Natural Gas Development in BC and the LNG Opportunity

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Natural Gas

✓ Cleanest burning fossil fuel
  ▪ 29% and 44% less carbon dioxide per joule delivered than oil and coal respectively
  ▪ Fewer air pollutants
✓ Non-renewable - but extremely abundant
✓ Mostly methane - but may contain depending on geologic formation:
  ▪ Impurities/other gases: water, carbon dioxide, nitrogen and hydrogen sulphide
  ▪ By-products: ethane, propane, butane, pentane
  ▪ Huge potential for value added products
Conventional vs. Shale gas

✓ Shale gas IS natural gas

✓ BC shale Gas-in-Place estimated at 2,900 trillion cubic feet (TCF) – not all producible
  ▪ To put in context: BC current production is 1.4 TCF

✓ Natural gas is not “scarce” anymore in North America

✓ We already knew about shale gas – but only accessible recently due to technology advances
  ▪ Horizontal drilling / hydraulic fracturing

✓ “Pad development” => Less impact on the land
Liquefied Natural Gas (LNG)

- LNG is natural gas - in liquid state
- Natural gas is cooled to -160°C to liquefy
- Takes up about $1/600^{th}$ the volume of natural gas in the gaseous state
- LNG mainly used to transport natural gas to markets
Upstream, Midstream, Downstream

✓ Upstream: find and produce oil and gas
✓ Midstream: process, store, market, transport
✓ Downstream: distribution / petrochemical industry / liquefaction
The integrated North American Natural Gas Market

- US/Canada natural gas market very integrated through network of pipelines
- Highly competitive, with thousands of companies active in development
- North American prices driven by supply and demand and determined competitively on spot and future markets

Source: US Energy Information Administration
The organization of the Canadian market

✅ Interprovincial / international pipelines (exports/imports) are regulated by the federal National Energy Board (NEB)

Source: Canadian Energy Pipeline Association
Organization of B.C. natural gas market

- Resource is own by the Province but developed by private companies
  - More than 100 active companies producing natural gas
- Provincial government provides land tenure for development through competitive process
- Provincial government charges royalties from production of the resource
- Oil and Gas Commission (OGC) one window regulator
A unique opportunity for B.C.

- Low natural gas prices in North America due to shale gas abundance
- High demand for clean, reliable fuels and need for source diversification in Asia

Arbitrage Opportunity
B.C. has a Plan

- Strategies and plans in place to ensure B.C. is a competitive and reliable exporter of natural gas
- B.C. has clear government commitments to maximize the natural gas development opportunity
- LNG and other value added opportunities identified
B.C.’s Shale Potential

Liard Basin – Devonian
- 9,340 square kilometres
- OGIP – (large) > 200 Tcf
- 3 wells producing (June 2013)
- Daily production – 4.2 MMcf/d
- Cumulative production – 8.3 Bcf

Horn River Basin – Devonian
- 11,400 square kilometres
- OGIP – 448 Tcf, Marketable – 78 Tcf
- 182 wells producing (June 2013)
- Daily production – 355 MMcf/d
- Cumulative production – 487 Bcf

Cordova Embayment – Devonian
- 2,690 square kilometres
- OGIP – 200 Tcf
- 17 wells producing (June 2013)
- Daily production – 31.5 MMcf/d
- Cumulative production – 15.9 Bcf

Montney – Triassic
- 29,850 square kilometres
- OGIP – 1,965 Tcf, Marketable – 271 Tcf
- 1,244 wells producing (June 2013)
- Daily production – 1.7 Bcf/d
- Cumulative production – 1.8 Tcf

Total Gas-in-Place estimates exceeding 2,900 Tcf

Source: MNGD/NEB/AER/CSUR
B.C. - Reliable producer and exporter

✓ BC drilling, producing and exporting natural gas for six decades
  ▪ Current production ~ 4 bcf/day or 1.4 trillion cubic feet per year
  ▪ Only 15% of current production consumed within Province
    • 85% exported to rest of Canada and US

✓ In an 82 Million Tonnes per Annum (MTPA) LNG scenario:
  ▪ Production to increase by 11.6 bcf/day (to more than 15 bcf/day or 5.5 trillion cubic feet per year).
B.C.’s Regulatory Regime

- Modern Oil and Gas Activities Act
- Single window regulator: B.C. Oil and Gas Commission
- Canada and B.C. regulatory alignment and common priority in the development of natural gas
- Alignment across government on environmental assessment process
- Commitment to streamlined and efficient processes with defined timelines
B.C.’s Transportation Advantage

Closest Gateway to Asia

Vessel Transit Times, in Days, from Major North American Ports to Major Asian Cities

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<th>Port</th>
<th>Hong Kong</th>
<th>Shanghai</th>
<th>Yokohama</th>
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*Estimated based on vessel speed of 20 knots

Source: B.C., Canada Prospects in Mining and Natural Gas
B.C. Proposed LNG Projects - Kitimat

- **Douglas Channel Energy Project**
  - Texan company / Haisla partnership / Golar
  - Received a NEB export license in February 2012
  - Expected to be online by 2015

- **Kitimat LNG**
  - Chevron/ Apache
  - Provincial and federal EA approved - Received a NEB export license in 2011
  - Pacific Trail Pipelines (Pacific Trail Pipelines Limited Partnership)
  - Expected to be online by 2017/18

- **LNG Canada**
  - Shell / Mitsubishi / Petro China / KOGAS
  - Project description filed with the B.C. EAO and CEAA in April, 2013 - A NEB export license granted in February 2013
  - Coastal Gaslink Pipeline (TransCanada)
  - Expected to be online by 2019

- **AltaGas/Idemitsu LNG Project**
  - AltaGas/Idemitsu Kosan
B.C. Proposed LNG Projects - Prince Rupert

- **Pacific Northwest LNG**
  - PETRONAS acquired Progress in December 2012
  - JAPEX joined the partnership in January 2013
  - Agreement with Prince Rupert Port Authority (Lelu Island)
  - NEB export license approved in December 2013
  - Project Description filed with the CEAA in February, 2013 and also with EAO
  - Prince Rupert Gas Transmission Line (TransCanada)
  - Online target: 2019

- **Prince Rupert LNG**
  - BG Group
  - Agreement with Prince Rupert Port Authority (Ridley Island)
  - NEB export license approved in December 2013
  - Project Description filed with B.C. EAO in April 2013
  - Natural Gas Transmission System (Spectra Energy)
B.C. Proposed LNG Projects - Grassy Point, Prince Rupert

- On February 23, 2013 the Provincial government issued a Request for Expression of Interest for Crown land tenure on Grassy Point for the purpose of developing an LNG plant and marine export terminals
- Four companies participated
- Northern parcel: CNOOC's Nexen and partners INPEX and JGC have finalized a Sole Proponent Agreement
- Southern parcel: negotiations in process
B.C. Proposed LNG Projects - Southern B.C. and Unspecified Location

- **Woodfibre LNG Project**
  - Woodfibre Natural Gas Limited (a subsidiary of Pacific Energy Corporation)
  - NEB application approved December 2013
  - Proposed to build small-scale LNG processing and export facilities at Howe Sound, Squamish, B.C.

- **Discovery LNG Project**
  - Quicksilver
  - Proposed to build LNG facilities on a former Catalyst Paper Corp. pulp mill site in Campbell River, B.C.
  - Expected to be online by 2019

- **4 Other Undisclosed Proponents**
Thank you!

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