



# APERC Annual Conference 2014

## Challenges and Opportunities for Shale Gas Development in Canada

26 March 2014

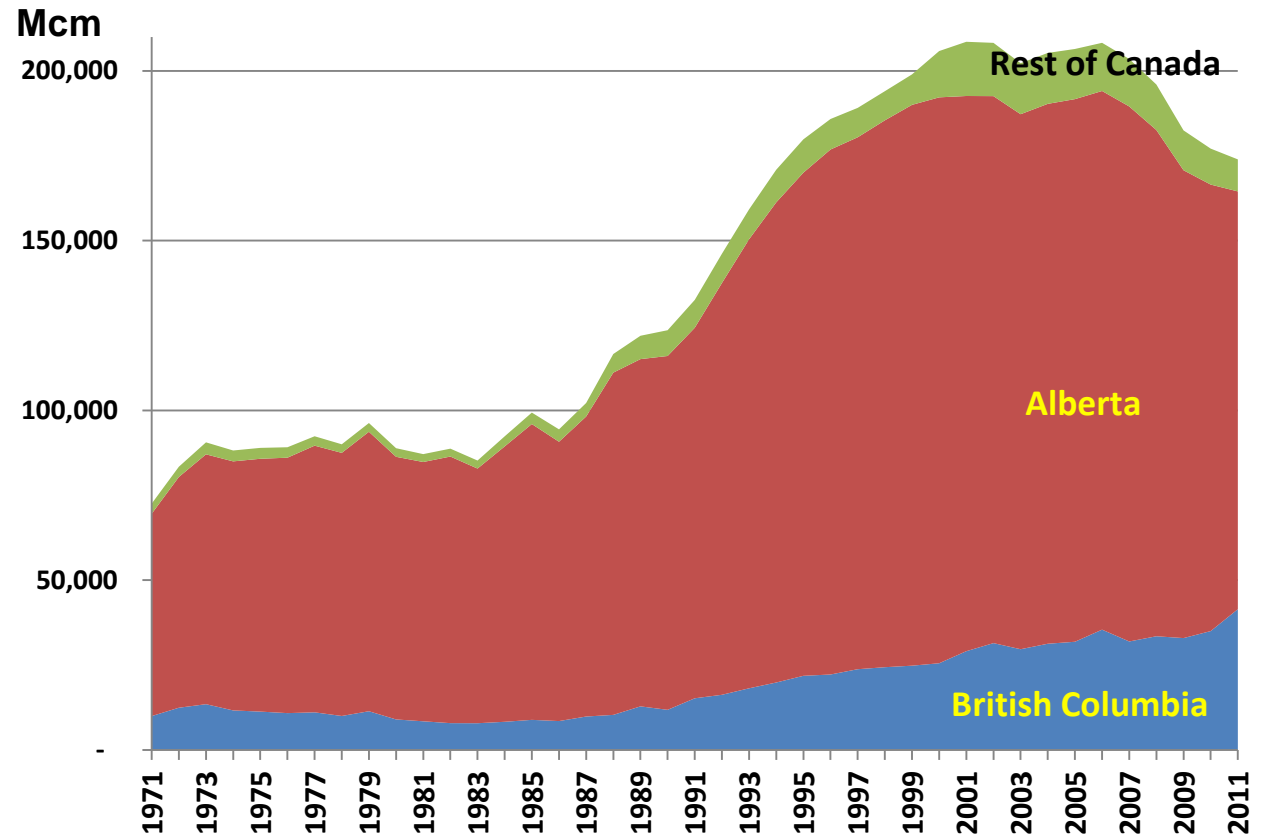
Francois Nguyen, Director

International Energy Policy, Alberta Department of Energy



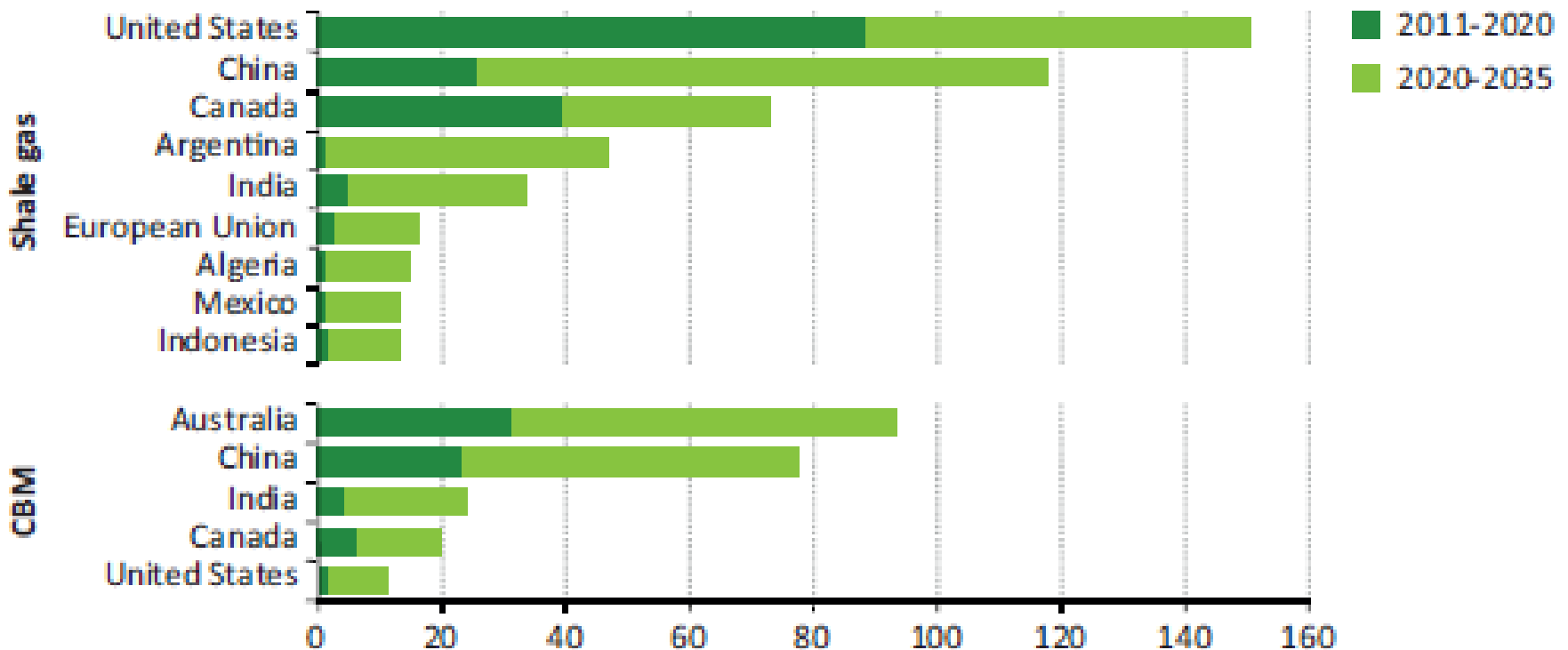
# Canada: World's third largest natural gas producer (2011)

<u>Producers (2011)</u>	<u>Bcm</u>
Russia	677
United States	651
<b>Canada</b>	<b>160</b>
Qatar	151
Iran	149
Norway	106
China	103
Saudi Arabia	92
Indonesia	92
Netherlands	81
Rest	1126
World	3388



