



The Importance of Unconventional Gas in North America's Energy Supply

Dave Russum, PGeol.

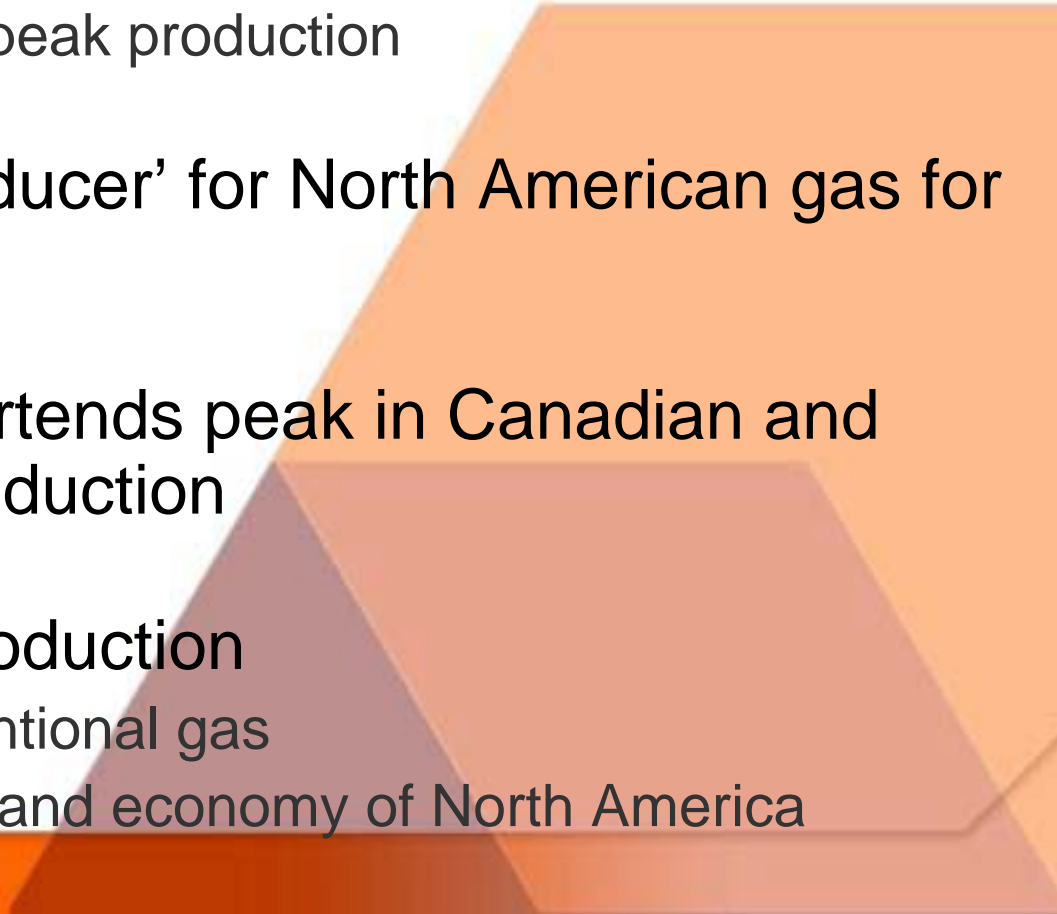
AJM Petroleum Consultants

14th March 2005

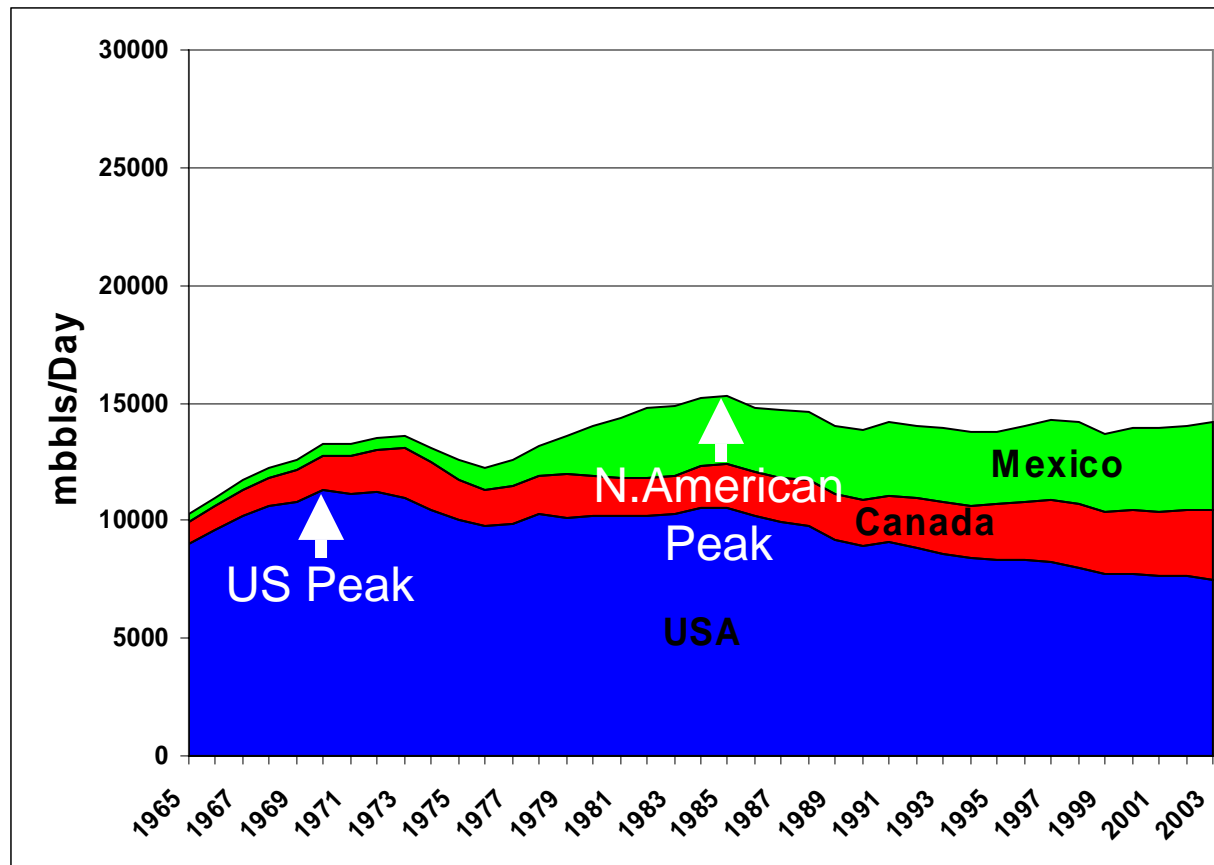
SPWLA Unconventional Reservoirs Symposium,

