting in of production. On the supply side, there is a need to keep gas supply as constant as possible to optimize the use of production and pipeline facilities, whereas gas demand fluctuates. Storage can also be used to smooth out production variations caused by weather and maintenance issues. In general, production area storage is important to optimizing gas field development. By stabilizing natural gas supply and pricing, British Columbia can generate higher natural gas royalties than it would without natural gas storage.

The province at present has only one production area natural gas storage facility. Chevron's Aitken Creek storage facility is located approximately 100 kilometres north of Fort St. John and has a capacity of approximately 71 Bcf of working gas capacity. Producers also have access to natural gas storage facilities in Alberta; however, having such facilities physically closer to the producer areas provides significantly greater benefits in managing the physical supply in British Columbia. Terasen Gas operates liquefied natural gas storage facilities in the Lower Mainland and on Vancouver Island, primarily to assist in managing physical market supplies for the benefit of consumers in those markets, not producers in northeast British Columbia.

With increasing unconventional natural gas production in northeast British Columbia, additions to storage infrastructure will benefit natural gas producers, processors, shippers and the provincial government. However, it may be difficult to encourage new storage infrastructure investment. British Columbia is the only jurisdiction in Canada that still regulates underground natural gas storage as a public utility. While the BC Utilities Commission (BCUC) has provided temporary rate regulation exemptions to producer area storage facilities, it maintains the ability to step in should the BCUC deem it necessary. In contrast, Alberta and Ontario, the two Canadian jurisdictions with significant underground storage, have provided clear policy direction to natural gas

storage facility investors that rates will not be regulated.

Transmission

British Columbia has approximately 4,000 kilometres of natural gas transmission pipelines. These pipelines are between 36 inches and 42 inches in diameter and operate at high pressure. The pipelines connect natural gas producers with consumers.

Spectra Energy is the major pipeline operator in British Columbia, providing approximately 2.2 Bcf/d of capacity through a system stretching 3,000 kilometres from Fort Nelson to the British Columbia/Washington border. This transmission system has provided British Columbians with access to affordable and clean burning natural gas. For producers, Spectra Energy's transmission system provides access to both provincial, Pacific Northwest and California natural gas markets. Spectra Energy recently announced that it will expand natural gas gathering and processing capacity at its Fort Nelson Gas Plant by 0.83 Bcf/d, plus an additional 0.15 Bcf/d capacity along the T-North pipeline.

Natural gas producers in British Columbia also have options to access eastern gas markets. Alliance Pipelines operates a bullet line to the Chicago market that begins at the Aitken Creek storage facility. Producers also have access to TransCanada PipeLine's Mainline pipeline through numerous smaller pipelines that cross the British Columbia/Alberta border. Both Alliance and TransCanada have announced plans to increase take-away capacity, or construct new infrastructure to connect with potentially growing production.

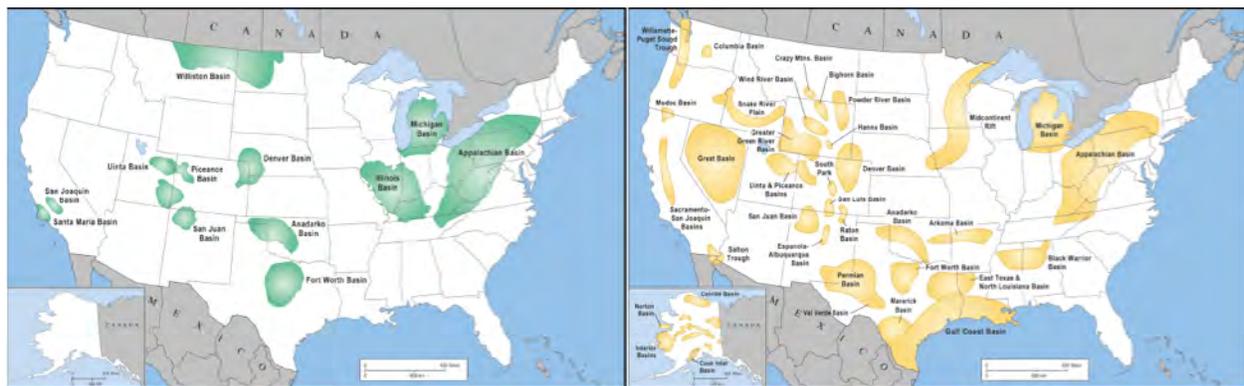
It is anticipated that British Columbia producers may soon have access to global markets for liquefied natural gas (LNG). Kitimat LNG has received an environmental license to construct an LNG export facility at Kitimat, British Columbia. This facility would receive British Columbia-produced natural gas via a new Pacific Trails Pipeline, where it would be liquefied and transferred to LNG carrier ships that would then deliver the LNG to foreign markets, most likely in Asia. The Pacific Trails Pipeline is a 1.0 Bcf/d proposed pipeline to replace the existing unreliable Pacific Northern Pipeline. The Pacific Trails Pipeline has also received an environmental license.

