



The Status of Exploration and Development Activities in BC's Shale Gas Regions

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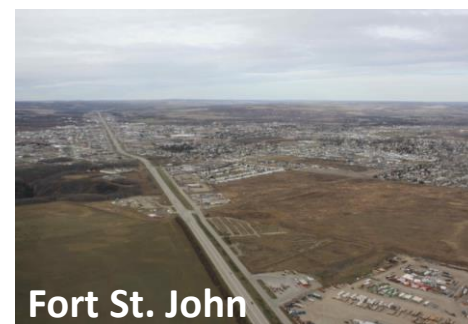
About this Presentation



This presentation has been prepared for the sole benefit of this audience and is an overview of industry exploration and development activity covering the shale gas regions in northeast British Columbia. All results are based on information available at the time of the review. Data for this summary has been collected from available public sources, including industry news and press releases. No confidential data or information has been utilized in its preparation. Readers are cautioned that the information provided does not necessarily represent official data prepared by the Ministry of Energy, Mines and Natural Gas. The Ministry of Energy, Mines and Natural Gas accepts no liability for errors or inaccuracies in information provided by others.

Presentation Outline

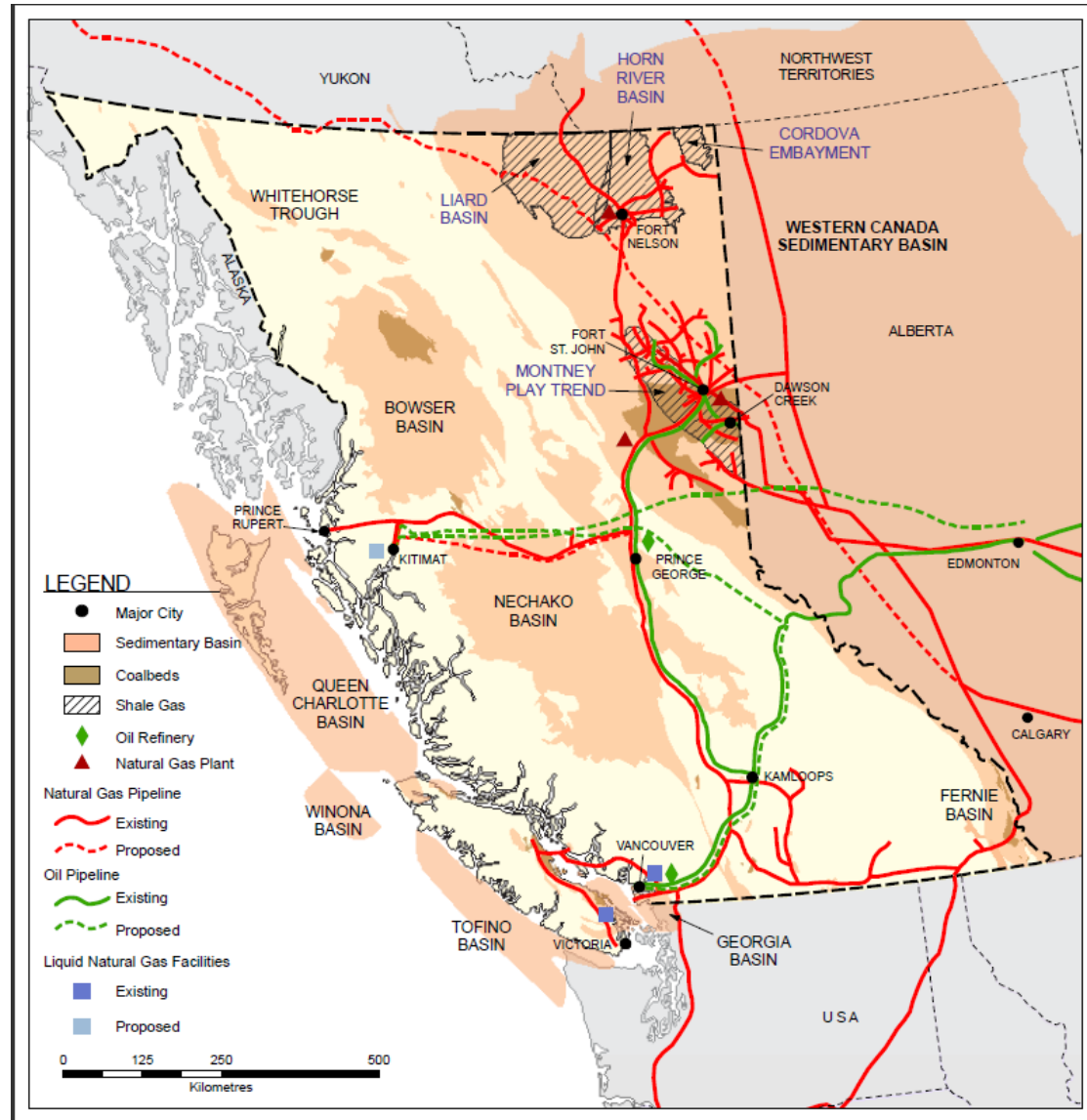
- **BC's Oil and Gas Profile, Production, Reserves, Resources**
- **Sector Indicators – land sales, wells drilled**
- **Examining Operator Activity by Shale Gas Region**
- **Summary**



BC Oil and Gas Profile



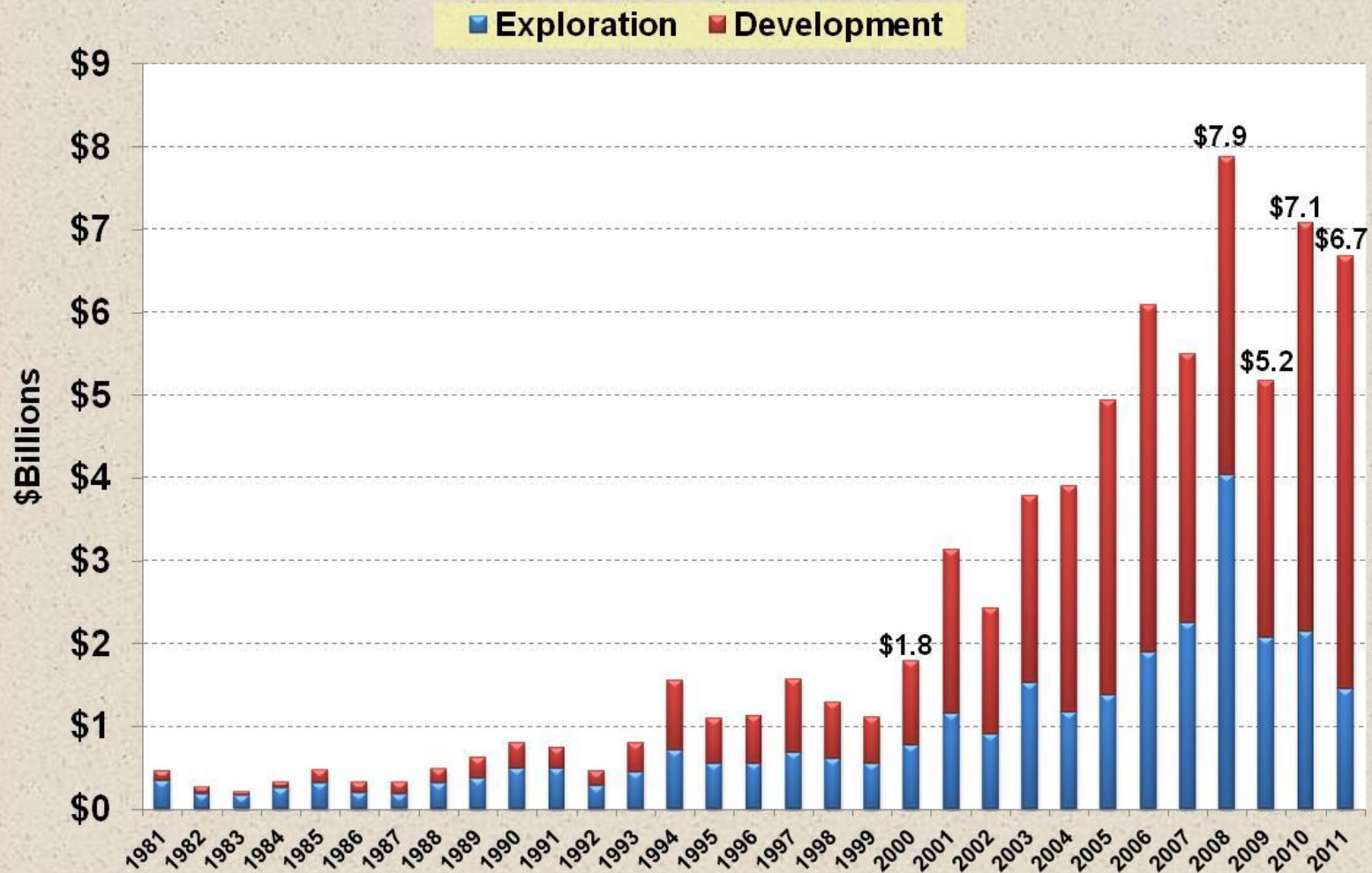
- Well connected to North American and Asian markets
- 90% of oil and gas rights owned by the Province
- BC's total oil and gas revenue in fiscal 2011/12 was \$1.37 billion.
- Oil and gas revenue in fiscal 2011/12 accounted for about 49% of total resource sector revenue in BC.



Capital Spending by Industry in British Columbia



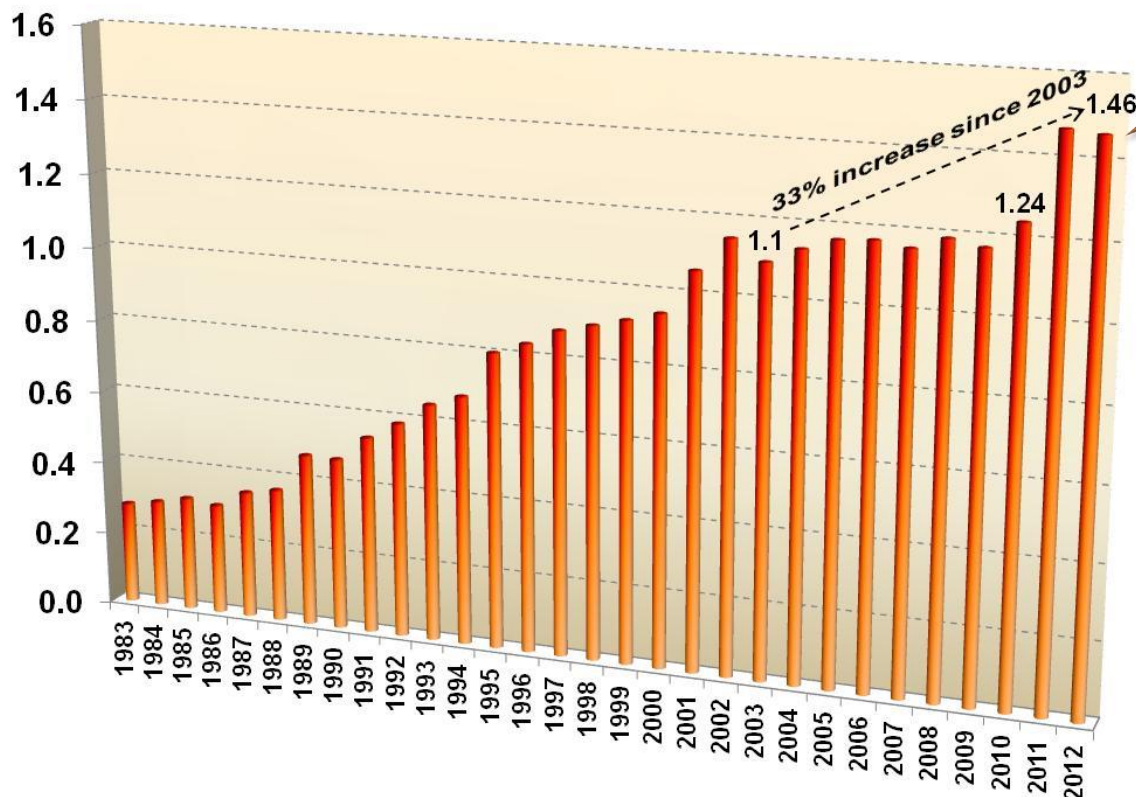
Industry Spending on Exploration and Development Activity in British Columbia



Source: CAPP

BC's Raw Natural Gas Production

Trillions of Cubic Feet

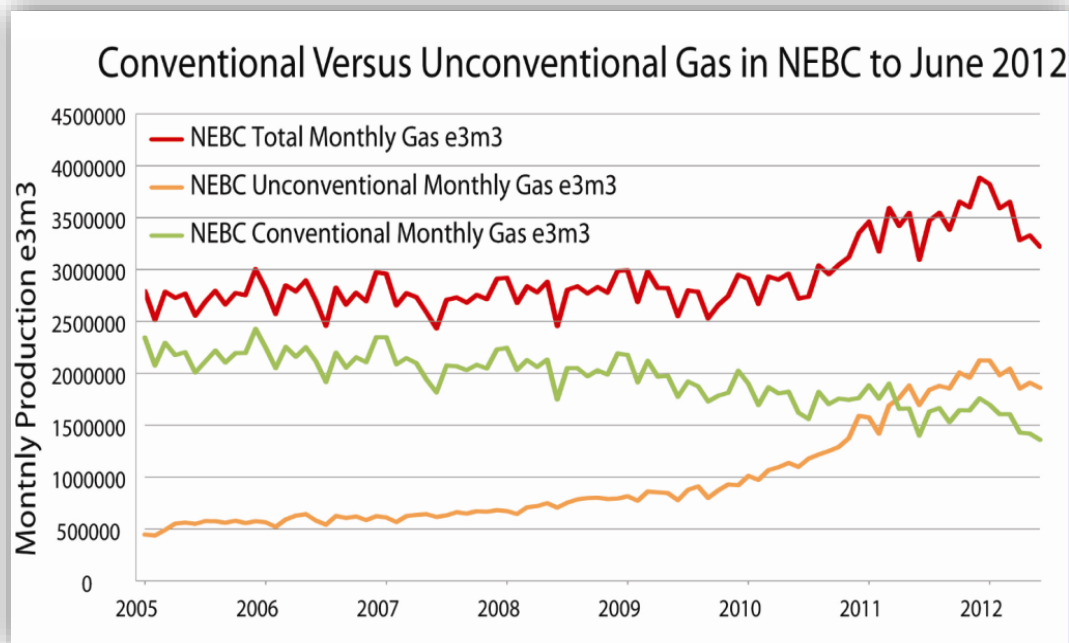


Now at 4
Bcf per day!

Source: Mineral, Oil and Gas Revenue Branch, Ministry of Finance

- BC produced 1.46 Tcf of raw gas in 2012 (1.27 Tcf marketable)
- BC consumed 15.2% of its marketable gas production in 2012 – remainder of production exported to eastern Canada and to the U.S.