**Alberta is the world's fifth largest gas producing region**

# Growth in Unconventional Gas Production 2011- 2035 (bcm)



# World's top ten countries based on technically recoverable shale gas

Rank	Country	Shale Gas (tcf)
1	China	1,115
2	Argentina	802
3	Algeria	707
4	U.S. <sup>1</sup>	665 (1,161)
5	Canada	573
6	Mexico	545
7	Australia	437
8	South Africa	390
9	Russia	285
10	Brazil	245
	<b>World Total</b>	<b>7299 (7,795)</b>

1-EIA estimates used for ranking order- Advanced Resources International estimates in parentheses

Source: EIA, 2013

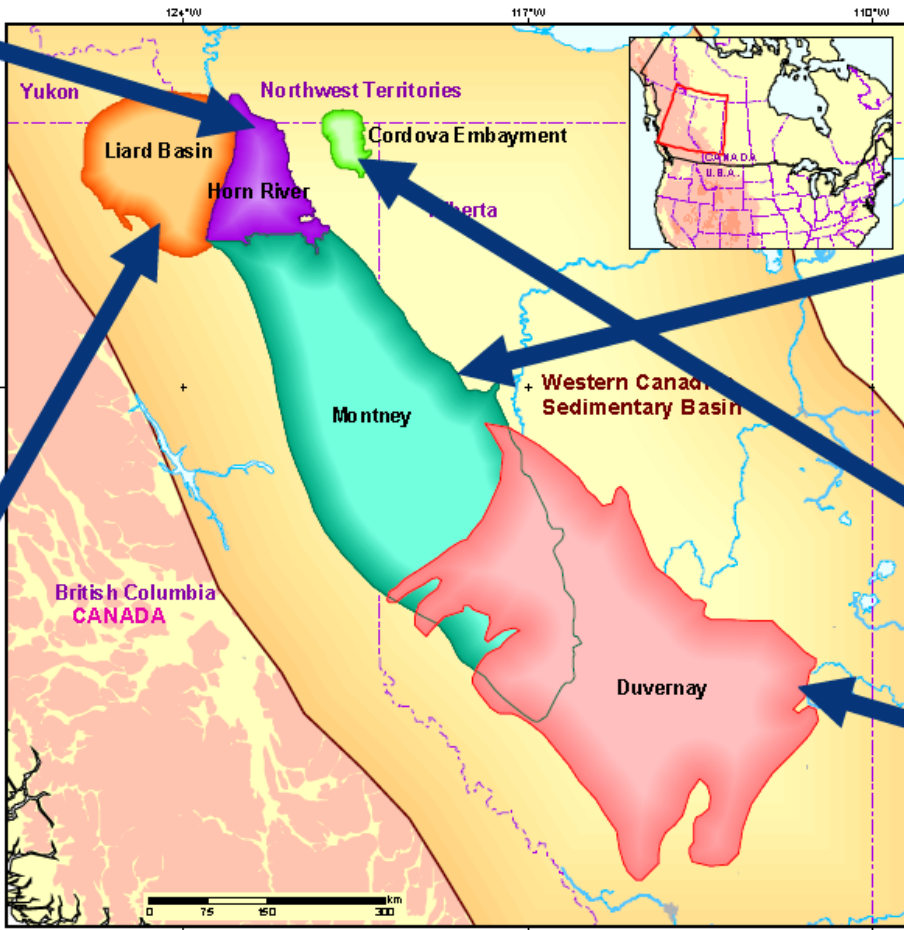
Alberta

# Unconventional Gas in Western Canada

Huge gas resources, established and emerging, are driving market pursuit

**Horn River**  
 Resource potential: ~ 90 tcf  
 Current production: ~0.5 bcfd  
 Dry gas, 10% CO<sub>2</sub> content  
 Prevailing low gas prices resulting in a depressed level of activity

**Liard Basin**  
 Emerging, potentially huge resource  
 Predominantly dry, but thought to be some liquids-rich gas  
 Few results, but Apache's wells are amongst best of any unconventional gas play globally  
 Quoted resource potential already totals over 70 tcf



**Montney**  
 Resource potential: > 120 tcf  
 Current production ~1.5 bcfd  
 Variable geology; gas-condensate window presents liquids-rich opportunity  
 Low CO<sub>2</sub> content  
 Commercial developments have accelerated since 2007

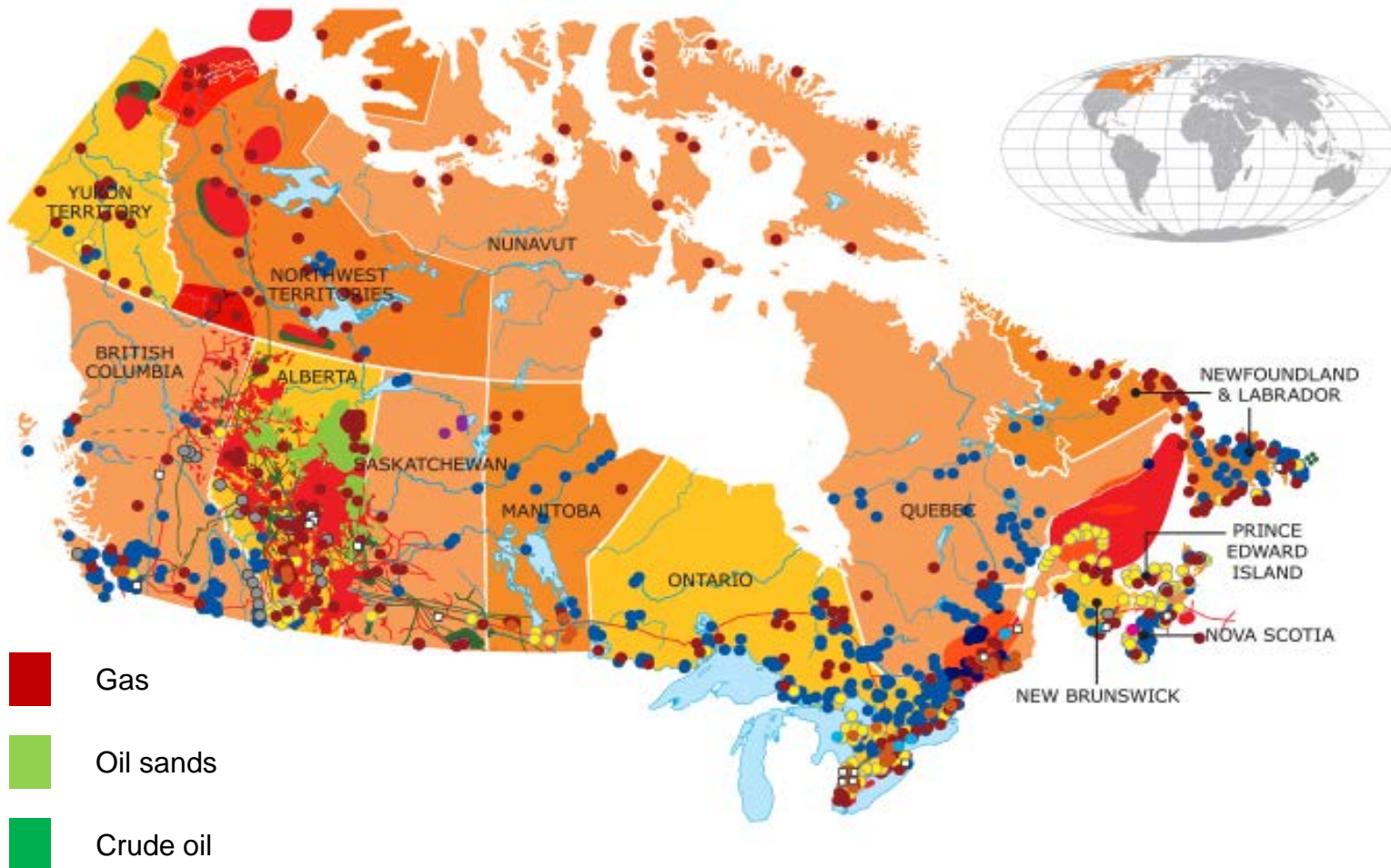
**Cordova Embayment**  
 Potential new resource – strong interest, but no recent results  
 Dry gas, 4% CO<sub>2</sub> content