Kananaskis, Alberta, Canada

The Current Reality

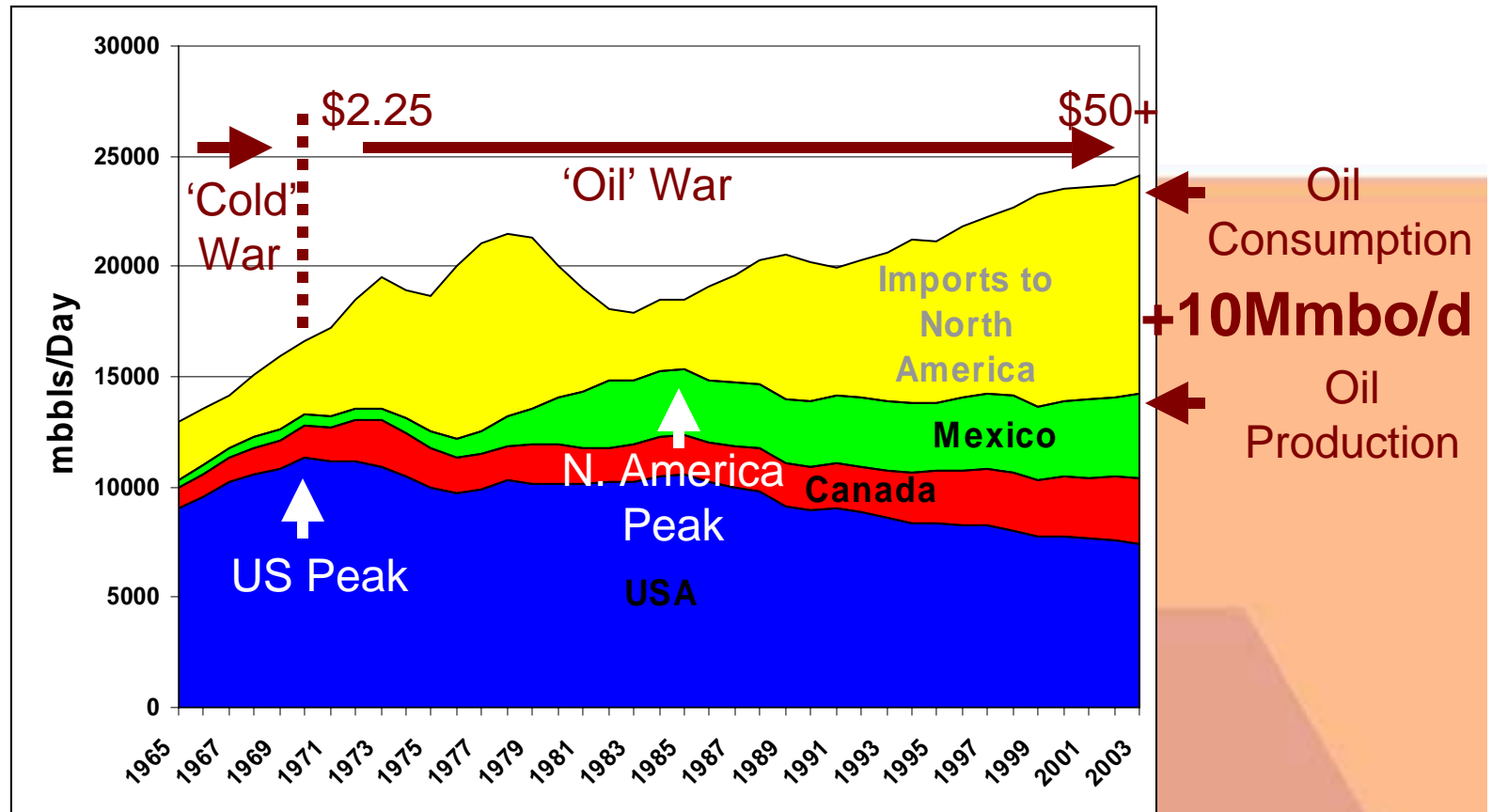
- ◆ World fixation on oil price
 - Close to World oil peak?
 - ◆ North America's situation more critical
 - Reached(?) natural gas peak production
 - ◆ Canada: the 'swing producer' for North American gas for the past decade
 - ◆ Peak of Alberta gas portends peak in Canadian and North American gas production
 - ◆ Flat or Declining gas production
 - good news for Unconventional gas
 - bad news for consumer and economy of North America
- 