BC's Conventional vs. Unconventional Gas Stream



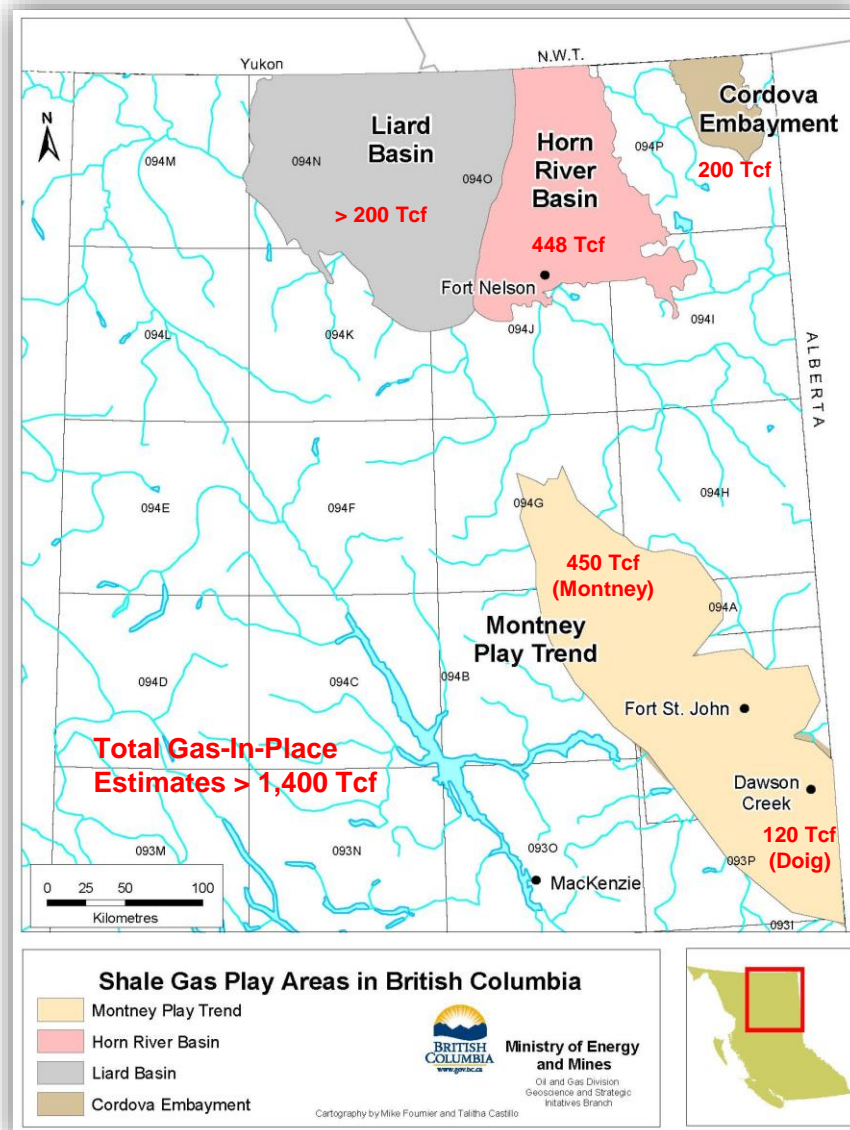
Source: BC Oil and Gas Commission, October 2012, Montney Formation Play Atlas NEBC, p. 4

- To June 2012, almost 60% of BC's gas production stream was from unconventional sources such as tight gas and shale gas.
- Horizontal multi-frac technology has increased production in many areas. Less than 30% of all gas wells drilled in BC are conventional vertical wells.
- Shift to unconventional gas continues...

Shale Gas Regions in BC

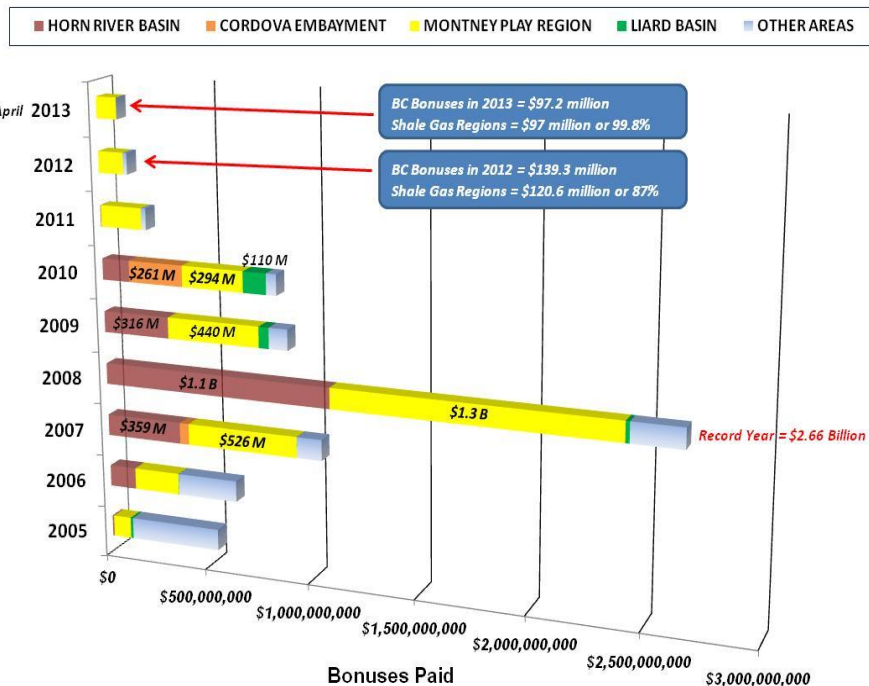
Unconventional Resources

- Enormous resource base in four basins
- Total GIP estimates may exceed 1,400 Tcf
- Shale gas potential within Devonian strata of Horn River Basin, Cordova Embayment and Liard Basin
- Several thick Devonian shale units have been the focus of most industry activity to date in Horn River. Some initial well production rates of 10 – 12 mmcf/d
- Triassic - several shale units – Upper, Middle and Lower Montney now producing in Montney play region – wet/dry gas

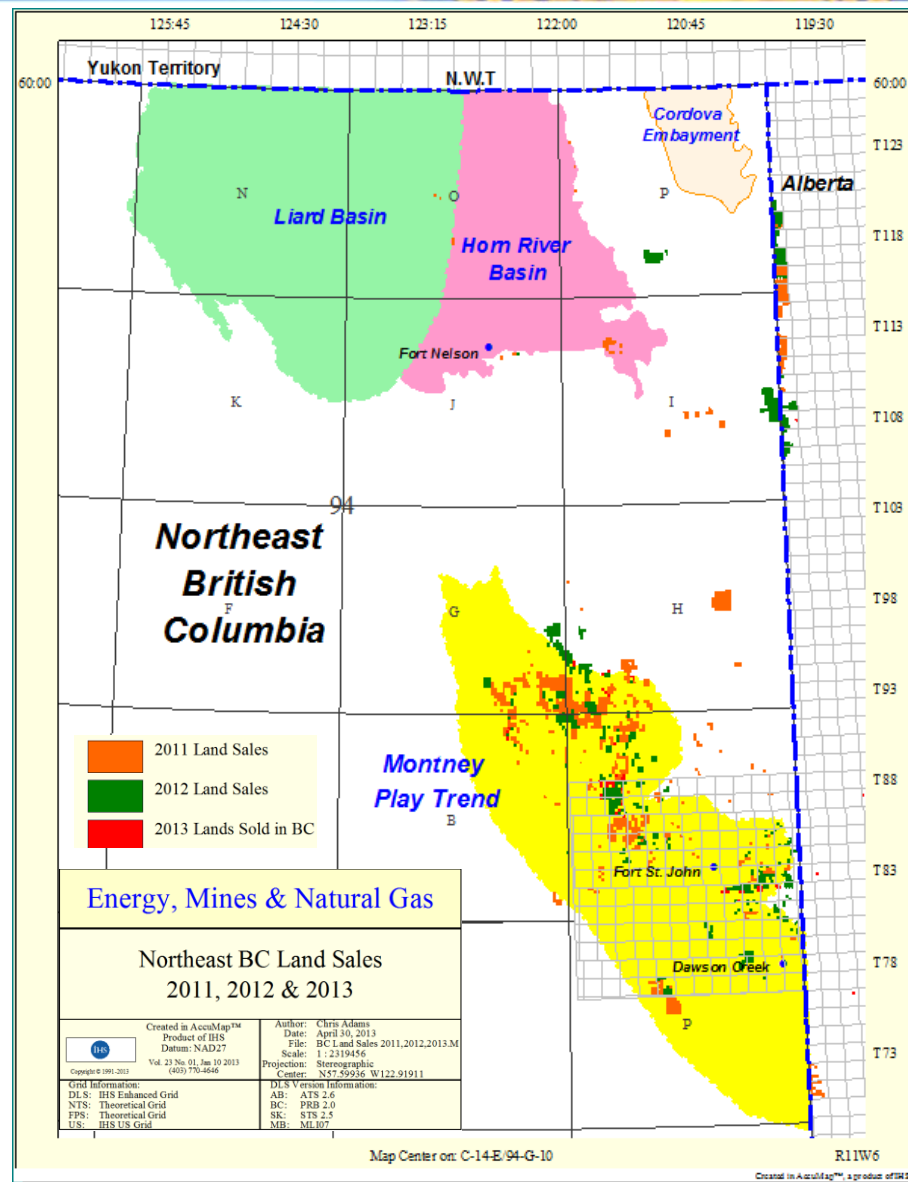


Land Sale Results in BC's Shale Gas Regions

Bonuses Paid for PNG Rights in BC's Shale Gas Regions

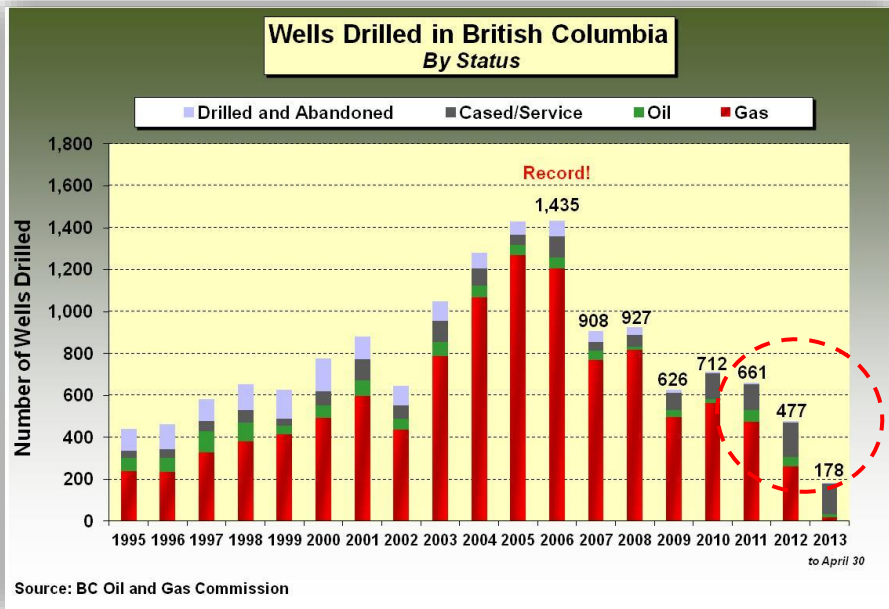


2011 land sales in BC - \$222.7 million on 191,534 hectares
 2012 land sales in BC - \$139.2 million on 61,969 hectares
 2013 land sales in BC - \$97.2 million on 45,489 hectares (to April)

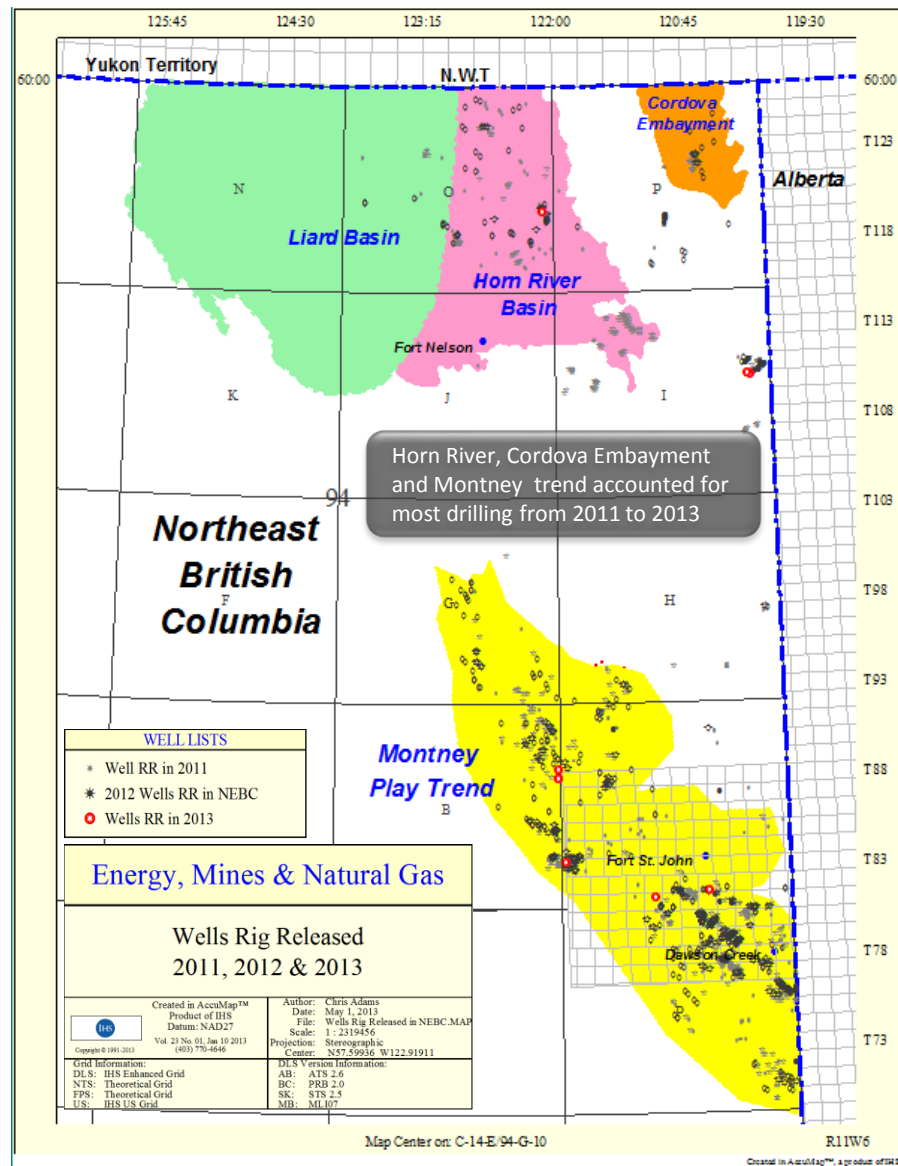


Where is the Drilling?

Mostly in the Horn River and Montney



- Record drilling achieved in 2006 but drilling levels have been down since. However, horizontal drilling is changing the way activity levels are measured (e.g. more metres drilled)
- BC has seen about a 67% drop in wells drilled since the record of 1,435 in 2006. So far in 2013, 178 wells have been recorded as rig released.
- The Petroleum Services Association of Canada is forecasting that 457 wells will be drilled in British Columbia by the end of this year (April 2013 PSAC forecast).