**Duvernay**  
 Evolving resource with liquids-rich gas opportunities  
 Some promising results, but still at early stage; no widespread commercialisation plans released

Source: Wood Mackenzie Upstream Service

Source: Wood Mackenzie

# Alberta - Leading energy production and resource development in Canada

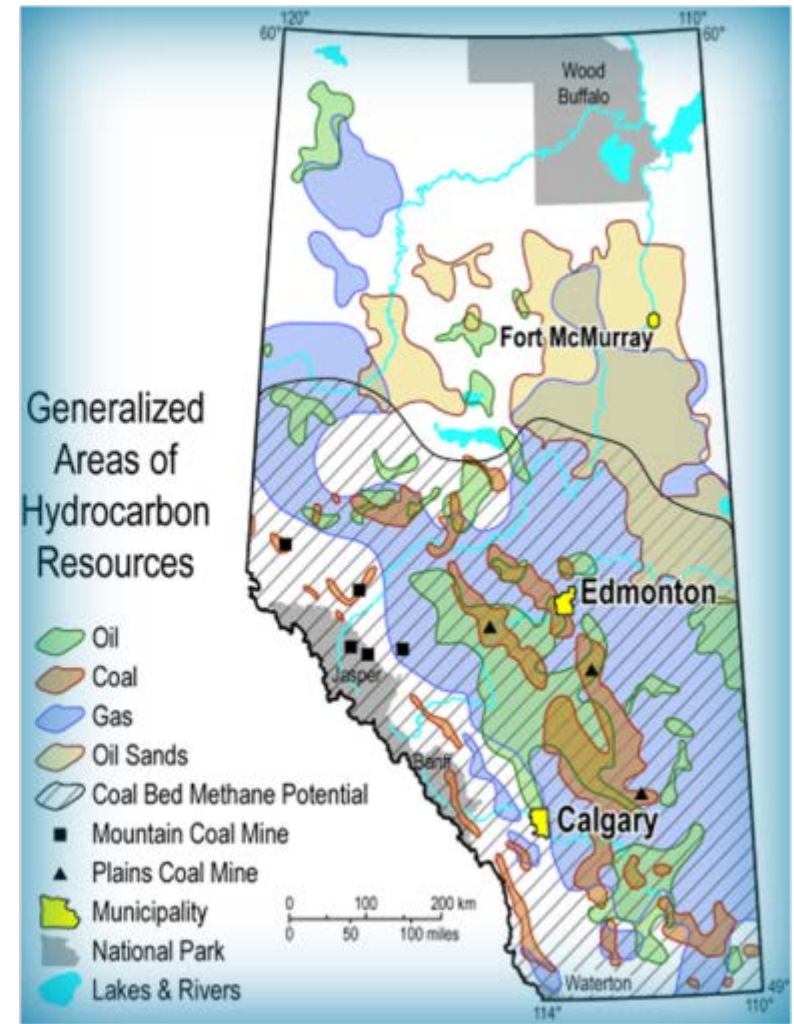


# Alberta – Canada's Oil and Gas Centre



## Canada:

- 3rd in crude oil reserves
- 3rd in natural gas production
- 6th in oil production



# Alberta's Shale Resource Potential

	Natural Gas (Tcf)	NGLs (billion bbl)	Oil (billion bbl)
<i>Montney</i>	2,133	28.9	136.3
<i>Duvernay</i>	433	11.3	61.7
<i>Muskwa</i>	419	14.8	115.1
<i>Basal Banff-Exshaw</i>	35	0.1	24.8
<i>North Nordegg</i>	148	1.4	37.8
<i>Wilrich</i>	246	2.1	47.9
<b>Total</b>	<b>3,424</b>	<b>58.6</b>	<b>423.6</b>



# Alberta's Gas in Place and Reserves

- Alberta's resource potential is in the same league as the Marcellus and Eagle Ford shale deposits in the United States.†

<i>Tcf</i>	Conventional	CBM	Shale gas	Tight gas
Gas in Place	326 <sup>^</sup>	500 <sup>^</sup>	1,291 <sup>*</sup>	2,133 <sup>**</sup>
Remaining established reserves	33.5 <sup>^</sup>	0.22 <sup>^</sup>	n/a	n/a

- Already home to one of the world's largest unconventional oil deposits, the oil sands, Alberta has the infrastructure, industry expertise and technological sophistication to unlock this new, largely untapped resource potential.

† The Alberta Geological Survey (AGS) estimate , 2012

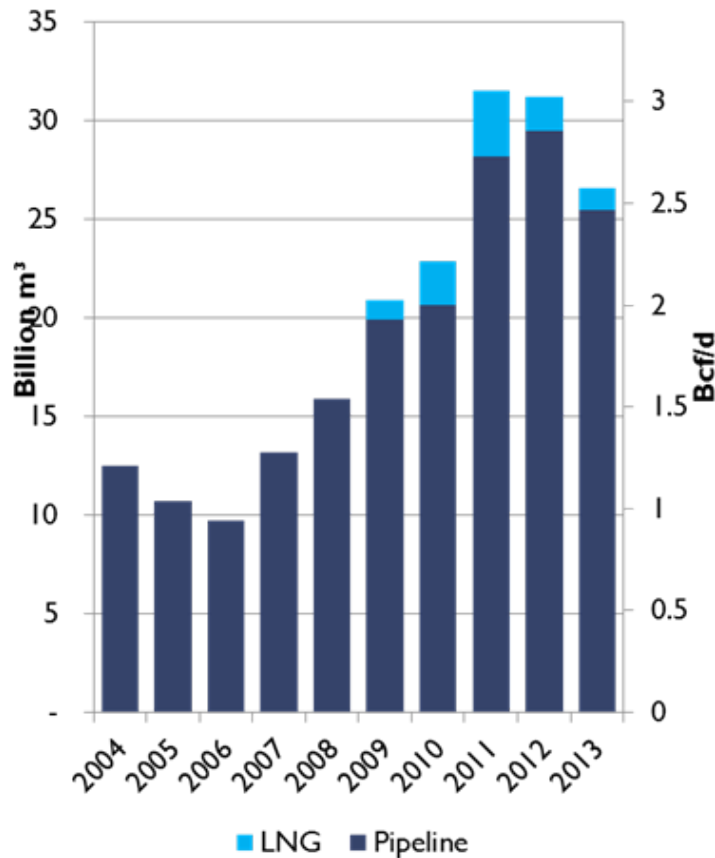
<sup>^</sup> the AER estimate, 2011

<sup>\*</sup>The Alberta Geological Survey (AGS) estimate, 2003 – five shale plays

