

British Columbia Oil & Gas Exploration Activity Report 2007-2008



Oil and Gas Division
Resource Development and Geoscience Branch





Ministry of
Energy, Mines and
Petroleum Resources

Oil and Gas Division
Resource Development and Geoscience Branch

BRITISH COLUMBIA OIL & GAS EXPLORATION ACTIVITY REPORT 2007-2008

Information Circular 2009-1

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Library and Archives Canada Cataloguing in Publication Data

Main entry under title:

[British Columbia oil & gas exploration activity report (CD-ROM)]

British Columbia oil & gas exploration activity report
[electronic resource]. -- 2004 -

Annual.

Also available in electronic and print formats.

ISSN 1715-4022 = British Columbia oil & gas exploration
activity report (CD-ROM)

1. Petroleum - Prospecting - British Columbia -
Periodicals. 2. Natural gas - Prospecting - British
Columbia - Periodicals. 3. Petroleum reserves - British
Columbia - Periodicals. 4. Natural gas reserves -
British Columbia - Periodicals. I. British Columbia. Oil
and Gas Division. II. Title: Oil & gas exploration
activity report. III. Title: British Columbia and gas
exploration activity report.

TN873.C32B74

622'.338'09711

C2005-960150-7

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BRITISH COLUMBIA OIL & GAS EXPLORATION ACTIVITY REPORT 2007-2008

Chris Adams¹ and Michelle Schwabe¹

ABSTRACT

Drilling activity in British Columbia moderated in 2007 and 2008 after reaching unprecedented levels over the previous four years. Raw natural gas production, which has seen an increase of 31 per cent over the last ten years, kept pace at three billion cubic feet (Bcf) per day in 2007 and 2008. Conventional oil production was 26,205 barrels per day in 2007. Raw gas reserves resulting from exploration and development activities in 2007 were successful in replacing 177 per cent of the year's total gas production. The established remaining raw gas reserves estimate of 17.1 trillion cubic feet (Tcf) is the highest level in the history of the province and represents a four per cent increase over 2006 year-end reserves. Bonuses collected from the sale of British Columbia's Crown petroleum and natural gas rights in 2007 totalled \$1.05 billion and, in 2008, reached a record total of \$2.66 billion. The average price per hectare of \$3,519 in 2008 was the highest ever recorded in the province.

Exploration activity highlights are covered for six resource regions in northeast British Columbia: Laird Basin and Fold Belt; Fort Nelson/Northern Plains; Fort St. John; Deep Basin; Northern Foothills; and the Southern Foothills. The Sierra area of the Fort Nelson region saw the highest activity in the province as producers continue to focus on Upper Devonian Jean Marie tight gas development. The Horn River Basin and Cordova Embayment areas continue to amass significant interest from land purchasers looking to unlock the potential of organic rich shales. In the Fort St. John region, the Chinchaga River and Drake areas witnessed strong drilling activity driven by development of the Lower Cretaceous Bluesky play trends and the lowstand sands of the Notikewin (Spirit River Formation). The north western edge of the Fort St. John region has also seen significant activity with expansion of the areally-extensive Triassic Halfway tight gas play. Operators in the Deep Basin region were kept busy developing gas potential from the sandstone, siltstone and shale sequences of the Triassic Montney as well as tight gas targets such as the Lower Cretaceous Cadomin. The Northern Foothills region continues to see activity targeting the shallow Cretaceous Bluesky/Gething sands in addition to a substantial new Triassic Halfway development fairway in the Trutch area. In the Southern Foothills region, producers remain active in opening up opportunities in folded and faulted structures that can potentially hold large reserves of natural gas.

Ninety-eight wells drilled in British Columbia to date have been identified as coalbed gas wells. In 2007/08, the BC Oil and Gas Commission authorized 23 coalbed well applications with drilling proceeding on 11 of those. Also, a number of tenure requests related to freehold coal owners were made. In early 2008, Hudson's Hope Gas Ltd. announced estimated capital expenditures of \$18 million for its Peace River coalfield project in the Hudson's Hope area. Commercial production of coalbed gas began at the Peace River project at the end of 2008, the first coalbed gas production in the province.

The Nechako Basin Project is in its third full year of a multi-year research program designed to generate new geoscience data and interpretations to facilitate oil and gas exploration. Work focussed on the northwestern part of the basin and in the Skeena Arch.

This report focuses mainly on exploration activity in 2007, but 2008 data is also presented when information for that year was readily available at the time of writing. Unless otherwise specified, data presented here refers to 2007 activity.

Adams, C., Schwabe, M., British Columbia Oil & Gas Exploration Activity Report 2007-2008, BC Ministry of Energy, Mines and Petroleum Resources, pages 1-39.

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Key Words: exploration and development, industry activity, northeastern British Columbia, petroleum and natural gas rights, resource region, land sales, drilling, production, reserves, rig releases, shale gas, coalbed gas, interior basins

INTRODUCTION

The Province of British Columbia continues to benefit from being one of the most competitive oil and gas development jurisdictions in North America. While promoting the development of conventional, unconventional and frontier oil and gas resource opportunities, the Province has taken specific measures to ensure these opportunities are managed in an environmentally and socially responsible manner.

Exploration and development activity by the oil and gas industry is a major force in the provincial economy and provides substantial opportunities for British Columbians. Capital spending by industry reached \$5.5 billion¹ in 2007. Crown revenue generated from royalties, land sale bonuses and fees was \$2.36 billion in 2007. In 2008, that figure increased to \$4.1 billion (Figure 1).

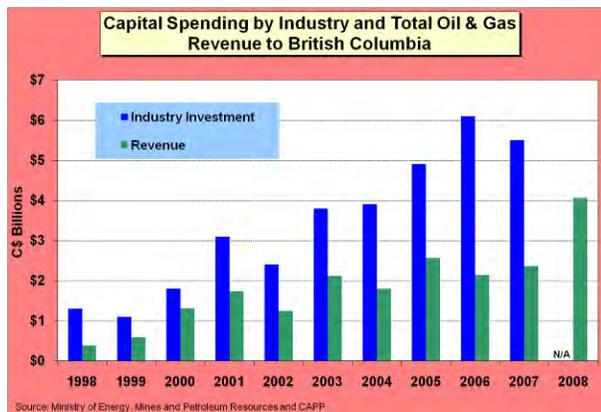


Figure 1. Industry investment and direct oil and gas revenue.

The number of wells rig released in the province in 2007 fell by 36 per cent from the previous year, but saw a slight increase in 2008 to 919 wells (Figure 2). Most drilling occurred in the northeastern portion of the province with one well drilled in southeastern British Columbia in 2007, focusing on coalbed gas exploration.

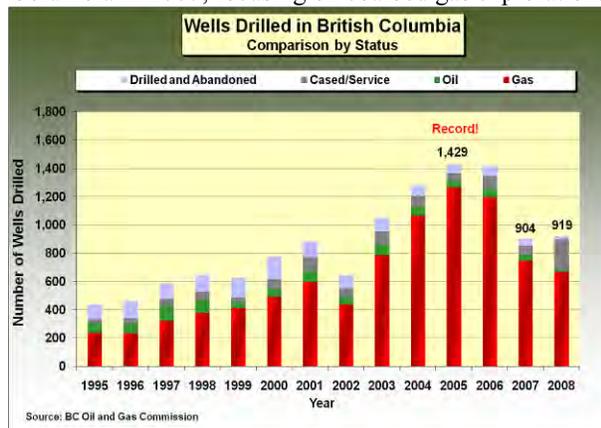


Figure 2. Number of wells drilled in British Columbia.

¹ As reported by the Canadian Association of Petroleum Producers.

Raw natural gas production in the province reached 3.2 Bcf² per day in 2007 and 2008. Conventional oil production was 26,205 barrels per day in 2007 and dropped to 23,205 barrels in 2008. The industry's exploration and development activities have contributed reserve additions that have more than replaced annual gas production for the last ten years (Figure 3). In addition, the 2007 reserves to production ratio (R/P) of 16.4 years was only down slightly from 2006. Since 2002, the R/P ratio has grown or held steady; this after a long period of slow decline (Figure 4).

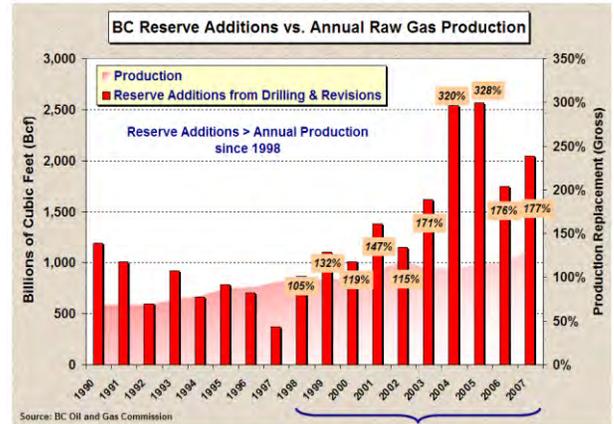


Figure 3. BC's annual natural gas reserve additions.

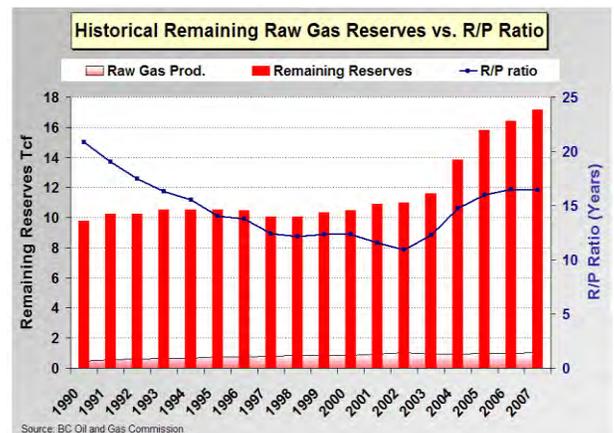


Figure 4. Reserves to production ratio in British Columbia.

The generally consistent nature of the reserves to production ratio over the last decade is a key measure of sustainability. It demonstrates the success that exploration and production companies have in converting BC's undiscovered resources into reserves. To measure how sustainable this trend is, the Resource Development and Geoscience Branch of the BC Ministry of Energy, Mines and Petroleum Resources (EMPR), in collaboration with the National Energy Board (NEB), completed a review of the undiscovered natural gas resource potential for northeastern British Columbia (EMPR/NEB, 2006). This report can be viewed at www.em.gov.bc.ca or at www.neb-one.gc.ca.

² As reported by the Mineral, Oil and Gas Revenue Branch of the Ministry of Small Business and Revenue.

Historically, drilling and production activity in British Columbia has focussed on the shallower Cretaceous and Triassic gas and oil-prone reservoirs in the Fort St. John region and on the shallower depths of the larger mid-Devonian gas pools in the Northern Plains region. Unlike other portions of the Western Canada Sedimentary Basin (WCSB), the northeast region of British Columbia has not seen a major shift towards development/step out drilling. The region continues to see wells drilled for resource-play exploitation.

Over the past few years, several new resource plays such as the Jean Marie, Doig/Montney and Cadomin formations have accounted for a significant portion of drilling in the province. Figure 5 displays a breakdown of the initial marketable gas reserves by geological period and illustrates where industry has directed its efforts. The data is based on 2007 year-end reserves.

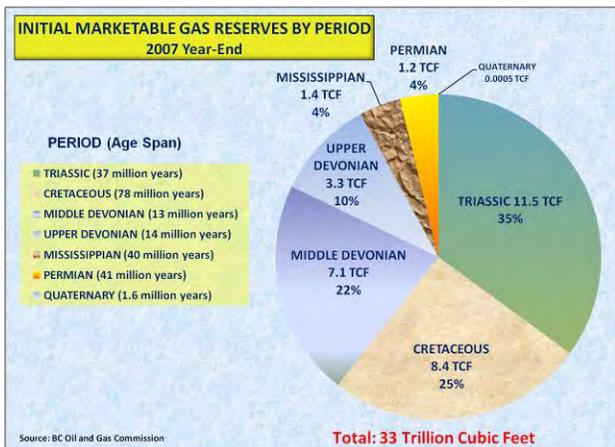


Figure 5. Distribution of marketable gas reserves by geological period for year-end 2007.

DATA SOURCES

Since 1998, the BC Oil & Gas Commission (OGC) has been the regulatory agency for oil and gas operations in British Columbia. Basic data and statistics regarding oil and gas activity can be acquired from the OGC website at www.ogc.gov.bc.ca.

The OGC is also responsible for maintaining the provincial reserves database. The most recent reserve statistics in this report are sourced from the *Hydrocarbon and By-Product Reserves in British Columbia 2007* (OGC, 2008). A new report estimating British Columbia's oil, natural gas and associated by-product reserves to year-end 2008 will be released in September 2009.

Data for this exploration and activity summary has been collected from available public sources. No confidential data or information has been utilized in its preparation.

OIL AND GAS EXPLORATION ACTIVITY (2007-2008)

Bonuses collected from the sale of British Columbia's Crown petroleum and natural gas rights in 2007 totalled \$1.04 billion. In 2008, a record \$2.66 billion in bonuses were collected and the average price per hectare came in at an astounding \$3,519 (Figure 6). The largest distribution of bonus payments in 2008 was seen in the Horn River Basin and in the Montney play region, both areas of significant shale gas potential (Figure 7).

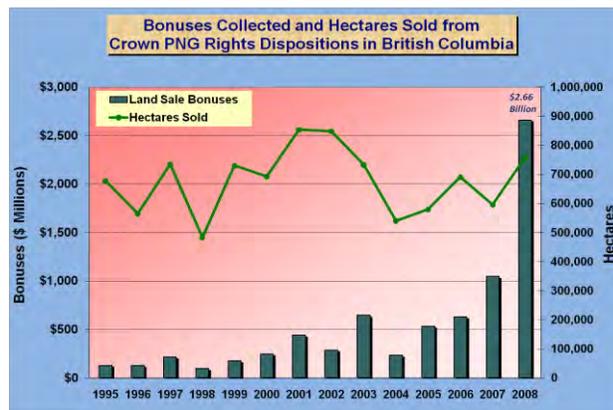


Figure 6. Bonuses collected annually from Crown PNG rights auctions in British Columbia.

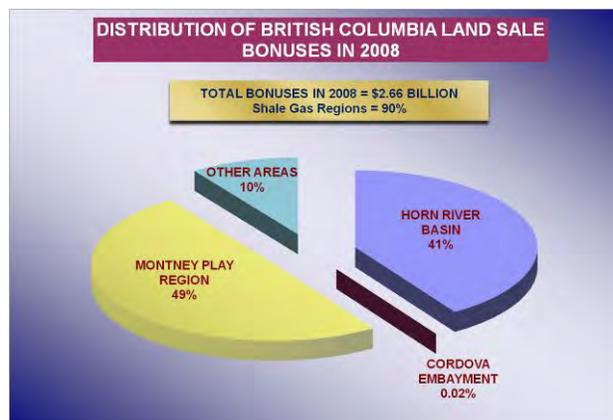


Figure 7. The Horn River Basin and the Montney play region brought in bonus totals of \$1.1 million and \$ 1.32 million, respectively.

The BC Oil and Gas Commission issued 1,205 well licences in 2007 and 1,412 licences in 2008 (Figure 9). Ninety-one per cent of well licences issued in 2008 listed gas as the objective, while five per cent targeted oil and four per cent were service wells.

For ease of analyses and description, activity in northeastern British Columbia has been broken down by regions, derived from physiographic and geologic attributes as well as previous EMPR competitiveness studies (Figure 9). Exploration activity is discussed for each of these regions in the sections that follow.

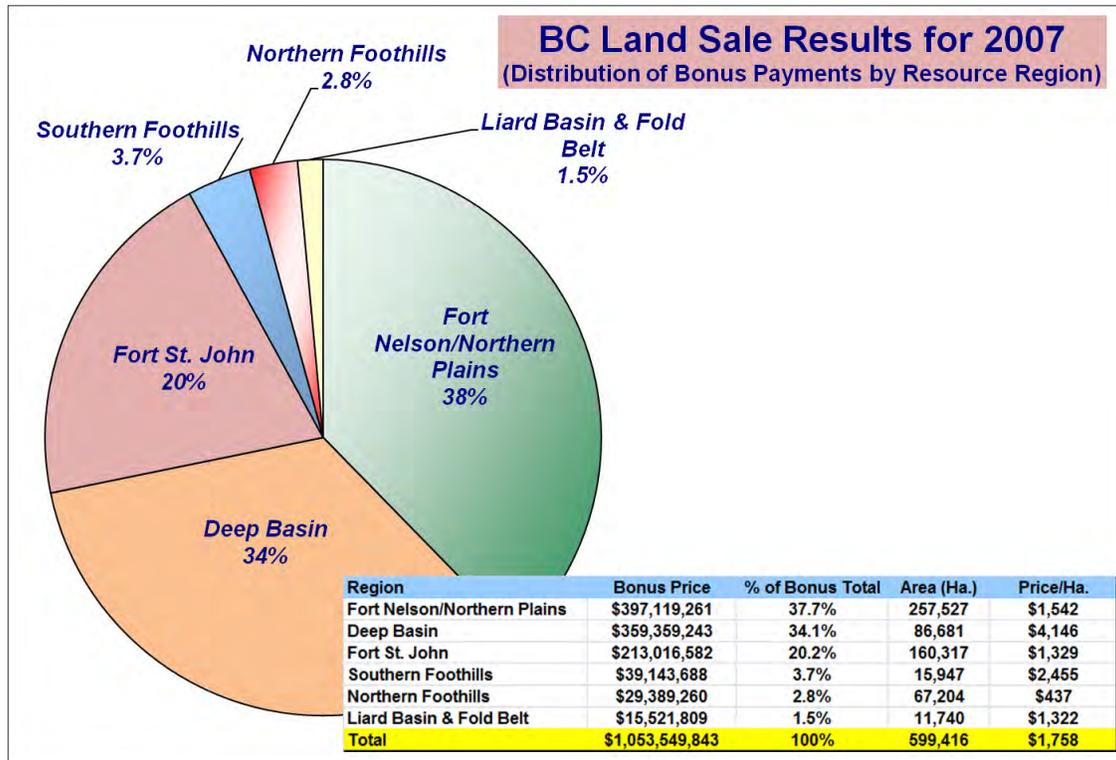


Figure 8. Bonus payments by resource region from BC's 2007 Crown PNG rights auctions.

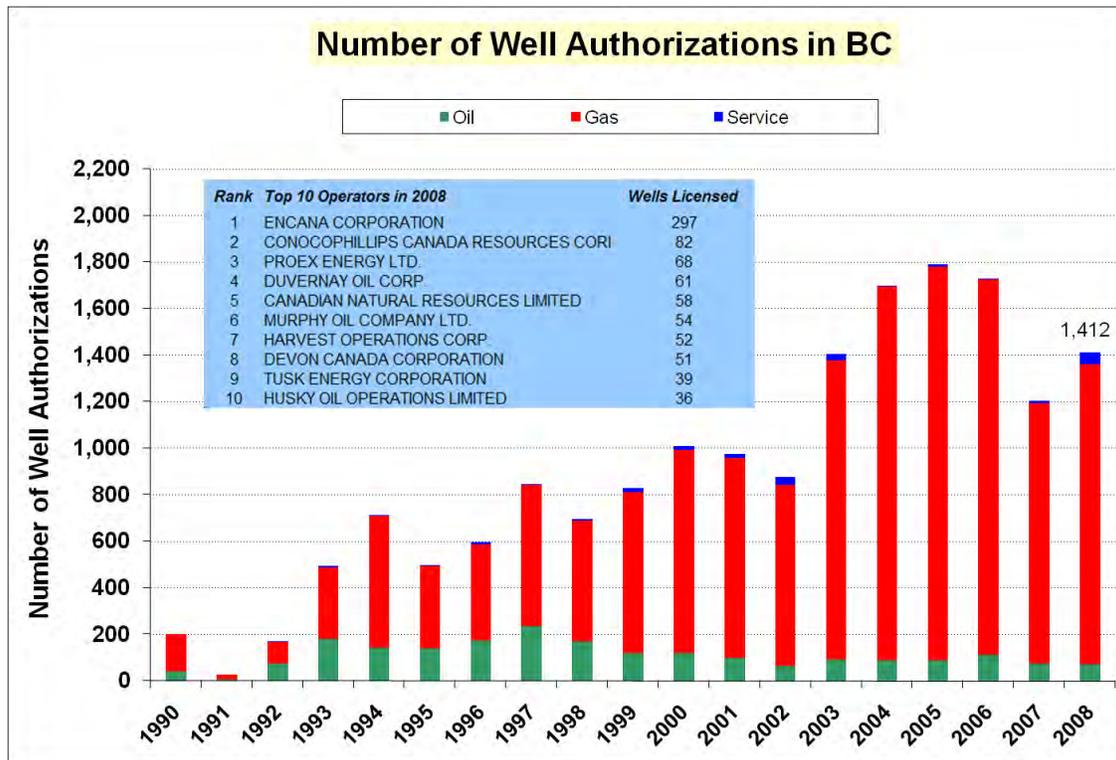


Figure 9. Well licences issued by the BC Oil and Gas Commission (1990 - 2008).

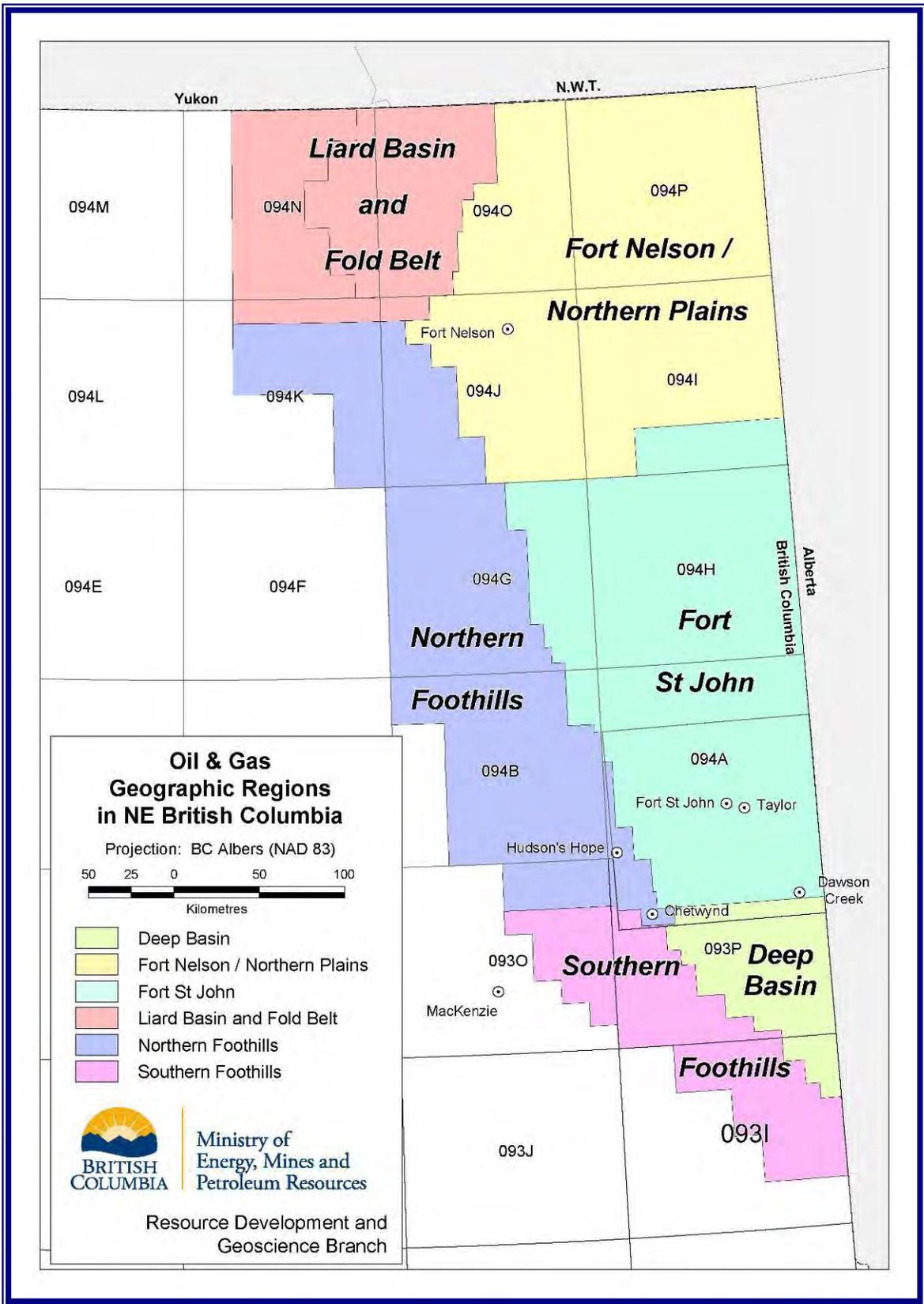


Figure 10. The six oil and gas resource regions of northeastern British Columbia.