Growth Scenario for Unconventional Natural Gas Development in British Columbia

Much of the preceding discussion has focused on looking backward over the past decade to understand the current state of British Columbia's natural gas industry. It is clear that the provincial government made a number of sound policy decisions that helped the natural gas sector become a vital part of British Columbia's economy. In fact, the main reason that BC is now poised to leap forward with unconventional natural gas development is that the increased activity over the past decade created a foundation from which industry could move to the massive future investments required for unconventional natural gas development.

It is difficult to forecast how British Columbia's unconventional natural gas development will evolve over the next decade. There are a multitude of factors, both local and global, that influence the investment decision process in the natural gas sector. However, the most fundamental factor is the commodity price for natural gas.

North American natural gas commodity prices are a function of the supply and demand for natural gas. On the supply side, British Columbia's unconventional natural gas discoveries, while large by North American standards, are not unique. New unconventional supply opportunities have also been identified throughout North America. (Figure 17) The US Energy Information Agency's 2009 Annual Energy Review forecasts US natural gas production to increase from 20.56 Tcf in 2008, to more than 21.54 Tcf in 2020.



US Shale Basins

US Tight Gas Basins

Figure 17: US Unconventional Natural Gas Regions

Source: Advanced Resources Ltd.

While the supply of natural gas has increased substantially from several years ago, demand has moved in the opposite direction. The 2008-09 recession had a significant impact on natural gas demand across North America. The US Energy Information Agency notes in its March 2010 Energy Outlook that US natural gas demand is projected to decline significantly over the next five years. The overall view on natural

gas prices for the next several years is that prices likely will remain below the levels that would result in increased in drilling for conventional resources, but high enough to support continued investment in unconventional resources.

There are potentially numerous development scenarios for British Columbia's unconventional natural gas resources. The National Energy Board's recent Update to Short-term Canadian Natural Gas Deliverability 2010-2011 forecasts natural gas production in BC to increase from approximately 2.65 billion cubic feet/day (Bcf/d) in 2008, to 3.2 Bcf/d by 2011, a more than 20% increase in production.

Looking further out to 2020, Spectra Energy has forecasted that British Columbia's natural gas production will increase to approximately 5.0 Bcf/d, or roughly double. To put this into perspective, Alberta currently produces approximately 13 Bcf/d, and is forecasted to decline down to approximately 12 Bcf/d by 2020.

As shown in Figure 18, production from current sources, primarily conventional natural gas wells, is anticipated to fall continuously over the period, as fewer conventional wells are drilled and producers focus on unconventional developments. This forecast depends on a number of assumptions about unconventional resources, the direction of natural gas prices, availability of other natural gas supply in North America and technological improvements to drilling and completion practices. There is a possibility that future unconventional natural gas production will be less than forecasted, and there is a possibility that it could be higher.