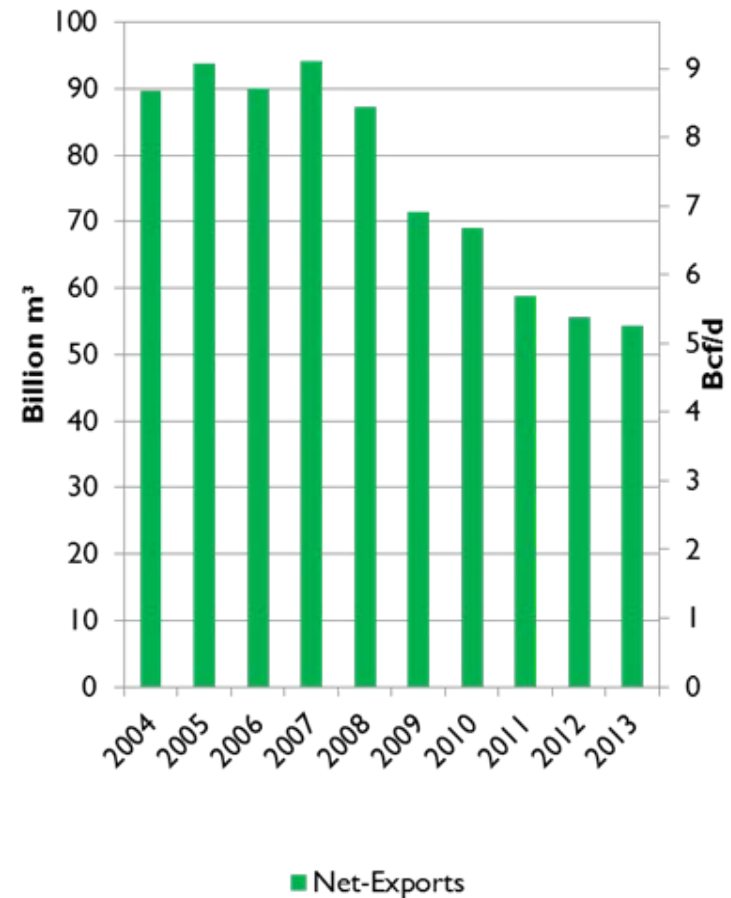
<sup>\*\*</sup>The Alberta Geological Survey (AGS) estimate, 2012 - Montney

# Natural Gas Imports and Exports

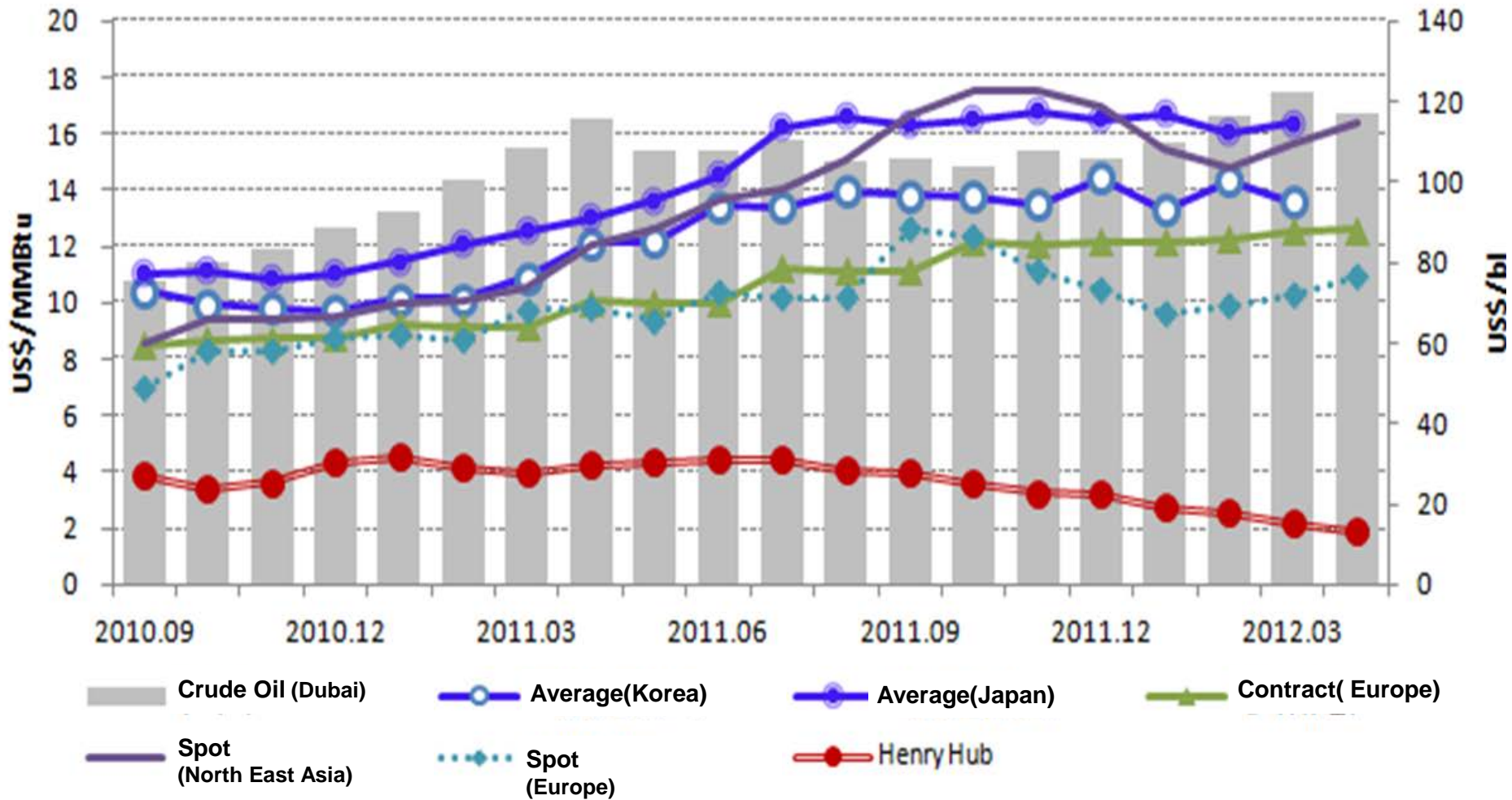
## Imports



## Net Exports



# Gas Pricing



# Federalism: Division of Powers

## The Canadian Federation

**Provincial  
Government**

***Natural Resources***

**Health**

**Education**

**Social Services**

**Federal  
Government**

**Defence**

**Foreign Affairs**

**Border Control**

**Treaty Indians**

**Equalization**

# Moratoriums & Bans in Canada (1/2)

## **New Brunswick**

No moratorium in place. The government has released reports on the potential impacts of shale gas development. Recently enacted rules for industry to address all stages of production, with particular emphasis on drilling.

## **Newfoundland**

Moratorium in place since November 2013. The government stated they will not approve any hydraulic fracturing projects, onshore or offshore, pending future review. This moratorium will allow the government to review rules, regulations, and guidelines existing in other jurisdictions and to assess the geological and environmental impact in Newfoundland.

## **Nova Scotia**

Moratorium in place since April 2012 and remains in effect until summer 2014. In August 2013, the Nova Scotia government pulled the plug on an internal review it launched in 2011 in favor of an independent study. The independent review is expected to be completed next year. No applications for hydraulic fracturing will be considered during the review process. Nova Scotia also put forth a bill to prohibit out-of-province HF waste.