Liard Basin and Fold Belt Region

Straddling the borders of the Northwest and Yukon Territories with the Province of British Columbia, the Liard Basin and Fold Belt region (*Figure 11*) is a relatively unexplored area situated immediately east of the Cordilleran Fold and Thrust Belt. In northeastern British Columbia, the Liard Basin and Fold Belt region covers an area of approximately 1.25 million hectares and contains over five kilometres of sedimentary strata of Cambrian to Upper Cretaceous age. Potential hydrocarbon objectives occur in the Devonian Dunedin/Nahanni Formation, the Mississippian Banff, Debolt, and Mattson formations, the Permian-Pennsylvanian Kindle and Fantasque formations, the Triassic Toad Formation, and the Cretaceous Chinkeh and Scatter formations. The Nahanni holds significant potential in dolomitized reservoirs in the structural belt. The Debolt, Mattson, Kindle, Fantasque, and possibly the Triassic Grayling and Toad formations are potential objectives in structural closures on the Bovie Lake structure on the margin of the basin. The Banff and Debolt formations are also potential objectives in stratigraphic traps on the platform to the east (Walsh *et al.*, 2005).

Land Sale Activity

Bonus payments from 2007 land sale activity in the Liard Basin and Fold Belt increased significantly from a year earlier. Only three parcels were sold during the year resulting in \$15.5 million in bonus payments, up from \$1.6 million for 11 parcels sold in 2006 (*Figure 12*). All three parcels sold in 2007 were purchased by land brokers; two of these were sold for a total of \$15.3 million within the northwestern section of the Horn River Basin (94-O-15). The remaining parcel, a drilling licence south of the Maxhamish area and covering rights in all zones, sold for \$176,462 on 2,646 hectares.

Drilling

Drilling activity in the Liard Basin/Fold Belt region usually lags well behind other resource regions in the province. That scenario was sustained in 2007 with only four wells rig released in the region compared to 15 in 2006. Two wells targeting the Mattson/Besa River horizon were drilled in the Beaver River area by Questerre Energy Corporation and Transeuro Energy Corp. EOG Canada Resources Inc. drilled an experimental well northeast of the Maxhamish area to evaluate and test the shale gas potential of the Muskwa, Otter Park and Evie formations on the westernmost edge of the Horn River Basin. And, in late 2007, EnCana completed drilling a Maxhamish area well, likely targeting the Mississippian Mattson sandstone.

Production

Production came from only one well in the Liard Basin/Fold Belt region in 2007. Questerre Energy Corporation's Beaver River well produced 47.4 million cubic feet (mmcf) from the Mattson "B" pool.

Oil and Gas Exploration Highlights

EOG Resources Canada and **EnCana Corporation** each drilled a well in or near the **Maxhamish** field in 2007. EOG completed an experimental well to the northeast area of the field (map sheet 94-O-15) as part of its experimental scheme program to unlock the shale gas potential of Devonian sequences. EnCana continues to focus on the development and optimization of the Mississippian Mattson south of the Maxhamish area. Its well was rig released in late 2007 and was drilled to a depth of 1,963 metres (a-B18-J/94-O-11).

Questerre Energy Corporation and **Transeuro Energy Corp.** continued with their development program in the **Beaver River** area in 2007. Completion operations have included the perforating, fracture stimulation and testing of multiple intervals in the Mattson/Besa River horizon. Questerre and Transeuro's A-8 well, which completed drilling operations in early 2007, has primarily targeted a structurally high Nahanni fault block. The well encountered three major faults and extensive fracturing in the first 1,600 metres of drilling. These prospective intervals were perforated and pre-stimulation showed dry gas to surface. Preliminary test results from a 51-cubic-metre acid squeeze indicated partial sealing of compartments in the Nahanni. However, without data from a full production test, the impact of the acid squeeze on the flow rates of gas and water cannot be established. Questerre and Transeuro expect the final production test to help determine a way to isolate the perforated intervals and improve on further acid stimulations. Gathering and analysis of the data is ongoing.

Fort Nelson/Northern Plains Region

Located in the northeast corner of British Columbia, the Fort Nelson/Northern Plains region covers an area of 3.85 million hectares (*Figure 13*). The region has been active in oil and gas exploration since the 1960s, with the search for conventional natural gas dominated by the Middle Devonian Keg River, Pine Point, and Slave Point carbonates. These plays have high reserves and deliverability, and include BC's largest recognized gas accumulation at Clarke Lake (3.72 Tcf OGIP). Within the last fifteen years, however, the Upper Devonian Jean Marie has become the major target for operators. Natural gas from this interval continues to be the largest contributor of new production in the region.

Other potential hydrocarbon objectives in the Fort Nelson/Northern Plains region are the Debolt, Pekisko, and Shunda subcrop edges. Cretaceous targets include a detrital lag at the top of the Mississippian and the Bluesky. New conceptual gas opportunities may also be

found in Tertiary sediments similar to the Sousa play in northwest Alberta.

In addition, the region is a major contributor to the province's oil production stream. There is continued development of the Hay River Bluesky heavy oil pools along with the revival of the Desan Pekisko and Shunda oil pools.

More recently, attention to unconventional gas opportunities in the Fort Nelson/Northern Plains region has sparked a significant boost in activity in the Horn

River Basin and the Cordova Embayment, both of which are prospective for shale gas. The two areas garnered over 37 per cent of the province's land sale bonus total of \$1.05 billion in 2007. In 2008, the areas captured over 41 per cent of the record land sale bonus total of \$2.66 billion. Experimental shale gas projects are testing potential reservoirs in the Upper Devonian/Lower Mississippian Exshaw shale source rock and the Muskwa/Otter park members of the Middle to Upper Devonian Horn River (Adams *et al.*, 2007).

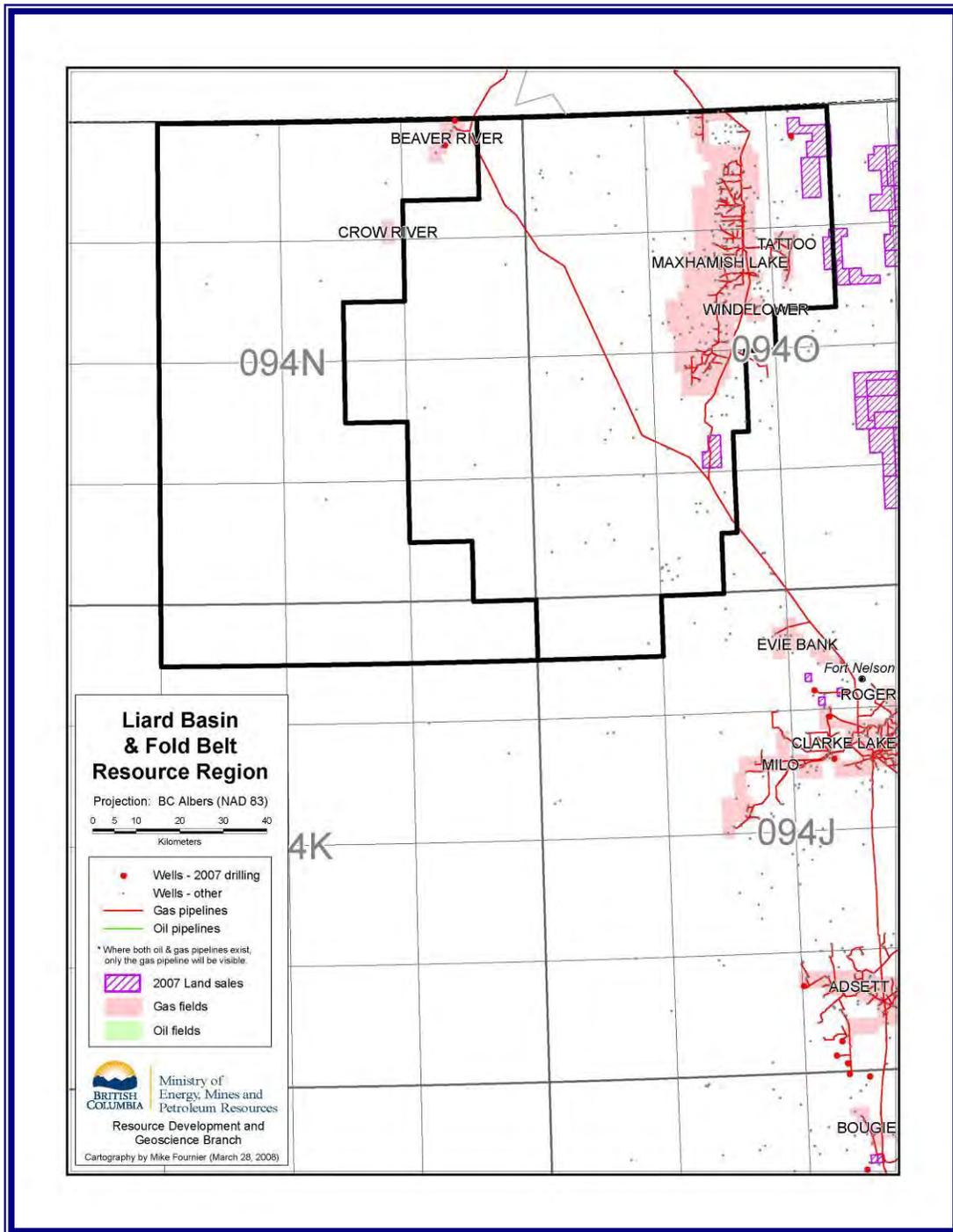


Figure 11. Land sale and drilling activity in the Liard Basin and Fold Belt region of NEBC in 2007.

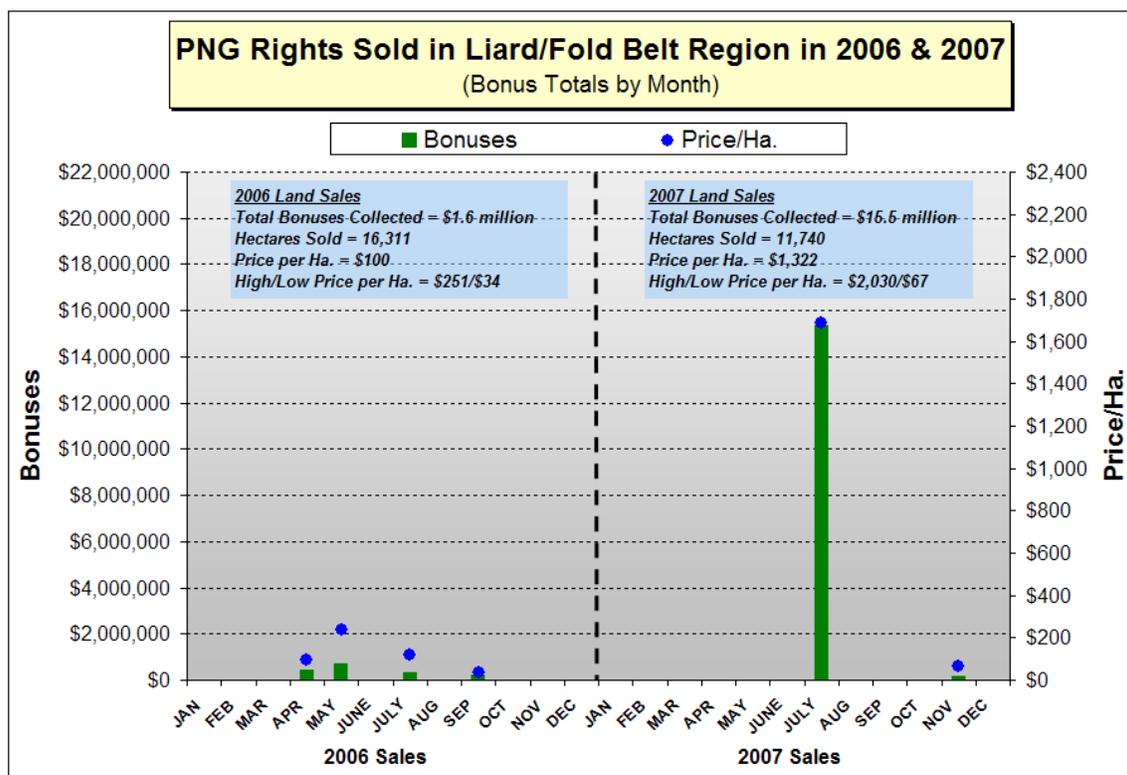


Figure 12. Monthly PNG rights sold in the Liard Basin/Fold Belt region in 2006 & 2007.

Land Sales

The Fort Nelson/Northern Plains region captured 38 per cent of the province's 2007 land sale bonuses. It was the highest distribution of bonus payments in the province compared to other resource regions. Bonuses totalled \$397.1 million, up an impressive 171 per cent from the 2006 total. Land brokers and producers acquired 257,527 hectares for an average price of \$1,542 per hectare (Figure 14).

A significant portion of all PNG rights sold in the Fort Nelson/Northern Plains region in 2007 was within the Horn River Basin and Cordova Embayment areas (Figures 15 & 16). These areas continue to capture the interest of land buyers and producers looking to unlock the potential of organic rich shales. The highest successful bonus bid during the year was for a 5,572-hectare parcel just west of the Komie area (94-O-1; Figure 13), within the Horn River Basin. Meridian Land Services (90) Ltd. paid \$30.7 million for the drilling licence, which translates to \$5,501 per hectare. In October of 2007, Devon ARL Corporation was granted experimental scheme approval by BC Oil and Gas Commission (OGC) to test the commercial viability of shale gas in the Komie area. This was the first experimental scheme approval for Devon in the Horn River Basin. The OGC issues approvals for experimental status under section 100 of the *Petroleum and Natural Gas Act*.

Another area of interest to land brokers and producers was north of the Gunnell Creek area (94-P-4;

Figure 13) along the southwest boundary of the Horn River Basin. Although generating significantly lower bonus totals than parcels within the Horn River Basin or Cordova Embayment, the area was active in terms of land purchases. Most parcels purchased in this area cover rights from the surface to the base of the Devonian Jean Marie. EnCana is known as a key operator in this area, however, an announcement by Result Energy Inc. revealed the purchase and re-interpretation of a three-dimensional seismic program over a portion of its lands in the Gunnell Creek area. The data show several encouraging drilling targets in the Devonian Jean Marie platform; one of those will be tested in the first quarter of 2009. Result also plans to core and evaluate the Evie and Otter Park shale sections, which extend into the Horn River Basin.

Drilling

A total of 208 wells were rig released in the Fort Nelson region in 2007 and EnCana Corporation was responsible for 119 of those. Twenty-one per cent of all rig releases occurred in the Sierra area with ongoing development of the Devonian Jean Marie. The Gunnell Creek area captured 16 per cent of all rig releases while the Hay River area, along the northern BC/Alberta border, accounted for 15 per cent as Harvest Operations Corp. continues with its multi-leg horizontal well program. The Jean Marie Formation accounted for 62 per cent of all identified target zones in the Fort Nelson region (Figure 17).

Production

The distribution of production from wells rig released in the Fort Nelson region in 2007 is shown in Figure 18.

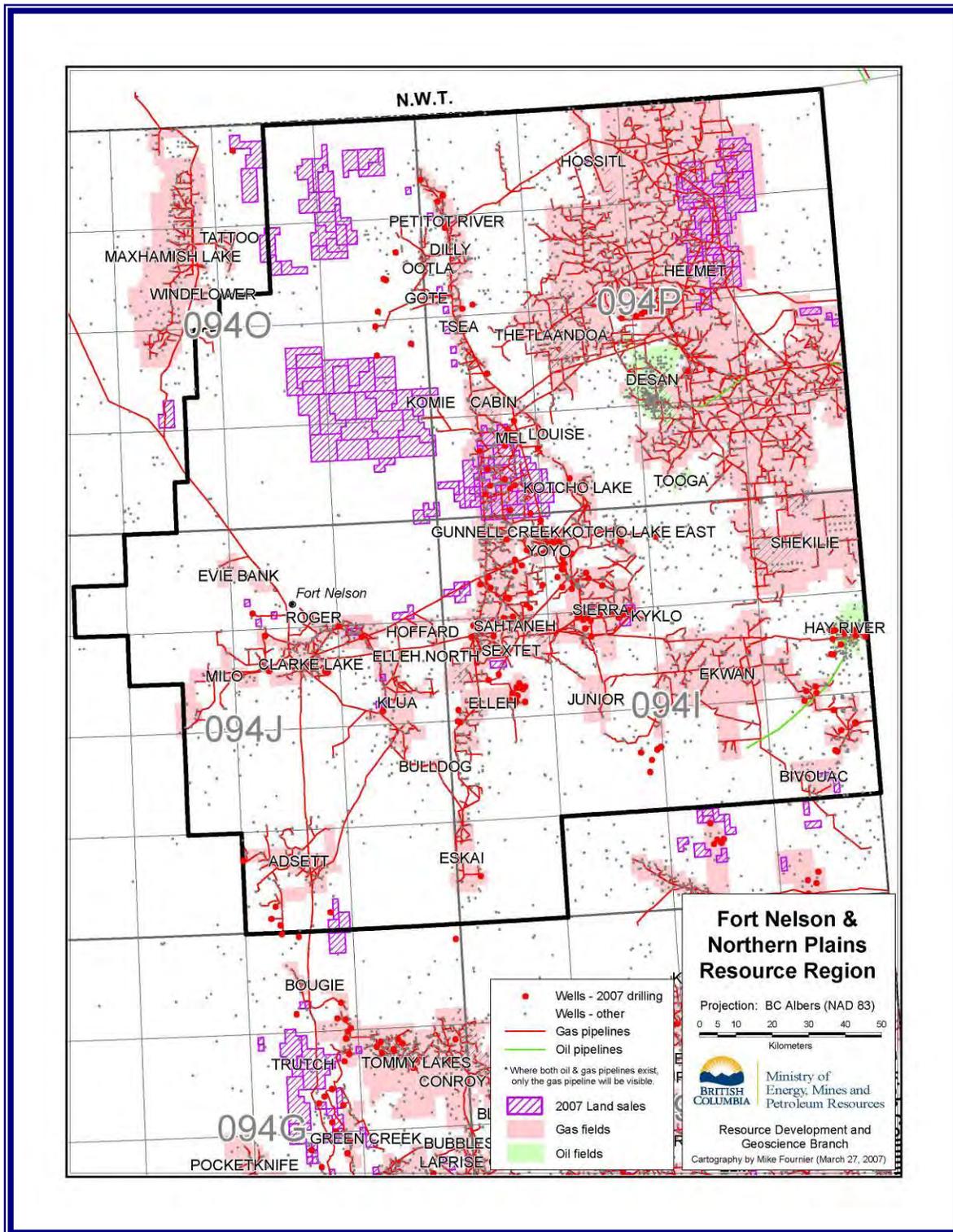


Figure 13. Land sale and drilling activity in the Fort Nelson and Northern Plains region of NEBC in 2007.

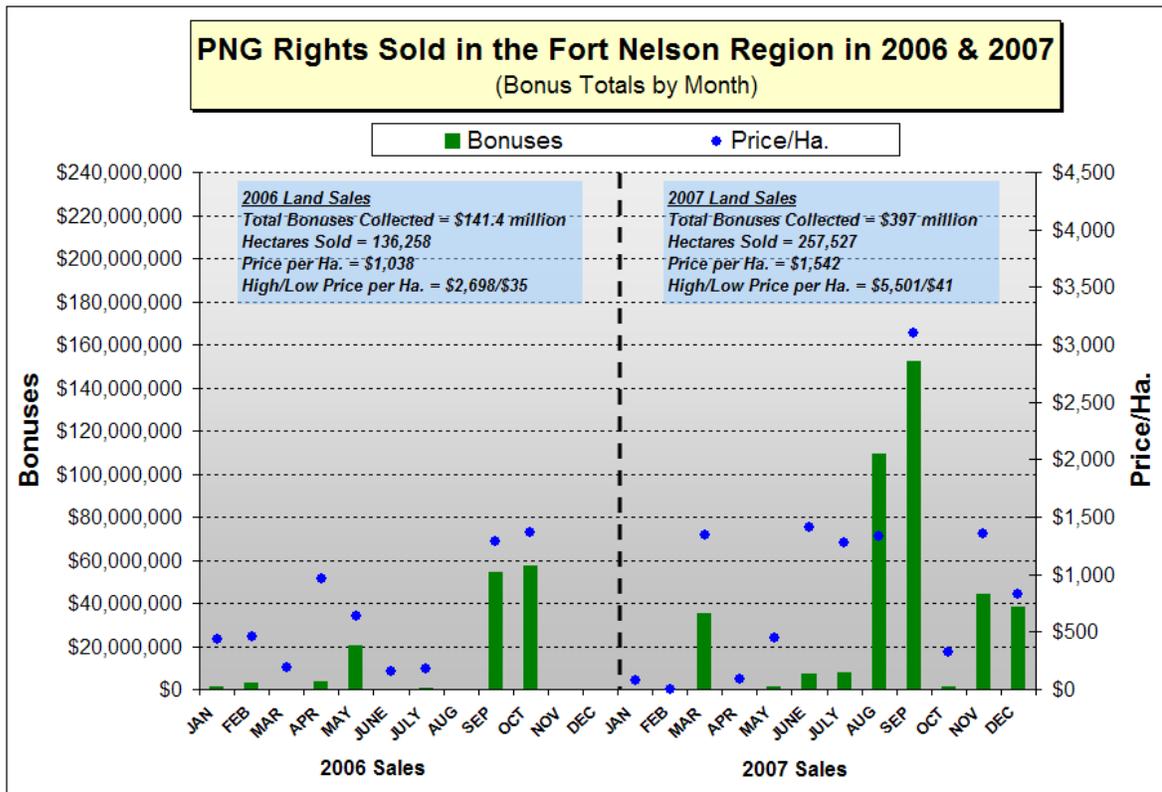


Figure 14. Monthly PNG rights sold in the Fort Nelson region in 2006 & 2007.



Figure 15. Bonuses paid from PNG rights sold in Fort Nelson region's Horn River Basin.