North American Oil Production



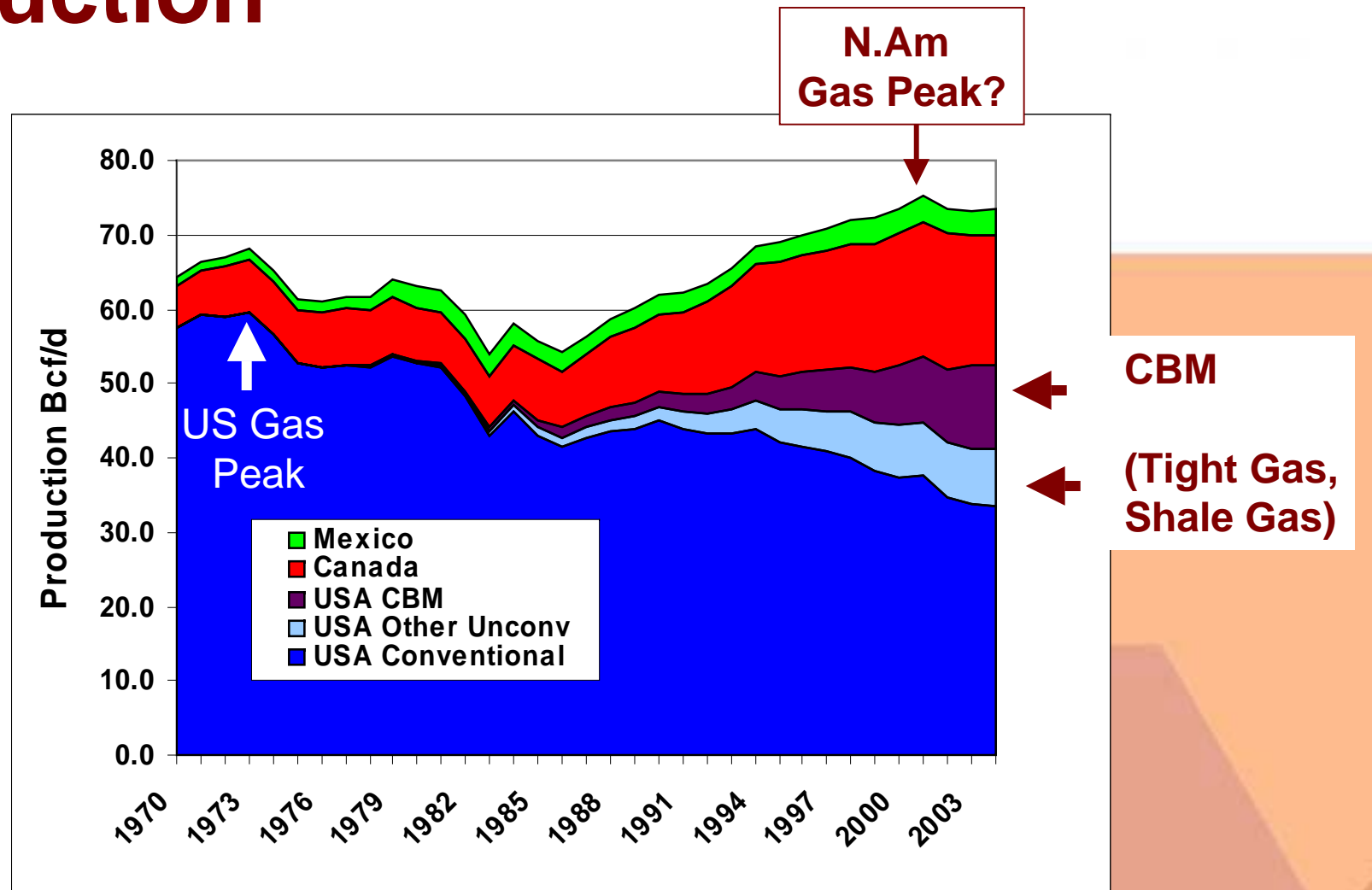
Source: BP, 2004

North American Oil Production + Imports



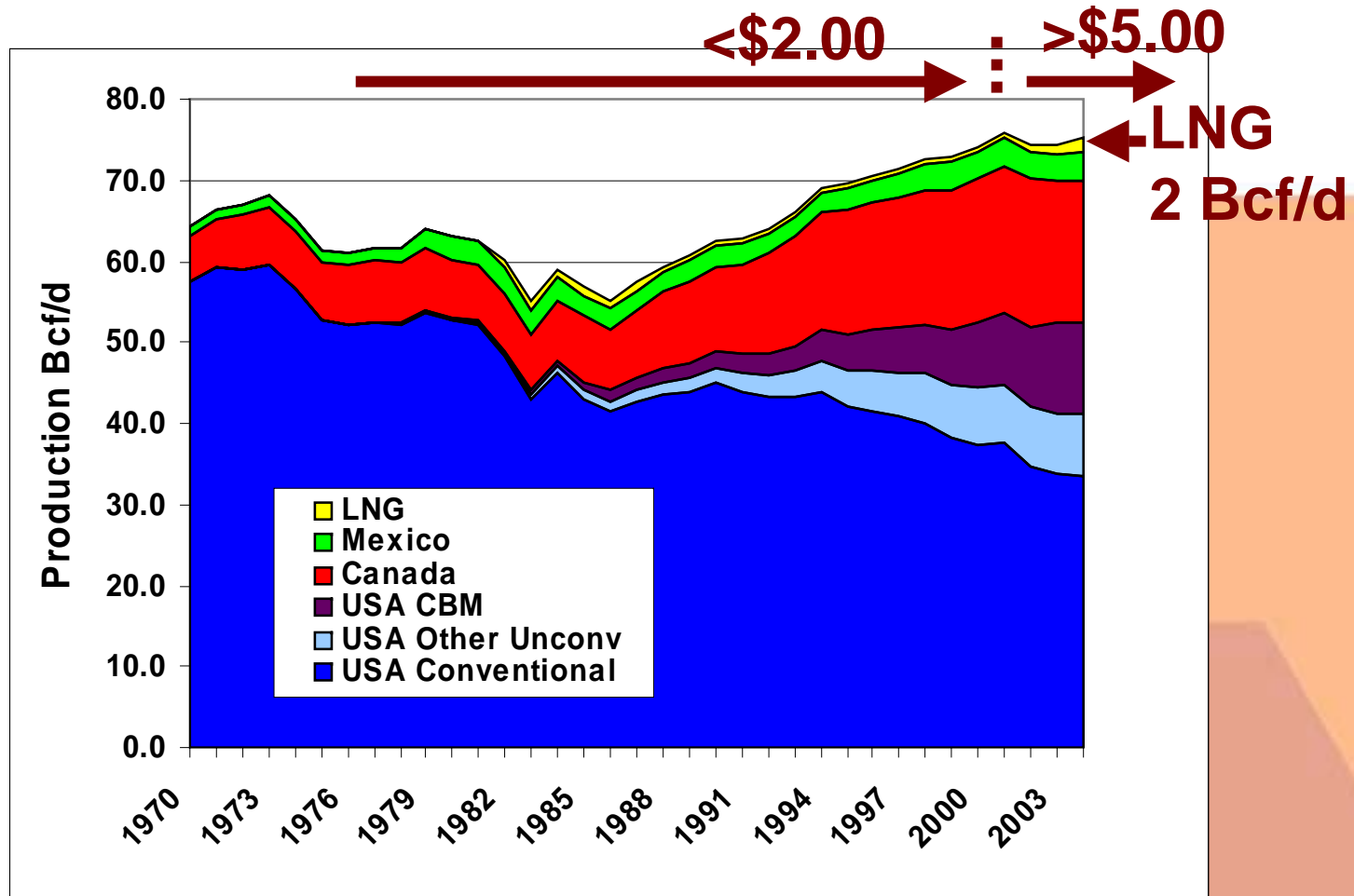
Import Growth after peak responsible for World instability