# Moratoriums & Bans in Canada (2/2/)

## Quebec

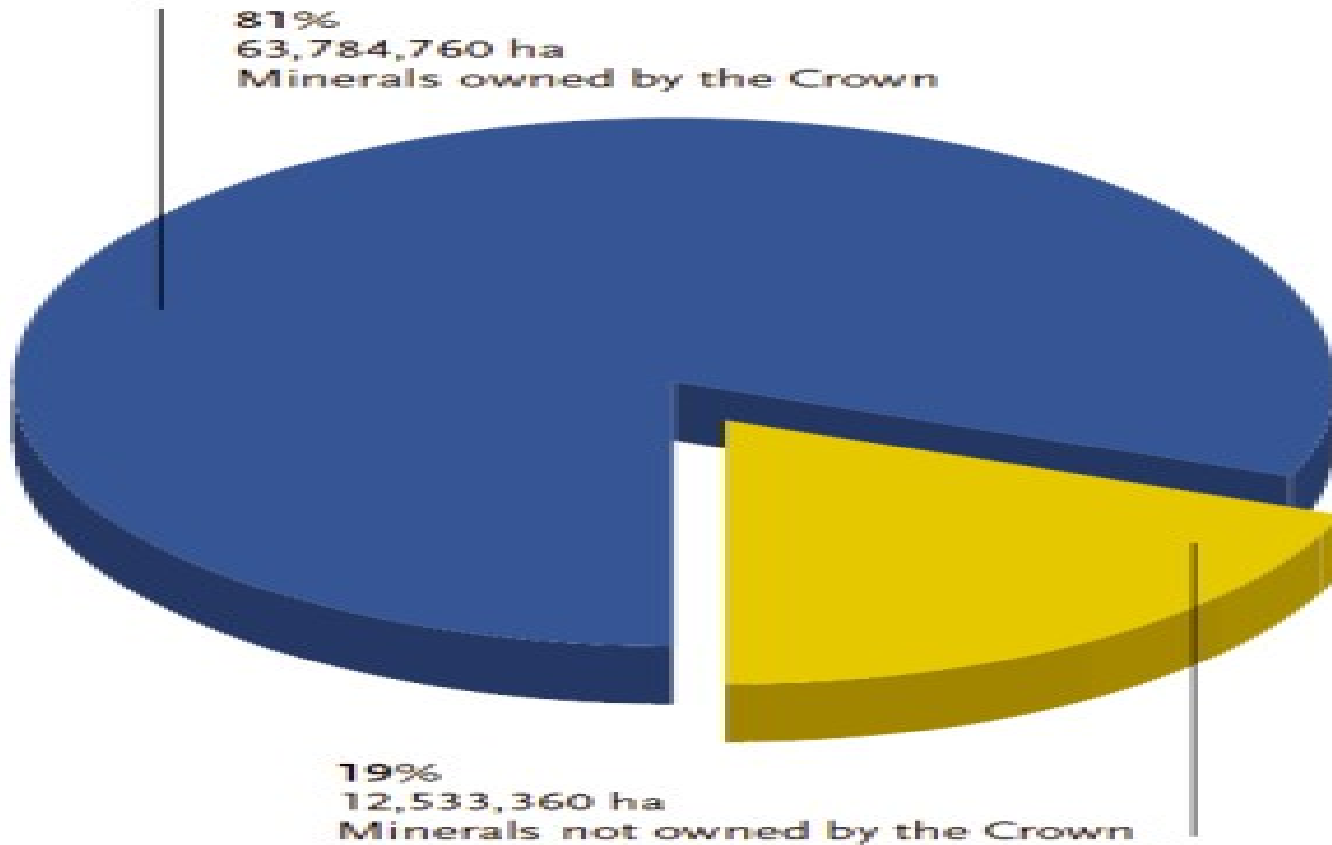
Moratorium in place. Legislation was tabled in May 2013 which would impose a moratorium on all drilling and HF operations related to shale natural gas exploration or production in municipalities (52 total) located mainly in the St. Lawrence River valley for a maximum of 5 years or until a new law is created which outlines rules for shale gas exploration and production. Although HF is done in other areas of Quebec such as in the Gaspé and on Anticosti Island, this moratorium is mainly limited to the St. Lawrence lowland due to the opposition the government has received from citizens to the exploration processes occurring in this area.

## Prince Edward Island

No moratorium currently in place. However, on November 26, 2013, the Standing Committee on Fisheries, Transportation and Rural Development recommended that the government put forth a moratorium on all oil and gas exploration and development in the Gulf of St. Lawrence.

# Mineral Rights

## Ownership of minerals in Alberta



Source: Energy Resources Conservation Board

# Water Management and Protection

## Challenges:

- Water sourcing and volumes
- Treatment and recycle
- Potential groundwater/surface water contamination

## Future:

- NEW water use measurement and sourcing details for all wells fractured in Alberta
- Clarified fracture fluid chemical disclosure
- Public access thru fracfocus.ca; January 2013
- Play or project plans showing water availability, assessment of alternative sources and recycle options, plans address NET environmental impacts

## Long term goals:

- . Minimisation of water use, maintenance of water quality



# Alberta Natural Gas Prospects

## ***Natural gas sector - Key challenges***

- Gas development and royalties core to Alberta's fiscal position
- North America gas demand not very promising
- Gas exports have declined significantly
- Low prices hurting economic activity (drilling), exacerbate government royalty impacts and restrict feedstock supply to petrochemical sector