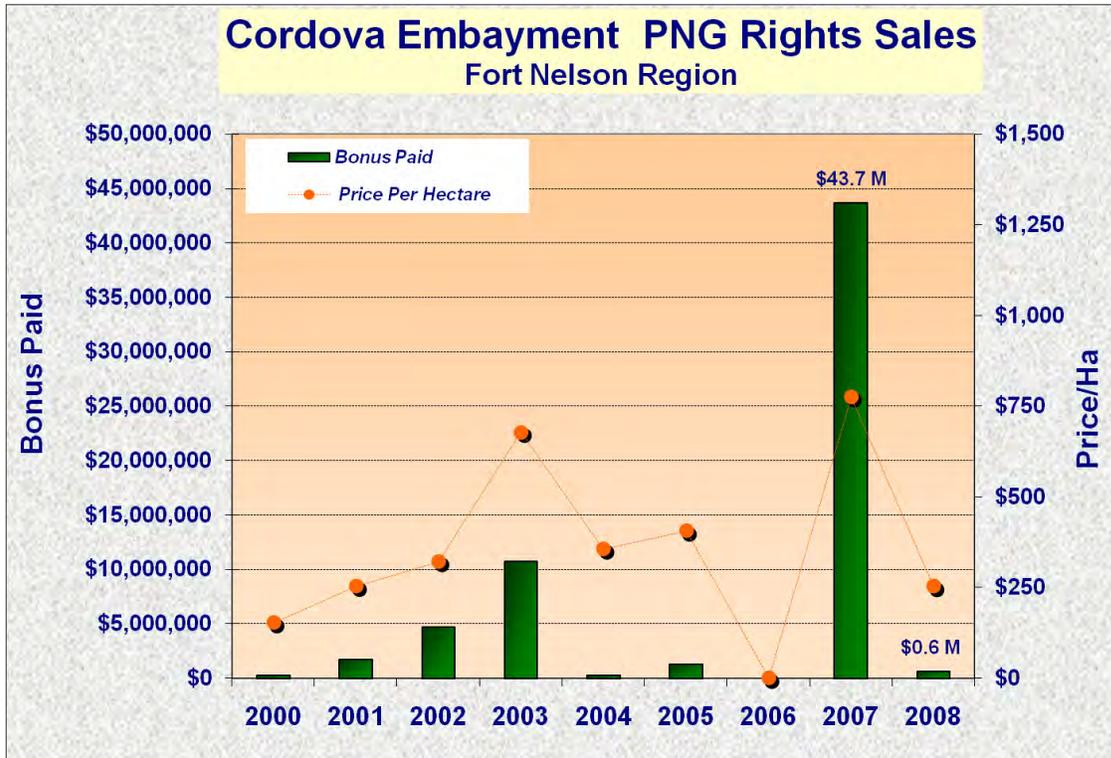


Figure 16. Bonuses paid from PNG rights sold in Fort Nelson region's Cordova Embayment.

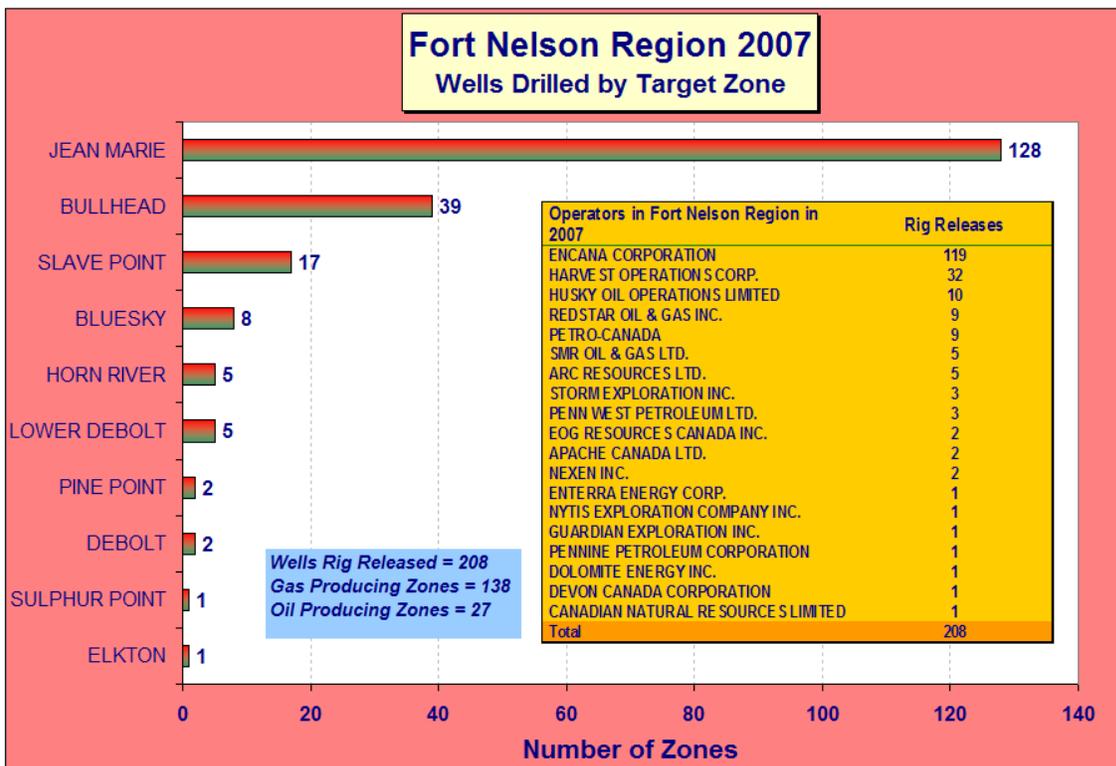


Figure 17. Target zones from wells rig released in the Fort Nelson region in 2007.

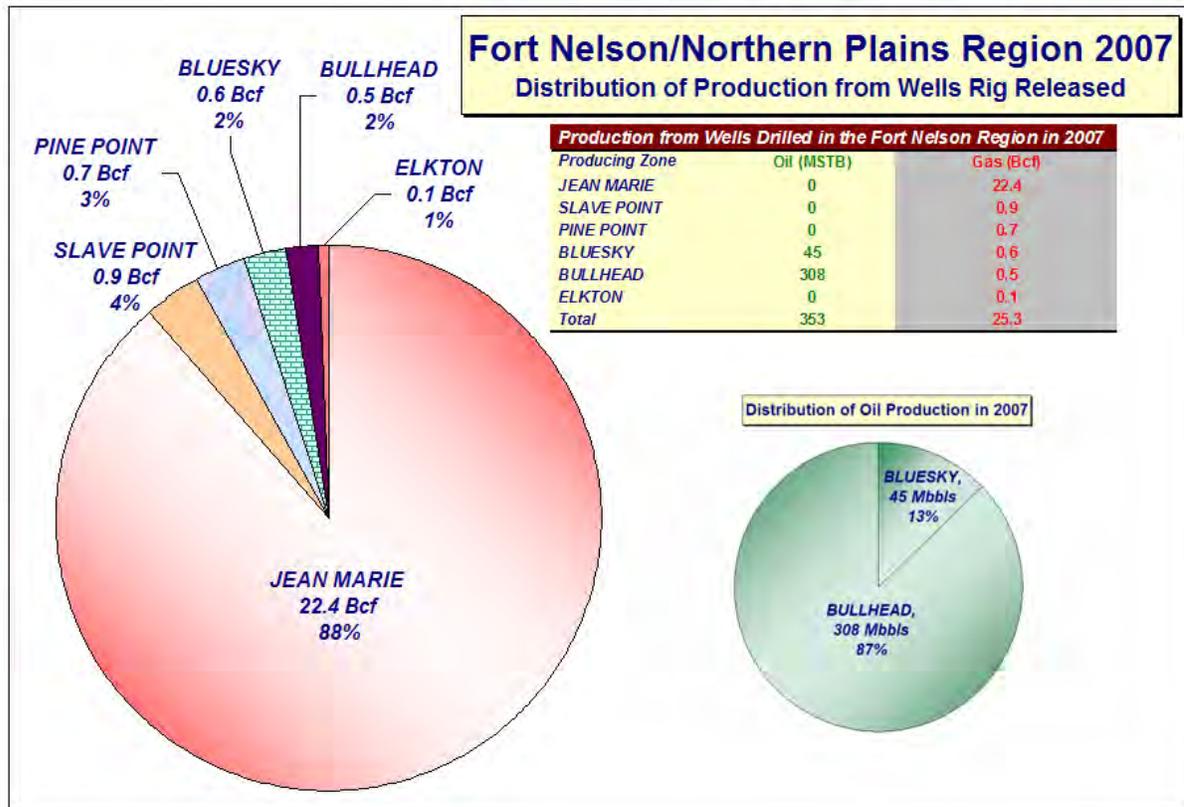


Figure 18. Distribution of production from wells rig released in the Fort Nelson region in 2007.

Oil & Gas Exploration Highlights

The **Sierra** area was the most active for drilling activity in the Fort Nelson region in 2007. Thirty-eight of the 43 wells rig released in the area focussed on horizontal well development of the Devonian Jean Marie. **EnCana Corporation** was the most active operator in the area with 37 rig releases, while **Red Star Oil and Gas** was second with five. **Red Star's** focus at Sierra is the Lower Cretaceous Bluesky-Bullhead.

Thirty-four wells were rig released in the **Gunnell Creek** area in 2007. This is an area where producers focus on the Shelf Edge Play, which contains sweet gas trapped in a barrier reef complex along the Jean Marie Formation's western edge. **EnCana Corporation** currently leads development along this Jean Marie reef trend and was by far the dominant operator in 2007 with 30 rig releases. Almost 80 per cent of EnCana's completed wells reported gas production. Other operators such as **Sabretooth Energy Ltd.** are looking at Jean Marie development at Gunnell Creek. Sabretooth drilled a new multi-lateral development well, which was rig released in late December 2007 and placed on stream in January 2008. Five additional wells on this property were planned for the summer of 2008.

Harvest Operations Corp. completed 32 wells in its multi-leg horizontal oil well program in the **Hay River** area in 2007. Production at Hay River is medium gravity crude oil (24° API) from the Cretaceous Bluesky Formation. The field was a winter-only access site along the northwestern Alberta and northeastern British

Columbia border but Harvest has now completed work on an all-season access road in the area. This provides better access for equipment and personnel into this key area, further supporting the ability to both optimize operations, and maximize the recovery of this large resource. The Hay River property has over 200 million barrels of estimated original oil-in-place but a recovery of only eight per cent. Harvest continues to increase its forecast recovery through development drilling and production optimization (pump upgrades, waterflood optimization and drilling downspacing). In fact, over the first quarter of 2008, a production increase of 600 barrels of oil equivalent per day resulted from enhanced water injection and field optimization.

Husky Oil Operations Ltd. completed 10 wells in the Fort Nelson region in 2007. Activity was focussed in the **Bivouac, Ekwan** and **Sierra** areas where **Husky** continued with its successful Devonian/Mississippian exploration program. In the Bivouac area, Husky drilled a total of five wells; two reported gas production from the Jean Marie and another from the Mississippian Prophet Formation. At Ekwan, the producer drilled four wells; one reported gas production from the Jean Marie and another from the Lower Cretaceous Bullhead Group.

RedStar Oil & Gas Inc. had another busy year in the Fort Nelson region. The natural gas company drilled nine of the sixteen wells planned for its 2007 capital program. The wells were drilled in the areas of **Gunnell Creek, Kotcho Lake East, Sierra,** and **Yoyo.** RedStar's 2007 winter drilling season was based on the interpretation of 3-D seismic programs in the Greater

Sierra region. Company production in the third-quarter of 2007 improved 25 per cent from a year earlier as a result of drilling in the region as well as the successful workover of three Kotcho Lake East area wells in early 2007. RedStar targets the Lower Cretaceous Bullhead Group and the Mississippian Debolt in the Greater Sierra region. In early 2008, it was announced that **Great Plains Exploration Inc.** would acquire RedStar Oil & Gas to diversify its operations in northeast BC. The acquisition will bring in an additional 1,000 barrels of oil equivalent (BOE) per day of 100 per cent natural gas production for Great Plains.

Stone Mountain Resources Ltd. was active in the **Adsett** and **Clarke Lake** areas in 2007. Target zones in the area include the Middle Devonian Slave Point, Sulphur Point and Pine Point. A total of five wells were drilled in the two areas with gas production recorded from a Clarke Lake area well at c-78-K/94-J-10 (159 mmcf cumulative production over 10 months from the Pine Point). Stone Mountain Resources has assets consisting of 55,442 net undeveloped hectares and 10 Bcf of proved and probable reserves in the **Tenaka** area of northeast BC. The company concentrates on relatively immature basins and builds scale by acquiring fields with good drilling potential. It also pursues farm-ins with large companies and trusts.

Another company active in the **Clarke Lake** area is **Penn West Energy Trust** (in a strategic combination with **Canetic Resources Trust**). The producer drilled two Slave Point development wells over the 2007 winter drilling season. Both wells went on production in May 2007 with initial production rates of approximately 2.7 mmcf per day. Rates have since stabilized to 1.5 and 1.1 mmcf per day, respectively.

Early in the year, **Ironhorse Oil & Gas Inc.** farmed-in on a natural gas exploration play in the **Kotcho Lake** area. The company drilled one well in the first quarter of 2007 targeting the Mississippian Debolt and Devonian Jean Marie. The well produced non-commercial quantities of gas and was subsequently abandoned. However, the company's presence in the Kotcho Lake area has provided an additional opportunity unique from the well it drilled. Ironhorse said it is evaluating 2-D proprietary seismic data to determine whether that opportunity is prospective for natural gas development. In 2007, total funds expended in the Kotcho Lake area totalled \$1.7 million.

Guardian Exploration Inc. continues to develop its **Kotcho Lake** Devonian Slave Point gas properties. Guardian now operates three gas wells at Kotcho Lake achieved through a combination of re-entry operations and new drilling. In 2006, Guardian tied in two Slave Point gas wells; one produced at rates as high as 1.5 mmcf per day (gross). Another Slave Point well at b-100-E/94-P-3 was successfully re-entered and whipstocked in 2007 as is currently producing at approximately one mmcf per day. In April 2008, Guardian sold gas from the Kotcho Lake field at a stabilized rate of 332 barrels of oil equivalent (BOE) per day.

Crew Energy Inc. has positioned itself for longer term growth in the **Horn River Basin** of the Fort Nelson region. The producer holds 16 net sections of land in the Missile/Helmet area, which will target the Upper Devonian Muskwa shale. A third party estimates that Crew's land in this area holds 400 Bcf to 2.1 Tcf of gas-in-place.

Apache Canada Ltd. feels its Muskwa play in the **Horn River Basin** is key to its production growth. The producer successfully drilled three wells in the **Ootla** area where the company believes the natural gas resource potential could be in the range of nine to 16 Tcf. Apache said it will have to make significant investments in infrastructure to produce the gas, which may produce significant volumes by 2011 or 2012. Apache will have to invest in gathering lines and processing plants in the area.

Nexen Inc. announced positive results from its 2007/2008 winter shale gas program in the **Horn River Basin**. The company has increased its land holdings in the **Dilly Creek** area to approximately 36,000 net hectares. Nexen has stated its Dilly Creek lands could contain as much as six Tcf of recoverable contingent resources (assuming a 20 per cent recovery factor), however, the producer states that further appraisal activity is required before these estimates can be finalized and commerciality established.

Devon Canada Corporation drilled three pilot wells on its 62,000 net hectares of land in the **Horn River Basin (HRB)** in 2007/2008. The producer drilled a three-well pilot project consisting of two horizontal wells and one vertical well, which have been onstream since April 2008. One of the horizontal wells was drilled into the Devonian Muskwa; the other into the Evie Member. Results from these wells are said to be consistent with those announced by competitors in the HRB. Devon's Horn River land holdings have the potential to produce up to 700 mmcf per day and five to eight Tcf of reserves, but it is very early in commercial development for all players involved.

Quicksilver Resources Inc. has started work in the **Horn River Basin**. The natural gas and crude oil producer based in Fort Worth, Texas acquired 19 licenses covering approximately 51,397 net contiguous hectares at the November 2007 and March 2008 BC PNG rights sales. Quicksilver plans to drill up to four wells on this its acreage in the 2008-2009 winter drilling season.

Other major producers operating in the **Horn River Basin** have reported significant gas-in-place estimates on their respective properties. **EOG Resources Inc.** has stated that its **Ootla** area holdings could yield as much as 6 trillion cubic feet of net natural gas reserves, while **EnCana Corporation**, with the largest land position in the Horn River Basin, has estimated 35 Tcf of gas-in-place and predicts that it can produce as much as one billion cubic feet per day from its holdings. The Horn

River Basin has the potential to yield vast gas reserves and is being compared favourably with the Barnett shale region of Texas.

Storm Energy Inc. is trying to expand its inventory at the edge of the **Horn River Basin**. In the winter-only access areas of **Cabin, Kotcho and Junior**, the producer has identified some Bluesky and Debolt formation prospects in addition to some infill opportunities. Storm is also amassing land in the Devonian shale gas play at Cabin and has set up a partnership with **Storm Gas Resource Co.**, which is owned 45 per cent by **Storm Gas International Inc.**

Fort St. John Region

Covering an area of 3.7 million hectares, the Fort St. John region continues as the hub of activity and production for the province (*Figure 19*). The region has a variety of geologic settings, which combine to offer good quality, low-risk gas and oil prospects with stacked, multi-zone potential. The deep Slave Point play, which is 2,800 to 3,200 metres true vertical depth along the Hotchkiss Embayment, continues to entice exploration since the discovery of Ladyfern (760 Bcf OGIP) in 2000. Deeper conceptual plays also occur in the Middle Devonian clastics and Keg River carbonates. On the western side of the area, Laramide-induced folding and structural trapping provides opportunity for Debolt, Halfway, Charlie Lake, Baldonnel, and various Cretaceous sands. The Fort St. John Graben houses numerous structural and stratigraphic objectives, ranging from hydrothermal dolomites in the Wabamun to sands in the Mississippian Kiskatinaw and Permian Belloy. Traditional targets in the region have been the Triassic stratigraphic and erosional edge plays in the Montney, Doig, Halfway, numerous Charlie Lake members, and the Baldonnel. Lower Cretaceous clastics have also been sought after in the region with the Dunlevy, Gething, and Bluesky as major production horizons. North of the Peace River Block, both the tighter Gething sands in erosional valley systems and the lowstand Notikewin sands have been the subject of developmental focus.

Recent industry activity in the south Peace area of the Fort St. John region has centered on unconventional gas reservoirs, including the Doig Phosphate in the Groundbirch area and the Montney Formation in the Dawson Creek and Sunrise areas. Bonuses from petroleum and natural gas rights within the Montney exploration and development play area have increased by over 500 per cent over the last three years.

Land Sales

Land brokers and producers spent \$213 million in 2007 to acquire PNG rights in the Fort St. John region, a 13 per cent drop from 2006 (*Figure 20*). Although land purchases were spread throughout the resource region, it was the south Peace region that saw the highest activity

in terms of these purchases. Industry activity in this particular portion of the Fort St. John region is centered on Triassic-aged stratigraphic plays in the Montney, Doig, Halfway, and Baldonnel as well as clastics in the Lower Cretaceous. Specifically, it was PNG rights sold within the Montney play trend that pushed the average price per hectare in the resource region up to \$1,329 in 2007 compared to \$728 a hectare a year earlier.

The Lower Triassic Montney play trend is where the highest land sale bonuses were paid in 2007. At the December 12, 2007 land auction, Petroland Services (1986) Ltd., paid a bonus of \$59.6 million for a 4,401-hectare drilling licence south of the Sunrise area. This equates to an average price per hectare of \$13,553. Land sale bonuses within the Montney exploration and development fairway have increased five-fold over the last three years. Annual bonus totals rose from almost \$85 million in 2005 to \$526 million in 2007 (*Figure 21*). Land sale bonus totals for the Montney play region in 2008 were over \$1.3 billion.

Approximately \$7.2 million was spent to acquire PNG rights in the west-central section of the Fort St. John region (94-A-13); only half the amount spent in 2006. Included in this section of the region are the areas of Aitken Creek, Birch, Fireweed, Blueberry and Inga. Prospects in these areas often target Cretaceous and Triassic reservoirs. Canadian Natural Resources Limited continues to be the most active operator in these fields. Most of the lands sold in these areas in 2007 were acquired by land brokers.

In the extreme northern section of the Fort St. John region, almost \$1.2 million was spent to purchase PNG rights to the north of the Kahntah River area (94-I-2). Industry activity in this area is centered on productive Bluesky-Gething-Montney gas.

Drilling

A total of 58 producers rig released 457 wells in the Fort St. John region in 2007 (*Figure 21*). Canadian Natural Resources Limited (CNRL) secured the top spot with 53 rig releases, a 58 per cent decline from 2006. CNRL's drilling activity extended throughout the region with the Drake, Doig and Pickell areas capturing the highest number of wells drilled. ConocoPhillips Canada Ltd. notched second spot as the Fort St. John region's busiest operator with 39 rig releases; this is down by almost half from the year before. ConocoPhillips' activity occurred exclusively within the Dahl, Gutah, Kahntah River and Ring areas. ProEx Energy Ltd. took a third place ranking with 30 rig releases; most wells were drilled in the Foothills area along the west-central edge of the Fort St. John region.

Production

The distribution of production from wells rig released in the Fort St. John region in 2007 is shown in *Figure 23*.

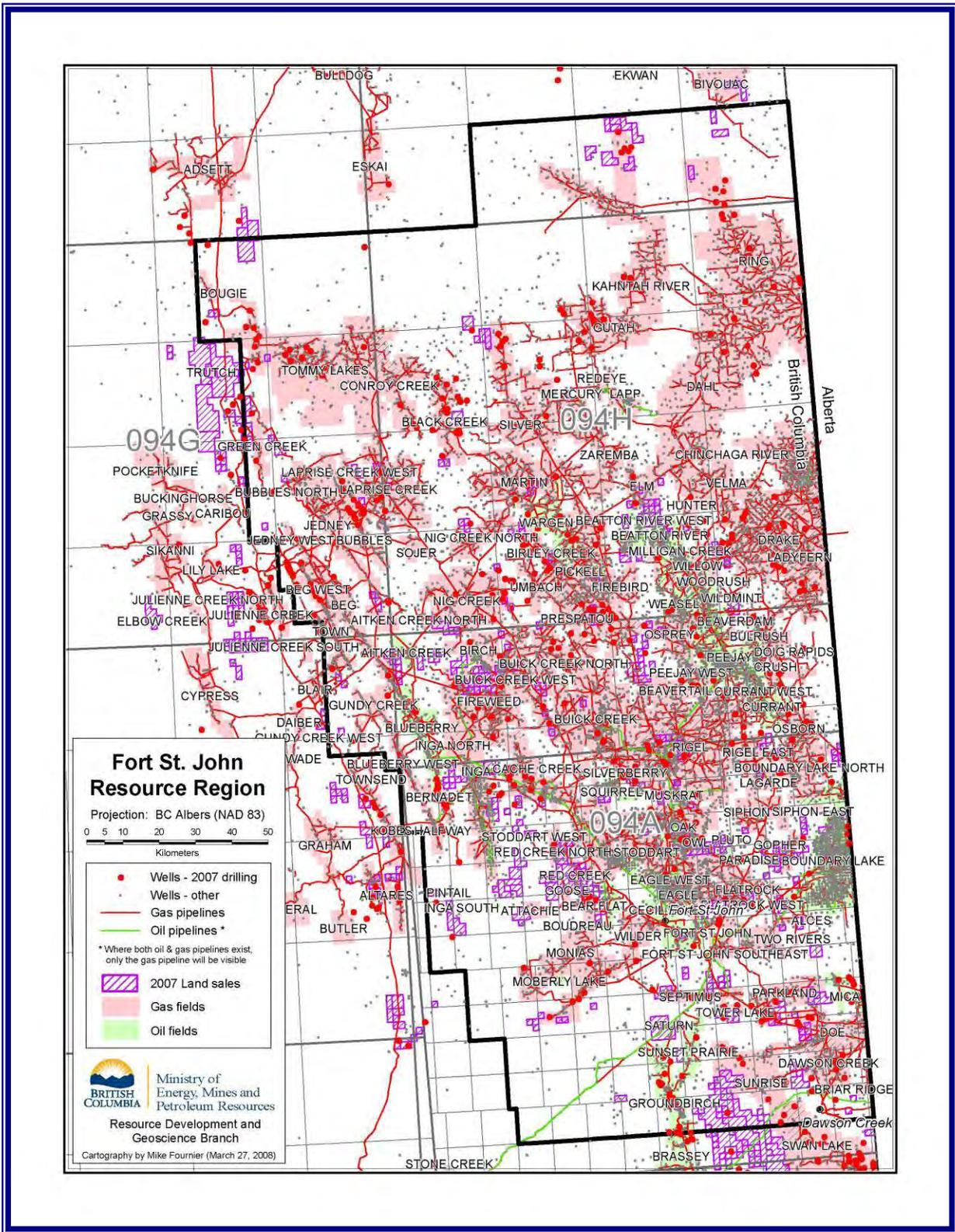


Figure 19. Land sale and drilling activity in the Fort St. John region of NEBC in 2007.