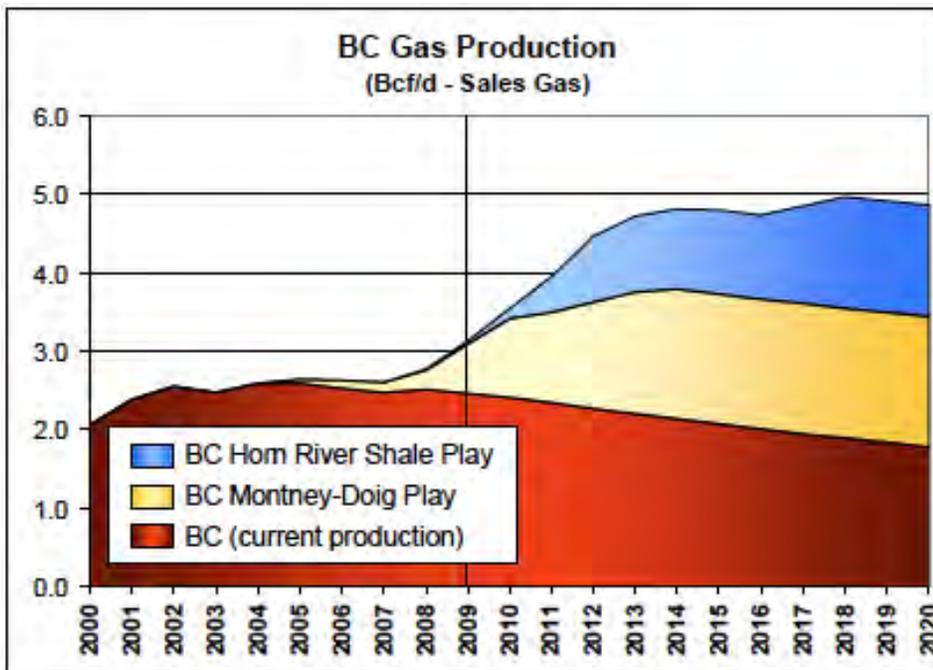


Figure 18: British Columbian Forecasted Natural Gas Production
Source: Spectra Energy

This forecast is a useful tool to consider what actions the provincial government can or should take to realize the unconventional natural gas opportunity. It is difficult to accurately predict the exact number of wells, roads and pipelines that will be needed or constructed, and the potential impacts. However, there are some general patterns that should evolve, including:

- Concentration of Activity – While obvious, unconventional natural gas development will be concentrated in northeast British Columbia, which is physically and temporally far from where most British Columbian’s live.
- BC Climate Change Objectives – British Columbia’s aggressive climate action objectives are a significant issue for the natural gas sector. Growing British Columbia’s natural gas sector while reducing emissions from the sector will be a major challenge for government and industry.
- Activity on the Land Base – Unconventional natural gas development will result in greater activity on the land base. This will include new activity taking place in areas that have not been subject of natural gas development in the past, but also actively developed areas having more intensive natural gas activities.
- Concerns About Development – Greater unconventional natural gas activity levels will result in greater concerns from communities, First Nations and environmental organizations about the pace and impacts of development.
- Local Pressures – Like Fort McMurray, Alberta, local communities in northeast British Columbia will experience new pressures from swelling populations and greater demands on their physical and social infrastructure.
- Local Service Sector – British Columbia’s local service companies will be under intense competition from Alberta-based service companies as producers look to manage costs as tightly as possible.
- Employment Opportunities – Increased natural gas activities will create new employment opportunities for British Columbians. However, most of these jobs require specific training that is generally not available in the province.
- Regulatory Regime – Increasing natural gas activity will increase the demands on British Columbia’s Oil and Gas Commission, the provincial regulator of oil and gas activities. The changing nature and technology used in the natural gas industry will also impact how the Oil and Gas Commission approaches regulation.
- New Infrastructure Requirements – With the development of unconventional natural gas resources, there will be increasing pressure for new infrastructure supporting the natural gas sector.

Potential Policy Responses and Action to Help Realize Long-Term Opportunities

The provincial government and the natural gas sector have been proactive in addressing the development of unconventional natural gas. Natural gas producers in the Horn River Basin have created the Horn River Basin Producers' Group. The Producers' Group brings natural gas companies together to work collaboratively on issues affecting the industry. In addition, the Producers' Group provides a single point of contact for government, First Nations and local communities to discuss issues of common concern. The Producers' Group is a new and innovative way for industry to approach development issues. While not perfect, it is clearly a positive and meaningful step in the right direction.

The provincial government has also been working to address issues arising as a result of unconventional natural gas development. A number of ministries and agencies are working to address issues linked to the evolving unconventional natural gas development. At the centre are the Ministry of Energy, Mines and Petroleum Resources, which sets the natural gas policy and legislative framework, and the Oil and Gas Commission, which regulates the natural gas sector. Ministries and agencies such as Environment, Transportation, Education and Training and Worksafe BC all play important roles creating the overall policy and regulatory environment for unconventional natural gas development. All of these organizations should be credited for recognizing the potential impacts of future development, and proactively working at addressing them.

The key issues that will require focus and attention include:

Leadership

At the most fundamental level, development of British Columbia's unconventional natural gas resources will require leadership by all of the players involved in the natural gas sector: government, industry, local communities and First Nations will all need to be leaders in their respective areas, and to trust and support the leadership from the others.

With the leadership in place, a deliberate approach to unconventional natural gas development can take place. A deliberate approach to development will mean that British Columbia's move to unconventional natural gas development will be an evolution – not a revolution. It also means that, for some areas, there will be clear and transparent decisions where and when unconventional natural gas can happen.