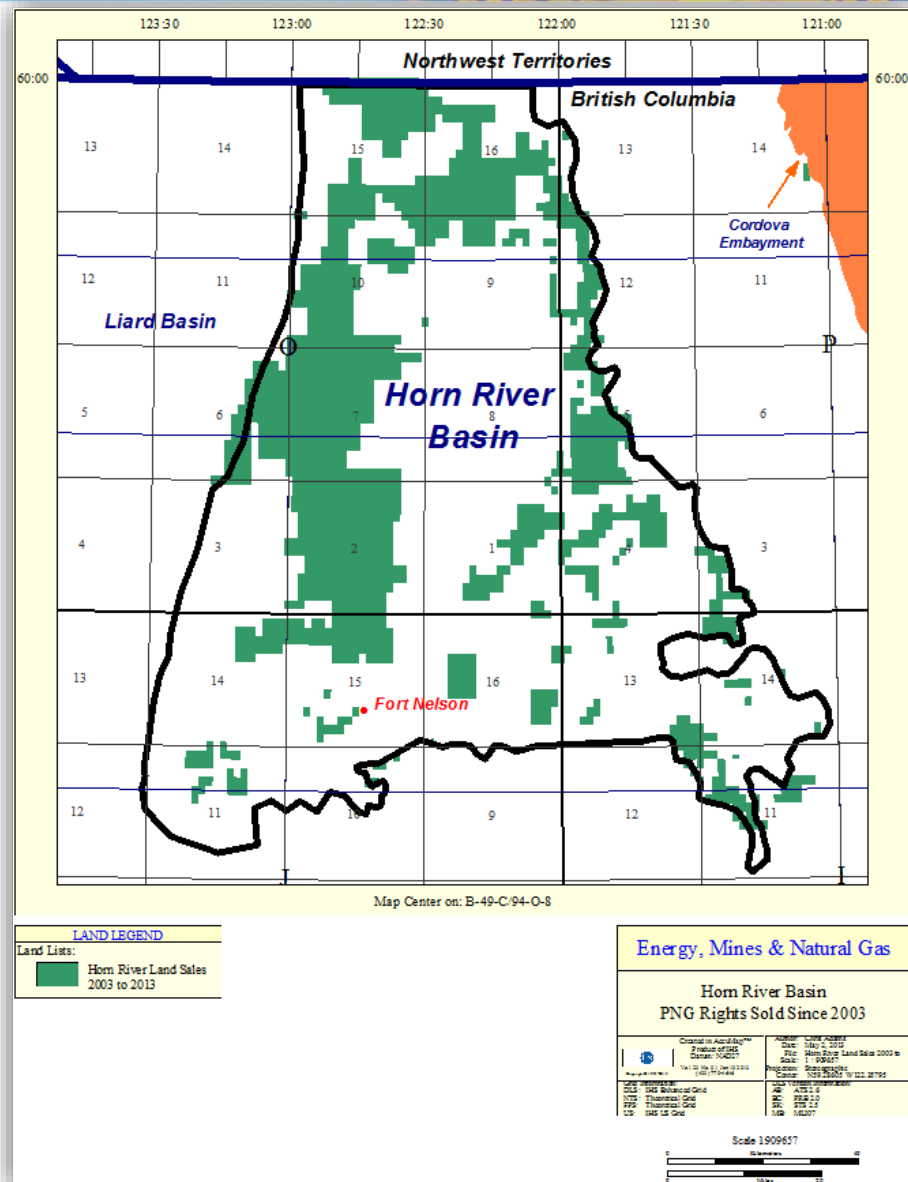
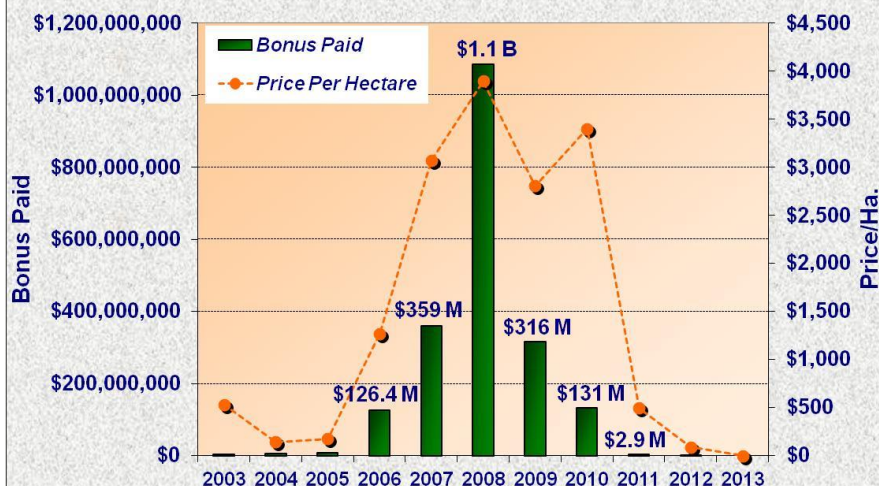


The Horn River Basin

Setting

- Area of activity is mostly north of Fort Nelson.
- Area of approx. 1.31 million ha. (140 townships)
- Potential in Devonian strata - primary targets Muskwa/Evie/Otter Park
- Ultimate GIP estimated at 448 Tcf
- Only \$2.9 billion in land sale bonuses in 2011
- \$23,330 on 269 hectares in 2012

PNG Rights Sales in Horn River Basin

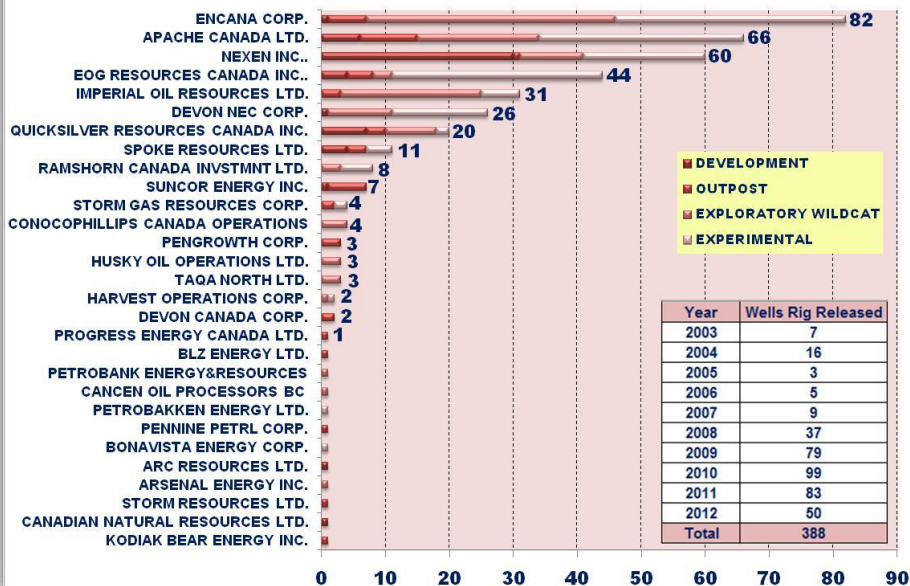


The Horn River Basin

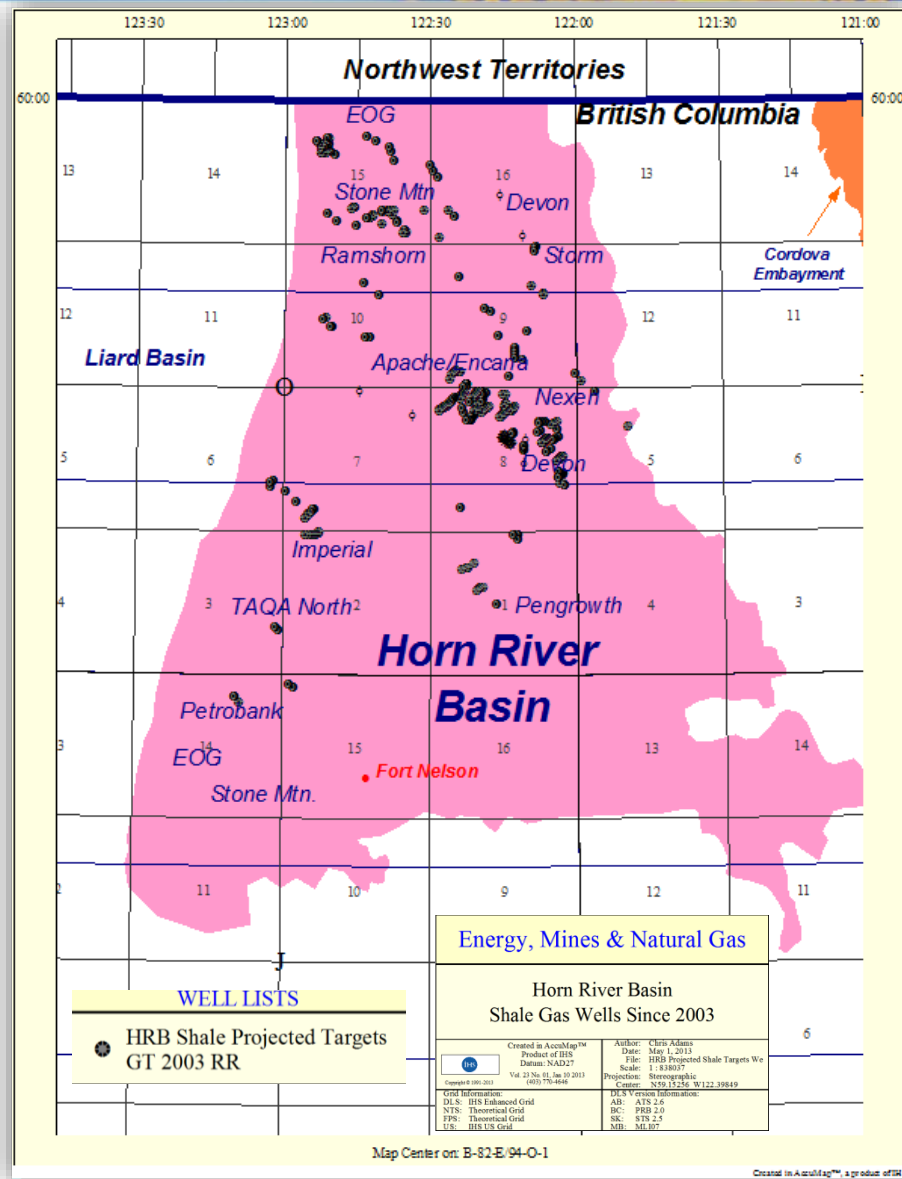
Drilling Activity



Wells Drilled Targeting Shale Gas Zones in the Horn River Basin
(2003 - 2012)



- Area of activity is mostly north of Fort Nelson.
- Since 2003, operators in the Horn River Basin have drilled 388 shale gas-directed wells under various Lahee classifications.
- Drilling peaked in 2010 with 99 wells rig released. That number has fallen to 50 in 2012.



The Horn River Basin

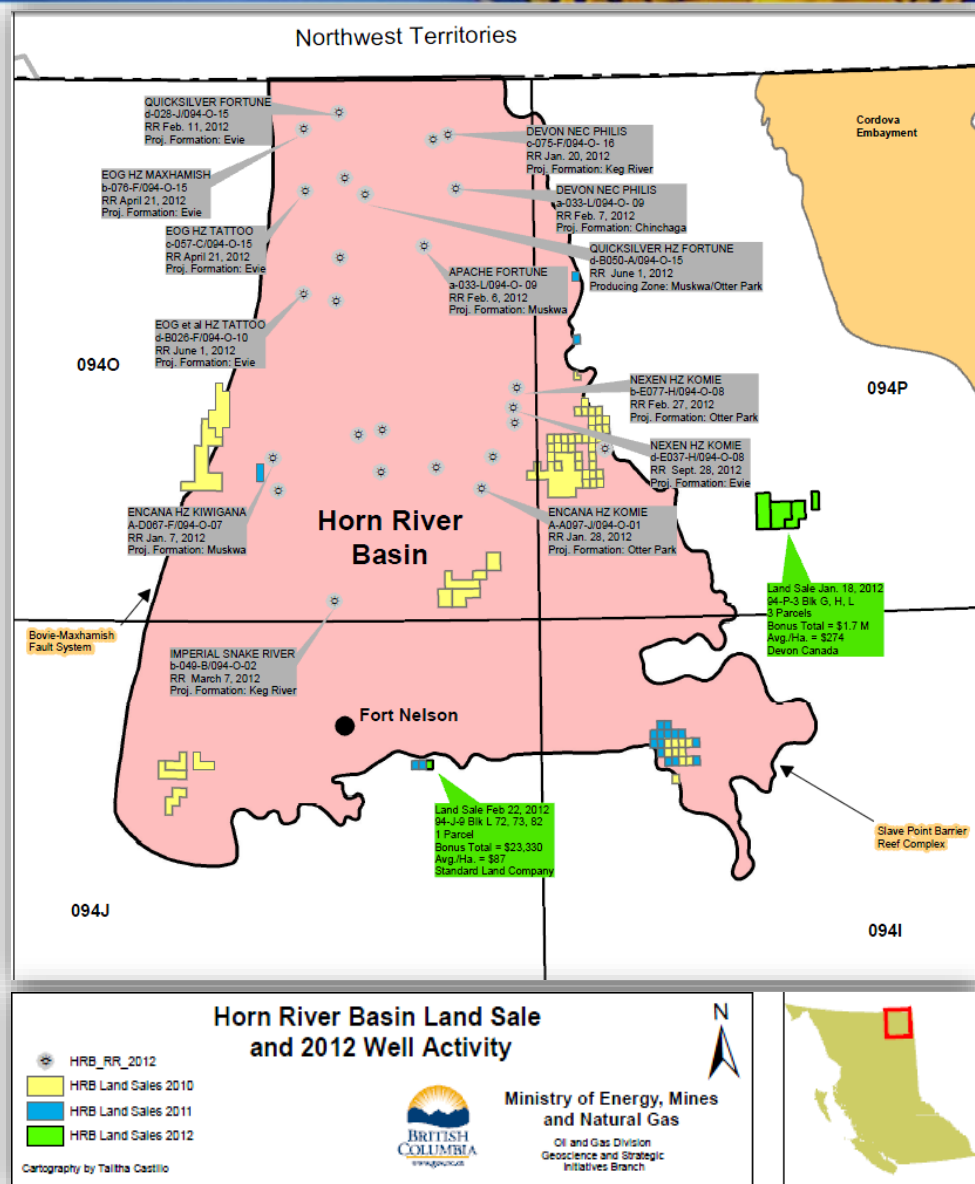
Current Operator Activity

Encana Corporation holds 116,549 net hectares (288,000 acres) in Horn River Basin. Most active shale gas operator in the Horn River Basin since 2003

- Drilled 82 shale gas-directed wells in the HRB since 2003.
- Current production at approx. 95 mmcf per day.
- Leads way with deep horizontals & multiple fracture stimulations
- Advanced its resource play hub design
- Encana and Apache designed and built the Debolt water treatment facility to handle large water requirements
- Extended farm-out agreement with **Korea Gas Corporation (KOGAS)** to invest \$185 million in approx. 8,100 hectares in **Kiwigana** area.
- Drilling of the first well pad at Kiwigana completed - first gas production from area in summer of 2012.
- Sold its 30% interest in the Kitimat LNG export terminal.