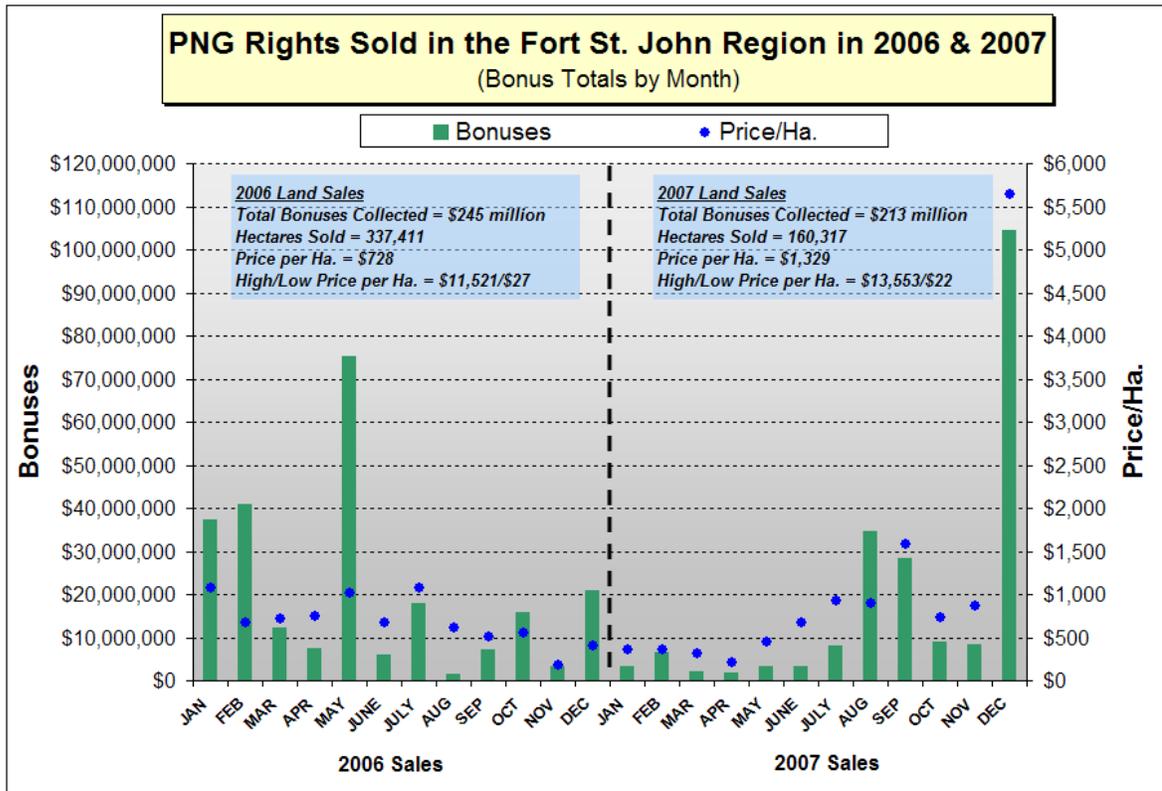


Figure 20. Monthly PNG rights sold in the Fort St. John region in 2006 and 2007.

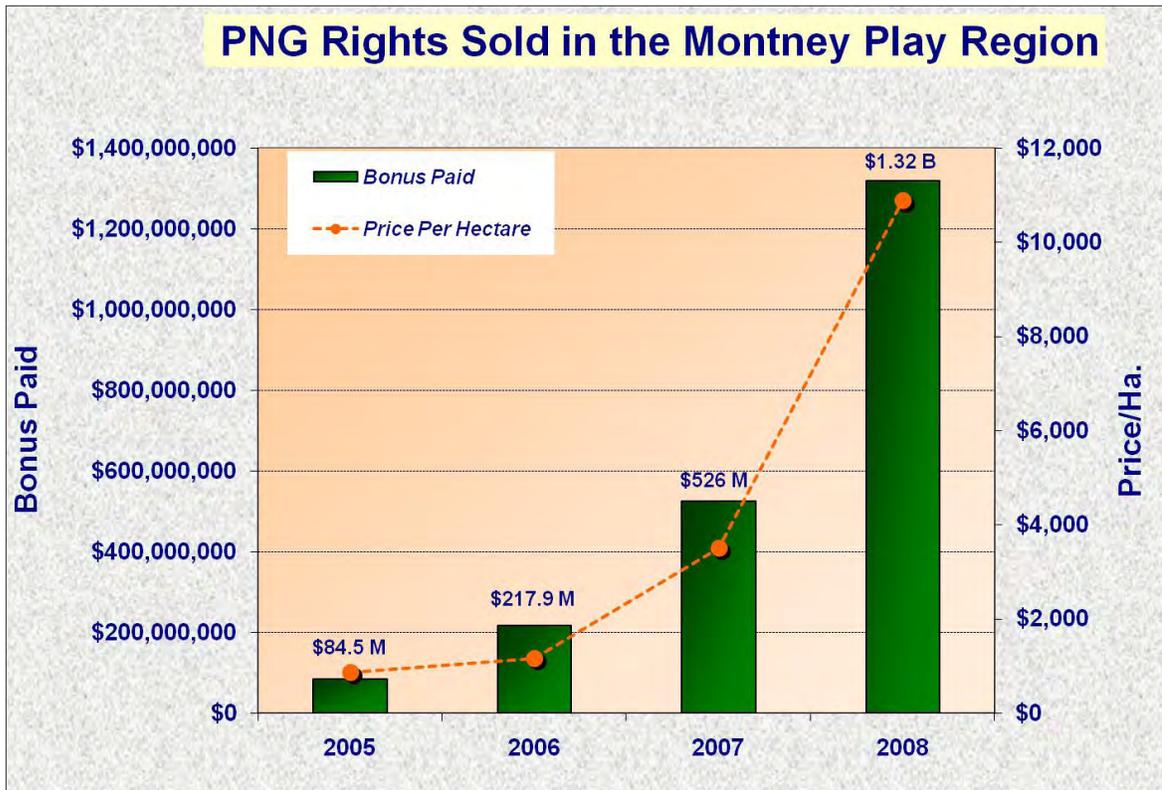


Figure 21. PNG rights sold in the Montney play region have been steadily increasing since 2005.

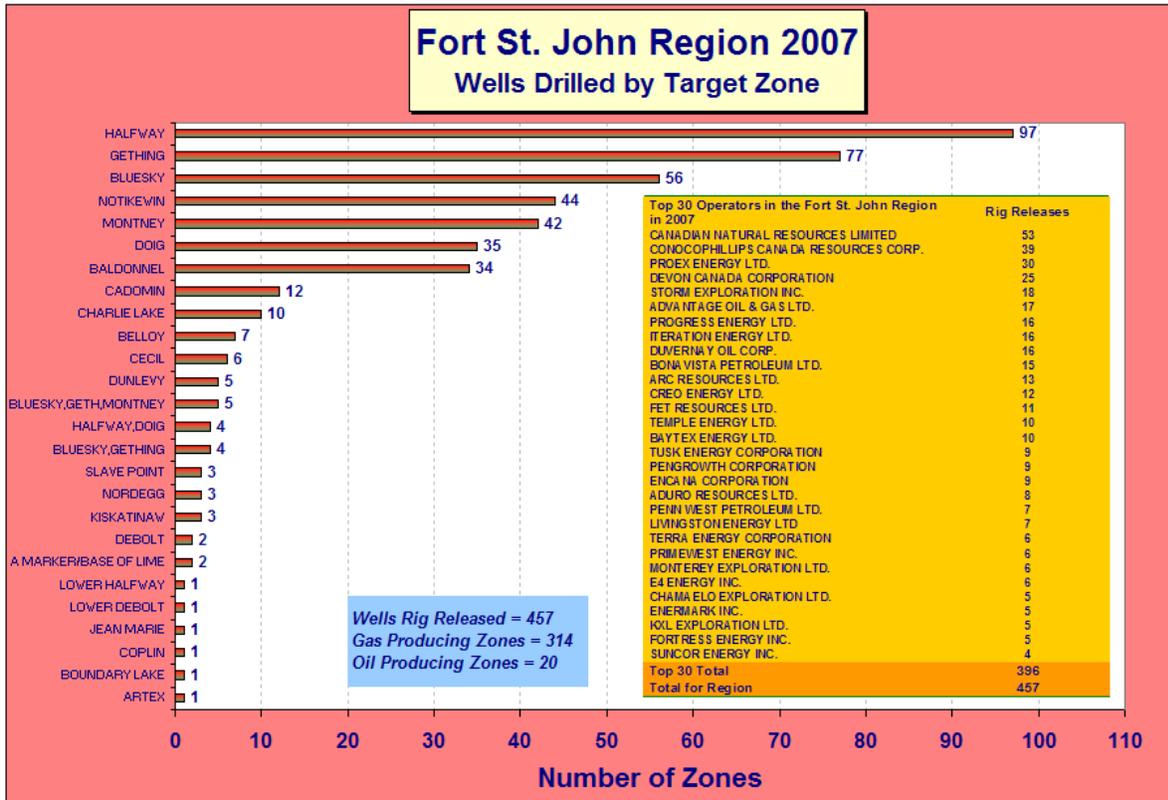


Figure 22. Target zones from wells rig released in the Fort St. John region in 2007.

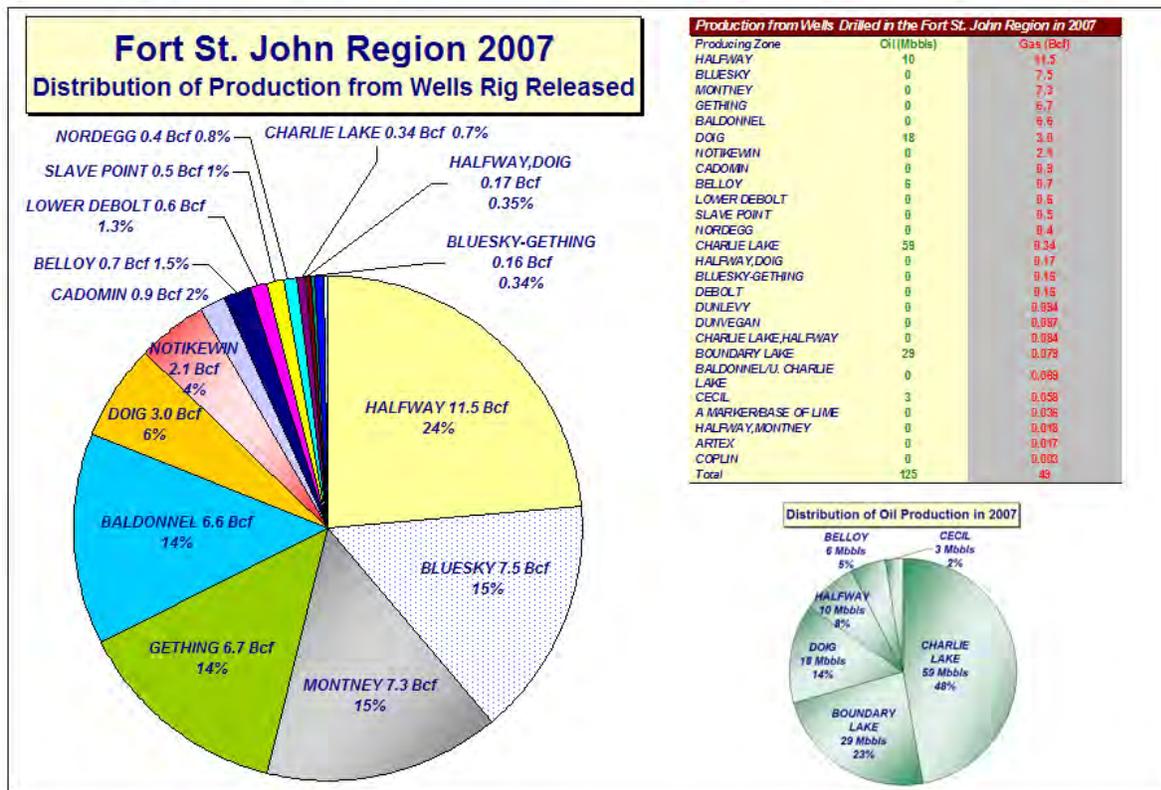


Figure 23. Distribution of production from wells rig released in the Fort St. John region in 2007.

Oil & Gas Exploration Highlights

Drilling activity in the Fort St. John region in 2007 was highest in the **Pickell, Tommy Lakes and Drake** areas. The Pickell area, located in the central part of the region at 94-H-3, hosts a number of production horizons in the Lower Cretaceous. Twenty wells were rig released in the area in 2007 with **Canadian Natural Resources Canada Ltd. (CNRL)** and **Devon Canada Corporation** accounting for more than half. Drilling activity at Pickell resulted in production from the Lower Cretaceous Bluesky and Notikewin as well as the Triassic Halfway. The Tommy Lakes area was home to 17 rig releases in 2007. **FET Resources Ltd.**, an operating company of Focus Energy Trust (recently acquired by Enerplus Resources Fund), was the lead operator in the area with most wells targeting the areally-extensive blanket sand of the Triassic Halfway Formation. In the Drake area, where the primary target is the lowstand sands of the Notikewin, 17 wells were rig released. Among the more active producers operating in the area was **Fortress Energy Inc.** The company continues to appraise the Notikewin in the Drake area as part of its winter capital programs.

Canadian Natural Resources Ltd. (CNRL) was the busiest operator in the Fort St. John region in 2007. The producer rig released 53 wells in 2007, down from 126 the year before. CNRL is usually the most active operator in the Fort St. John region; some of its busiest areas in 2007 included the Drake, Pickell, Doig Rapids, Weasel and Buick Creek areas. Wells drilled in these areas target a number of zones such as the Spirit River northern shoreface reservoirs and conventional Bluesky gas pools. CNRL's strategy in the Fort St. John region is to focus on relatively low risk natural gas plays and to add low-cost volumes utilizing existing assets. In 2007, CNRL was the second largest gas producer by sales volume in British Columbia (155.3 Bcf).

ConocoPhillips Canada Ltd. was the second most active operator in the Fort St. John region in 2007. All but two its 39 rig releases were in four areas: **Ring, Gutah, Dahl and Kahntah River**. Drilling in these areas is the result of ConocoPhillips' ongoing Bluesky-Gething-Montney gas development project. The average total depth into the Triassic Montney in this area is approximately 1,000 metres. Total gas production from ConocoPhillips' 2007 drilling in these four areas was 2.4 Bcf from 23 producing wells. The highest producer in 2007 was from a Gutah area well located at d-35-A/94-H-11. At the end of 2007, the well was producing gas from the Bluesky-Gething-Montney B pool at an average rate of 781 mcf per day. In 2007, CNRL's production from the **Ring/Border** area (94-H-16) yielded 87 mmcf per day of natural gas, 2,000 barrels per day of natural gas liquids and 1,000 barrels per day of crude oil.

Activity by **ProEx Energy Ltd.** in 2007 was focussed almost entirely in the BC Foothills Foldbelt regional tight gas play. This activity occurs primarily in areas along the western edge of the Fort St. John region. In 2007, ProEx rig released 30 wells in these areas; eight were in the **Beg West** area centering on the

extensive and thick Triassic Halfway Formation and some on the Lower Cretaceous Bluesky and Gething sands. ProEx is now able to consider full scale development and delineation of previously discovered Halfway pools because of advances made in horizontal drilling and completions technologies. Other areas of activity focussing on Halfway development are at **Beg West, Bernadet, Blueberry, Gundy Creek, Dogrib, Sasquatch, and Town**. Following a successful 2007/2008 winter drilling program in the Sasquatch area, ProEx expanded its Dogrib compressor facility. Additional compression has increased the capacity of this plant to 18 mmcf per day.

Advantage Energy Income Fund continued with its winter drilling program in the **Black Creek** area in 2007. Drilling in this area is an extension of the company's successful **Martin Creek** program and has confirmed extensions of natural gas pool boundaries by six and a half to eight kilometres in several directions. In fact, a new productive horizon was tested in several wellbores, which have resulted in commercial production rates. One Black Creek area well drilled in early 2007 is producing at an average of 1.7 mmcf per day from the Bluesky B pool. The a-35-G/94-H-12 well began production in March 2007. Another well in the area, also drilled in early 2007, is producing from the Triassic Baldonnel A pool at an average of 1.6 mmcf per day (c-82-J/94-H-5). The Black Creek area saw just as much drilling activity in 2007 as the usually more active areas of **Drake and Tommy Lakes** (17 wells drilled in each area).

The **Parkland** area, which falls within the greater Montney fairway, was home to 16 rig releases in 2007. Most wells focussed on the development of Triassic-aged targets such as the Halfway, Doig and Montney. The Parkland area is now a core operating area for **Storm Exploration Ltd.** as it focuses a significant portion of its activity on delineation and development of the Montney. In 2007, the junior oil and gas company drilled 14 wells in the area with 11 targeting the Montney and three targeting the Halfway. Development of Storm's Montney discovery at Parkland entails using four horizontal wells per section with six to eight fractures per wellbore. At the beginning of 2008, the company was producing 14 mmcf per day of raw gas from six horizontal Montney gas wells and another three mmcf per day of raw gas from nine Montney vertical wells. A seventh horizontal well was being drilled and completed at that time. Approximately 55 per cent of Storm's production is now sourced from vertical and horizontal wells producing from its Montney discovery. Storm's internal estimate of potential gas in place from the Montney at Parkland ranges from 330 to 430 Bcf (100 per cent working interest). In 2008, activity at Storm's Parkland property will include the drilling of eight horizontal Montney development wells and 10 vertical wells targeting the Montney, as well as potential in the uphole Halfway and Doig formations. As a result of increased gas production from the area, Storm will add a third compressor at its Parkland facility and will also twin part of its gas gathering system to allow for a further increase in production volumes.

Iteration Energy Ltd. was an active operator in the Fort St. John region in 2007. Its 16 rig releases were in various areas throughout the region, including **Birley Creek, Boundary Lake North, Pickell Creek, Osborn, Rigel and Squirrel**. Production targets in these areas include the Cretaceous Bluesky-Gething as well as the Triassic Charlie Lake and Halfway. One notable outpost well was drilled in the first quarter of 2007 in the Pickell Creek area (c-52-F/94-H-3). It recorded gas production gas from the Bluesky at an average of 2.1 mmmcf per day throughout 2007. Approximately 43 per cent of Iteration's natural gas production is from northeast BC. The junior producer works in multi-zone areas to minimize risk and consistently evaluates asset acquisition opportunities in its focus areas. Its most significant producing properties in northeast BC are at **Boundary Lake, Umbach and Rigel**.

Duvernay Oil Corp. (recently acquired by Shell Canada Limited) expanded its Montney program in the Sunset Prairie-Groundbirch area complex in 2007. The company drilled and completed its first two horizontal wells in the Triassic Montney in the **Saturn** area (2-9-80-19W) and the **Sunset** area (5-21-79-18W6). Both wells production tested at initial gas rates of over five mmmcf a day. Duvernay has 120 net sections of Montney rights in the prime Montney gas fairway. Depending on ultimate well spacing, this could represent up to 500 future horizontal drilling locations. Duvernay has also tested a deep Palaeozoic well in the **Groundbirch** area. The well at 2-10-79-19W6 was cased as a multi-zone gas well and production tested for both sweet and sour gas. The well flowed sweet gas at stabilized rates of 5.5 mmmcf per day from one of the sweet pay zones in the Mississippian Kiskatinaw. A follow-up Palaeozoic test was drilled after spring break-up of 2008. After achieving major success from its Triassic Doig discovery in 2002, Duvernay built an extensive gas infrastructure in the Sunset Prairie-Groundbirch area. Four natural gas processing plants now serve the area as well as two direct tie-in points to Spectra Energy's main sales gas system.

Bonavista Energy Trust has seen an active drilling and acquisitions program in British Columbia over the last few years. The company started operations as an energy trust in July 2003 and focuses on medium depth, multi-zone regions with relatively low operating structures. Northeast BC represents approximately 24 per cent of its current natural gas production and 12 per cent of its oil and liquids production. Current gas production in the Fort St. John region comes from the areas of **Nig Creek, Buick Creek North, Jedney, Blueberry and Rigel**; oil production is from the **Inga** area. In 2007, the trust rig released 18 wells; most were in the Nig Creek/Buick Creek North area targeting the Lower Cretaceous Cadomin and the lowstand sands of the Notikewin. Two wells were also drilled in the Blueberry/Jedney areas, which resulted in considerable Triassic Halfway and Mississippian Debolt production. In 2008, Bonavista Energy expects to drill 11 new wells in the Fort St. John region.

Tight Montney gas development in the **Dawson** area continues to be a top priority for **ARC Energy**

Trust. The largest portion of Arc's capital program in 2007 was committed to the Dawson area with \$58 million spent to drill six horizontal wells and six vertical Montney wells. The trust now recognizes 416 Bcf of proven plus probable reserves for the Dawson field. Total original gas-in-place (OGIP) for the Montney in the Dawson area is estimated to be 3.8 Tcf (3.5 Tcf is ARC's gross share). Arc now believes it can eventually achieve a natural gas recovery factor between 50 and 70 per cent from the Montney, depending on potential well density per section. Arc made two new gas discoveries at Dawson in 2007. A discovery well at 4-12-79-16W6 was drilled in the west portion of the field where 75 metres of greater than three per cent porosity of gas bearing rock was encountered. The new well provides a western extension of the Montney gas pool at Dawson. Further west in the Sunrise area, Arc drilled a discovery well (9-13-78-18W6) where it encountered 150 metres of greater than three per cent porosity gas bearing rock in the Montney. The well was tested with results confirming the presence of large gas resources associated with its lands at Sunrise. Gas production from the Dawson area reached a record 44 mmmcf per day in December 2007.