North American Natural Gas Production

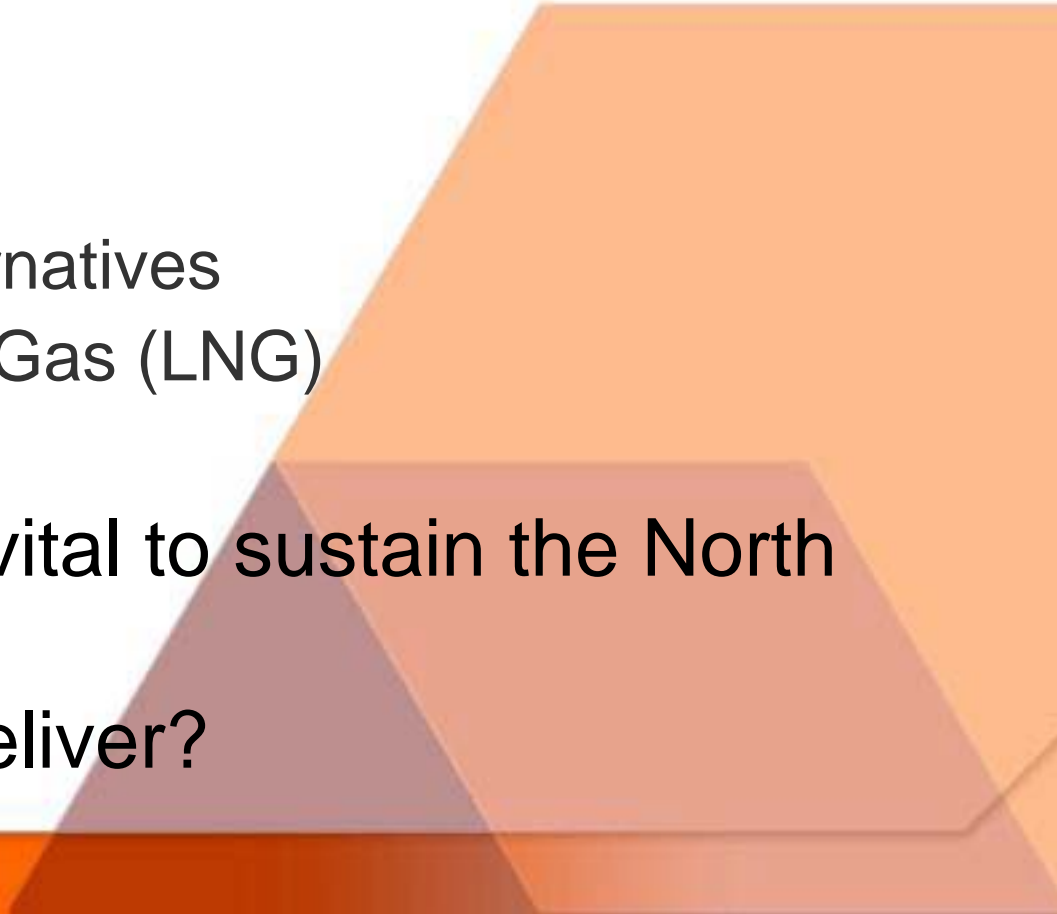


Source: BP, 2004 and others


North American Natural Gas Production + Imports



North American Natural Gas Production

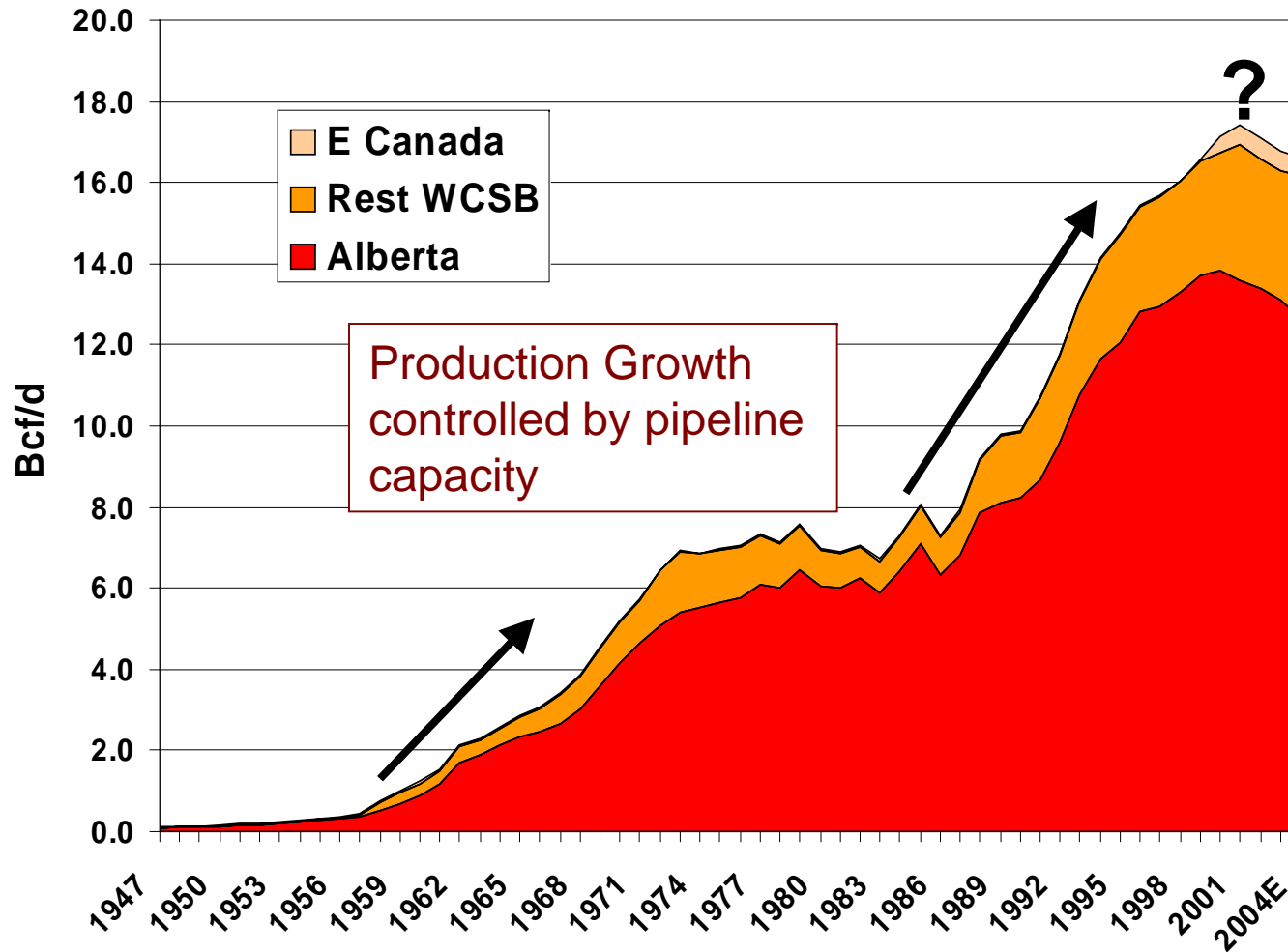
- ◆ Trend lags oil by about 30 Years
 - ◆ Demand increasing at same time that production is declining
 - ◆ Solutions:
 - Consume less
 - Promote energy alternatives