Apache Canada Ltd. second most active shale gas operator in the Horn River Basin– continues to optimize play.

- 66 wells drilled since 2003
- Operates upstream development on 260,000 hectares
- Primarily working in the **Two Island Lake** area
- Net production in 2012 of 90 mmcf per day.
- Estimates net recoverable gas resource of 9.2 Tcf.
- Finished hydraulic fracture operations on its d-70-K sixteen-well pad in the Horn River Basin in April 2010
- In 2011, Apache performed completion operations on 27 wells
- 79 wells now producing from 7 drill pads
- Plans for completion of two more pads with another 42 wells coming on production.



The Horn River Basin

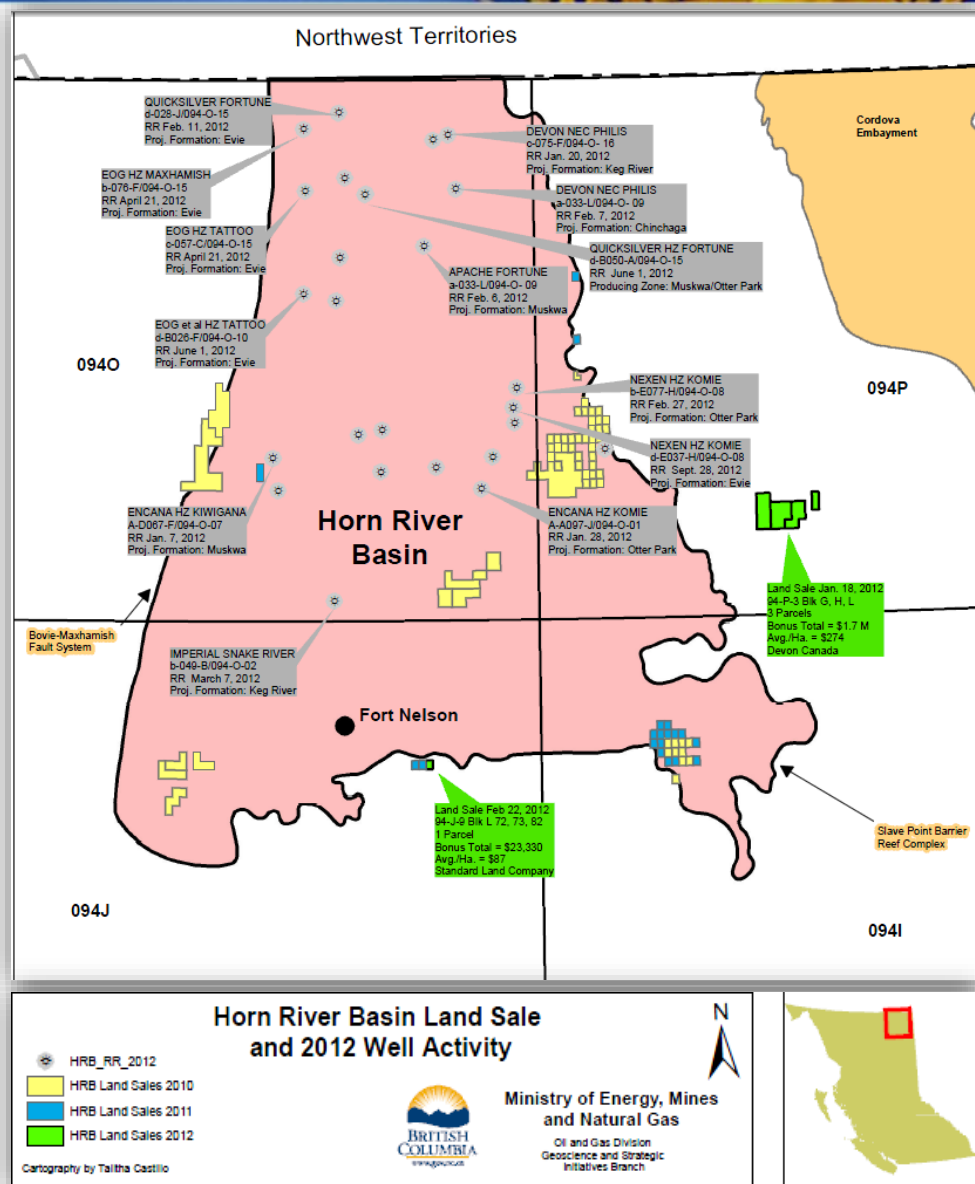
Current Well Activity

Nexen Inc. is a significant player with access to one of the highest reservoir quality portions in the basin.

- 100-per cent working interest lands at Dilly Creek, which could contain as much as six Tcf of recoverable contingent resources
- Production testing of an 18-well pad began in September 2012 with an industry record of over six fracture stimulations a day
- Could be producing as much as 175 mmcf per day out of the Horn River in 2013.

Devon Canada Corp. - solid position in the Horn River Basin.

- Has drilled 26 wells, mainly in the **Komie**, **Petitot River** and **Tattoo** areas.
- Holds over 70,000 net hectares
- potential to produce up to 700 mmcf/d from 1,500 risked locations
- Conduct minimal drilling in 2013 in order to hold acreage.



The Horn River Basin

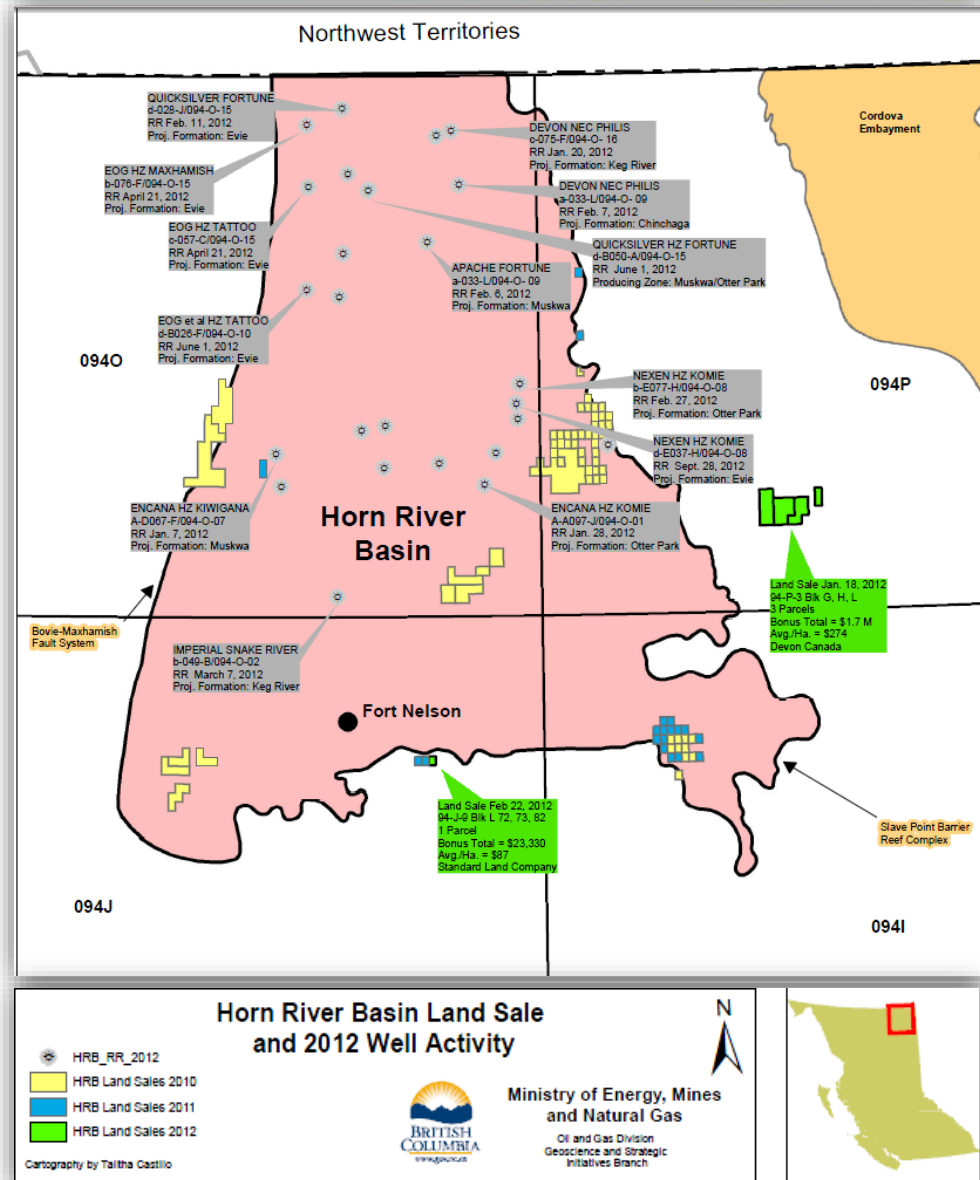
Current Well Activity

Imperial Oil Resources Limited and ExxonMobil Canada Energy are 50/50 partners in the HRB and have over 130,000 hectares leased in the basin.

- Initiated production at its multi-well pad pilot development project in the Komie area (map group 94-O-1).
- Eight-well horizontal pad began production August 2012
- Expected to produce at approx. 30 mmcf per day and will help Imperial evaluate longer-term well productivity and assess development costs

Quicksilver Resources Inc. successful horizontal well program in the **Fortune** area of HRB

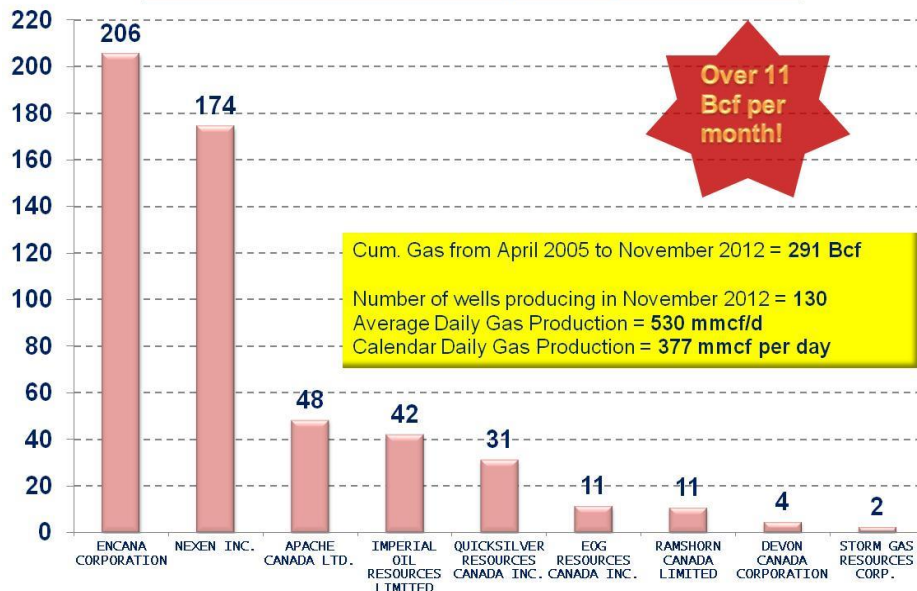
- 52,600 hectares in the Horn River Basin
- Converted all exploratory licences to 10-year development leases.
- Completed work on an eight-well pad in August of 2012
- 16 to 26 fracture stimulation stages in each well
- Ramped up raw gas production to 100 mmcf/d in late 2012
- Discounted treating capacity on an interim and interruptible basis in an existing gas plant



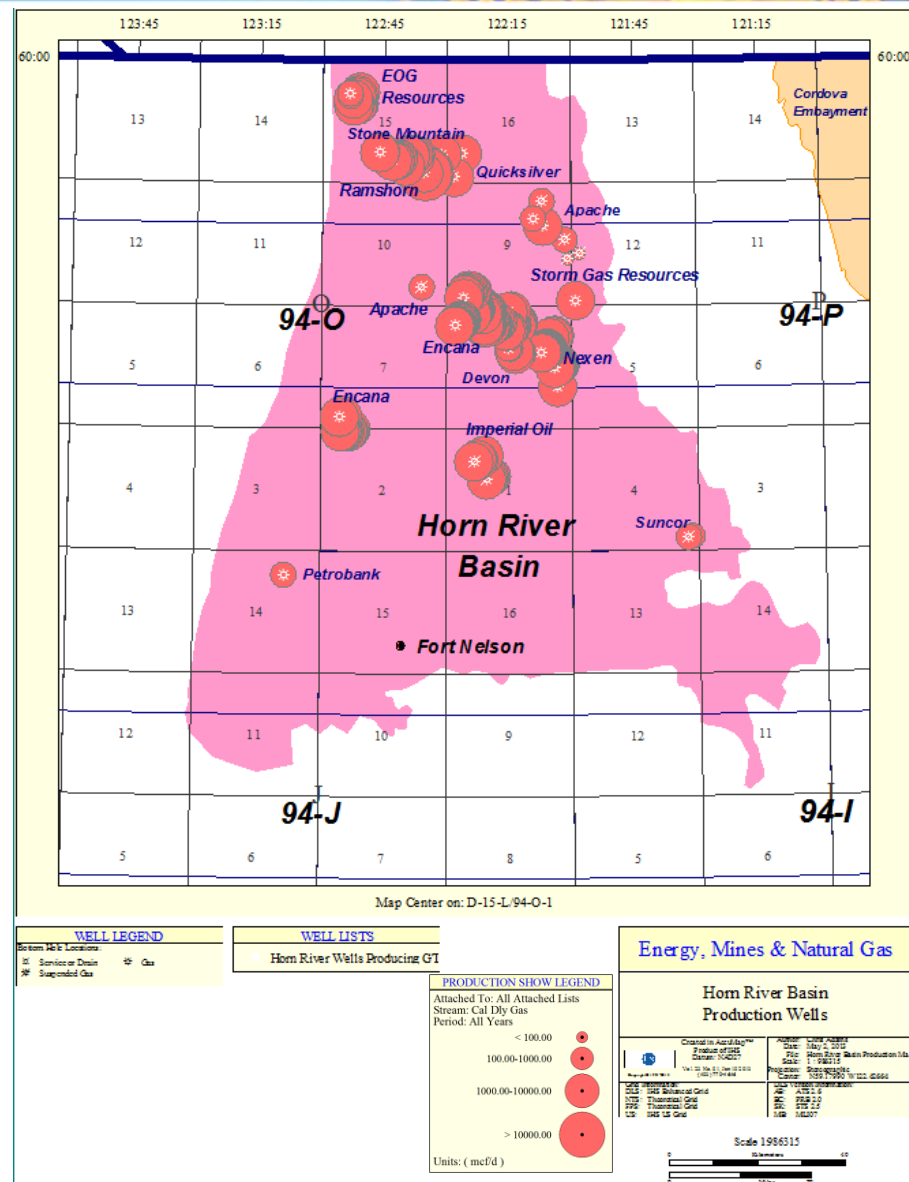
The Horn River Basin

Production

**Horn River Basin Avg. Daily Gas Production
in Nov. 2012 (MMcf/d)**



- Some wells remain on confidential status in the Horn River Basin - no production volumes reported
- Calendar daily gas production in Nov. 2012 was approximately 377 mmcf per day from 130 producing shale gas wells.
- Cumulative production of 291 Bcf to Nov. 2012