*Alberta's position as a major gas exporter at significant risk*

## ***Natural Gas Strategy: Alberta needs new markets for natural gas***

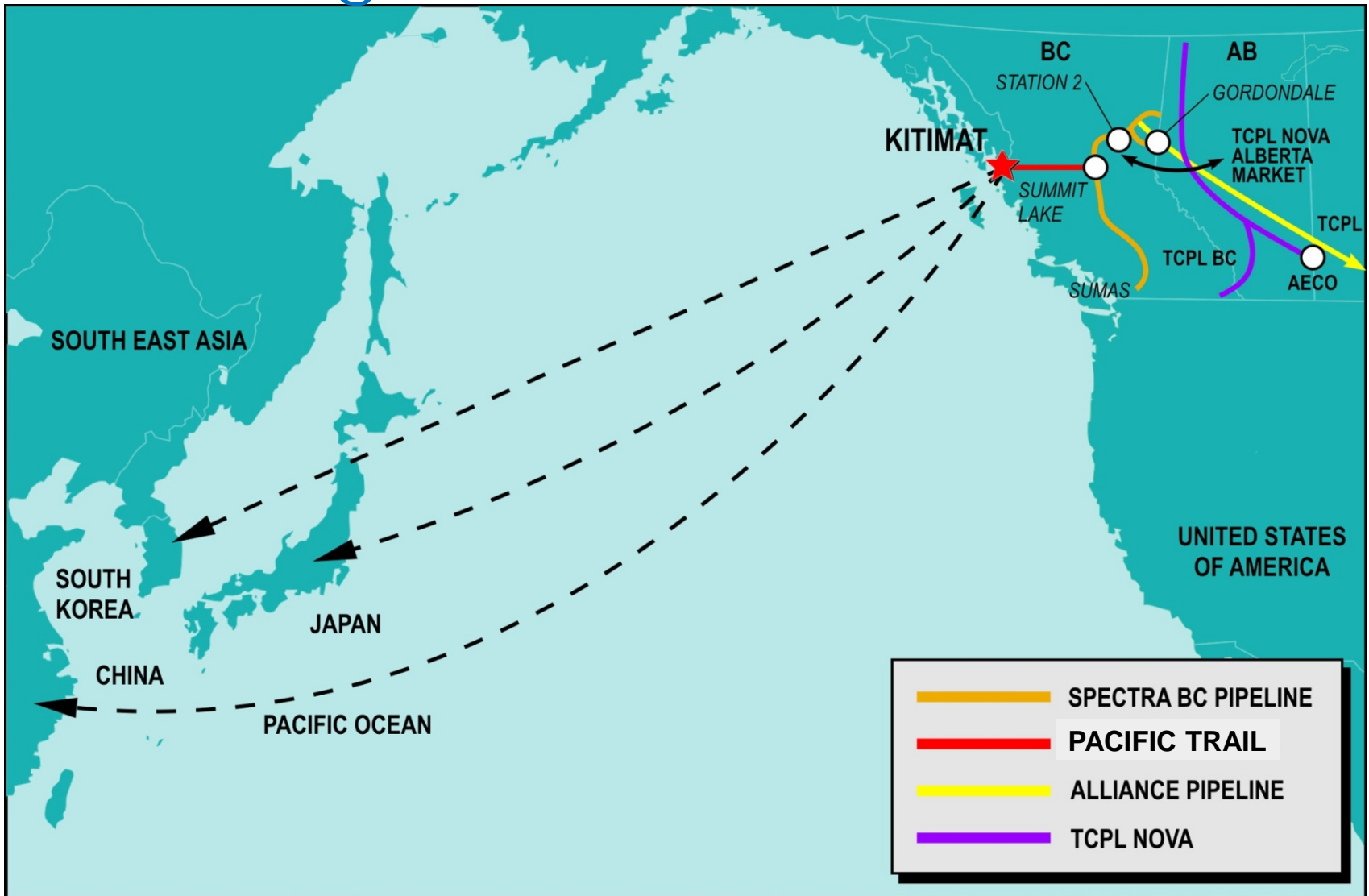
New markets = domestic + abroad

**Domestic** = petrochemicals, oil sands, electricity, fertilizers, manufacturing

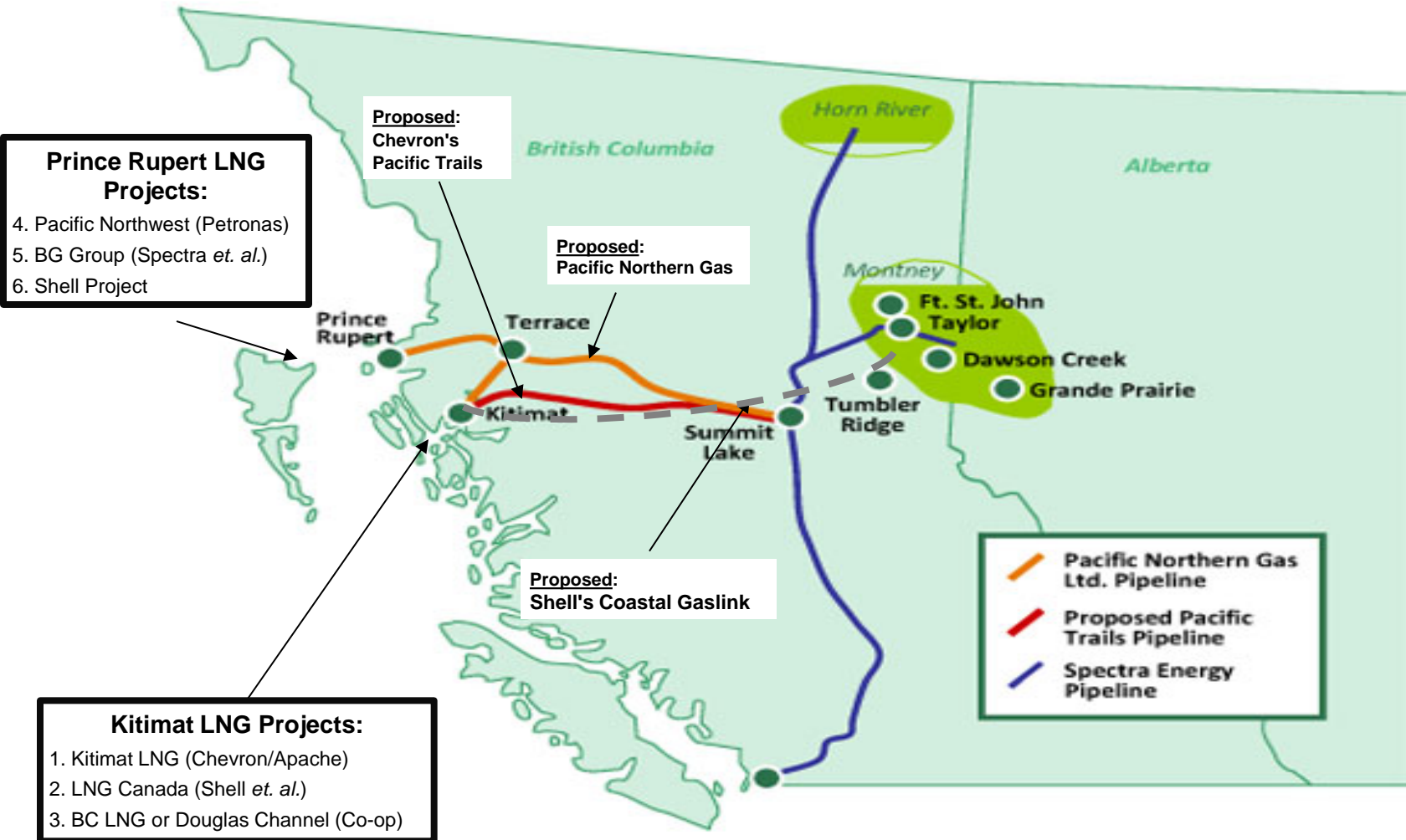
**Abroad** = via LNG facilities to Asia

*Both are critical to industry and Alberta's long term sustainability*

# Accessing New Asia-Pacific Markets

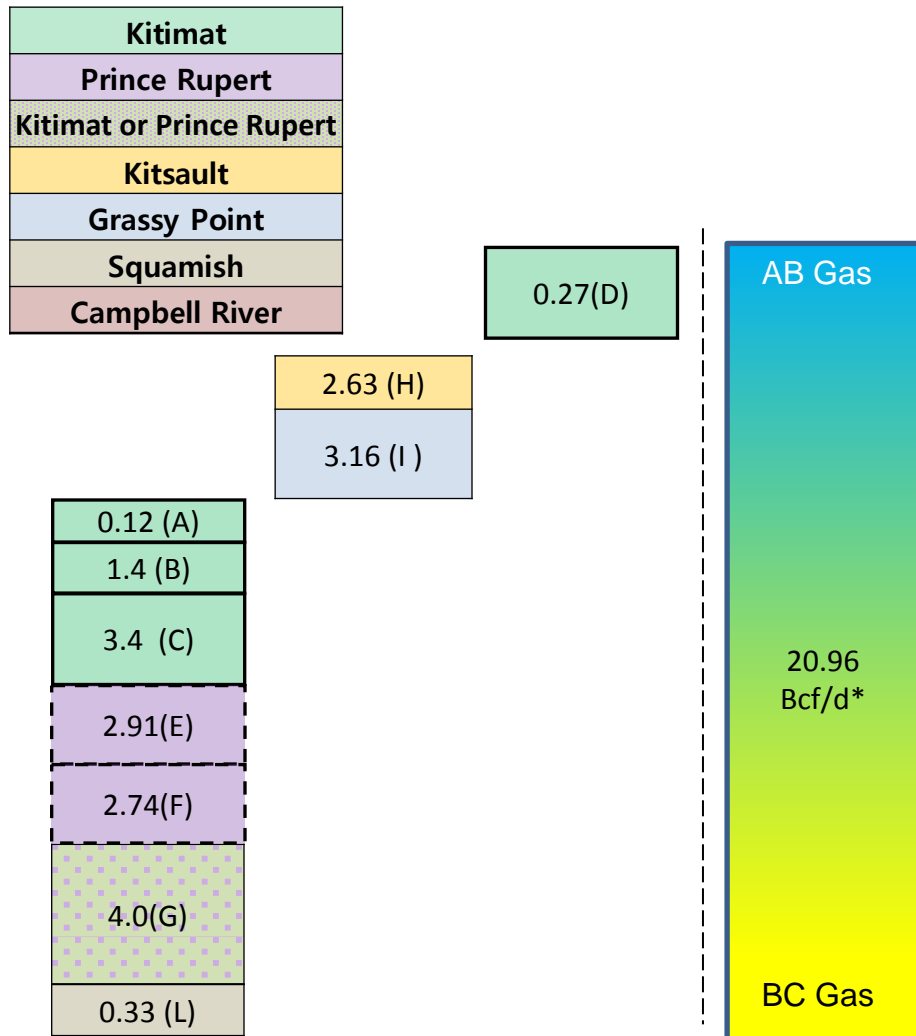


# Natural Gas Movement to the West



# Western Canada

## Project Status and Capacity (Bcf/d)



## Project Details

ID	Project Name	Description
A	<b>Douglas Channel Energy Partnership (BC LNG)</b>	<ul style="list-style-type: none"> <li>Liquefaction facility</li> <li>BC LNG Expert Cooperative LLC(50%), Houston based LNG partners LLC (50%)</li> </ul>
B	<b>Kitimat LNG</b>	<ul style="list-style-type: none"> <li>Liquefaction, storage and loading facilities</li> <li>Chevron (50%), Apache Canada (50%)</li> </ul>
C	<b>LNG Canada</b>	<ul style="list-style-type: none"> <li>Export terminal</li> <li>Shell (40%), Korea Gas Corp(20%), PetroChina Ltd.(20%), Mitsubishi Corp (20%).</li> </ul>
D	<b>AltaGas-Idemitsu</b>	<ul style="list-style-type: none"> <li>Feasibility study on liquefaction plant and expected to ship as early as 2017</li> </ul>
E	<b>Prince Rupert LNG</b>	<ul style="list-style-type: none"> <li>LNG facility</li> <li>BG group PLC, Prince Rupert Port Authority and Spectra Energy</li> </ul>
F	<b>Pacific Northwest LNG</b>	<ul style="list-style-type: none"> <li>Two train export facility</li> <li>Petronas (90%), JAPEX (10%)</li> </ul>
G	<b>WCC LNG</b>	<ul style="list-style-type: none"> <li>Applied for NEB approval, location unspecified (Kitimat or Prince Rupert)</li> <li>WCC: Joint Venture Exxon and Imperial</li> </ul>
H	<b>Kitsault Energy project</b>	<ul style="list-style-type: none"> <li>Floating LNG Facilities.</li> <li>Applied for 25 years export license.</li> </ul>
I	<b>Aurora</b>	<ul style="list-style-type: none"> <li>Applied for 25 years export license.</li> <li>Nexen (CNOOC, China), INPEX(Japan).</li> </ul>
J	<b>Woodside Petroleum</b>	<ul style="list-style-type: none"> <li>LNG Terminal</li> </ul>
K	<b>SK E&amp;S</b>	<ul style="list-style-type: none"> <li>LNG Terminal</li> </ul>
L	<b>Woodfibre</b>	<ul style="list-style-type: none"> <li>Applied for 25 years export license.</li> </ul>