 - Import more Natural Gas (LNG)
 - Unconventional Gas
 - ◆ All four will become vital to sustain the North American economy
 - ◆ What can Canada deliver?
- 

Canada:

- ◆ 3rd Largest Natural Gas Producer
 - ◆ 2nd Largest Natural Gas Exporter
 - ◆ 1% of World Natural Gas Reserves
 - ◆ ~20% of World Drilling Rig Count
- 

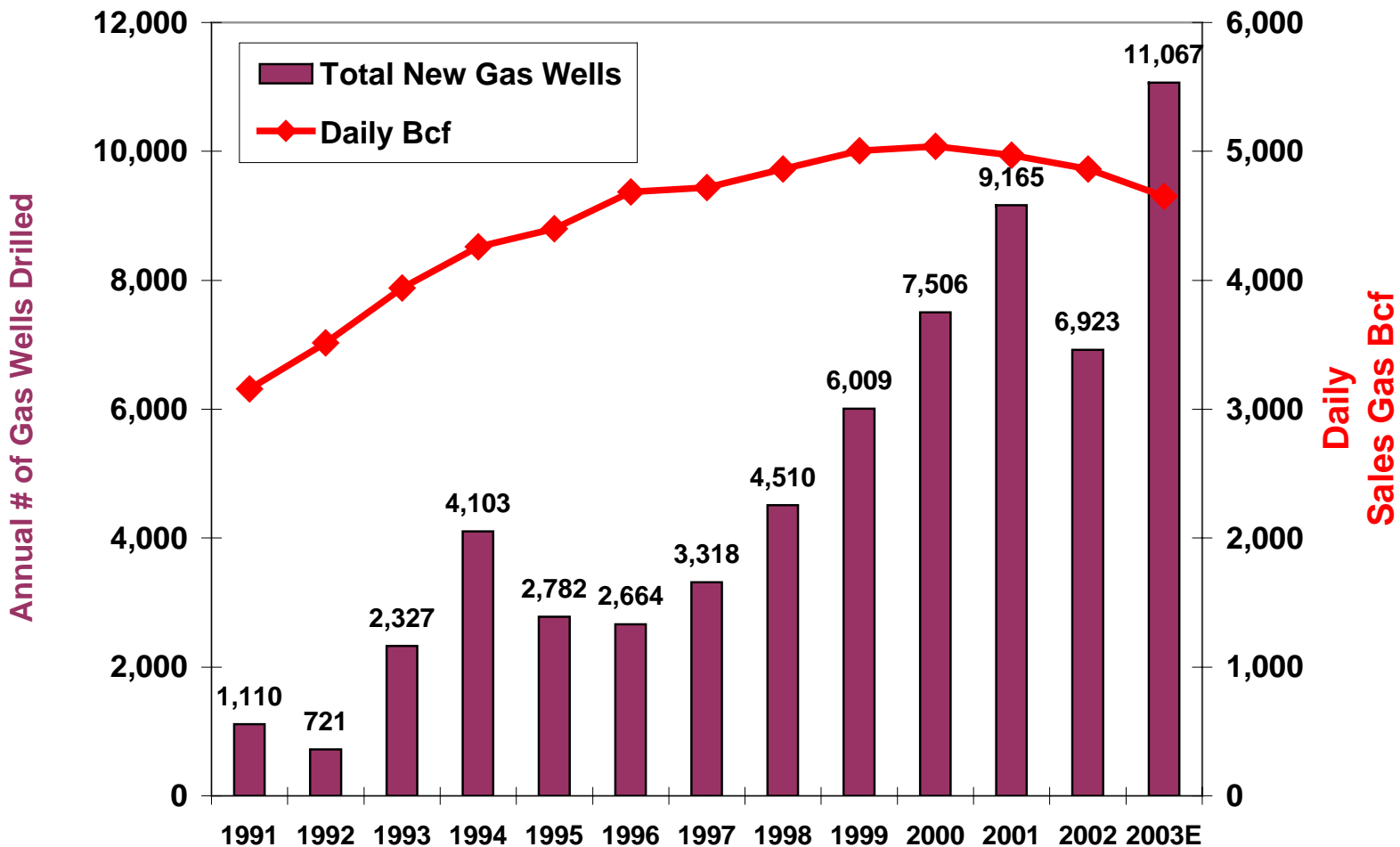
Canada's Natural Gas Production

(Bcf/d Adapted from CAPP Data)