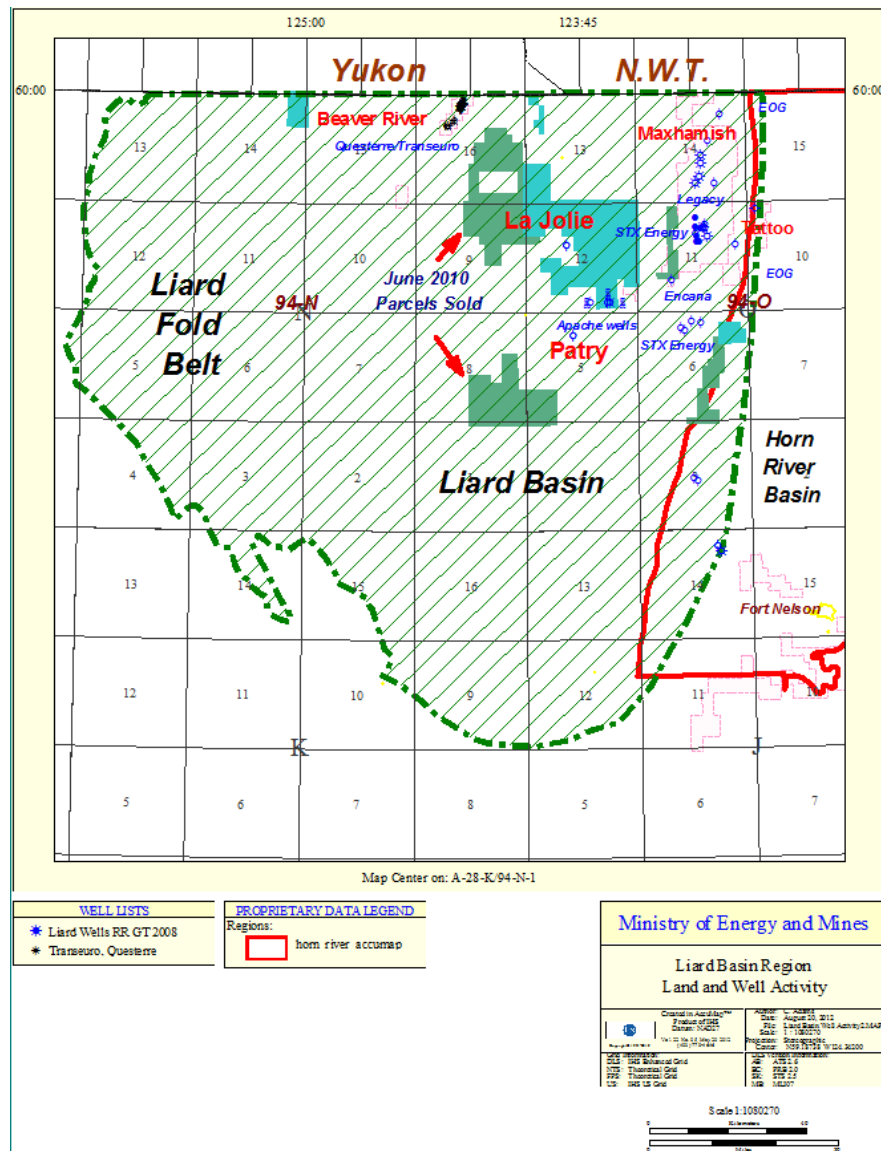
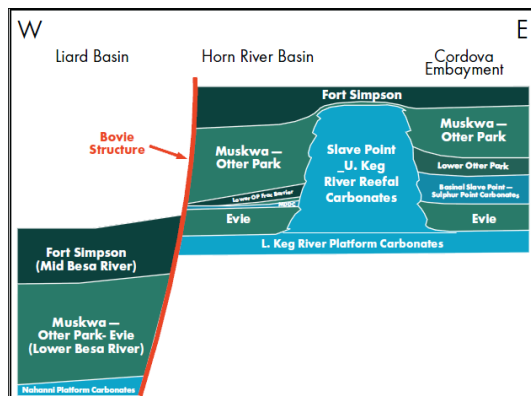
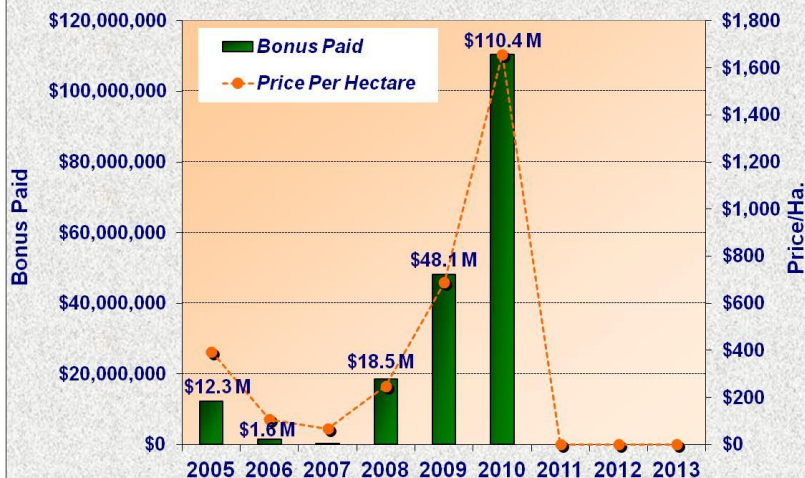


Liard Basin & Fold Belt

Land Sales

Bonuses reached over \$110 million at June 2010 BC land sale. Fourteen licenses covering 66,645 hectares were sold in La Jolie and Patry areas.

Liard Basin PNG Rights Sales



Liard Basin & Fold Belt

Activity

Apache Canada Ltd. has been working in the east-central region of the Liard Basin in an area called **Patry**.

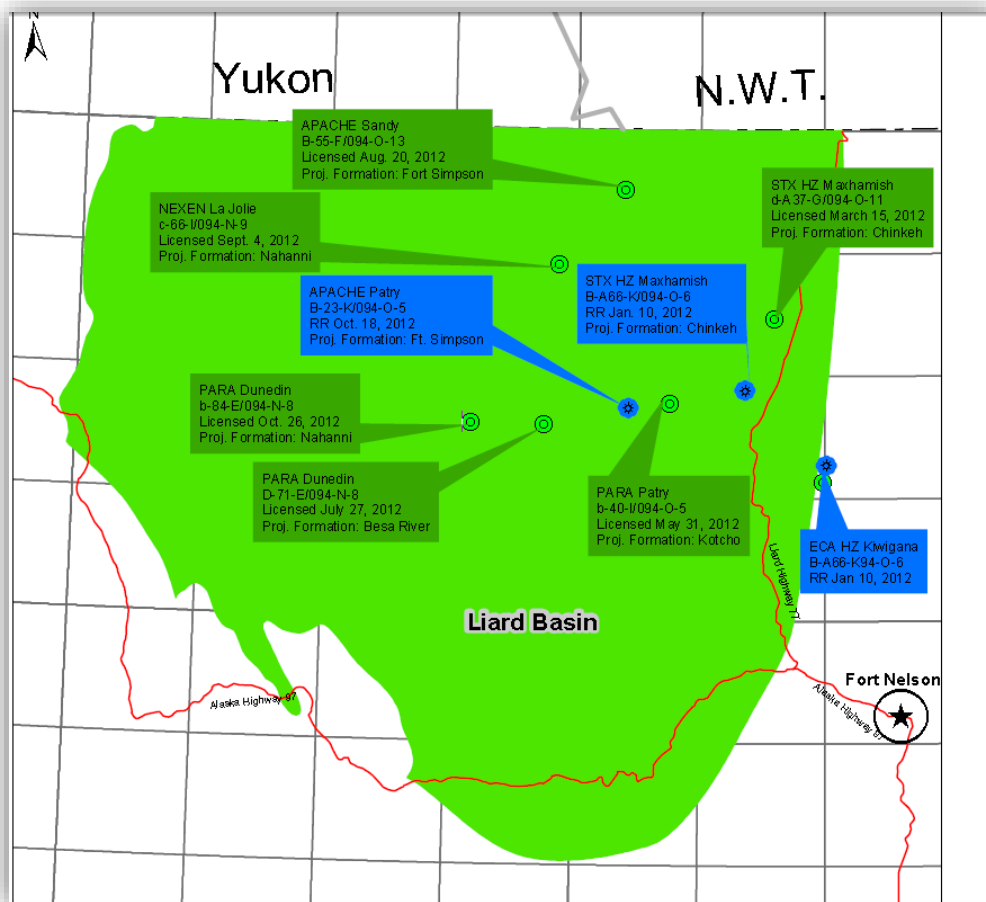
- Holds approx. 171,600 hectares in the area
- Targeting Upper Devonian Lower Besa River Black Shale
- A 2012 well recorded 30-day initial production rate of 21.3 mmcf per day on a six-stage fracturing operation.
- Estimates of net gas-in-place of 201 Tcf, which could yield net sales gas of 48 Tcf
- 6 wells drilled to date; 3 producing into existing pipeline

Nexen Inc. plans to develop shale gas resources in the Liard Basin in a strategic partnership with a consortium led by INPEX CORPORATION of Japan

- Holds 51,800 hectares of 100-per cent working-interest land
- Contains 5 to 23 Tcf of prospective resources
- Early September 2012 - well licensed to evaluate Middle Devonian/Early Mississippian shales in **La Jolie** area

Paramount Resources Ltd. holds over 51,000 net hectares in the Liard Basin that are prospective for shale gas in the Middle Devonian Besa River.

- October 2012, began drilling operations on its second well in the **Patry** area
- Most recent test results released from Paramount indicate that the Liard Basin holds an original gas-in-place of 170 to 500 Bcf per section with expected recovery of 20 per cent.



Liard Basin 2012 Rig Release and Well Licenses

- Liard_RR_2012
- Licensed_2012



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and Natural Gas
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Cartography by Mike Fournier and Fabrice Cadillo

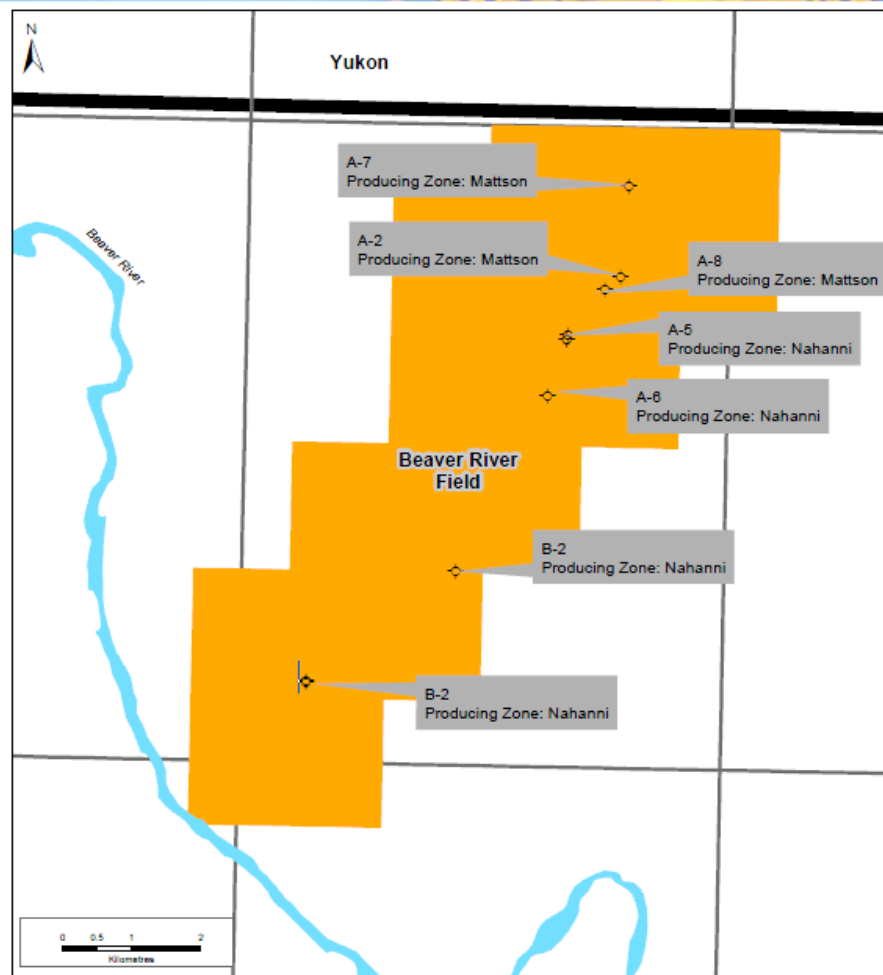


Liard Basin & Fold Belt

Activity

Questerre Energy Corporation/Transeuro Energy Corp. have conducted joint operations in the Beaver River area to evaluate Mississippian-age shales of the Mattson/Besa River. These have included the perforating, fracture stimulation and testing of multiple intervals in the Mattson/Besa River horizon.

- Transeuro Energy now owns a 100-per cent interest in the field.
- Beaver River field has series of shale formations thought to contain producible gas columns.
- Wells A-2 and A-7 are producing from Upper Besa River shale at 2.5 mmcf per day and 0.25 mmcf per day, respectively.
- A-5 well has periodically produced as much as 3.0 mmcf per day from Lower Besa River shale (operational issues).
- Transeuro plans to re-enter the existing A-5 and A-8 wells
- Phase 1 program in the summer includes acid stimulation of the A-8 well in the Nahanni Formation and preparing the A-5 well for hydraulic fracturing; also conducting acid stimulation in the Lower Besa River.
- Phase 2 program in winter includes fracturing at A-5 in the Lower Besa, fracturing of the A-6 well (Upper Besa River) and fracturing the B-3 well (Upper Besa River).



Gas-In Place

Nahanni 2.0 Tcf

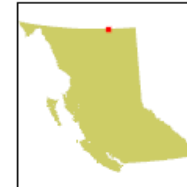
Lower Besa R. 4.1 Tcf

Upper Besa R. 4.3 Tcf

Source: Transeuro Energy Corp.