M	<b>Discovery LNG</b>	<ul style="list-style-type: none"> <li>Initial engagement activities with the public, First Nations, and government</li> </ul>

Approved by NEB

Under Regulatory Review

Feasibility Study

Total

(Sources: National Energy Board, Various industry sources, 2013)

\* This total amount does not include 5 projects(J,K and M) for which capacity has not been defined

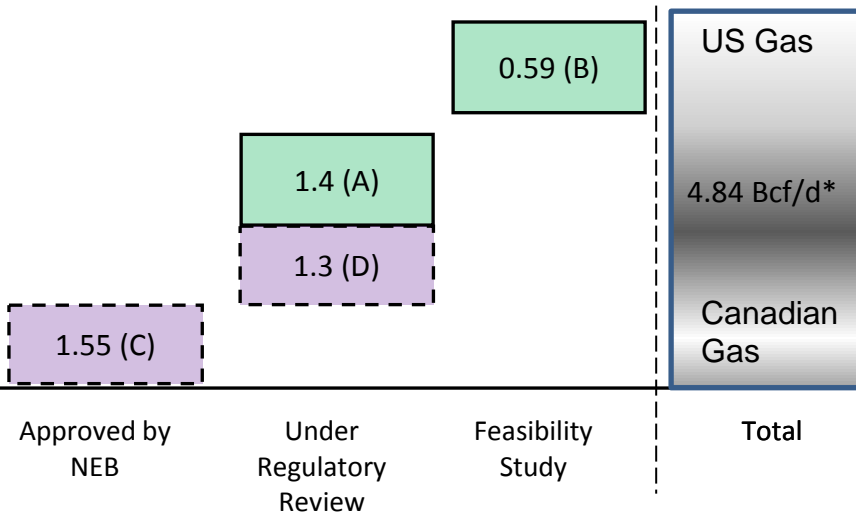
# Eastern Canada and U.S. West Coast

## Project Status and Capacity (Bcf/d)



Canada East Coast

U.S. West Coast



## Project Details

ID	Project Name	Description
A	<b>Pieridae Energy Canada</b> (Goldboro, NS)	<ul style="list-style-type: none"> <li>➤ Pieridae Energy Limited, Goldboro LNG Limited Partnership.</li> <li>➤ Import up to 1.0 bcf/d from US and export up to 1.4 bcf/d.</li> <li>➤ Applied for NEB license for 20 years</li> </ul>
B	<b>H Energy LNG</b> (Melford, NS)	<ul style="list-style-type: none"> <li>➤ H-Energy is a division of the Hiranandani Group, India's largest real estate developer and also has holdings in hotels and health care.</li> <li>➤ Target market include Latin America, Europe and India.</li> </ul>
C	<b>Jordan Cove</b> (Port of Coos Bay, Oregon)	<ul style="list-style-type: none"> <li>➤ Approved by NEB for 25 years export.</li> <li>➤ The proposed export points: existing natural gas pipelines near Kingsgate, British Columbia and near Huntingdon, British Columbia</li> </ul>
D	<b>Oregon LNG</b>	<ul style="list-style-type: none"> <li>➤ Oregon LNG Marketing Company</li> <li>➤ Applied for 25 years export license to NEB</li> </ul>

(Sources: National Energy Board, Various industry sources, 2014)

\* This total amount does not include 5 projects (J, K and M) for which capacity has not been defined

# Asian Investment in Canadian LNG

Project	Stake	Export Capacity	Country
<b>LNG Canada</b>			
<b>PetroChina</b>	20%	0.68 Bcf/d	China
<b>KoGas*</b>	20%	0.68 Bcf/d	Korea
<b>Mitsubishi</b>	20%	0.68 Bcf/d	Japan
<b>Pacific Northwest LNG</b>			
<b>Petronas**</b>	77%	2.11 Bcf/d	Malaysia
<b>Petroleum Brunei</b>	3%	0.08 Bcf/d	Brunei
<b>Japex</b>	10%	0.274 Bcf/d	Japan
<b>IndianOil***</b>	10%	0.274 Bcf/d	India
<b>Aurora LNG+</b>			
<b>Nexen/CNOOC</b>	60%	1.90 Bcf/d	China
<b>INPEX</b>	33%	1.04 Bcf/d	Japan
<b>JGC Corps</b>	7%	0.22 Bcf/d	Japan
<b>Triton LNG+</b>			
<b>Idemitsu</b>	50%	0.135 Bcf/d	Japan