>50% of Canada's production is exported to USA

Alberta New Gas Drilling and Daily Sales Gas (CAPP Data)



High activity, high price and declining production = Red Flag



Canada's Natural Gas Resources and Reserves

Resource Triangle

**Conventional
Reservoirs**

Small Resource
High Quality
Difficult to find
Easy to develop
Low cost
High margin

**Obvious
Traps**



W.C.S.B.

Basin Maturity
Better Technology
(Higher prices)



**Unconventional
Reservoirs**

**Oil
Shale**

**Shale
Gas**

**Gas
Hydrates**

Large Resource
Low Quality
Easy to find
Difficult to develop
High cost
Low margin

Canada's Resources and Reserves

Natural Gas

(Conventional data adapted from CGPC 2001)

?1000'sTcf

Ultimate
Resources

Total
Conventional + Unconventional
592Tcf

?>1,000Tcf

Discovered

340Tcf

Raw Gas

Sales Gas

204Tcf

Unproduced

58 Tcf

(>95% WCSB)

Rate of
Conversion:

Accessibility
Technology

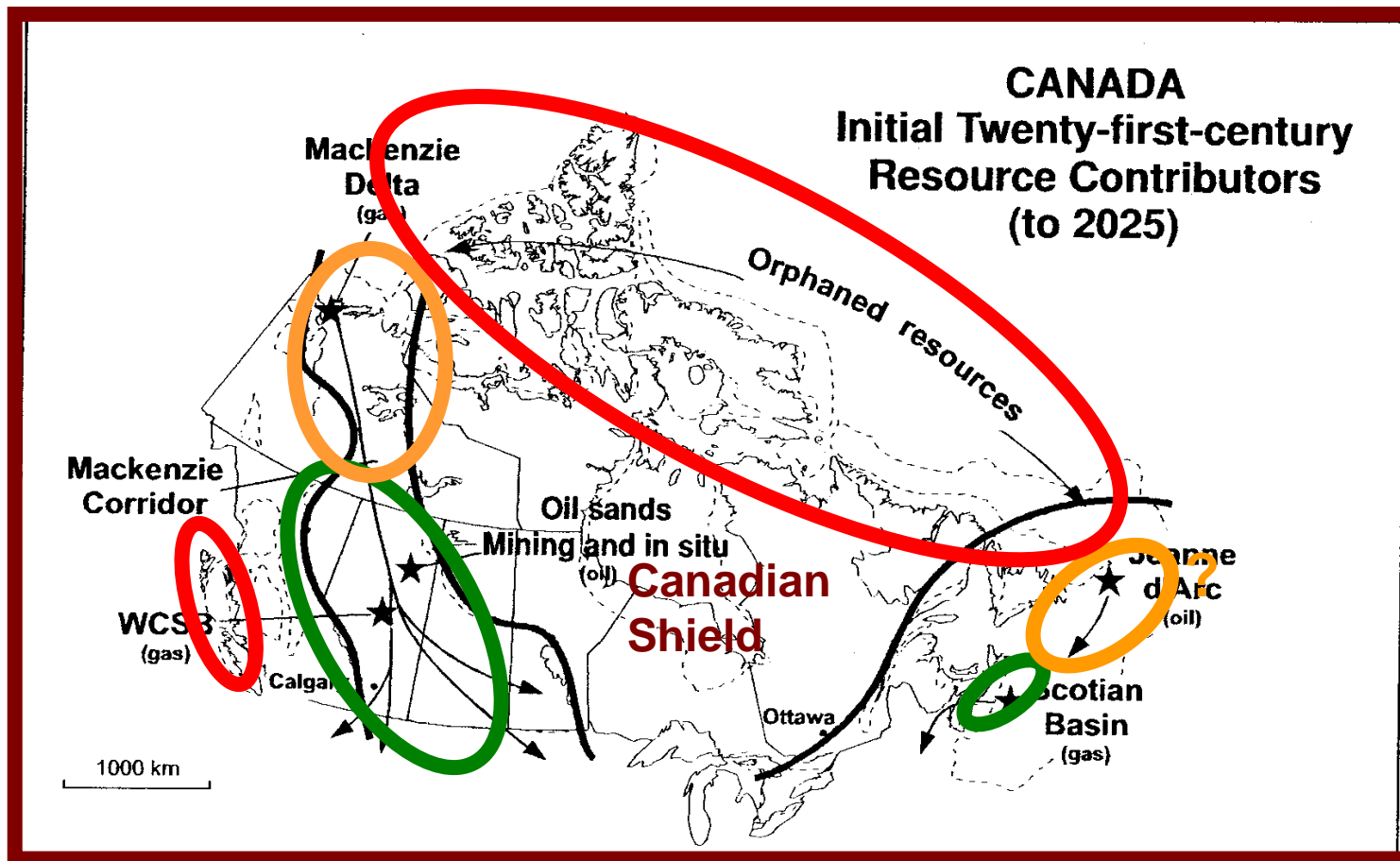
Price

Motivation

Remaining
Reserves



'Orphaned' Conventional Resources (Skipper, 2001)



Green-Amber-Red Resource Assessment

Understanding Remaining Gas Resources – Accessible and Economically Available

	Accessible	Accessible with restrictions	Inaccessible
Available at current prices	Presently Available Resources	Future Available Resources	Unavailable Resources
Available at higher prices	Future Available Resources	Future Available Resources	Unavailable Resources