FET Resources Ltd., acquired by **Enerplus Resources Fund** in February 2008, remains active in its tight gas resource play in the **Tommy Lakes** area. In 2007, FET Resources rig released 11 wells in the area, all targeting the areally-extensive blanket sand of the Triassic Halfway Formation. The Tommy Lakes area represents a key asset in Enerplus' growing deep tight gas presence in northeast BC. Development at Tommy Lakes over the next three years could result in over 50 future drilling locations. The original gas-in-place (OGIP) for the total Halfway Sandstone formation is over 600 Bcf. It produces about 30 mmmcf a day with 600 barrels of oil equivalent (BOE) per day of natural gas liquids.

The **Stoddart, Stoddart West and Cache Creek** fields are key operating areas for **Baytex Energy Trust** in the Fort St. John region. The areas offer largely year-round-access to oil and liquids rich gas production from the Triassic Baldonnel, Charlie Lake, Halfway, Doig, and Cretaceous Bluesky formations. In 2007, Baytex drilled 10 wells in these areas; most targeted the Triassic Doig in the Cache Creek area. One of the most productive wells was drilled in the Cache Creek area at 13-5-88-22W6. At the end of 2007, it was producing gas at an average rate of 1.4 mmmcf per day and oil at 73 barrels per day. Production in 2007 from Baytex Energy's Stoddart asset area averaged approximately 11.2 mmmcf per day of gas and 1,800 barrels per day of oil and natural gas liquids. In 2008, Baytex planned to drill as many as six wells in northeast British Columbia as well as re-completing several other wells.

TUSK Energy Corporation announced that a significant portion of the company's capital investment program would be directed outside of Alberta in 2008. The new Alberta Royalty Regime would have affected approximately 55 per cent of TUSK's production output. By redirecting capital investment opportunities outside Alberta, TUSK estimated that the impact on its production would drop to less than 40 per cent. The

added uncertainty with TUSK's Alberta-based capital projects provides a significant upside to drilling and development projects in northeast BC, where lower royalty rates apply. This bodes well for TUSK's long-life natural gas assets located in the **Conroy Creek** area where the company farmed into a large block of lands with existing production and infrastructure. Fifteen wells were completed over the 2007/2008 winter drilling season at Conroy; four are listed as standing. Another 25 wells were budgeted for summer drilling in 2008. TUSK has 100 per cent interest in two gas plants in the Conroy Creek area with 85 kilometres of gathering system extension and sales lines.

Terra Energy Inc. remained active in the South Peace region in 2007 with six rig releases. Among those was an exploratory outpost well drilled in the Sunrise area at 7-9-80-17W6. Wellhead AOF tests were highest from this well (18.5 mmcf per day) compared to six other Doig tests in the area. Terra targets the Triassic Doig shoreface sands as part of its development program in the **Eight Mile/Sunrise** areas. With the greater part of its South Peace gathering system completed in 2007, Terra Energy is well positioned for growth in the Fort St. John region. Terra's core areas include the fields of **Boudreau, Wilder, Monias, Septimus, Tower Lake, Eight Mile, and Sunrise**. The company announced in early 2008 that its Eight Mile South gas field was placed on production, adding approximately 500 barrels of oil equivalent (BOE) per day to the company's production base. Terra's exit production in 2007 was 3,266 BOE per day.

Monterey Exploration Ltd. recently stated that the majority of its operations and future capital spending will be directed to northeast British Columbia. The step up in spending will accelerate development of Monterey's project inventory in the **Laprise Creek/Dahl, Buick Creek/Squirrel and Brassey** areas. In the Laprise Creek area, Monterey has started a three-well drilling program to further develop its Cretaceous Bluesky and Triassic Baldonnel gas holdings. These wells will be tied into existing facilities and the program was expected to be completed by the end of October 2008. Future activity in the Buick Creek and Squirrel areas will mainly target the Lower Cretaceous Gething and Dunlevy prospects, which have been delineated from proprietary seismic with the use of horizontal drilling and multi-stage fracture technology. In 2007, Monterey drilled six wells in northeast BC. One well in the **Fireweed** area (d-30-D/94-A-14) recorded production from the Bluesky at an average of 231 mcf per day to the end of December 2007.

Alberta Clipper Energy Inc. expected to spend \$1 million in northeast BC over the first half of 2008. In early 2007, the company rig released four wells in the **Tommy Lakes** area as part of its western extension of the Triassic Halfway play. Two of these wells recorded gas production; one from the Halfway and the other from the Charlie Lake. Alberta Clipper reports that its Halfway play at Tommy Lakes contains 137 Bcf of gas-in-place.

E4 Energy Inc., now Twin Butte Energy Ltd., completed a successful drilling program in the **Airport**

and **Teal** areas in 2007. In the Airport area, a well rig released in June 2007 was producing gas from the Cretaceous Bluesky at an average rate of 288 mmcf per day. In the Teal area, completion work continues on a well drilled at 9-19-87-22W6. The well was drilled on lands purchased from a third quarter 2007 Crown land sale and is listed as a standing potential gas well. Total depth was reached in the Permian Belloy. E4 holds a total of 2,873 hectares in this multi-zone, exploration area and maintains extensive 3-D seismic data coverage on both proprietary and crown lands. Over 50 per cent of E4's natural gas production is from British Columbia. In February of 2008, Twin Butte Energy Ltd. announced the closing of a strategic combination with E4 Energy Inc. The acquisition brought approximately 34,804 of net undeveloped hectares of land to Twin Butte Energy in Fort St. John region.

Breaker Energy Ltd., which has experienced tremendous growth since 2004, completed a 32 square kilometre 3-D seismic program in the **Monias** area in early 2008. The junior explorer considers the Monias field to be a high impact area in its exploration program. It has an exclusive working interest in a deep Devonian reef play in the area with a target size of one Tcf of unrisks potential. The summer of 2008 saw Breaker close an agreement to acquire a 100 per cent working interest operated property in the **Fireweed** area. Current production at Fireweed includes vertical wells producing from the Triassic Doig tight sand. Breaker will drill the property using horizontal multi-frac wells, which are projected to cost \$5 million each with two to five Bcf of ultimate recoverable gas. The first Doig/Montney horizontal well to be drilled on the property was slated for late 2008. Breaker has identified 14 additional drilling locations at Fireweed and is hoping that successful drilling operations will confirm the potential of a high rate, liquids rich resource play.

Sabretooth Energy Ltd. plans to spend a significant portion of its capital budget in northeast BC in 2008. In 2007, the producer drilled three wells in the Fort St. John region; one resulted in a new pool oil discovery in the Oak area. In September 2007, Sabretooth received Good Engineering Practice (GEP) from the BC Oil and Gas Commission allowing it to initially produce the well at 100 barrels of oil per day. Once further production history has been obtained from the well, this allowable rate could increase. Follow up drilling to this oil discovery was expected to start in mid-2008. Also in the Oak area, Sabretooth proved natural gas production from the Montney as a result of drilling two vertical wells. Two long reach horizontal wells targeting the Triassic Montney were expected to be drilled after the 2008 spring breakup. These development wells will further evaluate 12,546 net hectares that Sabretooth holds within the Upper, Middle and Lower Montney fairway.

The **Montney** play region in northeast British Columbia and Alberta is becoming a core area for **Talisman Energy Inc.** Talisman is building a considerable land position in the Montney fairway (16,200 hectares) and is making progress on its pilot programs, some of which are moving into the

development phase. Specifically, in the **Groundbirch** area of northeast BC, the producer holds interests in over 65 net sections after having purchased approximately 32 sections at various PNG rights auctions in the first half of 2008. Each section has the potential for up to eight development wells per prospective Montney zone. In the spring of 2008, Talisman announced that total capital spending worldwide in 2008 would be \$4.9 billion with \$310 to \$420 million going to unconventional natural gas pilot projects in North America.

With increasing levels of natural gas production in the Fort St. John region and other producing areas in northeast British Columbia, **Spectra Energy Corp.** is seeking approval from the National Energy Board to expand its T-North (Transportation North) gas transmission system. The \$53.8 million expansion will provide an additional 153 mmcf per day of incremental capacity for natural gas to flow eastbound to the Gordondale area near the British Columbia/Alberta border. Work on the expansion is expected to take place between the spring of 2009 and early 2010. The incremental capacity will provide a better interconnect between the Westcoast system in northeast BC and the **TransCanada Pipelines** and **Alliance Pipeline** systems on the Alberta side.

Deep Basin Region

The Deep Basin region (*Figure 24*) comprises an area of 692,000 hectares and offers thick sequences of stacked, regionally extensive, gas-saturated, Mesozoic clastic reservoirs. Traditionally, exploration has focussed on identifying stratigraphic sweet spots that feature conventional reservoir quality in the Cadotte and Falher. In fact, some of these conglomeratic reservoirs continue to offer some of the highest initial deliverability rates in the province. The tight gas component of the Deep Basin, however, offers a huge potential resource that is now being exploited. In the *Exploration Assessment of Tight Gas Plays Northeast British Columbia* (BC EMPR, 2003), the gross OGIP resource was estimated at 70 to 200 Tcf. Potential Deep Basin tight gas targets include the Cardium, Dunvegan, Cadotte, Bluesky, Cadomin, Nikanassin, Halfway, Doig and Montney. Development of the Cadomin was initiated in 2004, and production continues to come on stream in 2007 and 2008.

Land Sales

Land brokers and producers spent \$359 million acquiring Crown petroleum and natural gas rights in the Deep Basin region in 2007, a significant increase from the \$42 million spent in 2006 (*Figure 25*). The Montney play fairway, which extends into the northeast portion of the Deep Basin region, accounted for approximately 64 per cent of the 2007 land sale bonus total. Twenty seven of the 42 parcels sold in the Deep Basin were within the Montney play fairway. One parcel, northeast of the Brassey area, sold for \$102.6 million for an average price per hectare of \$15,401, capturing the highest successful bid of all parcels auctioned at 2007 provincial land sales. Other notable parcels sold in 2007 were south of the Jackpine and Moose areas where Shell Canada Limited purchased three drilling licences for \$38.37 million at the January Crown land sale. Over the last two years, Shell Canada has been building its Canadian gas portfolio and has acquired significant tight gas acreage, particularly in northeast BC.

Drilling

A total of 151 wells were rig released in the Deep Basin region in 2007, down 34 percent from the previous year. Again, EnCana Corporation and ConocoPhillips Canada accounted for most of the activity in the Deep Basin capturing almost 75 per cent of the rig release total (112 rig releases combined). The major target interval for operators was the Lower Cretaceous Cadomin with approximately 86 zones identified as such. This was followed by the Triassic Montney and Doig with 57 and 15 zones identified, respectively (*Figure 26*). Gas production, however, was highest from the Montney at almost 25 Bcf from 43 producing zones. The Cadomin saw gas production of 17 Bcf from the same number of zones. The Cadomin was the target interval in many areas of the Deep Basin including the Brassey, Cutbank, Kelly and Sundown fields, while every well drilled in the Swan Lake area listed the Montney as the objective. Wells targeting the Nikanassin totalled 14, mostly in the Hiding Creek, Kelly and Ojay areas.

Production

The distribution of production from wells rig released in the Deep Basin region in 2007 is shown in *Figure 27*.

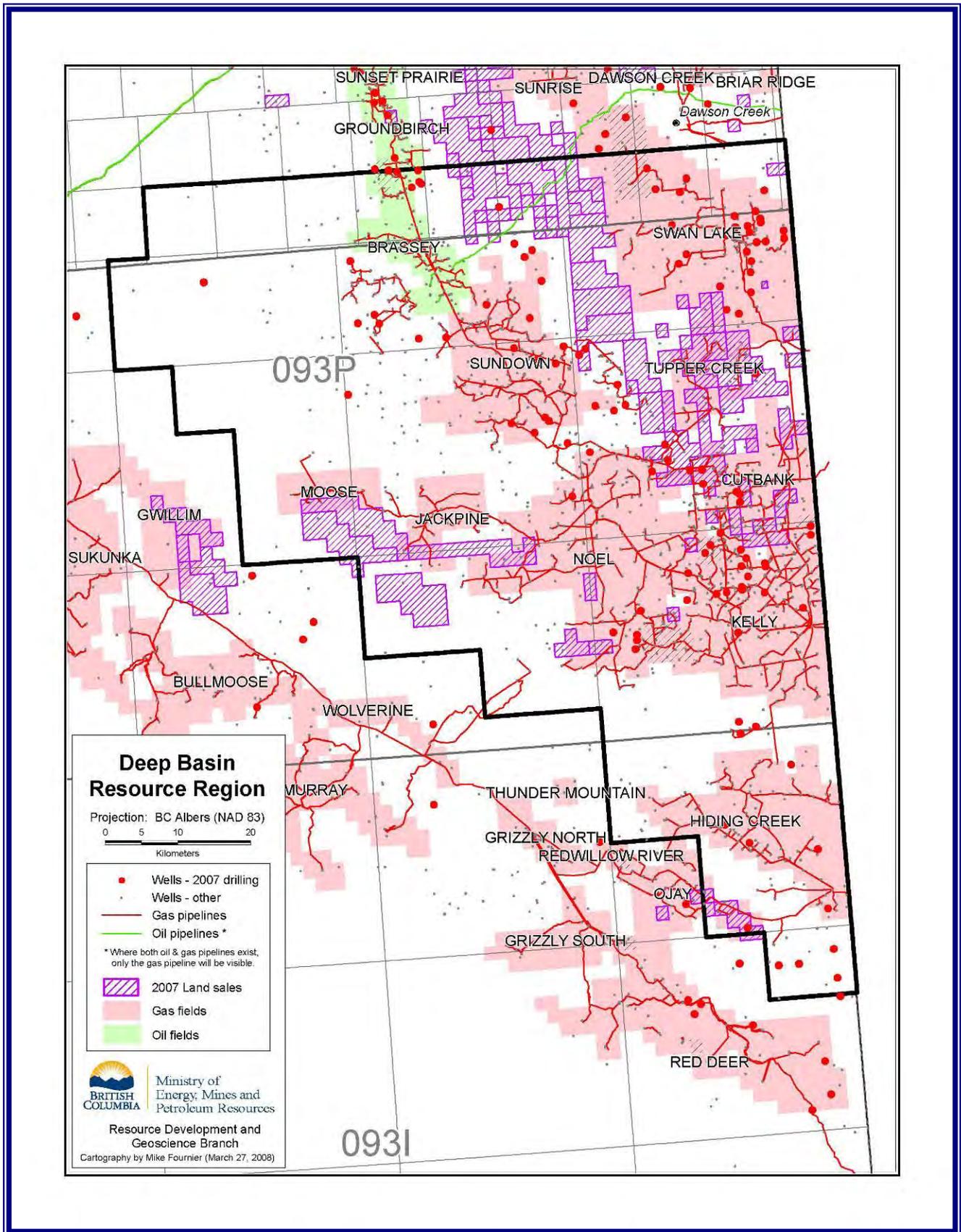


Figure 24. Land sale and drilling activity in the Deep Basin region of NEBC in 2007.

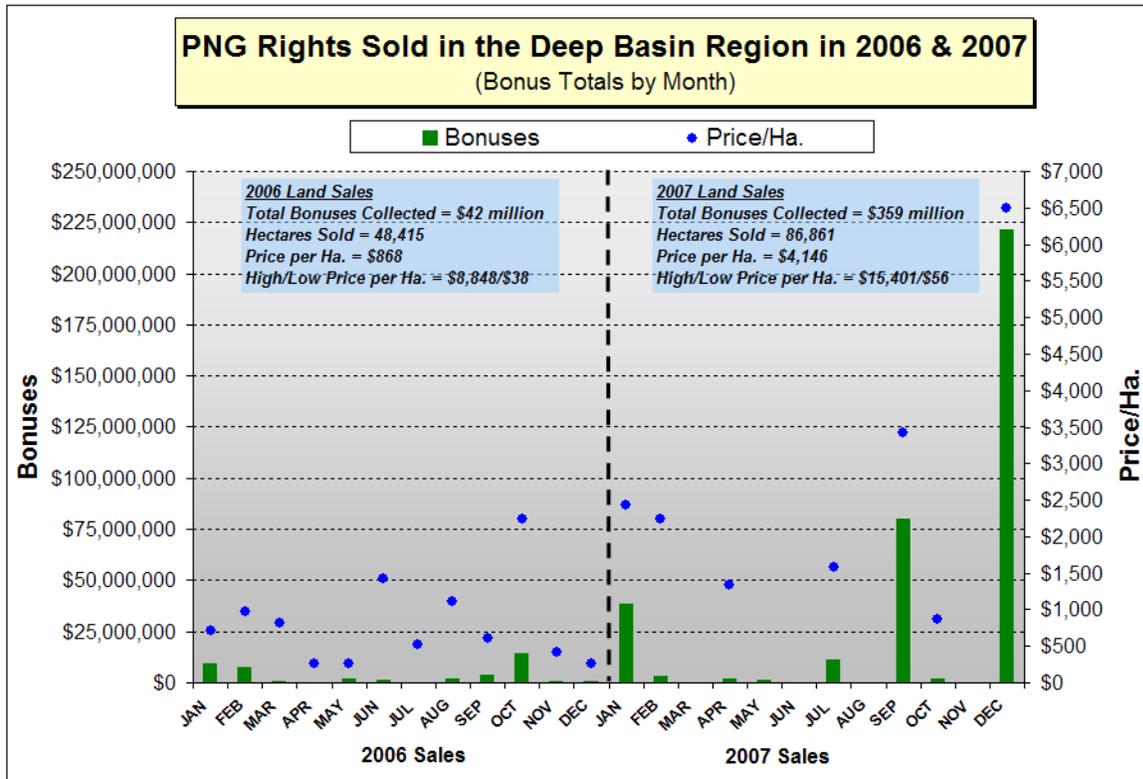


Figure 25. Monthly PNG rights sold in the Deep Basin region in 2006 and 2007.

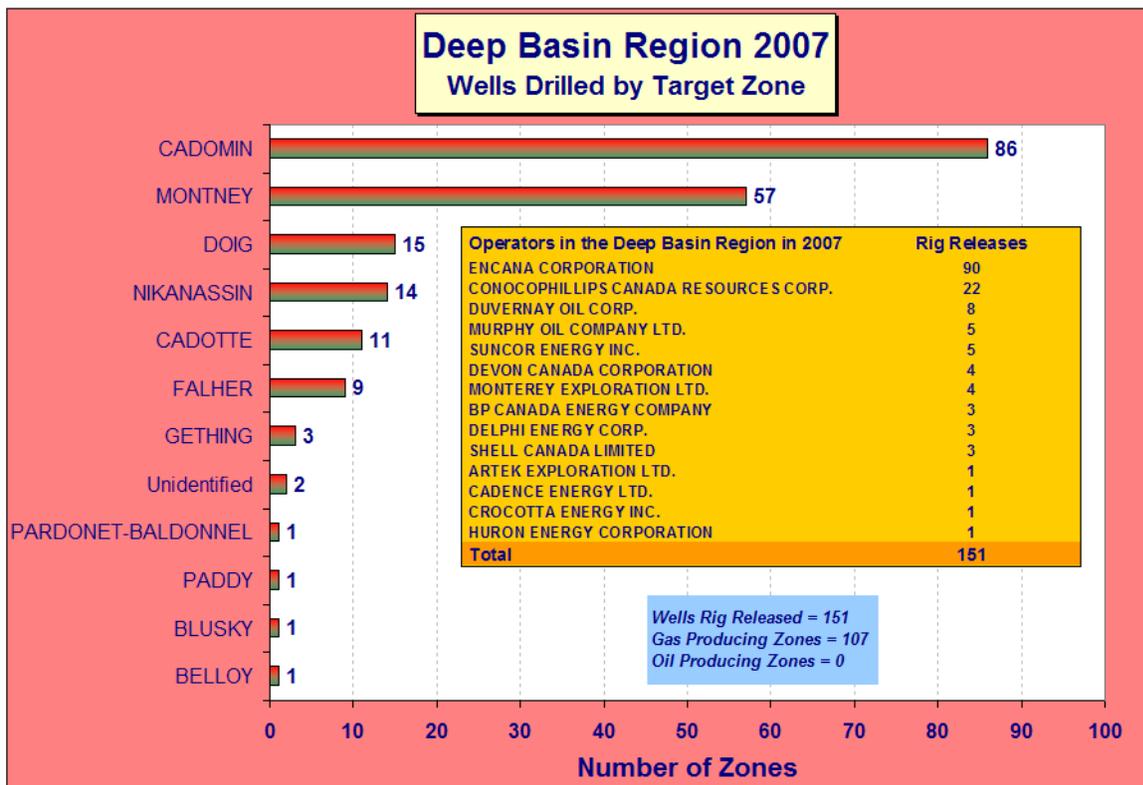


Figure 26. Target zones from wells rig released in the Deep Basin region in 2007

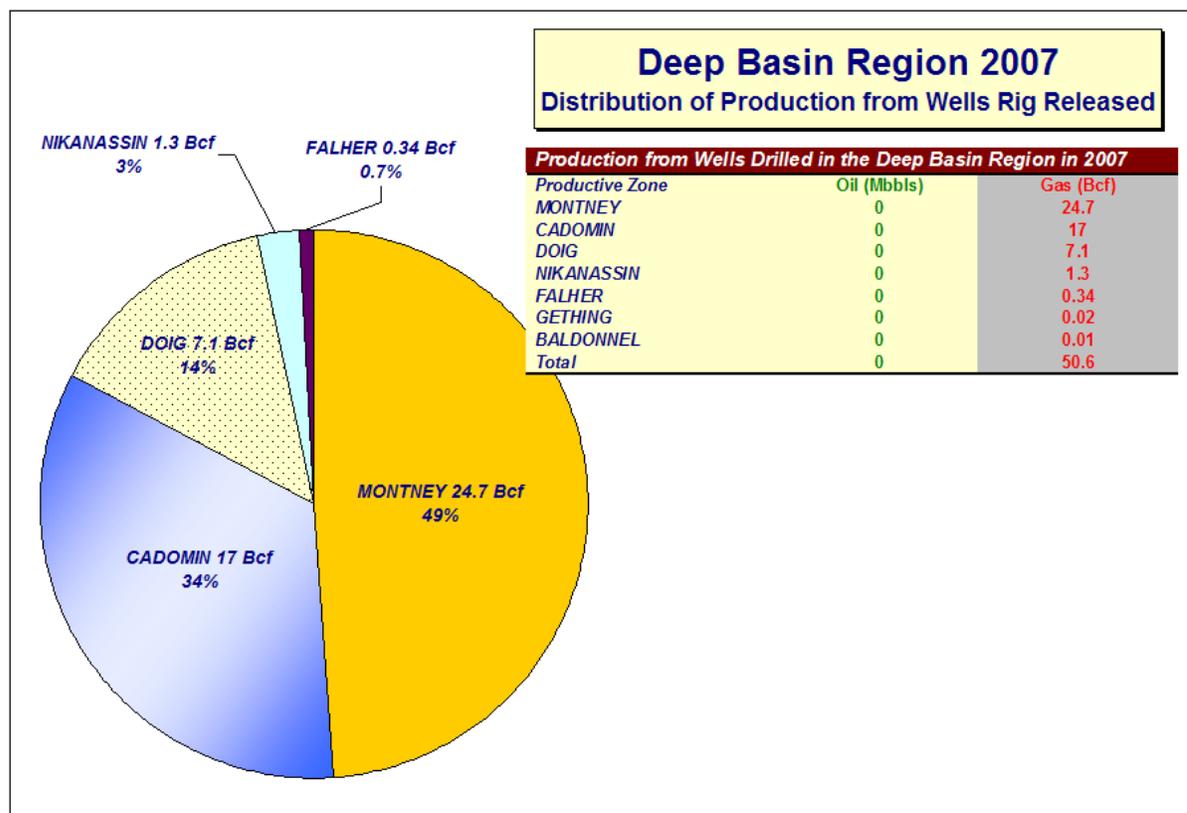


Figure 27. Distribution of production from wells rig released in the Deep Basin region in 2007.