+ Subject to NEB approval

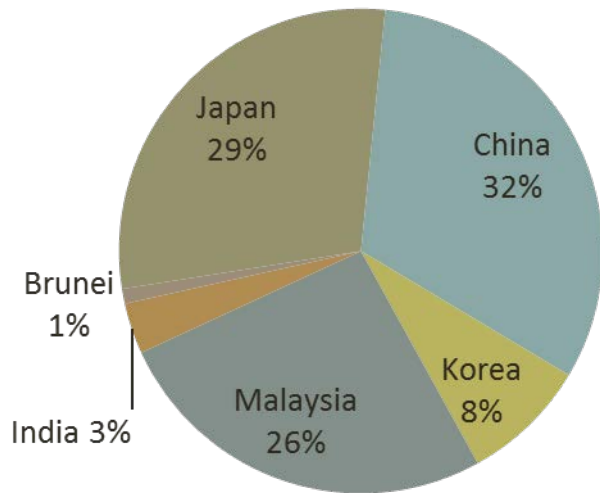
\* Speculation that KoGas to sell 50% of its stake

\*\* Petronas is speculated to reduce its stake to 50%. Rumored to offer 12% to “established Asian LNG buyer.

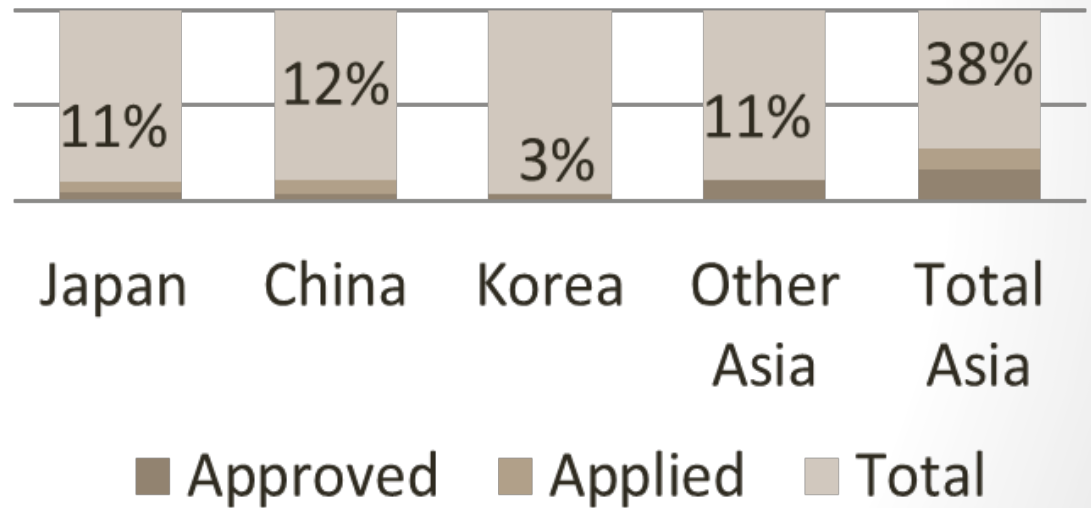
\*\*\* Approval of IndianOil purchase still to be formally announced.

# Asian investments in Canadian LNG

Total Export Capacity to Asia



Export Capacity by Total Capacity



Asian participation in LNG projects provides some assurance of market access and reduces risks of Canadian LNG projects

# Alberta's Downstream Industry

Imperial Oil

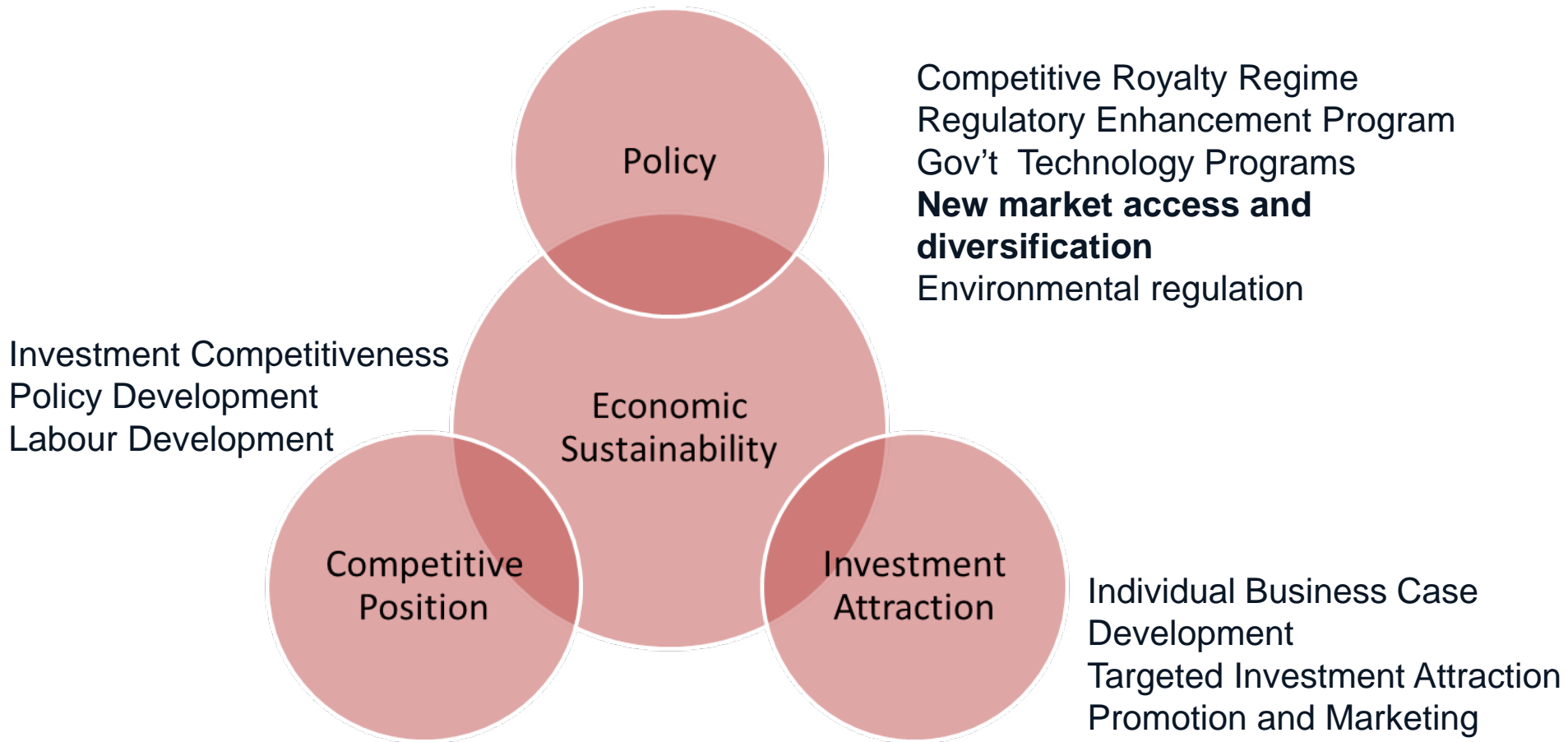


Shell





# Stimulating unconventional resource development: Comprehensive and coordinated initiatives





Freedom To Create. Spirit To Achieve.

# Thank You

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Government  
of Alberta 