Liard Basin Land Sales and Well Rig Releases 2012

Transeuro Energy Corp

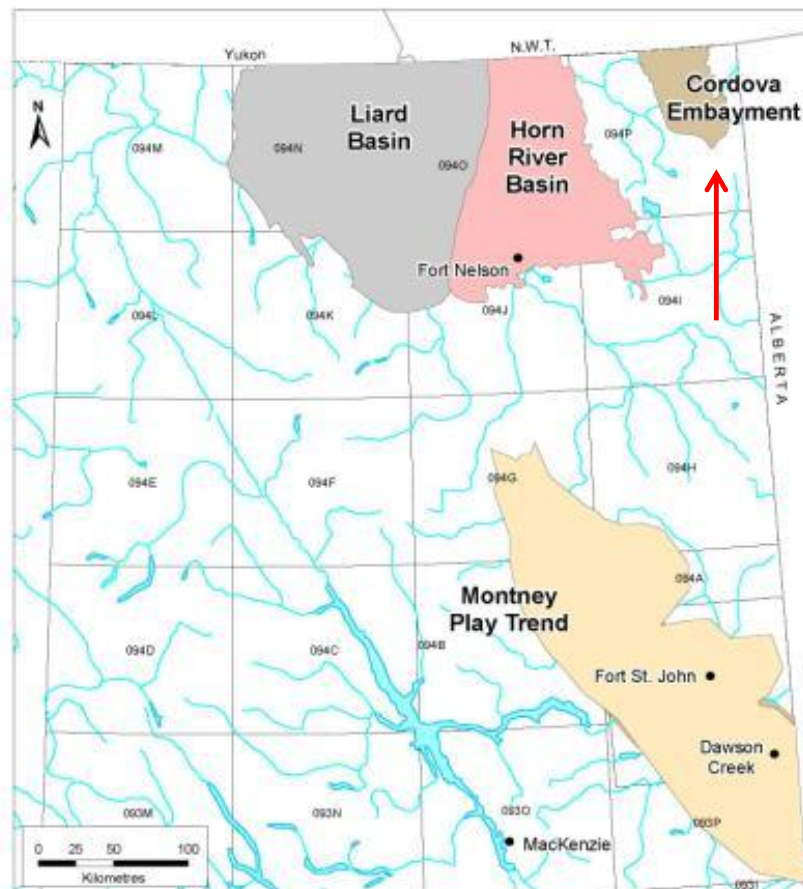


Cordova Embayment

Land Sales

- 150 kilometres northeast of Fort Nelson in far northeast corner of the province
- Area of approx. 379,000 hectares
- Geologically similar to Horn River
- Potential exists in Devonian strata - Muskwa/Evie
- Several experimental schemes underway
- OGIP 200 Tcf

PNG Rights Sales in Cordova Embayment



Shale Gas Play Areas in British Columbia

- Montney Play Trend
- Horn River Basin
- Liard Basin
- Cordova Embayment



Cordova Embayment

Operator Activity

Almost all land sale and well activity in the Cordova Embayment from 2010 to 2012 has been directed towards shale gas targets. Penn West Exploration Ltd. was the most active operator in the region in 2012 with 10 wells recorded as rig released.

Penn West Exploration. has acquired over 70,000 hectares in the Cordova Embayment.

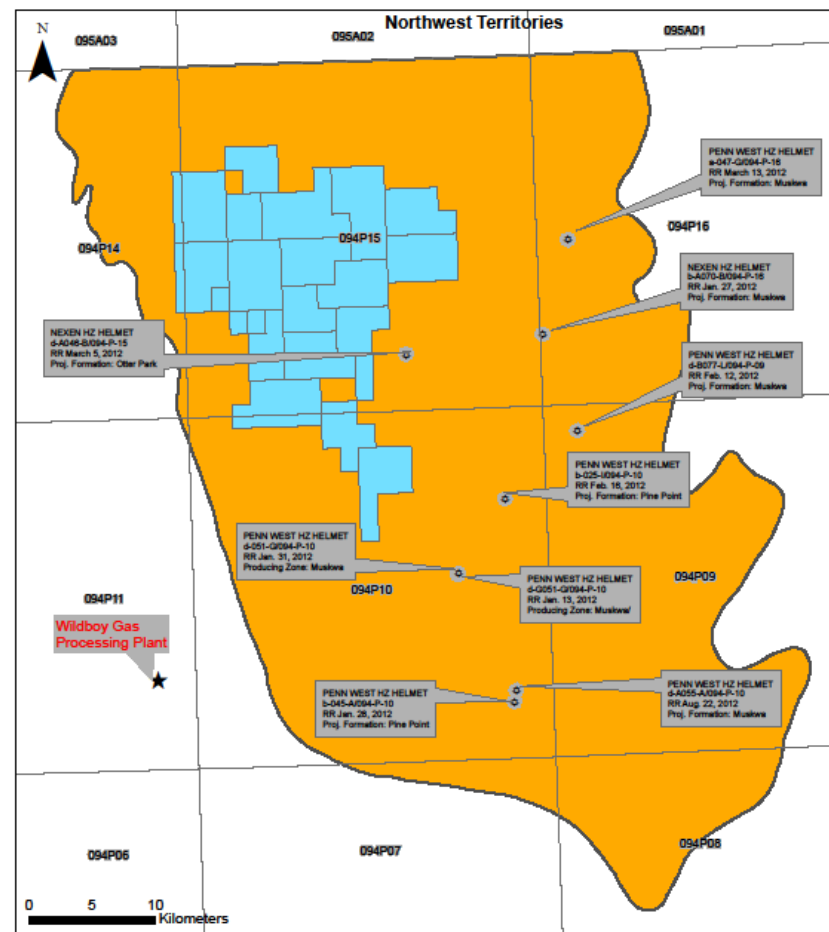
- Longer term development costs could be lower in the Cordova compared to HRB (a shallower target, a lower CO₂ cut of 5% and spare capacity at Penn West's Wildboy plant).
- **Mitsubishi Corporation** is a joint venture partner with Penn West to develop shale gas in Cordova. Goal is to increase production from assets in the area to 500 mmcf a day.
- 19 rig releases in 2011 – another 9 in 2012. Anticipating 25 wells on several multi-well pads in 2012.
- Completion operations are underway on an eight-well pad in the area. IP testing occurring now.
- Gathering and processing infrastructure in the area allows for quicker economic returns.

Nexen Inc. over 3,300 hectares in the Cordova Embayment with a 100% working interest.

- First experimental scheme approved in 2008 (Muskwa, Otter Park)
- Nexen has drilled two vertical and three horizontal wells in the Cordova since 2008.
- Continues with a series of drilling, well completion and production testing programs
- Aided considerably by Nexen's Nov 2011 agreement with **INPEX CORPORATION** of Japan.

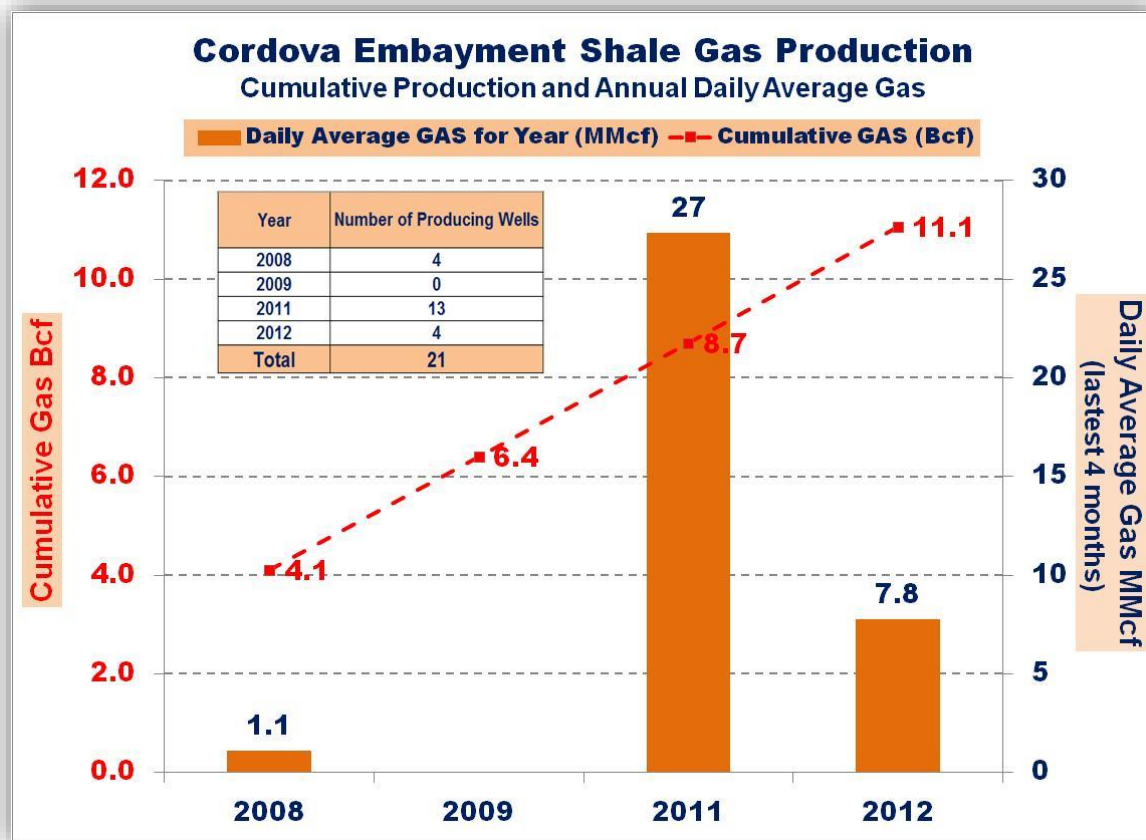
Canadian Natural Resources Ltd.

- Allocated long-term capital to the experimental stage of its Cordova Embayment project
- Further evaluation of Muskwa potential by drilling more wells



Cordova Embayment

Production



To December 2012, twenty-one wells in the Cordova Embayment have recorded gas production of over 11 Bcf of from Devonian shale sequences in the Muskwa, Otter Park and Evie.

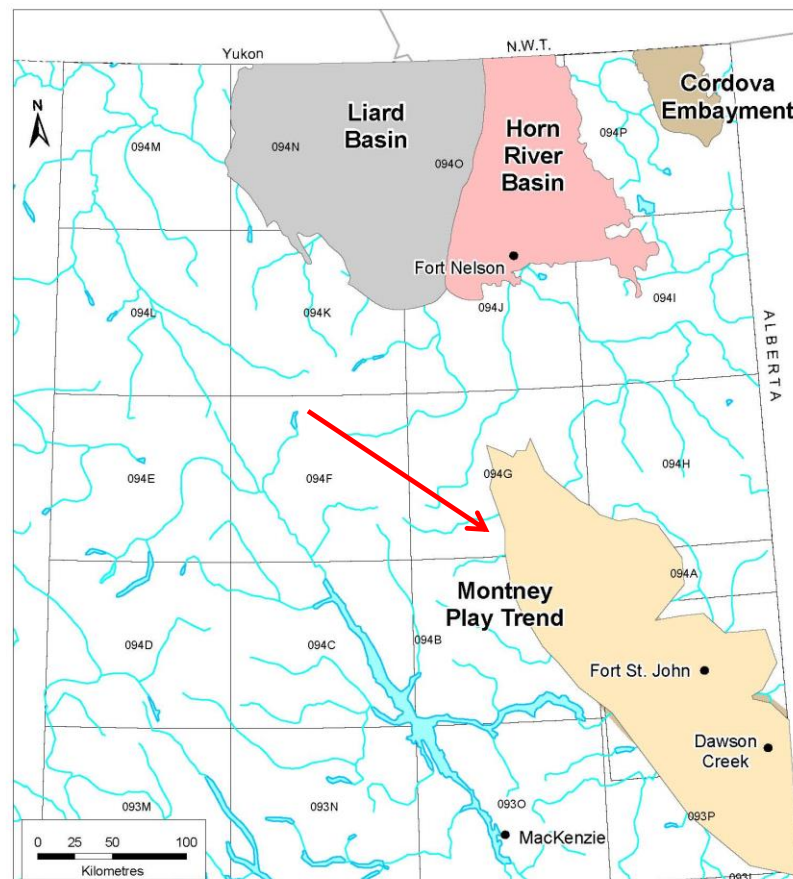
These producing wells were drilled by Canadian Natural Resources Limited and Penn West Exploration Ltd. from 2008 to 2012.

Prior to shale gas exploration, the Cordova Embayment saw cumulative gas production of approximately 600 Bcf, primarily from the Upper Devonian Jean Marie and the Middle Devonian Slave Point and Keg River in the Helmet North and Midwinter areas.

The Montney Play Region

Location and Setting

- A thick, regionally charged formation - continues to be one of the most active gas plays in B.C.
- Unconventional tight gas/shale distributed over an area extending from north central Alberta to the northwest of Fort St. John, British Columbia
- Major facies include fine-grained shoreface, shelf siltstone to shale, fine-grained sandstone turbidites, and an organic rich phosphatic shale.
- The revised Montney play trend now covers approximately 2.6 million hectares (10,196 km²) in the Peace region.
- Primary focus is on the Upper, Middle and Lower Montney targets (horizontal drilling techniques)
- The main Montney producing area is in the South Peace region with proven production (Upper Montney) in the Dawson Creek/Fort St John area
- The North Montney has increased activity with wells targeting the Upper, Lower and Middle Montney, particularly in the Altares and Town areas.



Shale Gas Play Areas in British Columbia

- Montney Play Trend
- Horn River Basin
- Liard Basin
- Cordova Embayment



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Cartography by Mike Fournier and Talitha Castillo