Oil & Gas Exploration Activity

The **Swan Lake** and **Sundown** fields were by far the most active areas for drilling in the Deep Basin region in 2007. The two areas accounted for almost half of the 151 wells rig released in the region. **EnCana Corporation** and **Murphy Oil Corporation** continue to develop Triassic shale gas potential from the Montney turbidites in the Swan Lake/Tupper areas while the Sundown area continues to attract a number of producers chasing the Cretaceous Cadomin and the Triassic Montney/Doig.

EnCana Corporation has significantly ramped up its operations in the **Swan Lake** area from a year ago. Its well program to develop gas potential from the sandstone, siltstone and shale sequences of the Triassic Montney has exceeded expectations. Gas production from EnCana's 43 wells drilled in the area in 2007 reached 24.7 Bcf, more than tripling volumes from a year earlier. EnCana is producing more than 140 mmcf per day from about 70 horizontal wells at Swan Lake. The producer can now complete as many as eight staged fracture stimulations along the horizontal leg of a well in just four days. Only a year earlier, the average time for a staged frac was one every four days using the labourious procedure of coiled tubing conveyed bridge plugs and perforating guns. Continued optimization of these horizontal completion techniques will continue to unlock the economic potential of the area. With current mapping of the Upper Montney, EnCana has identified 3.7 Tcf of original gas-in-place (OGIP) or 25 to 40 Bcf per section. The OGIP for the Lower Montney is estimated to be 5.6 Tcf (30 to 50 Bcf per section).

In the **Sundown** area, a total of 25 wells were rig released in 2007. Among the five producers operating in the area, **EnCana Corporation** overshadowed others with 19 rig releases, followed by **Devon Canada Corporation** and **Duvernay Oil Corp.** with two each. The remaining wells were divided between **BP Canada Energy Company** and **Huron Energy Corporation**. The key objective in this area is the Cadomin but other identified target zones included the Cadotte, Falher, Nikanassin and the Triassic Doig.

In the **Kelly** area, **Delphi Energy Corp.** drilled, completed and tied-in two 2,400-metre wells targeting multi-zone sweet gas in the Falher, Cadotte, and Paddy formations. Delphi is now producing approximately 275 barrels of oil equivalent (BOE) a day of natural gas and natural gas liquids from four wells in the Kelly area. Delphi added the Kelly area to its drilling portfolio following a late 2007 industry farm-in, which accessed 15 sections of undeveloped land. Delphi has identified six drilling locations on its 100 per cent working interest lands and planned to drill up to three wells during the second half of 2008. Over the last two years, Delphi has managed to maintain its capital spending programs and increase production in northeast BC amid a low commodity price environment.

The number of wells drilled in the **Brassey** area in 2007 reached 17, down significantly from 2006 when 55 wells were drilled. **ConocoPhillips Canada** was the most active driller with five wells rig released, followed by **Duvernay Oil Corp.** and **Monterey Exploration Ltd.** with four each. Fourteen of the area's 17 rig releases targeted the Lower Cretaceous Cadomin Formation while three wells, all drilled by Duvernay

Oil, were drilled for delineation of the Triassic Doig tight sands. Monterey Exploration Ltd. has been very active in the Brassey area as it begins applying multi-stage fracture technology to the Cadomin resource play trend. Monterey's first horizontal well, which was drilled to 3,500 metres including a 1,000 metre horizontal leg, is part of a four-well Cadomin program for the Brassey area. All wells will be completed using multi-stage fracturing and first production was expected to be onstream in the latter part of 2008. The company has identified over 15 additional locations in the area where horizontal wells could be drilled and completed using the same multi-stage fracturing methods. Test flow rates after the first two horizontal wells completed in the program will determine how quickly Monterey develops its 21 section land block at Brassey.

ConocoPhillips Canada Resources Ltd. was the sole operator in the **Hiding Creek** area in 2007. The exploration target in this area of the Foothills Disturbed Belt is structurally-trapped natural gas in the Lower Cretaceous sands. Nine wells were drilled by ConocoPhillips in the Hiding area with four placed on production. A development well at c-36-G/93-I-16 has been producing from the Nikanassin at an average of over 1.5 mmcf per day since it came on stream in May of 2007. Cumulative production to November 2008 is 852 mmcf. Also, a Nikanassin outpost well (d-97-J/93-I-16), which came on stream later in March of 2008, is producing at an average of 1.8 mmcf per day and has produced 434 mmcf to November 2008. The highest producing well came from a Nikanassin development well which also began producing in March 2008. It's been producing at an average rate of 5.1 mmcf per day with cumulative production of 1.3 Bcf to November 2008.

Spectra Energy Transmission has received federal regulatory approval for its 221 mmcf per day South Peace Pipeline project in northeast BC. The 87.5 kilometre pipeline will enable Spectra to provide raw natural gas transmission and sour gas treatment to producers with gas supply in the Noel area to the southern end of Spectra's existing Peace River Crossing Pipeline (near the McMahon processing plant at Taylor). The potential supply area includes the Deep Basin region and the southern portion of the Fort St. John region. The supply area would include gas reserves from the Triassic Montney, Doig, Halfway and Charlie Lake as well as the Lower Cretaceous Cadomin Formation along with the Falher and Cadotte members of the Spirit River and Peace River groups.

Northern Foothills Region

The Northern Foothills region incorporates an area of 2.9 million hectares (*Figure 28*) and covers mostly foothills and mountainous terrain. Laramide-aged structures provide the opportunity for structural traps where natural gas may accumulate. Prospective intervals include Cretaceous clastics, but traditional targets are the Triassic Baldonnel, Charlie Lake, and Halfway formations, and the Mississippian Debolt Formation. The western boundary of the Triassic play is constrained by outcrop and subsequent breaching of

any trap. The Mississippian type play is typified by the Sikanni and Pocketknife fields where natural gas is trapped in linear northwest trending thrust-fault related structural features. In addition, Devonian-aged rocks outside of the region are hosts to very significant hydrocarbon accumulations. While subsurface well control is limited within the region, there remains significant undiscovered potential. The Devonian Keg River and Slave Point formations host major natural gas accumulations in northeastern BC such as at Clarke Lake. These occur in ancient barrier reef complexes and atolls that can be mapped trending into the region. These rocks are prospective in areas that have been uplifted. Optimum positioning of reservoir rock, in a structurally high position, may result in the creation of very large pools. The western limit for Devonian-play types is defined by a line about five to ten kilometres west of the outcrop belt of Devonian or older sediments. This five-to-ten kilometre band accounts for the possibility of encountering second-sheet Devonian reservoirs in an overthrust scenario.

Land Sales

Just three per cent of British Columbia's land sale bonuses in 2007 were collected from parcels sold in the Northern Foothills region. Most PNG rights purchases occurred along the eastern boundaries of the resource region from the Trutch area in the north down to the Portage area in the south (*Figure 28*). In terms of dollar totals, \$29.4 million was spent acquiring rights on 67,204 hectares at an average price of \$437 per hectare (*Figure 29*). Although these numbers compare favourably to 2006, the provincial distribution of PNG rights sold in the Northern Foothills region has dropped significantly since 2004, when 19 per cent of all bonuses collected in the province were attributed to the region.

Land sale activity was particularly strong in the Trutch area (94-G-10) as producers proved up a substantial new Triassic Halfway development fairway. The most expensive parcel sold in 2007 in the Northern Foothills region came from the August 15th PNG rights sale where Meridian Land Services (90) Ltd. purchased a 1,140-hectare drilling licence for \$3.55 million in the Horseshoe area (94-B-10).

Drilling

A total of 53 wells were rig released in the Northern Foothills region in 2007, down from 62 in 2006 (*Figure 30*). Again, the Altares and Julienne Creek areas saw the highest activity with 10 and nine wells drilled, respectively. Most wells drilled in the two areas were targeting the shallow Cretaceous Bluesky/Gething sands but three wells listed the Triassic Halfway and Doig zones as targets. The lead operator in the region was ProEx Energy Ltd. with 26 wells drilled followed by Petro-Canada with 11 wells completed. Canadian Natural Resources Ltd. (CNRL), which drilled 10 wells in the Northern Foothills region in 2006, only drilled three in 2007.

Production

The distribution of production from wells rig released in the Northern Foothills region in 2007 is shown in *Figure 31*.

Oil & Gas Exploration Activity

ProEx Energy Ltd. (now combined with **Progress Energy Trust**) continues to see successful results from its exploration and development programs in the Northern Foothills region. The primary target for ProEx in the region is the Triassic Halfway, a thick sandstone reservoir encompassing several hundred square kilometres in its operating area. The Halfway, which is encountered at approximately 1,800 metres depth, has been penetrated by ProEx/Progress over 150 times vertically, but almost entirely on the crests of the anticlines. Evolving horizontal drilling and completions technologies have given ProEx access to full scale development and delineation of previously discovered Halfway pools. These advances allow for a wider range of drilling in mid to lower grade Halfway reservoirs situated on crests and flanks of known anticlines and to reservoirs in areas where surface topography is a challenge for conventional methods.

In 2007 and early 2008, ProEx continued to put together its undeveloped land position in the region through Crown sales and strategic asset acquisitions. The company rig released 26 wells in the region; areas of activity occurred primarily at **Julienne Creek**, **Altaires**, **Green Creek**, **Cameron**, **Caribou**, **Lily Lake**, and **Butler**. ProEx achieved an overall success rate of over 90 per cent in these areas. The **Julienne Creek** area is one of the more active operating areas for ProEx. Activity entails expansion of the shallower Cretaceous Bluesky/Gething formations and the deeper Mississippian Debolt. The Bluesky/Gething has the potential to reach 25 per cent the company's inventory, with production estimates at Julienne Creek reaching almost two Bcf per day.

A significant number of pipeline and facility expansions were completed by ProEx during the first quarter of 2008. In the **Julienne Creek** area, a partnership with the British Columbia government helped complete the construction of a pipeline to tie-in stranded gas at **North Julienne**. Also completed was a 7.2-kilometre pipeline at **Caribou**, which involved two river crossings. This followed the first phase of the Caribou pipeline completed in the fourth quarter of 2007. It consisted of a 10-kilometre section connecting to the Caribou gas plant, which is operated by **Keyera Facilities Income Fund**. Following successful drilling activity in the **Sasquatch** area in 2007, ProEx expanded its facility at **Dogrib** during the first quarter of 2008. Adding compression increased the capacity of the plant to 18 mmcf per day. Another partnership with the provincial government resulted in the building of a pipeline to tie-in stranded gas in the recently-acquired **Blair Creek** property. This project connects to the company's facility at **Gundy Creek**.

Petro-Canada drilled 11 wells in the Northern Foothills region in 2007. Seven of those wells were drilled in the **Kobes** area where production of 376 mmcf was realized from the Upper Triassic Charlie Lake Formation and Coplin Member. Gas production data from one of those wells drilled in early 2007 at b-51-1/94-B-8 shows a marginal average rate of 1.1 mmcf per day in 2007, falling to 880 mcf per day in 2008.

All wells drilled in 2007 by **Northpoint Energy Ltd.** in the Northern Foothills region were in the **Altaires** area. Above average daily production was reported from one of those wells located at d-44-H/94-B-8. Drilled in November of 2007, the well has been producing at an average rate of 1.8 mmcf per day since it began production in January 2008. Cumulative production to November 2008 is over half a Bcf.

Welton Energy Corporation drilled and cased its first two wells of a three-well program in the **Trutch** area in 2007. In January 2008, Welton completed the third well in the program. The Trutch area is a multi-zone natural gas prospect for Welton. In the first quarter of 2008, capital spending on exploration was almost entirely devoted to the completion of one of the three wells. Welton has identified multiple locations at Trutch using three-dimensional seismic. There are 19 sections under a farm-in agreement in the Trutch area project.

Canadian Spirit Resource Inc. (CSRI) has made a substantial investment to build on its unconventional gas play in the **Farrell Creek** area. The pilot project at Farrell Creek entails the staged stimulation and production testing of the Gething Formation coals, interbedded sands and Bluesky tight gas. CSRI says it entered into a joint venture with **Shell Canada Ltd.** to advance the development of the Farrell Creek project. The joint venture would require a disbursement of almost \$50 million to acquire land and to expand CSRI's existing pilot program. The initial capital program at Farrell Creek will include the drilling of five wells targeting the Gething as well as one deep water disposal well. CSRI is now working towards bringing this gas play to a commercially productive level. This joint venture will result in a significant investment in the pilot project without CSRI having to issue additional equity. In 2007, Sproule Associates Limited evaluated the unconventional natural gas resource on CSRI-interest lands at Farrell Creek area and reaffirmed a total raw gas-in-place of 1.8 Tcf (1.4 Tcf attributed to Gething, 0.4 Tcf to Moosebar and Gates).

Another producer now actively involved in the Farrell Creek area is **Talisman Energy Inc.** As part of its work in the Montney natural gas play, the producer is looking to spend over \$7.5 billion in the Farrell Creek area over the next decade. In 2009, Talisman plans to drill four horizontal and three vertical wells in the area. Gas processing facility locations for the area are also being surveyed.

In early 2007, Talisman Energy Inc. drilled a successful natural gas well in the Federal area with Husky Oil Operations Limited (50% working interest). The d-28-H/94-B-7 well tested at restricted rates of 21 to 25 mmcf per day (gross raw gas) with a flowing wellhead pressure of 2,300 psi. The well came on stream in March 2008 and is producing at a rate of 19 mmcf per day of sales gas from the Lower Deboit.

Talisman has used its extensive thrust and fold belt exploration experience in opening up this new, high potential area in the Northern Foothills. The successful Federal area well was drilled along a new exploration fairway and Talisman has identified two other opportunities on the structure, which it expects to drill over the next year or two.

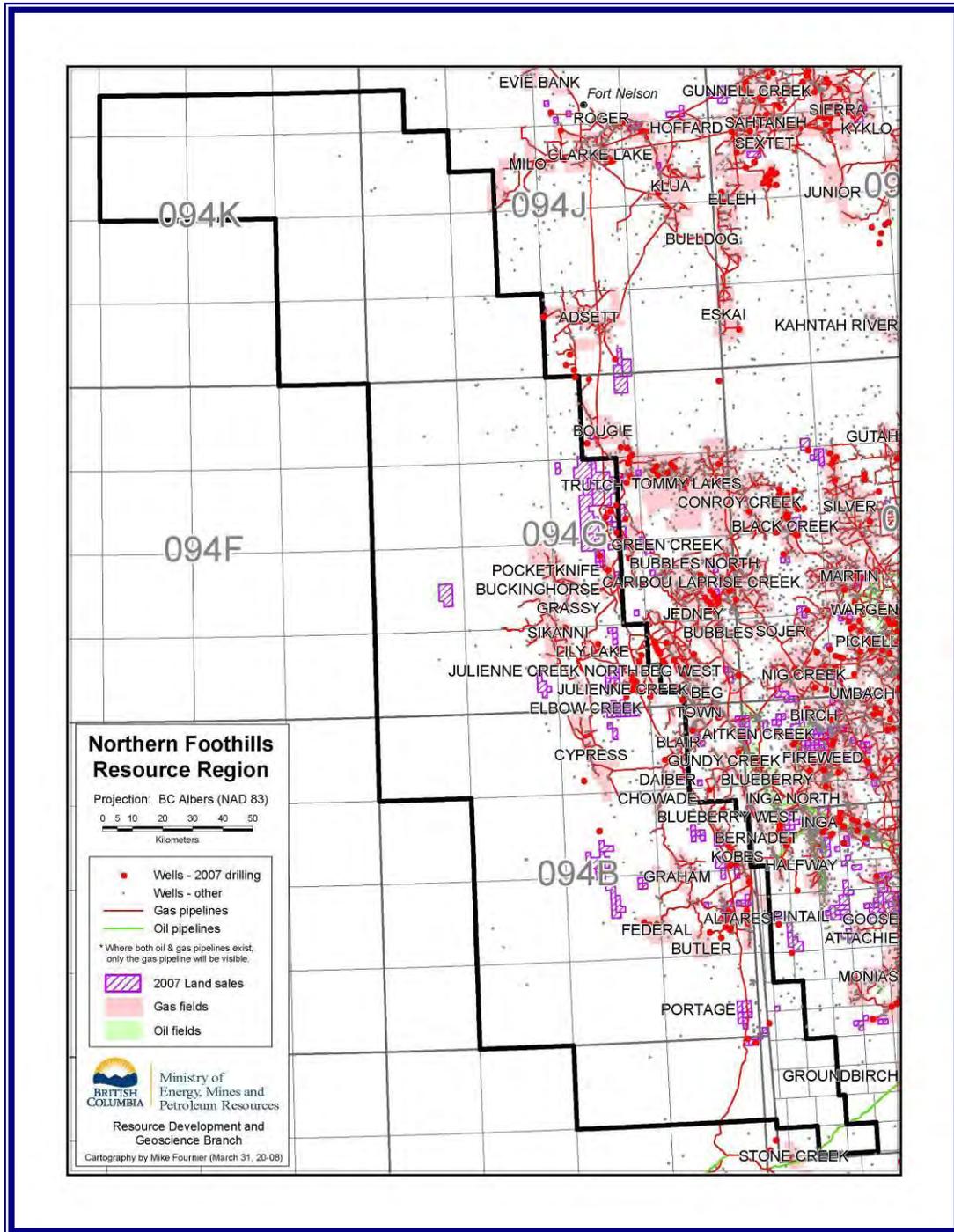


Figure 28. Land sale and drilling activity in the Northern Foothills region of NEBC in 2007.

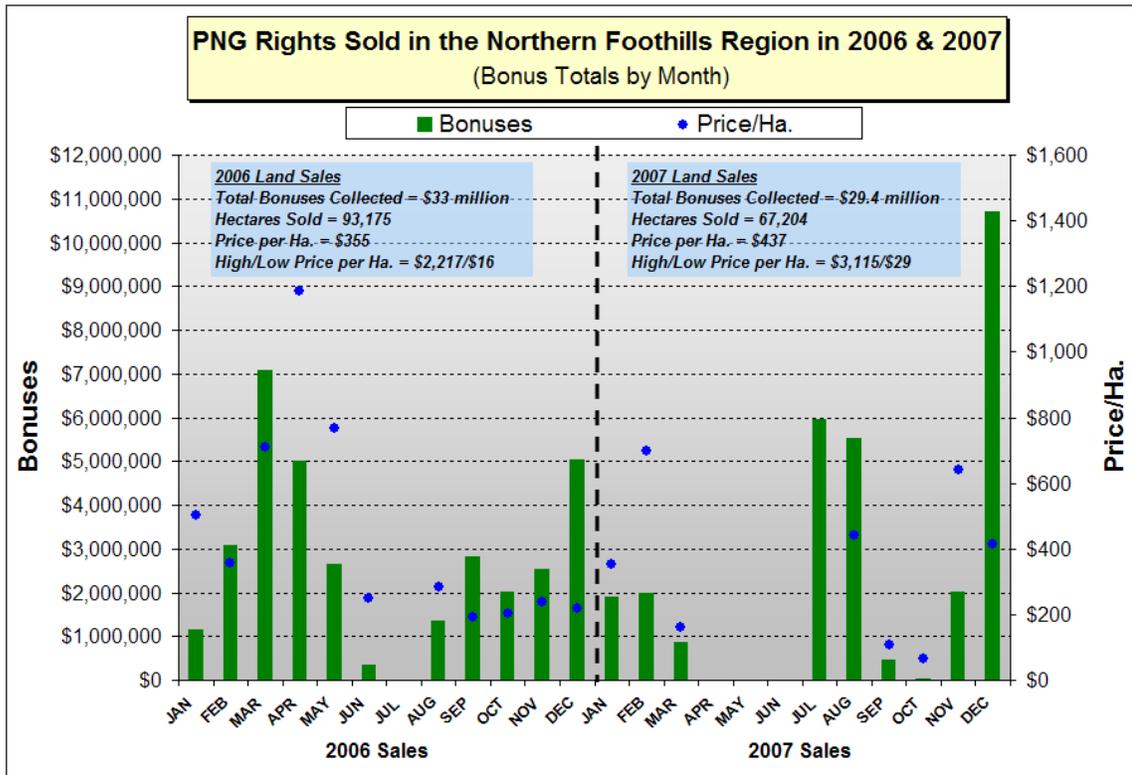


Figure 29. PNG rights sold in the Northern Foothills region in 2006 and 2007.

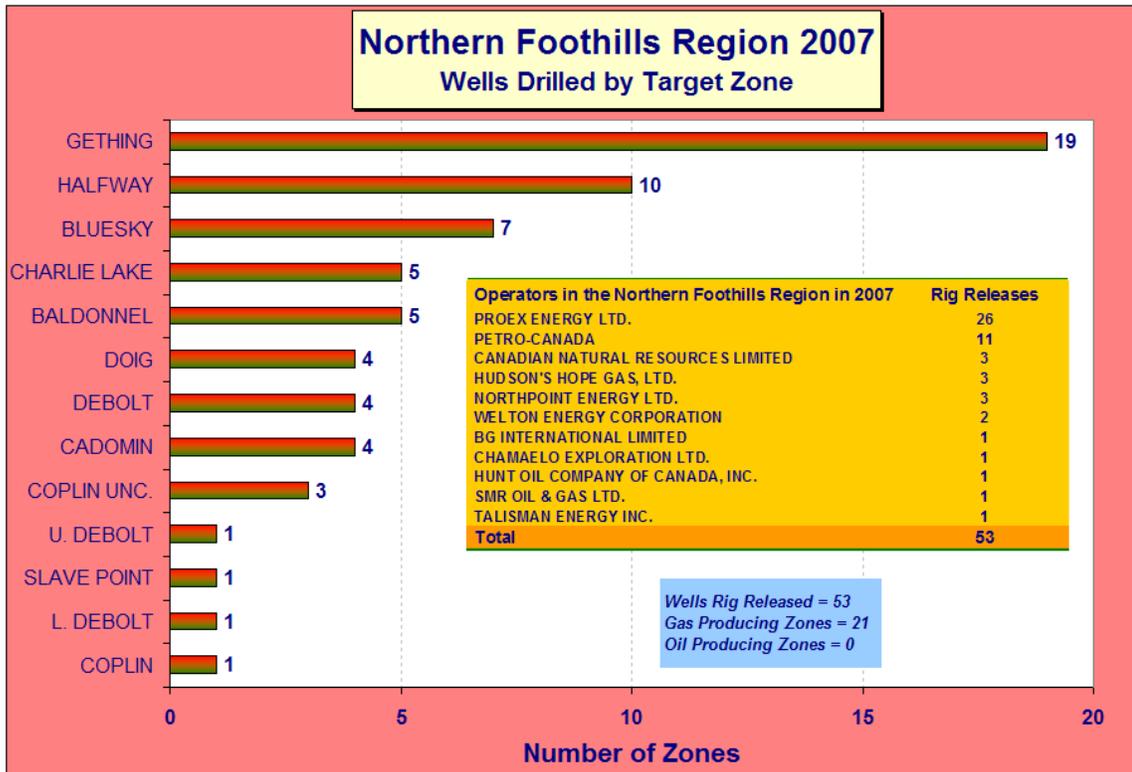


Figure 30. Target zones from wells rig released in the Northern Foothills region in 2007.