Social License to Operate

Social license to operate is the acquisition of free, prior and informed consent for local development activities from First Nations and local communities through mutual agreements. Without a social license to operate, unconventional natural gas development will face a very rough and challenging road in British Columbia.

There are many players involved in achieving a social license to operate. At the centre, the natural gas sector must work collaboratively throughout northeast British Columbia to continue to advance relationships and dialogue. The provincial government also plays a key role, acting as a facilitator to bring relevant parties together, promote discussion and, where needed, put in place requirements that will support the social license to operate.

A recent successful example is the creation of the Living Together – Working Together program in northeast British Columbia. This is a voluntary, community-based initiative to address local area concerns such as traffic safety, speed control and dust. Several natural gas companies operating in the Montney have made a public commitment to adhere to the Living Together – Working Together guiding principles.

In addition, the Horn River Basin Producers' Group is an excellent example how industry can collaborate to address resource development issues. This approach would be worthwhile in other areas of the province, particularly the Montney. As other areas develop, such as the Liard Basin and Cordova Embayment, the provincial government will need to work proactively to create synergies similar to the Horn River Producers' Group.

Local Communities

With expanding unconventional development, local communities will face increasing pressures on infrastructure and social services as populations, both permanent and temporary, grow. British Columbia need only look to Fort McMurray, Alberta to see the challenges that smaller communities have to grapple with due to rapidly expanding resource development.

The provincial agreement, with municipalities in the Peace River Regional District, provides provincial local infrastructure funding that is tied to activity levels. While funding may be adequate to fund infrastructure development, communities will need support with managing for growth. It will be critical for the BC government to recognize growing needs within these communities for provincially supported services, such as health and education, and respond to this demand.

The Fort Nelson Regional Municipality, with the rapidly developing Horn River Basin, has no such agreement with the provincial government for infrastructure funding. Although it has broad property taxing abilities, funding infrastructure solely out of the local tax base will create significant property tax inflation. The regional municipality, the provincial government and industry need to jointly develop a long-term strategy to

ensure that infrastructure development is supported without creating impediments to development.

First Nations

First Nations communities in northeast British Columbia have a unique relationship with the provincial government and the natural gas sector. In 1899, 39 First Nations across northeastern British Columbia, Alberta and northwestern Saskatchewan signed the 8th treaty with the Queen of England. This treaty has had a significant influence on the evolving relationship between First Nations, the provincial government and the natural gas sector.

In 1982 existing aboriginal and treaty rights were recognized and affirmed in Section 35(1) of the Constitution Act. Subsequent Court decisions have clarified the nature of these rights and the level of protection that section 35 provides. In short, government activities cannot infringe on aboriginal rights unless there is proper justification in accordance with legal criteria that have been developed by the Courts. Section 35(1) of the Constitution Act, 1982 provides general protection, but does not define or set out particular aboriginal rights.

The Courts have now clarified what aboriginal rights and aboriginal title mean, and have established tests for proving aboriginal rights. Aboriginal rights, which have been recognized in several cases across Canada, are distinct from treaty rights, which flow from particular treaties with various aboriginal peoples. The Courts have clarified that an aboriginal right is a modern practice, tradition or custom that has a reasonable degree of connection with the practices, traditions or customs that existed prior to European contact. Activities that qualify as an aboriginal right may vary from group to group, depending on the customs that formed an important part of their cultures pre-contact. Examples of aboriginal rights may include the right to hunt or fish for sustenance, social, spiritual and ceremonial purposes.

In addition, the 1997 Supreme Court of Canada decision in *Delgamuukw* clarified that aboriginal title is a distinct type of aboriginal right. The content of aboriginal title and the test for establishing it are different than the content and test for establishing other types of aboriginal rights. For example, aboriginal title, if proven, confers a right on the First Nation to exclusively use and occupy the land for a variety of purposes. By contrast, a proven aboriginal right typically confers a non-exclusive right to carry out a particular activity in a specified area.

In 2004, the Supreme Court of Canada's decisions in the *Haida* and *Taku River* cases clarified that even before aboriginal rights and/or title are proven through a Court process, the province has a duty to consult with First Nations when it has real or constructive knowledge of the potential existence of an aboriginal right or title and contemplates conduct that might adversely affect it. In addition, although it is provincial authorities who are duty-bound to consult with First Nations groups, the project proponent is often better placed to share information with the First Nation and to

address particular First Nations' interests or concerns.