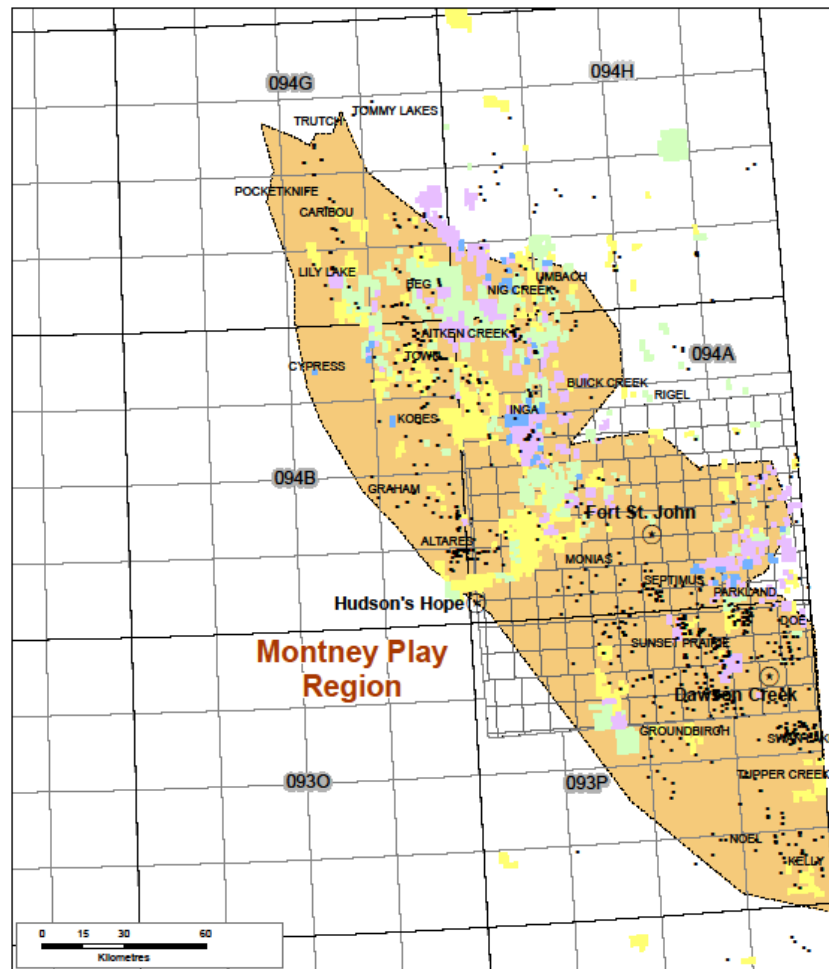
The Montney Play Region

Land Sales and Drilling

PNG Rights Sold in Montney Play Region



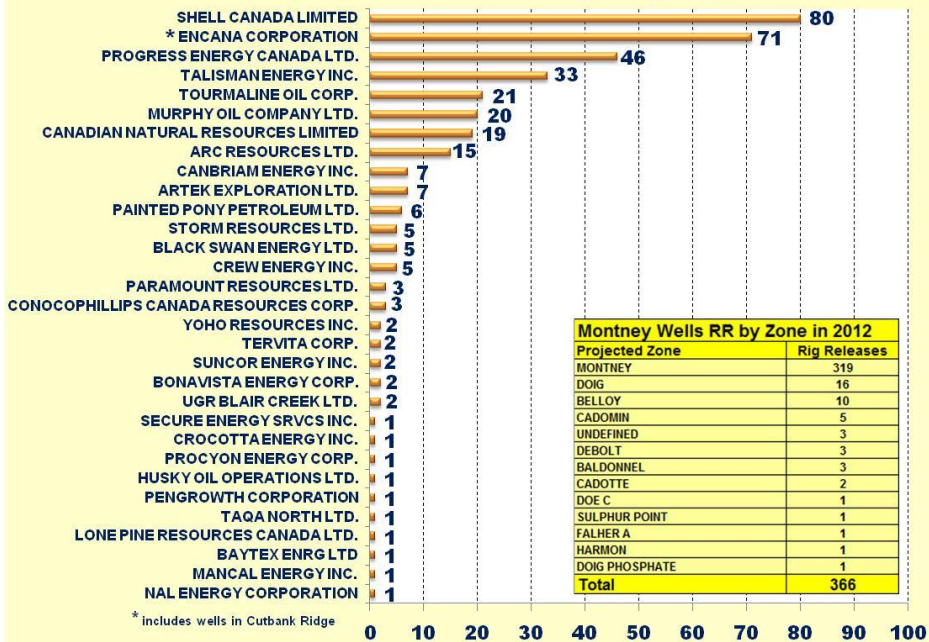
- Montney play trend accounted for 87 per cent of the 2012 BC land sale bonus totals.
- Only shale gas region where land sales have continued in 2013
- Gas production from the Triassic Upper Montney has seen exceptional growth. Now seeing production from Lower & Middle Montney.
- High producing areas in southern Montney region include Groundbirch, Swan, Dawson, Saturn, Monias and Tupper.
- Increasing production in North Montney – Altares, Town, Lily Lake, Julianne Creek, Farrell Creek.



The Montney Play Region

Operator Activity in 2012

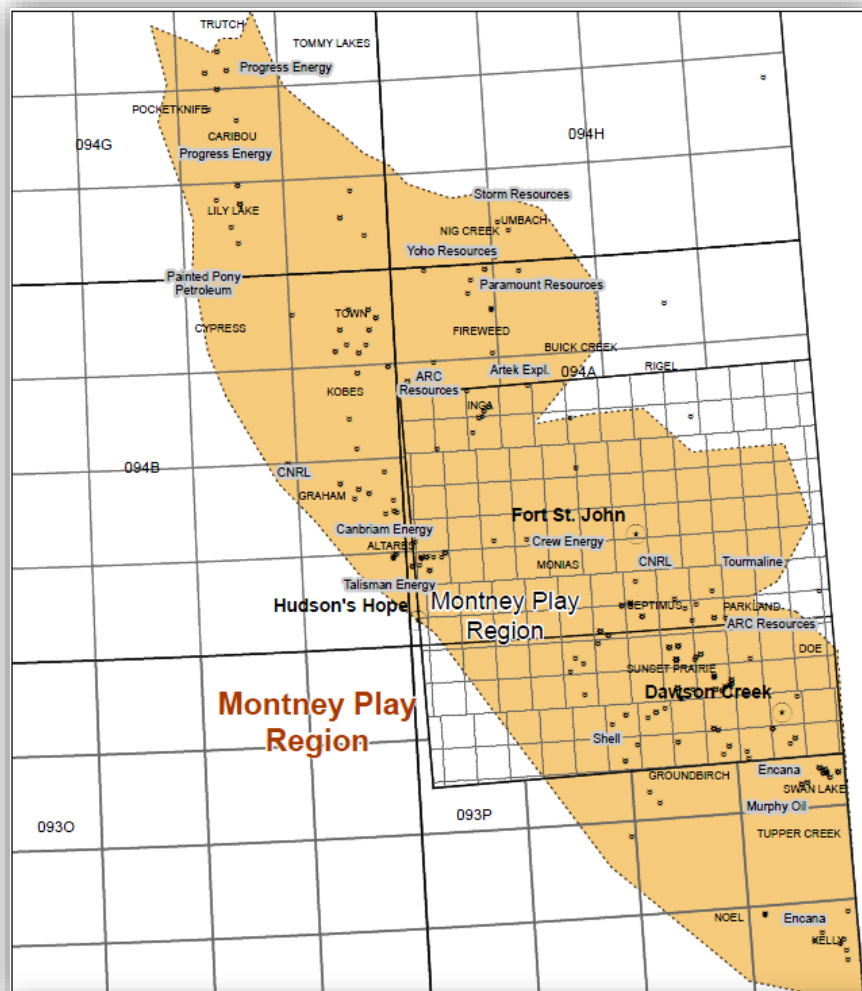
Wells Rig Released in Montney Play Region in 2012



Montney Wells RR by Zone in 2012	
Projected Zone	Rig Releases
MONTNEY	319
DOIG	16
BELLOY	10
CADOMIN	5
UNDEFINED	3
DEBOLT	3
BALDONNEL	3
CADOTTE	2
DOE C	1
SULPHUR POINT	1
FALHER A	1
HARMON	1
DOIG PHOSPHATE	1
Total	366

➤ Thirty-one operators finished drilling on 366 wells in 2012.

➤ Over 90% of those wells listed the Triassic Doig and Montney formations as the projected target.



Montney Play Trend Wells Rig Released in 2012

* Montney RR 2012



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The Montney Play Region

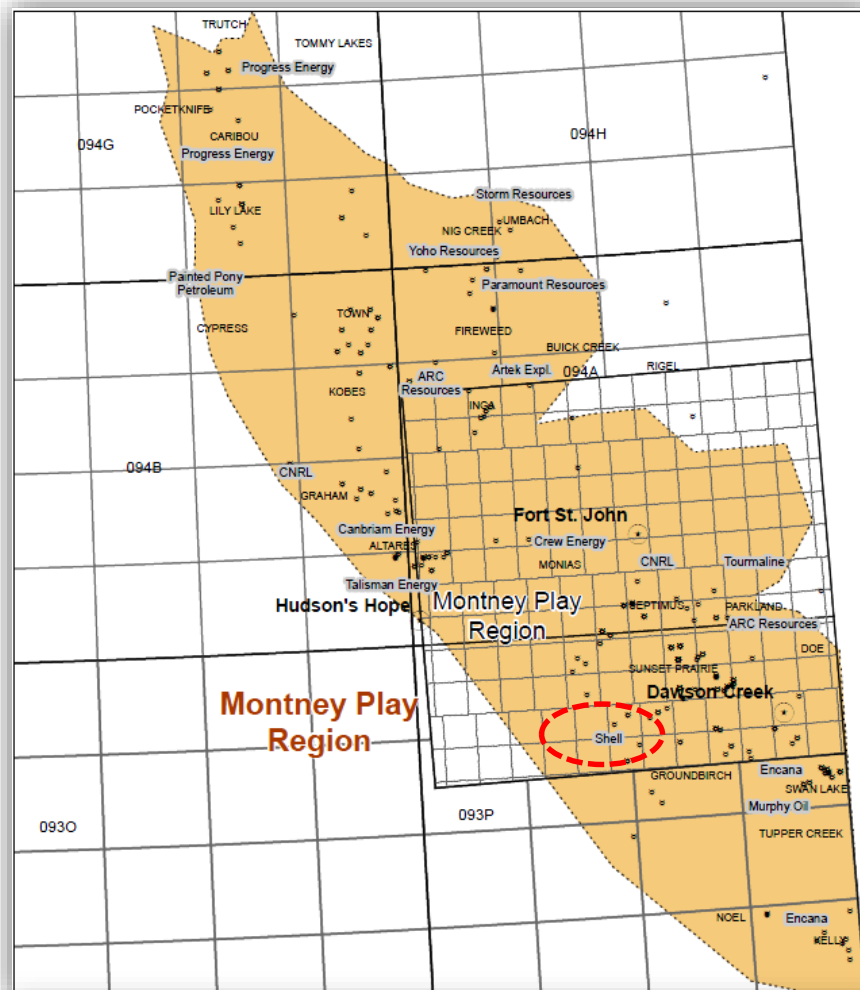
Operator Activity in 2012

Shell Canada Limited has a material position in the Montney region and has expanded its program in the **Sunset Prairie-Groundbirch** area complex. Also operating in the **Gundy Creek** area for Montney zone production.

- Holdings of 300 sections of prime Montney gas fairway with a resource potential of over 12 trillion cubic feet equivalent
- Wells at Groundbirch are drilled with a mix of single and multi-well pads at moderate target depths of 2,200 to 3,000 metres
- Includes five natural gas processing plants and over 900 kilometres of pipeline
- Production from the Groundbirch complex in early 2012 reached over 190 mmcf per day from 250 wells.
- Gas production from Groundbirch can now be easily transported to the Alberta market (Groundbirch Mainline Project).
- 10-year agreement signed with City of Dawson Creek to reclaim municipal wastewater for use in hydraulic fracturing operations
- **PetroChina Company Limited** now has a 20-per-cent stake in Shell's Groundbirch assets. Could link supply to LNG liquefaction plant off the BC coast.



Shell production pad at Groundbirch



Montney Play Trend Wells Rig Released in 2012

* Montney RR 2012

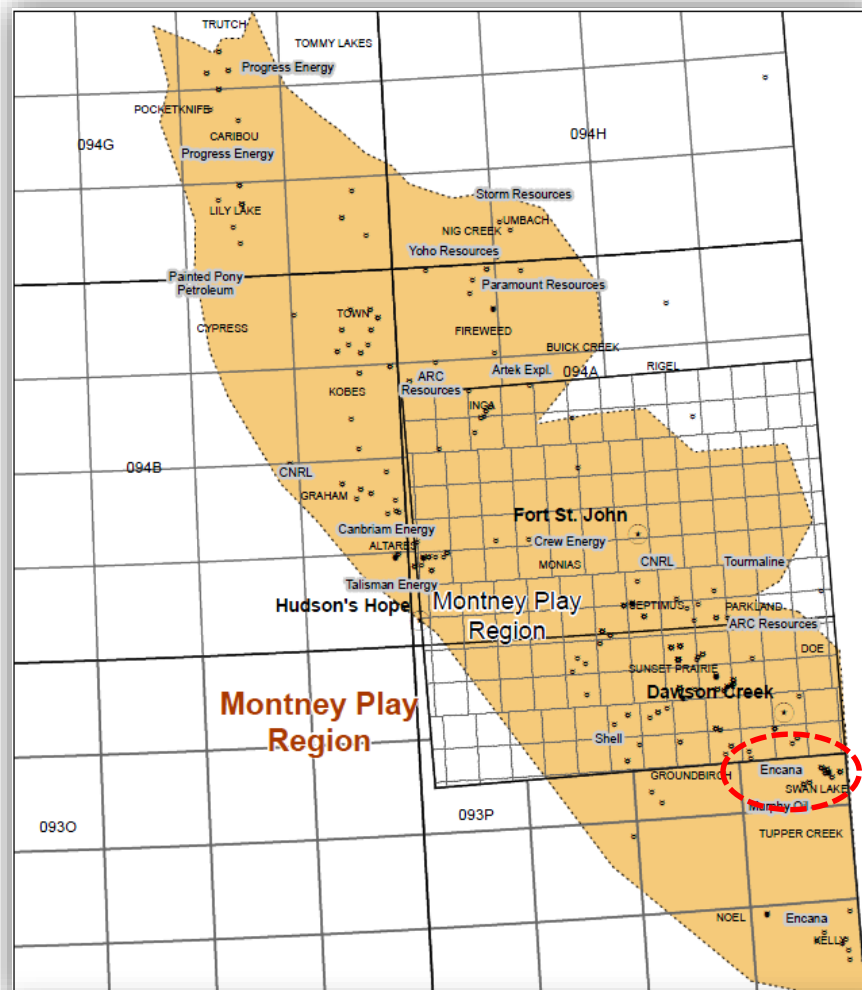


The Montney Play Region

Operator Activity in 2012

The Montney is one of the strongest performing assets for **Encana Corporation**. Significantly ramped up its operations in the Montney play trend over last five years.

- Holds over 290,000 net hectares of Montney rights in its **Cutbank Ridge** resource play within the southern portion of the Montney play trend.
- Assets in the **Cutbank Ridge** resource play consist of gas production from the Montney, Cadomin and Doig geological formations.
- Most of the 71 wells drilled in the play area in 2012 were directed towards Montney and Doig development.
- Cutbank Ridge production in 2012 was 433 mmcf per day - driven by Montney production.
- Encana's strategy for its Montney trend wells in its Cutbank Ridge region is to increase its focus on liquids rich areas and continue to reduce supply costs.
- Encana plans to drill approximately 46 wells (gross) in the Cutbank Ridge area in 2013
- Encana entered into a partnership agreement with **Mitsubishi Corporation** to jointly develop certain Cutbank Ridge lands. Mitsubishi agreed to invest approximately \$2.9 billion for a 40-per cent interest in the partnership.