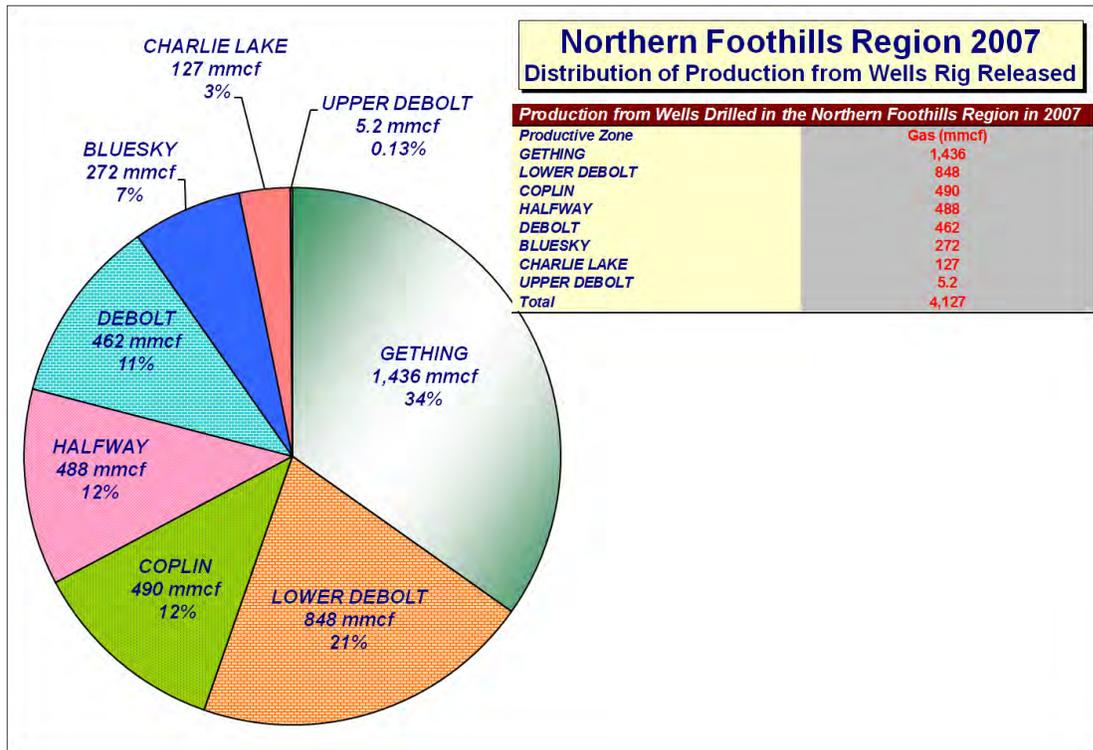


Figure 31: Distribution of production from wells rig released in the Northern Foothills region in 2007.

Southern Foothills Region

The Southern Foothills region of northeastern British Columbia covers an area of 1.2 million hectares (Figure 32). The region has varied topography, ranging from low rolling hills in the east to anticlinal hills and relief of 1,800 metres in the western region. This topography reflects the structure of underlying bedrock, which ranges from Palaeozoic in the southwest to Upper Cretaceous in the northeast. Exploration for natural gas in the Southern Foothills region tends to hold a moderate to high associated risk along with relatively high capital costs. But hydrocarbon traps found within these folded and faulted structures can contain large reserves of natural gas, occasionally with extraordinary productivity. Faulted Triassic Baldonnel and Charlie Lake formations are the principal exploration targets in the region.

Land Sales

In 2007, industry paid \$39.1 million to acquire PNG rights in the Southern Foothills region, a 77 per cent drop from 2006 (Figure 33). The number of hectares sold also fell significantly from a year earlier as only 15,947 hectares were purchased in 2007 compared to 70,061 in 2006. The average price per hectare held steady at \$2,445, slightly higher than 2006. The most popular area for PNG rights sales was in the Burnt River, Highhat Mountain and Gwillam areas in the northern half of the region. There was also some land sale activity further south in the Ojay area. Only 10

parcels were purchased throughout the year with Standard Land Company Inc. paying the top bonus of \$8.6 million for a 3,248-hectare drilling license near the Gwillim area. The parcel, acquired at the December 2007 tenure sale, covers rights to the base of the Pardonet-Baldonnel zone to the basement. The area offers ample drilling opportunities on seismically defined structures with significant gas development potential. Faulted Triassic Baldonnel and Charlie Lake formations are key exploration objectives. The Gwillim area also offers infrastructure development opportunities to facilitate market access for expanded gas production volumes. The second most expensive parcel sold in the year was west of the Highhat Mountain area, where a 2,054-hectare licence was purchased by Scott Land & Lease Ltd. for \$8.5 million.

Drilling

A total of 26 wells were rig released in the Southern Foothills region in 2007. The most active operators in the Southern Foothills region tend to be the large producing companies such as those listed in Figure 34. The busiest areas for drilling activity in 2007 were the Ojay and Bullmoose fields with 10 and four wells drilled, respectively.

Production

The distribution of production from wells rig released in the Southern Foothills region in 2007 is shown in Figure 35.

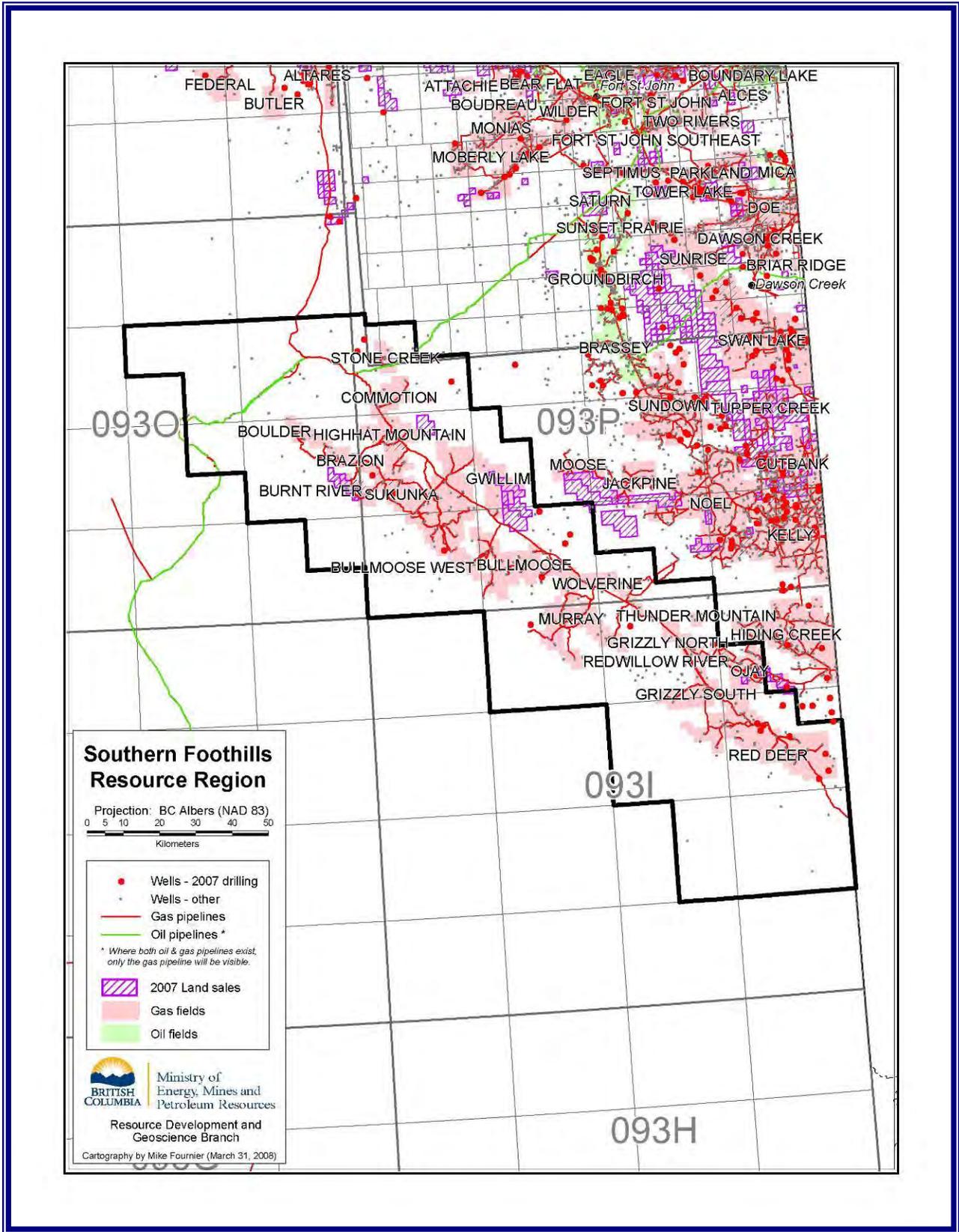


Figure 32. Land sale and drilling activity in the Southern Foothills region of NEBC in 2007.

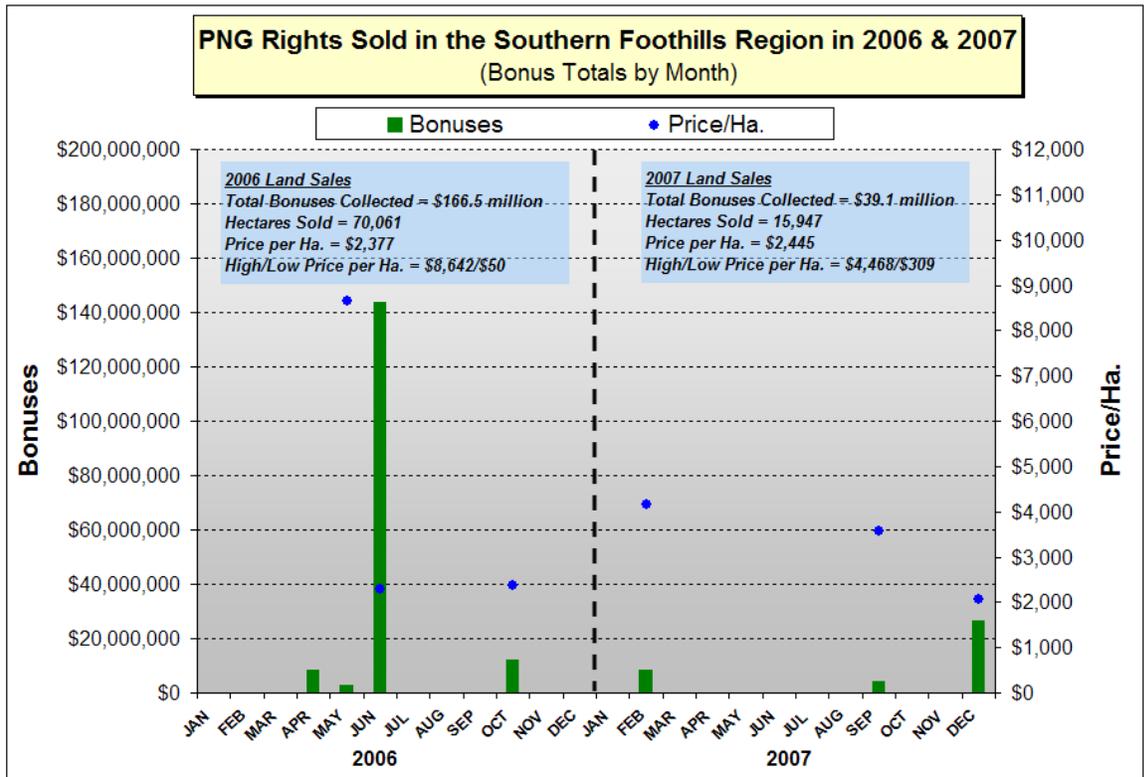


Figure 33. PNG rights sold in the Southern Foothills region in 2006 and 2007.

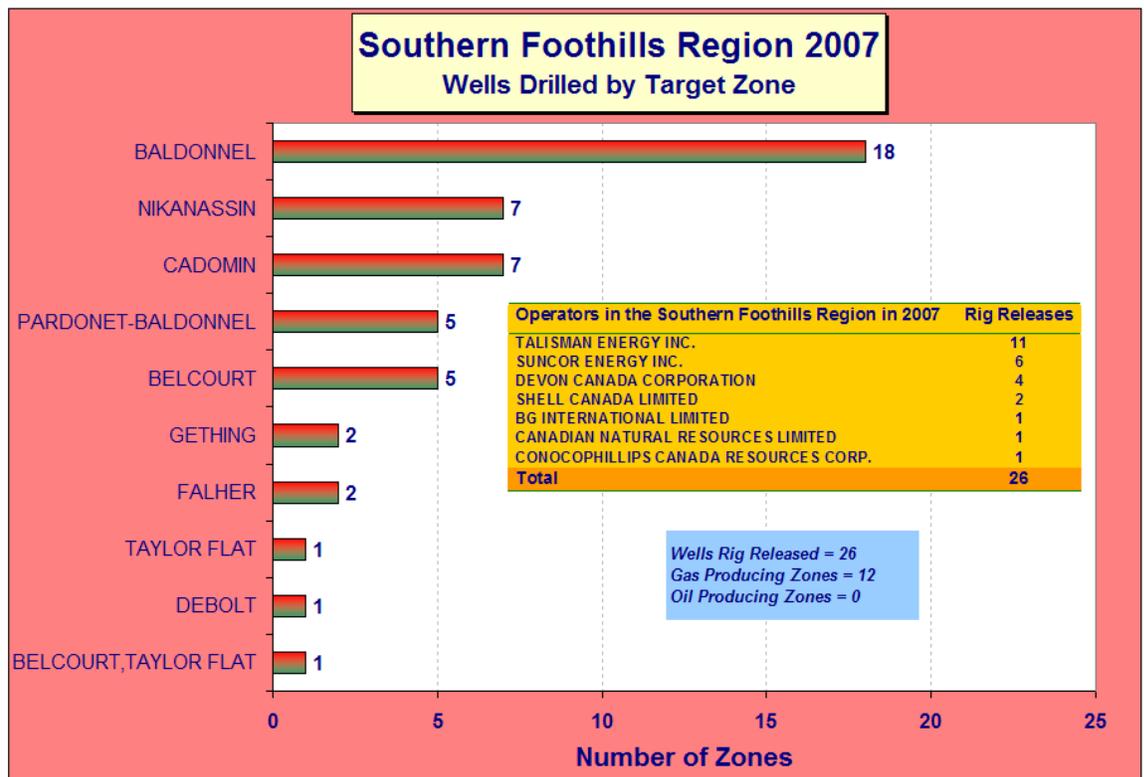


Figure 34. Target zones from wells rig released in the Southern Foothills region in 2007.

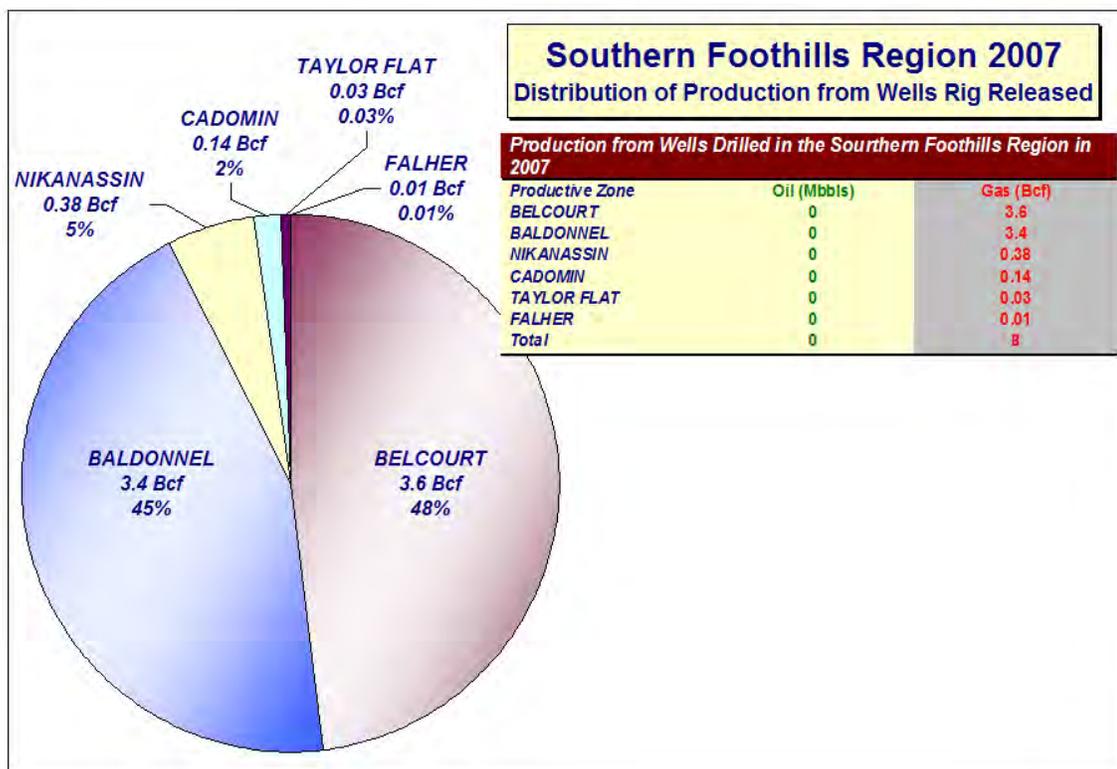


Figure 35. Distribution of production from wells rig released in the Southern Foothills region in 2007.

Oil & Gas Exploration Activity

The highest drilling activity in the Southern Foothills occurred in the **Ojay** area. **Devon Canada Corporation** drilled four outpost wells in the area with two wells showing gas production from the Cretaceous Cadomin, Falher and the Jura-Cretaceous Nikanassin. The most productive well in the Ojay area was drilled by **Canadian Natural Resources Ltd.** The well at c-19-K/93-I-9 shows gas production from the Triassic Baldonnel at an average rate of over 23 mmcf per day with production of 7.4 Bcf between December 2007 and November 2008. Chasing the deepest zone at Ojay was **Suncor Inc.** with an outpost well at c-49-J/93-I-9. The well reached a total depth of 4,970 metres in the Taylor Flat Formation (Early Pennsylvanian). Production of 32 mmcf was reported from this well in February 2008.

The **Bullmoose** area was the second most active in terms of 2007 rig releases. Three wells were drilled by **Talisman Energy Inc.** and the other by **Shell Canada Limited.** The wells drilled by Talisman targeted the Cretaceous Cadotte, Falher and Nikanassin with no production reported. Shell Canada's horizontal outpost well reported production from the Baldonnel of 33.5 mmcf in November 2007. It appears Shell Canada is looking to extend its Bullmoose area play further east. The producer was very active at the January 2007 PNG rights provincial auction where it purchased three parcels for a total of \$37.4 million covering portions of map sheets 93-P-2, 93-P-3, 93-P-6 and 93-P-7.

Talisman Energy Inc. was the busiest operator in the Southern Foothills region in 2007 with 11 rig releases. The producer remains focussed on its complex over thrust/faulted projects within the Southern region.

In April 2008, a completed multizone well in the **Brazion** area (a-26-E/93-P-5) came on stream and was forecast to produce at a constrained rate of 24 mmcf a day sales gas. The well is a component of Talisman's deep gas strategy and of its continued commitment to conventional gas production in British Columbia. Talisman expects to spend approximately \$230 million in 2009 on exploration and development in its active **Monkman** area of northeast BC and in the northern Alberta Foothills areas.

The **National Energy Board (NEB)** had set a hearing date of October 28, 2008 for the proposed 149-kilometre **Redwillow** natural gas pipeline, which will transport 70 mmcf per day of dehydrated sour natural gas from the Grizzly Valley into existing Alberta gathering and processing facilities. The **SemCAMS Redwillow ULC** pipeline project will allow anchor customers such as **Shell Canada Energy** and **Husky Oil Operations Limited** to begin early commercial gas production from its projects in the **Wolverine River** area. Meanwhile, the NEB has approved the **Spectra Energy Transmission** Grizzly Pipeline looping project in the Southern Foothills region. The looping project, which is a component of the Spectra-owned Pine River gas plant expansion, will enable gas producers upstream of the Kwoen sour gas facility to have their sizable potential and established gas reserves treated for sour gas and brought to market. Most of these reserves, which can have an acid gas content of up to 30 per cent, are located in the Murray River and Ojay areas of the Southern Foothills region.

INTERIOR BASINS OF BRITISH COLUMBIA

The Resource Development and Geoscience Branch (RDGB) continues with its efforts to determine the petroleum potential of the Nechako Basin. The Nechako Basin is one of several intermontane basins within British Columbia and occupies the central and southern part of the Interior (*Figure 36*).

The Nechako Basin Project is in its third full year of a multi-year research program designed to generate new geoscience data and interpretations to facilitate oil and gas exploration. The program includes geological field reconnaissance, Rock-Eval, thermal maturity, reservoir quality analyses, apatite fission track thermochronometry, biostratigraphy, and radiometric dating. In 2007, field work focussed on the northwestern part of the basin and in the Skeena Arch. The Jurassic Smithers and Ashman Formations as well as the Cretaceous Skeena Group were evaluated for source and reservoir potential (Riddell and Ferri 2008).

In July of 2008, a new seismic survey funded by the province was announced by Geoscience BC. The \$2.5 million Vibroseis seismic reflection survey was conducted in the northern part of the Nechako Basin. The 350 line-kilometre survey will assist in determining the petroleum potential of the Nechako Basin and will potentially provide diversification opportunities for companies hit hard by the forest industry downturn. It may also help offset the economic impact of the Mountain Pine Beetle infestation in the area. The seismic work is the first to be carried out in the area since the early 1980s when Canadian Hunter Exploration collected approximately 1,300 kilometres of seismic data using Vibroseis. The initiation of this survey accompanies ongoing seismic monitoring, geophysical and geological studies of the Nechako Basin. These studies are supported by the BC Ministry of Energy, Mines and Petroleum Resources and Natural Resources Canada in partnership with Simon Fraser University, the University of British Columbia and Geoscience BC.