First Nations expressing an aboriginal right and/or title have a reciprocal duty to identify their aboriginal interests and concerns once they have had the opportunity to consider the information provided, and they must make a reasonable effort to inform the Crown about any impacts of the proposed activity on their aboriginal interests. First Nations communities' concerns typically relate to potential impacts on claimed aboriginal rights and title, including traditional practices and cultural resources, and environmental concerns including impacts on the land, air, water, forests, fish and wildlife.

The evolving development of unconventional natural gas resources will create new opportunities for economic development for First Nations, but will also pose significant challenges around developments on traditional lands and influences on traditional practices.

The provincial government, through the Oil and Gas Commission, and Treaty 8 First Nations have Consultation Protocol Agreements that set out requirements for First Nations consultation. These agreements are set to expire over the next year. It will be critical that the provincial government and First Nations negotiate new agreements to enable the continued orderly development of unconventional resources. In addition, the provincial government has negotiated several Economic Benefits Agreements with a number of individual Treaty 8 First Nations. Completing Economic Benefit Agreements to support unconventional natural gas development will be critical for First Nations and the provincial government to realize opportunities from unconventional natural gas development.

British Columbia Service Sector

British Columbia's local natural gas service sector has been working through its association, Energy Services BC, to promote the growth and development of its members throughout northeast British Columbia.

With continued growth in unconventional resources, the local service sector will be challenged to provide services to natural gas producers. This will require continuously upgrading both the skills and equipment used to support the natural gas sector. Locally based service companies will also be competing against Alberta-based service companies that are increasingly looking toward unconventional natural gas development for their own business opportunities.

In order for local service companies to thrive, there is a critical need for highly skilled people to work in the natural gas sector. This requires education and training programs. The recent creation of the oil and gas training Centre of Excellence at Northern Lights College is an important foundation from which to grow training programs throughout British Columbia's colleges and universities. In addition, the local service sector will need to replace a significant portion of its equipment.

The provincial government has partnered with Energy Services BC to assist the development of the local service sector. This relationship must continue to be strengthened and focused on unconventional natural gas development.

Infrastructure

Infrastructure development is one of key factors affecting the development of British Columbia's unconventional natural gas resources. When natural gas producers are required to invest in new infrastructure, they are directing available capital from the drill bit. The provincial government has been a strong supporter of new road infrastructure to support resource development. British Columbia's infrastructure royalty programs and investments in road infrastructure have been a key reason for the province's success since 2001.

With potentially significant increases in natural gas production will come significantly higher royalty revenue. It is important that the provincial government continue to invest a portion of this royalty revenue back into supporting road infrastructure and local communities used by the natural gas sector.

With growing natural gas production, the need for producer area storage will increase. Greater availability of producer area storage will create significant benefits for natural gas producers, processors and shippers and higher provincial royalties. British Columbia requires an updated storage policy that is consistent with other jurisdictions and encourages investment in new storage infrastructure.

Climate Change Policy

British Columbia's climate change policies will have a significant influence on the development of the province's unconventional natural gas resources. Requirements to cap emissions will call for more costly technology to capture and store GHGs. The cost to achieve CCS technologies will ultimately be borne by natural gas producers, which will negatively affect the return on investment.

In order to achieve its climate change policy objectives while minimizing negative impacts on unconventional natural gas development, British Columbia must be supportive and flexible with the natural gas sector. This does not mean that the natural gas sector should not do its part to achieve the province's goals. However, British Columbia must be aware of the trade-offs that it is making.

Regulating the Natural Gas Sector

Through the Oil and Gas Commission, British Columbia has an effective and efficient regulatory framework that protects the health and safety of people working in the industry and the residents in local communities. Growing activity levels from unconventional natural gas development are sure to create new demands on the Oil and Gas Commission. It is important that British Columbia's regulatory framework evolves with the industry.

British Columbia recently passed a new *Oil and Gas Activities Act* that will replace and modernize the patchwork of older legislative tools. Regulations under the new legislation are currently under development and will likely be implemented in 2010. It is important that these new regulations reflect the unique aspects of unconventional natural gas development.

Conclusions

Over the past decade, British Columbia's natural gas sector has become one of the most important parts of the provincial economy. It is a major source of capital investment, employment and government revenues. This has been accomplished by constructing a policy framework that has created a highly competitive environment to attract investment.

With the development of unconventional natural gas resources, British Columbia has the potential to substantially increase the value of the natural gas sector. However, the provincial government faces a number of key challenges that must be addressed in order to realize this potential.

While this report identifies several areas that will need a sustained focus, the most fundamental requirement will be leadership from government, the natural gas sector, local communities and First Nations to ensure that British Columbia's unconventional natural gas resources are developed responsibly and maximize benefits for all British Columbians.