Montney Play Trend
Wells Rig Released in 2012

* Montney RR 2012

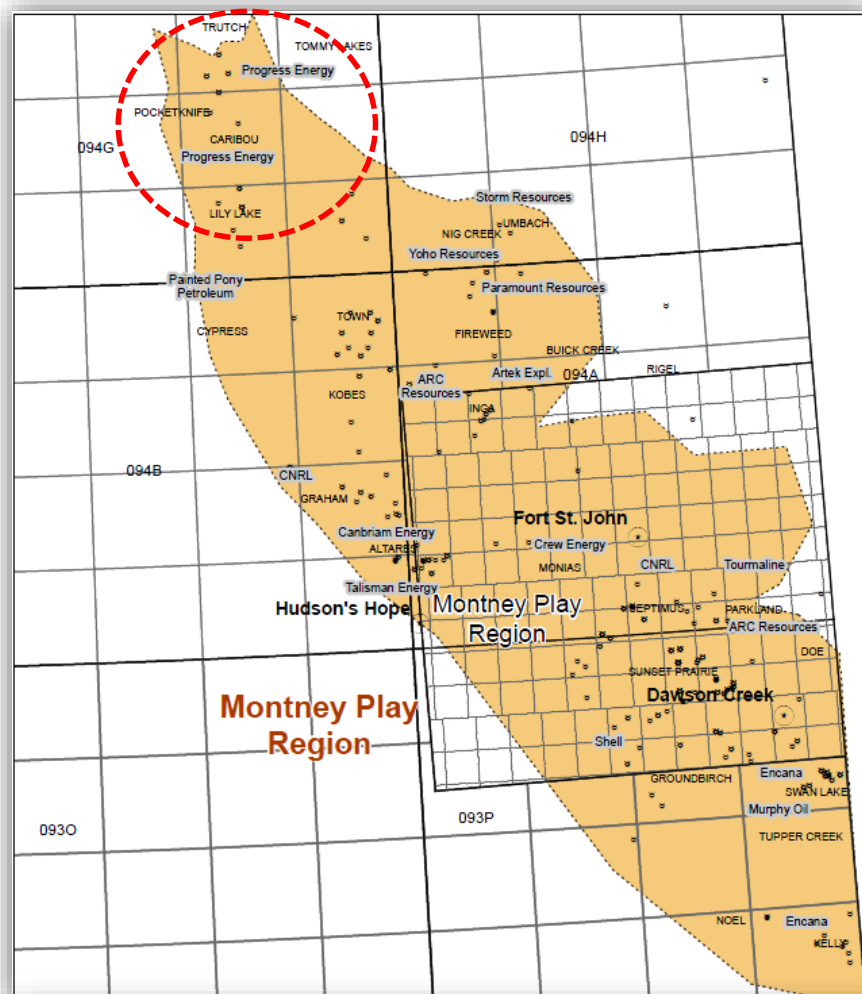


The Montney Play Region

Operator Activity in 2012

Progress Energy Canada Ltd. has amassed approx. 384,000 hectares within the commercially productive Montney fairway and continues to have one of the largest land positions in the northeast BC foothills.

- Progress Energy's capital program is weighted towards Montney fairway; investment of \$211 million in North Montney activities over first nine months of 2012
- The producer was one of the first movers in the North Montney region and has now identified a potential drilling inventory of 2,500 to 7,500 locations.
- Goal is to expand the areal extent of productive Montney fairway in the Foothills to the north with vertical delineation wells and re-completions. Aggressive approach to develop the **Altare, Lily and Kahta** areas.
- Would like to double production over next five years with multiple 50-mmcf per day development pads.
- Strategic location for delivery of natural gas to Prince Rupert, BC (Prince Rupert Gas Transmission project - Pacific Northwest LNG export facility).
- Has selected **TransCanada Corporation** to design, build, own and operate its proposed \$5-billion Prince Rupert Gas Transmission project



Montney Play Trend
Wells Rig Released in 2012

* Montney RR 2012

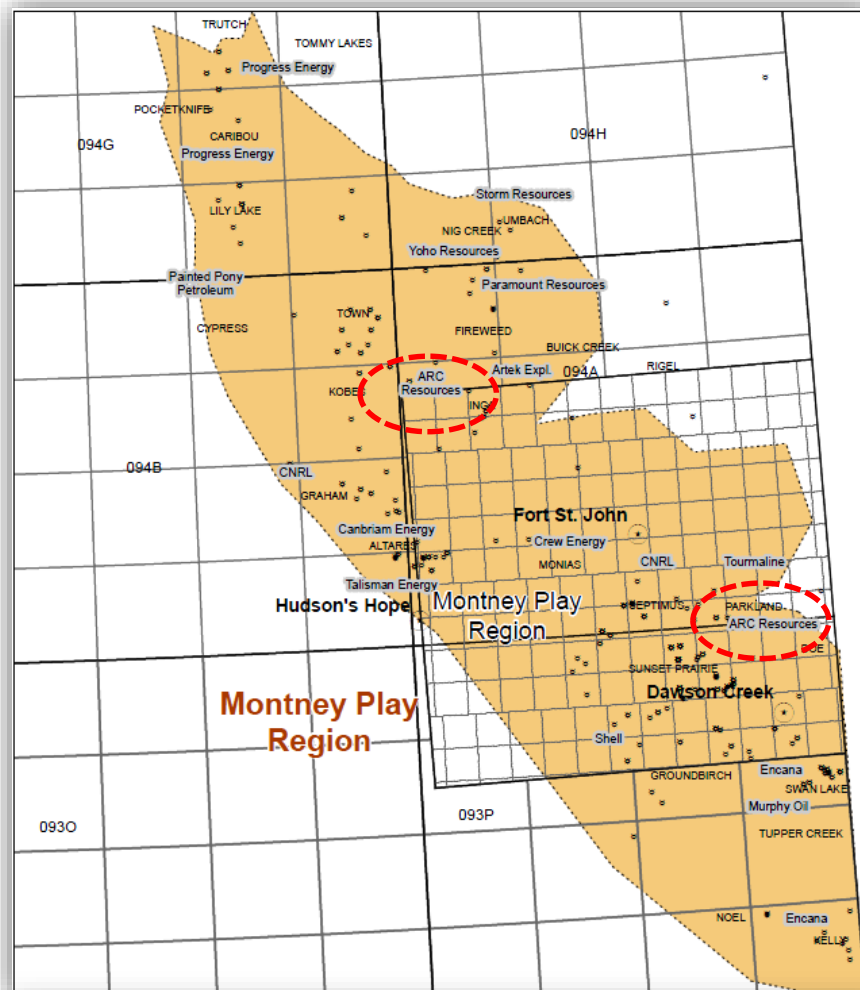


The Montney Play Region

Operator Activity in 2012

ARC Resources Ltd. is a dominant producer of Upper Montney shale gas in the Montney play trend. It entered the play region over eight years ago. Land base in the main Montney fairway totals 434 net sections.

- Has developed significant operational expertise in developing tight, low permeability formations.
- Main operations in the **Dawson, Sunrise, Sunset** areas (natural gas plays) and in **Parkland, Tower Lake, Septimus, Attachie** (liquids-rich gas resource plays)
- At year-end 2012, daily production from these assets was 235 mmcf per day and 2,600 barrels per day of oil and liquids.
- Discovered resource potential is significant at 27.5 Tcf of Discovered Petroleum Initially In Place
- One of the first operators to drill a horizontal well at Dawson.
- Daily production from Dawson field is 165 mmcf per day and 800 barrels per day of liquids from Montney assets.
- In the Parkland/Tower Lake areas, ARC produces approximately 42.5 mmcf per day of gas and 1,710 barrels per day of liquids
- Received construction approval for two 60 mmcf/d gas processing and liquids handling facilities in the Parkland/Tower Lake areas. First facility is scheduled to come on stream in early 2014.
- In the Attachie area (West Montney lands), ARC is planning to drill two wells in 2013. Production continues from a pilot project on the eastern portion of the Attachie properties to assess options for commercial development and infrastructure requirements.



Montney Play Trend
Wells Rig Released in 2012

• Montney RR 2012



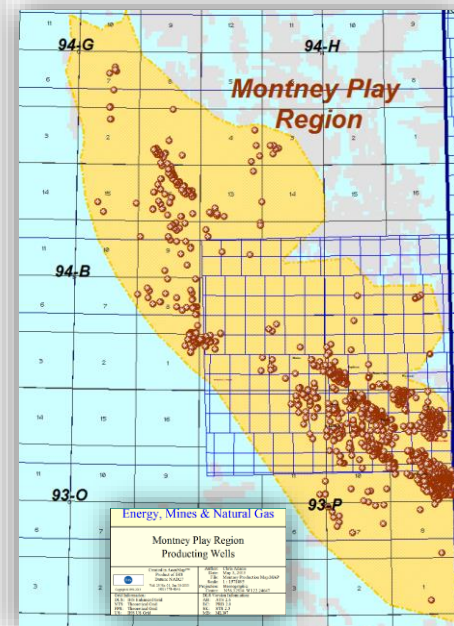
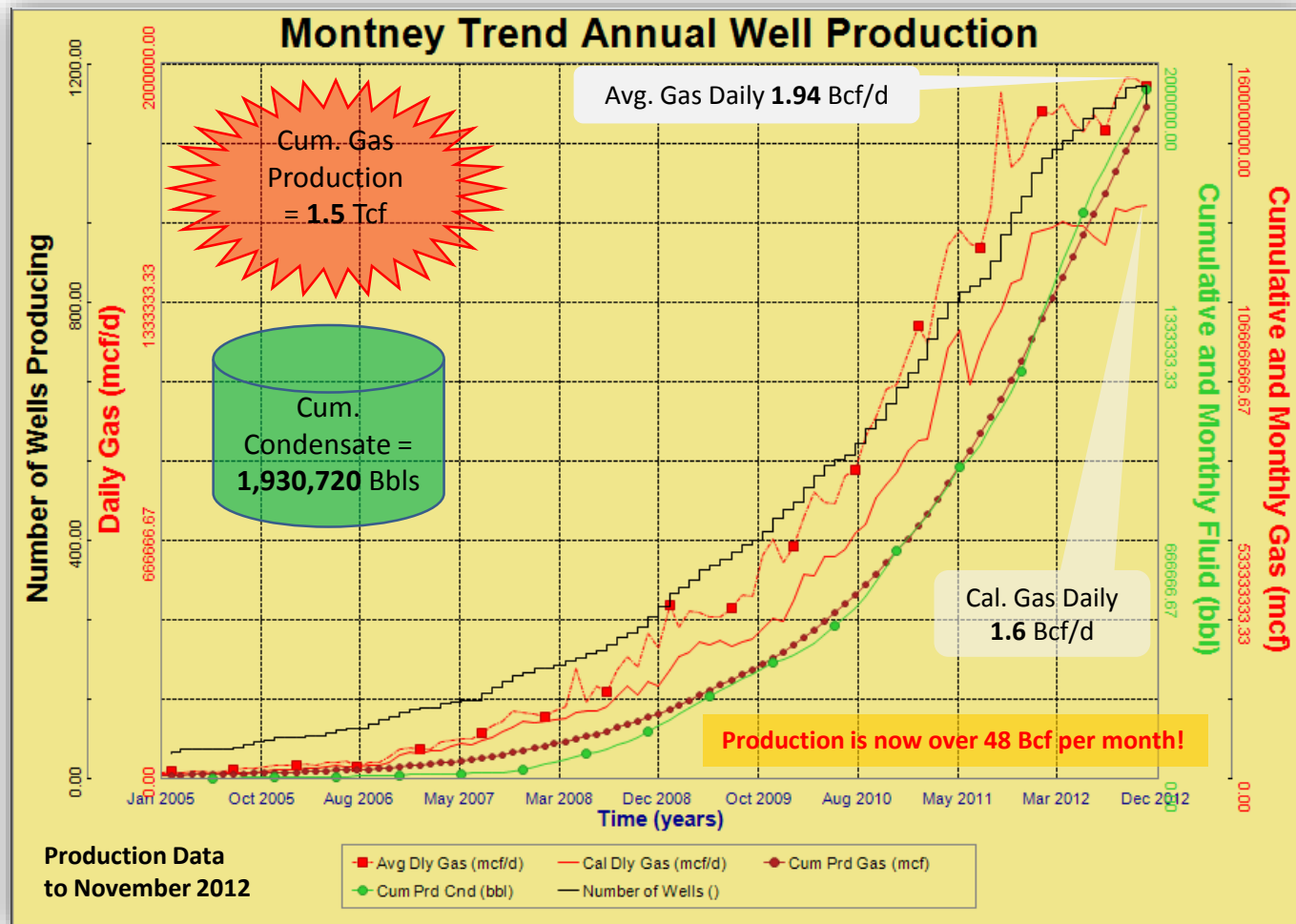
Ministry of Energy, Mines
and Natural Gas
Oil and Gas Division
Geoscience and Strategic
Initiatives Branch

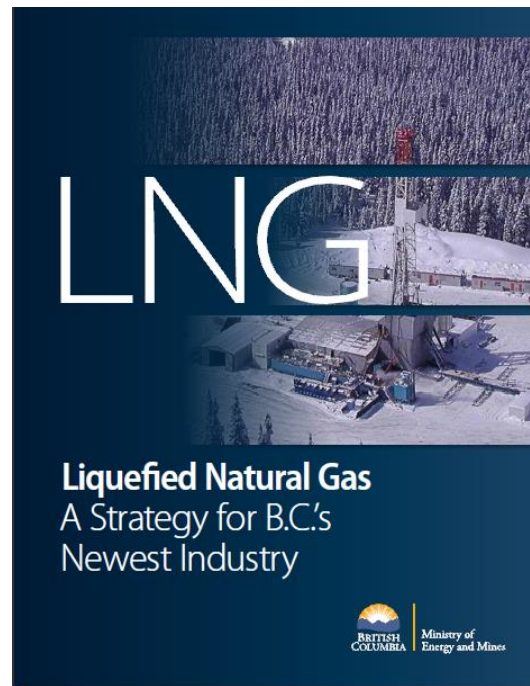
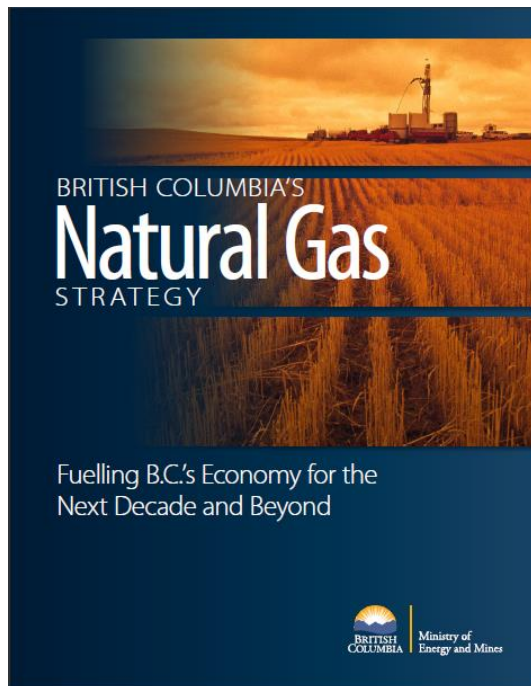


Montney Trend Annual Production (2005 to Nov. 2012)

➤ Production Life Summary Well Count = 1,356 wells

➤ Production in November 2012 is from 1,134 wells





Available on Ministry web page: <http://www.gov.bc.ca/ener/>

- B.C. Natural Gas Strategy
- LNG Strategy
- One Year Update

Strategies and actions, to address the above issues and more, and to meet BC's Natural Gas Sector goals.

Summary

- Horn River, Cordova Embayment and Montney have attracted major investments - operators are now focussing on evaluation and gas extraction. Liard Basin remains in early stages with new opportunities available.
- Producers continue to push drilling activity northward in Montney play trend. Increased liquids production within many portions of the entire trend. A globally competitive asset.
- Shale gas production will continue to grow in BC as producers advance development of the resource.
- Operational complexities associated with pumping large fracture treatments are becoming better understood.
- Continued refinement of drilling and completion processes to where economics are favourable.
- Access to water for hydraulic fracturing and suitable formations for disposal have become key considerations for BC's natural gas industry.
- BC producers continue to seek partnership opportunities for liquids-rich assets and for dry natural gas plays that could be linked to LNG projects.
- Access to alternative global markets has become increasingly important.