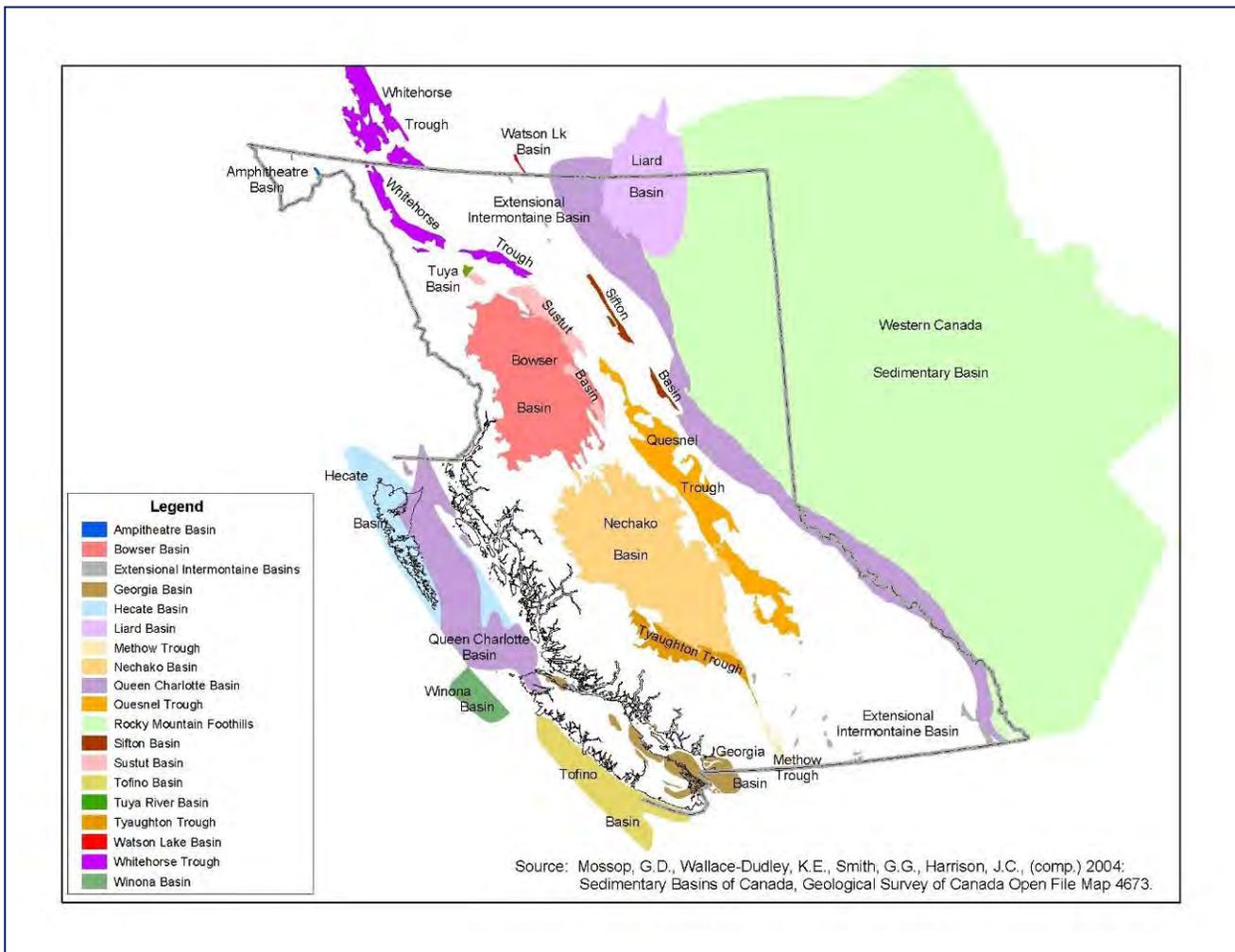


Figure 36. The resource basins of British Columbia.

COALBED GAS IN BRITISH COLUMBIA

The Government of British Columbia will continue to encourage coalbed gas development with the intent of demonstrating that British Columbia is a leading socially and environmentally responsible coalbed gas developing jurisdiction. New standards announced and outlined in the February 2007 BC Energy Plan state that companies will not be allowed to surface discharge produced water. Any re-injected produced water must be injected well below any domestic water aquifer.

British Columbia is still in the early stages of coalbed gas (CBG) exploration and evaluation, but the potential for CBG becoming a new source of gas supply is increasingly significant. The province has an estimated resource of 100 Tcf of coalbed gas. The

resource is distributed throughout the province and is generally close to markets and infrastructure (*Figure 37*).

2008 was a significant year for British Columbia's coalbed gas industry as the first commercial production of coalbed gas was realized with **Hudson Hope Gas Ltd.** sending gas to the sales pipeline in December. Industry continues to acquire petroleum and natural gas rights and has spent over \$150 million on various evaluation projects. Other projects in the Peace River and Elk Valley Coalfields are progressing and expect to reach commercial production in 2009. There have been 98 wells drilled in the province to date that are identified as coalbed gas wells.

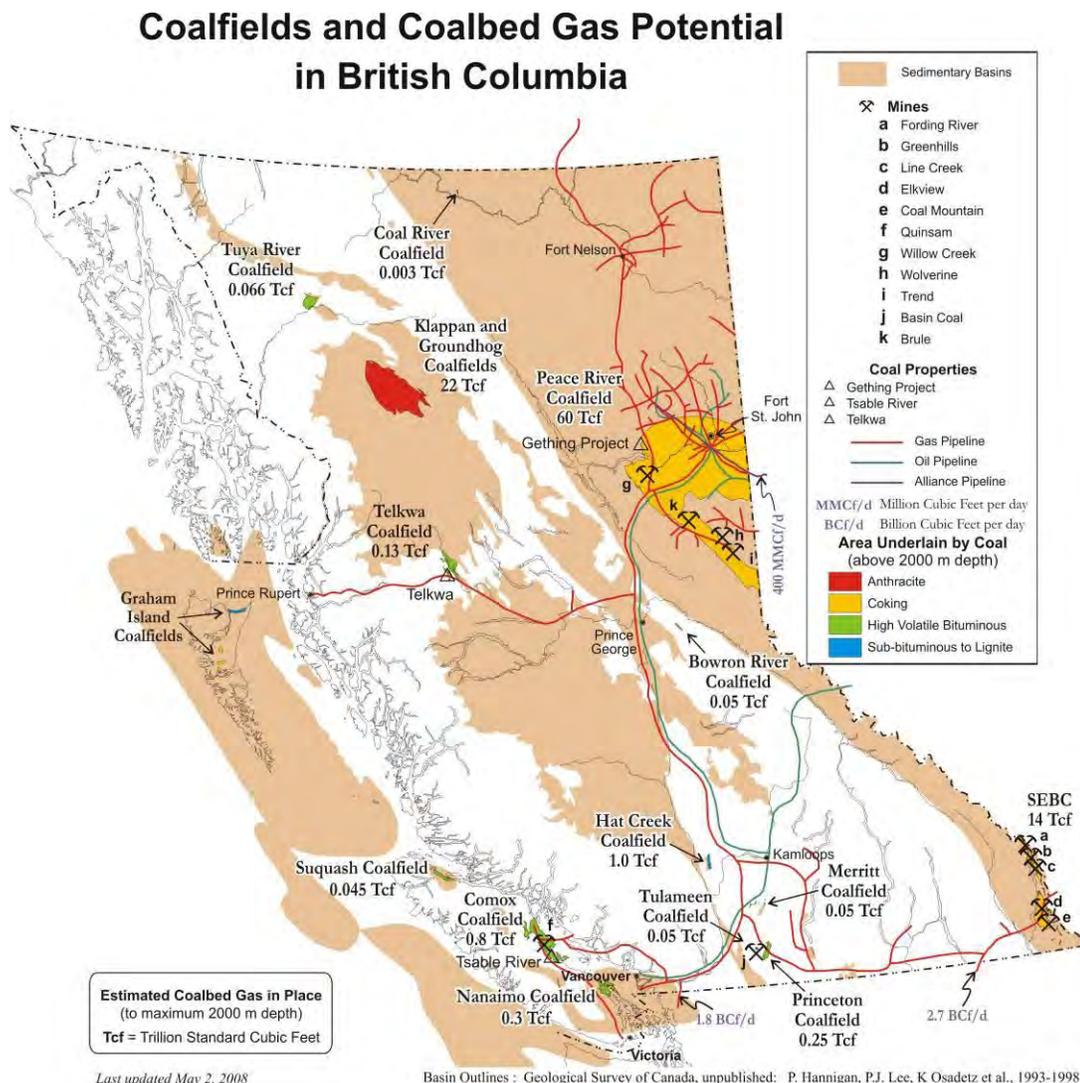


Figure 37. Areas of coalbed gas (CGB) potential in British Columbia.

CBG Tenure Activity in 2007/2008

In British Columbia, coalbed gas (CBG) is developed and regulated in much the same way as natural gas. A company must obtain petroleum and natural gas (PNG) rights in order to develop CBG. In 2007, eleven parcels sold were attributed to coalbed gas exploration. A total of \$756,626 in bonuses were paid to acquire rights to the Cadomin-Dunlevy-Nikanassin on 5,462 hectares in the Hudson's Hope area.

In 2008, **Shell Canada Limited** acquired approximately 95 sections of shallow rights in the Farrell Creek area of northeast BC. In December 2008, tenure disposition was made to **BP Canada Energy Ltd.** (BP) under terms set through an Order in Council. **BP** acquired the shallow rights on 16,740 hectares and the deep rights for water disposal wells on 32,585 hectares in the Crowsnest coalfield.

Freehold coal owners continued to request and acquire petroleum and natural gas rights. In 2003, an agreement was made with major freehold coal owners that they may apply for Crown petroleum and natural gas tenure overtop of their coal rights. Upon receipt, the applications go through the normal pre-tenure referral process, after which the tenure goes on for approval pursuant to section 72 of the *Petroleum and Natural Gas Act*. The rights do not go to public auction. The freehold coal owners had until December 2008 to make selections for PNG rights on their freehold.

The following tenure requests relate to freehold coal owners:

- **Quinsam Coal** (Hillsborough Resources Limited) has applied for a total of 13,970 hectares on their freehold properties near Campbell River on Vancouver Island. Quinsam Coal has formed a partnership with **Cornerstone Gas Corp.** to evaluate the coalbed gas in the **Comox** coalfield.
- **West Fraser Timber Co. Ltd.** (formerly Weldwood of Canada Ltd.) applied for gas rights on its freehold properties near Tsable River in the **Comox** coalfield. In 2008, **Compliance Energy Corporation** acquired the freehold coal and mineral rights and has initiated a request for the gas rights under the Freehold Coal Agreement.
- In the **Crowsnest** coalfield, of southeast BC, a tenure disposition to **Elk Valley Coal Partnership** (EVCP) was confirmed in March 2005 for 10,359 hectares on its freehold properties. In 2006, EVCC applied for the rights for an additional 5,556 hectares. A tenure referral was conducted in the spring of 2008 and tenure disposition followed in early 2009 by terms approved through Order-in-Council.
- Also in the **Crowsnest** field, **Tembec Inc.** has made selections of 4,696 hectares for PNG rights on its freehold coal properties.

CBG Drilling Activity in 2007/2008

The BC Oil and Gas Commission (OGC) approved 23 CBG well authorizations in 2007/08. Eleven of these well authorizations have been drilled bringing the total number of CBG wells drilled in British Columbia to 98 wells (*Table 1*).

**TABLE 1. COALBED GAS DRILLING ACTIVITY
1985 – 2008**

Year	AUTHORIZED TEST HOLES AND CBG WELLS			AUTHORIZED TEST HOLES AND CBG WELLS DRILLED
	Test Holes	CBG Wells	Total	
1985 to 2000	10	9	19	17
2000 - 2001	4	21	25	11
2001 - 2002	12	1	13	17
2002 - 2003	1	1	2	2
2003 - 2004	5	6	11	7
2004 - 2005	13	6	19	12
2005 - 2006	28	0	28	9
2006 - 2007	6	8	14	12
2007 - 2008	0	23	23	11
Total	79	75	154	98

In 2007/2008, the OGC approved ten CBG well authorizations for **Hudson's Hope Gas Ltd.** in the Hudson's Hope area of northeast BC; drilling proceeded on five of these applications. Also in the northeast, four CBG well authorizations were approved and drilled by **Canadian Spirit Resources Inc.** and one was approved for **Koch Exploration Canada Corporation**. Two wells were approved and drilled by **Arawn Energy Ltd.**

In the Elk Valley area of southeast BC, the OGC approved four well authorizations for **Storm Cat Energy Corporation**.

The OGC received a scheme application from **Canadian Spirit Resources Inc.**, which was approved in January 2007 for a three-year period.

Industry Highlights

Northeast BC

Since 2003, **Canadian Spirit Resources Inc.** (CSRI) has been active in the **Farrell Creek** prospect north of Hudson's Hope. As of March 2009, CSRI held approximately 12,950 hectares of Gething Formation rights and approximately 11,914 hectares of Montney and other deep rights.

In 2008, CSRI announced it had entered into a joint venture with **Shell Canada Energy** (Shell) to advance the development of the Gething on a combined 37,556 hectares in the Farrell Creek area. Shell expanded CSRI's pilot program through the acquisition of approximately 95 sections of shallow rights. Since project inception to the end of 2007, CSRI had drilled eight test wells. In 2008, Shell, as the new operator, drilled four vertical wells on the property targeting the Gething and other shallow rights. A water disposal well was also drilled. CSRI is proceeding with the

engineering of a pilot facility and a tie-in plan. Tie-in to the Farrell Creek Pilot Project to Spectra Energy pipeline was expected in the first quarter of 2009.

CSRI is optimistic about the results of its Farrell Creek pilot program and anticipates continued development of commercial production from the area. Evaluation of the unconventional natural gas resource on CSRI-interest lands at Farrell Creek (Sproule Associates Limited) reaffirms a total raw gas-in-place of 1.8 Tcf (1.4 Tcf attributed to Gething, 0.4 Tcf to Moosebar and Gates).

In 2004, **GeoMet Inc.** set up **Hudson's Hope Gas Ltd. (HHG)** as its Canadian operating company in the Peace River project to assume operation of the existing **Peace River Corporation** wells. The Peace River project is comprised of approximately 20,311 hectares along the Peace River near Hudson's Hope, British Columbia. **GeoMet Inc.** and **Canada Energy Partners Inc.** each own a 50 per cent working interest in this project. Since inception, the project has drilled a total of 22 wells; four coreholes for determination of gas-in-place, two wells for water disposal, and 12 production wells, of which eight are on production.

The Peace River project targets the Lower Cretaceous Gething coals with an average coal thickness of 16 metres over the acreage and an average gas content of 400 cubic feet per ton. Water disposal capacity for the initial eight production wells has been established and a feasibility plan has been approved by OGC. In July 2007, Canada Energy Partners reported an estimated total gas-in-place of 1.07 trillion cubic feet (**Netherland, Sewell & Associates, Inc.**) for the Peace River Project. A February 2009 assessment prepared by Netherland, Sewell & Associates, Inc. increased that estimate to 1.47 Tcf.

In 2008, the OGC approved nine well authorizations for this project. **Hudson's Hope Gas Ltd. (HHG)** completed the installation of a water and gas gathering system, associated pipelines, treating and compression facilities, and by year end, had initiated gas sales. This achievement by **HHG** is significant as it represents the first commercial production of coalbed gas in the Province of British Columbia. The eight wells on production represent the first phase of a project with a potential 315 well locations.

In 2007, **BP Canada Energy Company** completed evaluating data from its **Ojay** area project and conducted reservoir simulation activities. BP acquired the Ojay property (south of Dawson Creek) in 2000. In 2001, two wells were drilled and completed in coal seams of the Lower Cretaceous Gates Formation. Both wells were placed on long term production tests producing both gas and water. The wells were subsequently shut-in in 2002. BP will continue to develop a production plan for this project in 2008.

In 2008, **Arawn Energy Ltd.** initiated its first project, which, under existing agreements, will earn interest in 17,560 hectares in the **Grizzly** and **Red Deer** area prospects near Fort St. John. **AJ Lucas Group Limited** (Australia) is a partner in the Grizzly Project. Arawn

drilled two wells in 2008. The Grizzly c-55-B/93-I-15 well (spudded February 16, 2008) was drilled to a vertical depth of 460 metres and cored proving over 40 metres of coal in the wellbore. Arawn intended to complete drilling and coring in 2008 in conjunction with reservoir testing to validate the formation properties, especially permeability.

Southeast BC

In October 2006, **Storm Cat Energy Corporation (Storm Cat)** assumed ownership and operational responsibility for the **Elk Valley** project on 31,110 hectares, which was previously owned and managed by **EnCana Corporation**. Storm Cat had reactivated the EnCana Elk Valley pilot (2000 to 2004), in which 19 exploratory wells were drilled.

In 2007, the OGC approved four well authorizations for this project. Storm Cat finished completion and commenced production of the five wells drilled in 2006. To advance de-watering efforts, larger downhole equipment and fluid level sensors were installed. Storm Cat's activities to date have been encouraging, resulting in the production of 2,000 to 2,500 barrels of water per day and upwards of 1.3 mmcf per day from the nine producing wells. Storm Cat has OGC approval for a gas line to tie-in to an existing pipeline. The gas line has been surveyed and right-of-ways have been secured.

In April 2007, following evaluation of a proposal submitted in response to the Ministry of Energy, Mines and Petroleum Resources 2003 Call for Proposals, **BP Canada Energy Company (BP)** was acknowledged as the sole proponent to evaluate Crown available coalbed gas resources in the **Crownest** coalfield subject to successful negotiations of the terms and conditions of a tenure agreement. BP's Mist Mountain Coalbed Gas Project will include three to five years of environmental studies, technical activities and ongoing public consultation. In addition to seeking Crown tenure, BP has entered into a commercial agreement with **Elk Valley Coal Corporation (EVCC)** to evaluate CBG opportunities on EVCC-owned land.

Throughout 2007, BP conducted extensive public consultation activities which included engaging with local government representatives, First Nations, rights-holders and local residents, in the City of Fernie and the Districts of Sparwood and Elkford. In July 2007, BP began a comprehensive environmental baseline data collection program in the region.

From February 21 to April 21 2008, the Ministry of Energy, Mines and Petroleum Resources conducted a tenure referral for BP's project proposal. The tenure agreement was finalized in December 2008 on terms approved by Order-in-Council. BP will defer technical appraisal, the drilling of any wells and acquisition of seismic data, until mid to late 2009. This will allow for more time to continue environmental studies and plan for an environmentally responsible development that is consistent with local community values.

Northwest BC

In 2004, **Shell Canada Limited** (Shell) acquired petroleum and natural gas rights in the **Klappan** coalfield to explore for an estimated coalbed gas resource of 11 Tcf. Shell holds 322,466 hectares in this coalfield located south of Dease Lake.

Three test holes were drilled and 84 kilometres of seismic was conducted in 2004. Shell delayed its exploration program for two years to allow for further consultation with First Nation leadership and the broader Tahltan and Iskut communities.

Shell prepared an exploration field program for 2007 to collect data to determine the potential for commercial development. The proposed program consisted of re-entering the three wells drilled in 2004 and drilling seven to 15 exploratory wells with accompanying logistical activities as well as ongoing environmental programs.

In August 2007, Shell proceeded with planned field operations and began upgrading the Ealue Lake Road in order to access the tenure area. In addition to road construction, on-going environmental studies as well as community and First Nation engagement activities were conducted. In April 2008, Shell indicated that it would be postponing drilling in recognition of First Nation's concerns with drilling in the summer (a high use time for this area).

In December 2008, Shell agreed to a tenure amendment, which specified a minimum two-year, no activity period. Shell retains its interest in the area; however, exploration activities have been suspended. The break in activity will allow for more discussions with First Nations who have expressed concerns about the project and will provide time for the Tahltan/Iskut First Nation to develop a community outreach program to increase local understanding about coalbed gas development.

Central BC

Petrobank Energy and Resources Ltd. (Petrobank) and its partners hold the coal, petroleum and natural gas rights in the **Princeton Basin**, an area which covers 15,379 hectares and contains very thick Tertiary-aged gas-bearing coals. Petrobank has been developing this play slowly, analyzing all available data and building relationships with the local community. In 2004, Petrobank drilled and completed an exploration well south of Princeton. The exploratory well intersected thick coals, which after completion and fracture treatment, flowed methane with minor amounts of fresh water.

For the second phase of exploration, Petrobank identified two additional locations for wells - one north and the other south of Princeton. In the fall of 2007, Petrobank began sharing exploration plans with the local community and First Nations and in 2008 submitted applications to the OGC. Petrobank has since delayed the drilling program in order to more fully engage with First Nations and the local community.

Vancouver Island

Quinsam Coal Corporation has an alliance with **CornerStone Gas** to explore for coalbed gas on its freehold coal properties near **Campbell River**. Quinsam has made selections on its freehold coal properties for petroleum and natural gas rights totalling 13,970 hectares in the **Comox** coalfield. In 2007, Cornerstone Gas conducted community and First Nation engagement activities regarding its proposed project in the Campbell River area. The tenure request has yet to go to a tenure referral.

West Fraser Timber Co. Ltd., formerly **Weldwood of Canada**, formed an alliance with **VWVulcan Energy of Canada, Ltd.** to explore for coalbed gas on its freehold coal properties in the Comox coalfield. West Fraser initiated a tenure request for acreage under the Freehold Coal Agreement. In 2008, **Compliance Energy Corporation** acquired the freehold coal and mineral rights and has initiated a request for the gas rights under the Freehold Coal Agreement.

CONCLUSION

British Columbia remains the second largest natural gas producer in Canada and the fourth largest crude oil producer. Annual marketable natural gas production has increased 40 per cent in the last decade and solid demand for natural gas continues to entice producers to invest in new exploration projects and develop new supplies from conventional and unconventional sources.

To further encourage growth in the energy sector, British Columbia has a number of incentive programs in place. For example, under the Infrastructure Royalty Credit Program 2009, the Province invited oil and gas companies to apply for a royalty credit to construct and/or upgrade roads and pipelines that would develop or sustain new oil and gas exploration and development activity. A royalty credit allocation of \$120 million was recently made available for this program and the credit can be as much as 50 per cent of the cost of constructing roads, pipelines or associated facilities. Improvements have also been made to the Deep Well Royalty Program, which is aimed at improving competitiveness and maximizing development of British Columbia's resources. The program specifically targets deep wells of more than 2,500 metres for vertical wells and more than 2,300 metres for horizontal wells. New well qualification criteria for the program entails a redefinition of depth determination, recognition of longer portions of horizontal lengths drilled, and a modification of the east/west line to reflect updated geological, reservoir and drilling data.

In addition, the province's Net Profit Royalty Program, initiated in May 2008 to encourage development of technically complex, high-risk projects, has garnered industry interest from a recent request for applications. Five companies that operate shale gas projects in the Horn River Basin have submitted proposals that may be eligible under the program. The Net Profit Royalty Program is a distinct targeted royalty program focusing on unconventional reservoir types

such as coalbed gas, shale gas, tight gas, enhanced gas recovery, enhanced (tertiary) oil recovery, gas hydrates, and resources remote from existing infrastructure. The program consists of a small gross royalty levied on production before payout of the capital investment, and thereafter a higher royalty rate applied to the net or gross revenue.

The BC Energy Plan (released in February 2007) outlines specific steps required to develop realistic and achievable goals for conservation, energy efficiency and clean energy. Among the BC Energy Plan's 55 policy actions, are the establishment of the Innovative Clean Energy Fund and measures to capture and store carbon dioxide emissions. Specific to oil and gas, the Energy Plan includes policies that attract oil and gas development investment through measures such as the Net Profit Royalty Program, promoting a BC service sector, undertaking geoscience programs, harmonizing and streamlining regulations, and developing a Petroleum Registry.

The oil and gas industry in British Columbia has seen unprecedented growth and investment over the last eight years. The trend towards both conventional and unconventional resource play development, promising discoveries, and a fiscal-friendly, non-prescriptive energy regime continues to give British Columbia a competitive advantage as an oil and gas jurisdiction. Industry activity in the province has been fairly robust in 2008 and is expected to remain strong in 2009. The Petroleum Services Association of Canada (PSAC) is estimating that 905 wells* will be drilled in British Columbia by the end of 2009. Despite a slumping North American economy, the provincial government is still forecasting revenue from natural gas royalties to reach \$1.38 billion in fiscal 2008/2009 and 1.01 billion in fiscal 2009/2010ⁱ.

ACKNOWLEDGEMENTS

I would like to thank Mike Fournier for his work on preparing many of the maps contained in this report and Cassandra Lee for her contribution of data, specifically related to the Horn River Basin and the Montney play region. This report has benefited greatly from reviews by Vic Levson.

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* Canadian Drilling Activity Forecast update from the Petroleum Services Association of Canada on January 28, 2009

ⁱ British Columbia Budget and Fiscal Plan 2009/10-2011/12 tabled on February 17, 2009



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