Can apply this approach to Conventional and Unconventional Resources

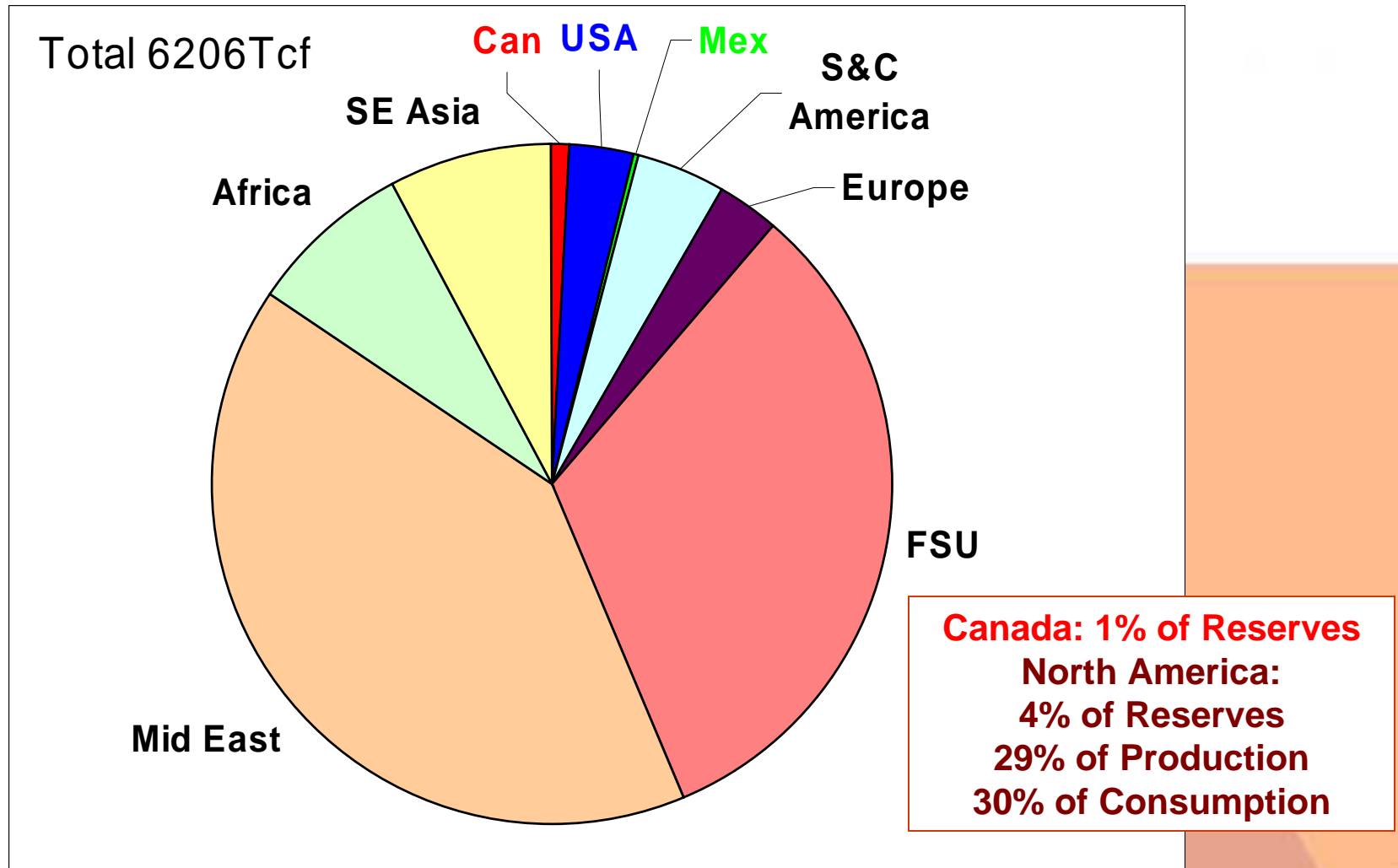
Russum, CSEG Recorder, June 2003



North America and the World of Natural Gas

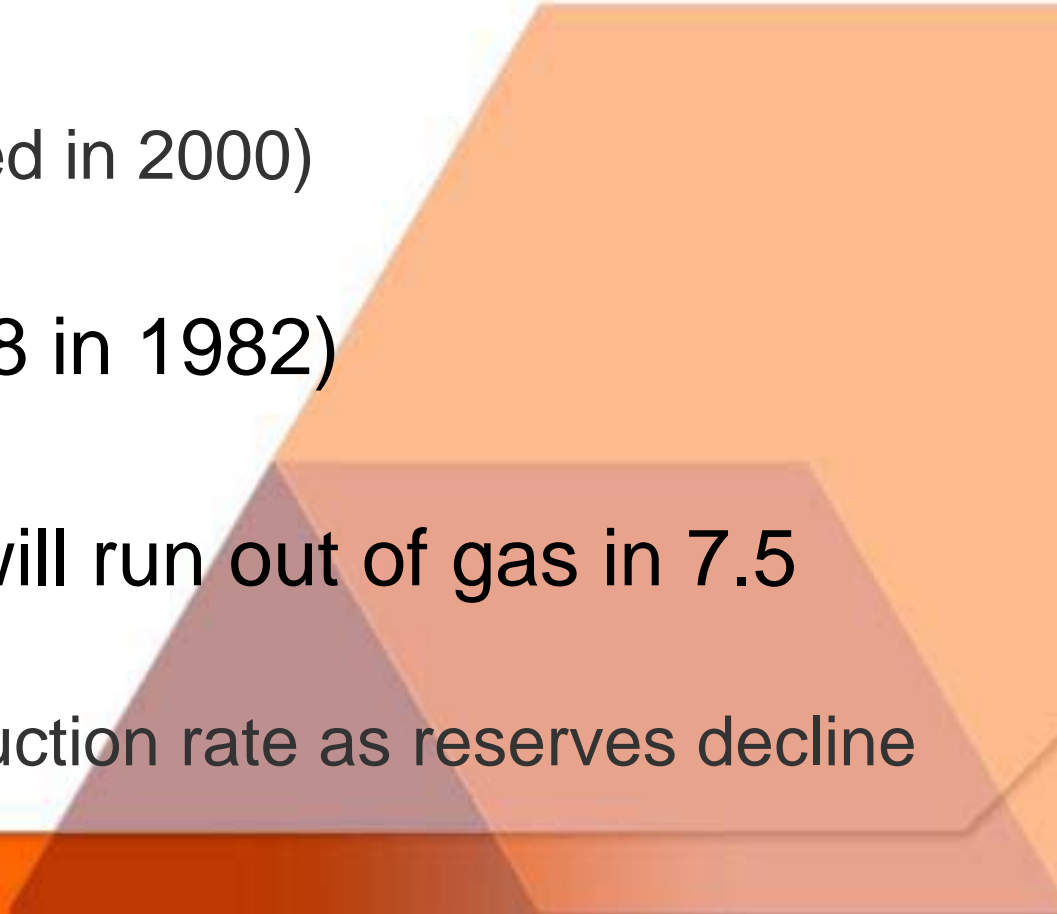
World Gas Reserves

(BP, 2004)



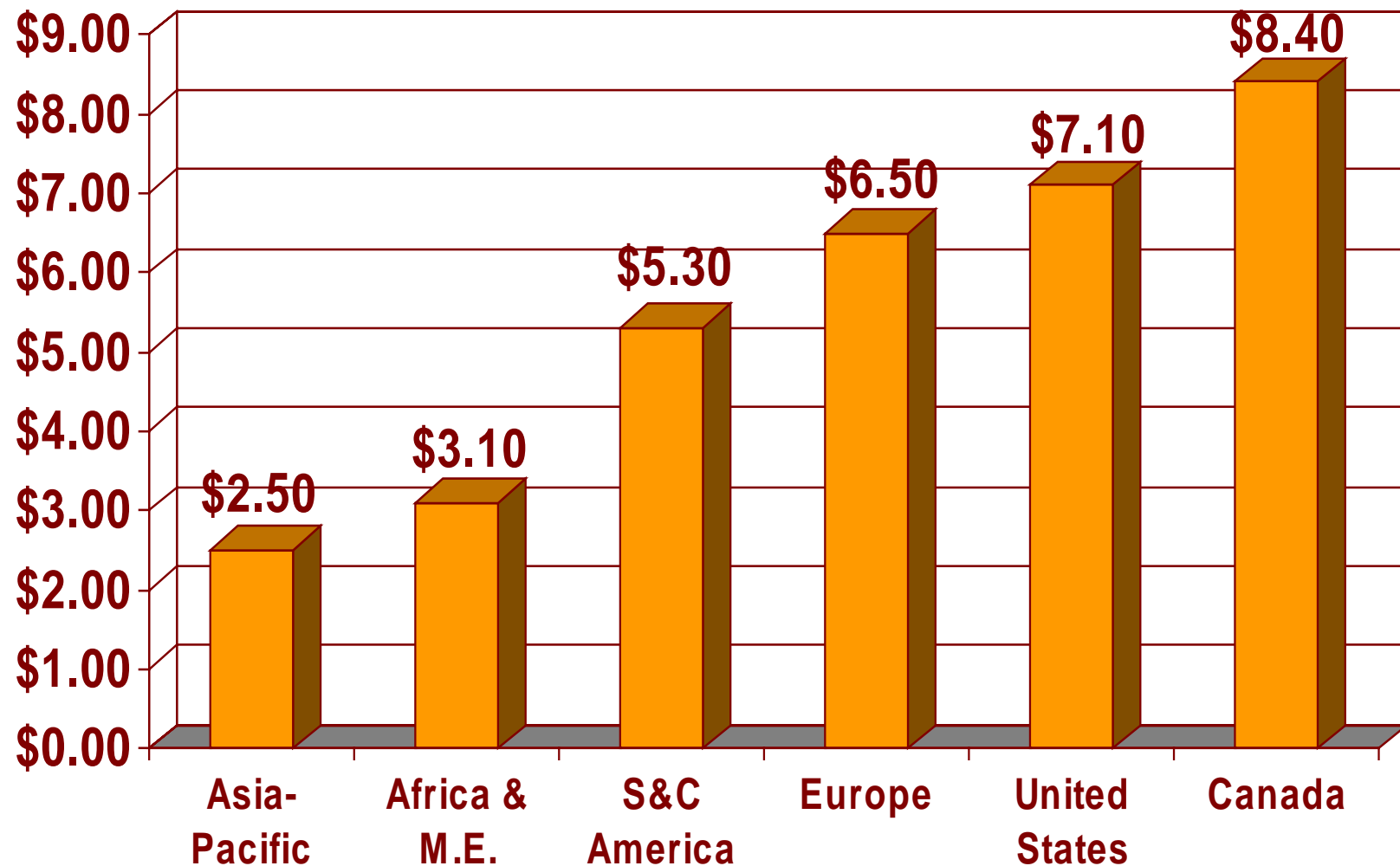
Currently a landlocked resource, LNG could make gas a world commodity

Reserves to Production R/P or RLI

- ◆ Total World: 67.1 Years
 - Russia 81.2 Years
 - USA 9.5 Years
 - Canada 9.2 Years
 - UK 6.2 Years (Peaked in 2000)
 - ◆ Alberta's R/P: 7.5 (28 in 1982)
 - ◆ Does not mean we will run out of gas in 7.5 years!!!
 - Cannot sustain production rate as reserves decline
- 

Reserve Replacement Cost 2002

\$US/BOE (Adapted from: John S. Herold / Harrison Lovegrove & Co.)



“Don’t worry - Canada is less explored than the US”

- ◆ We have fewer Basins
- ◆ Every Basin and geologic trend has different potential
- ◆ The WCSB has been more efficiently exploited than any other Basin in the World
- ◆ Some of early ‘Unconventional’ knowledge evolved in Canada (Deep Basin=BCG, Shallow biogenic gas)

Should not assume we will see the same trends in Canada as have occurred in the USA



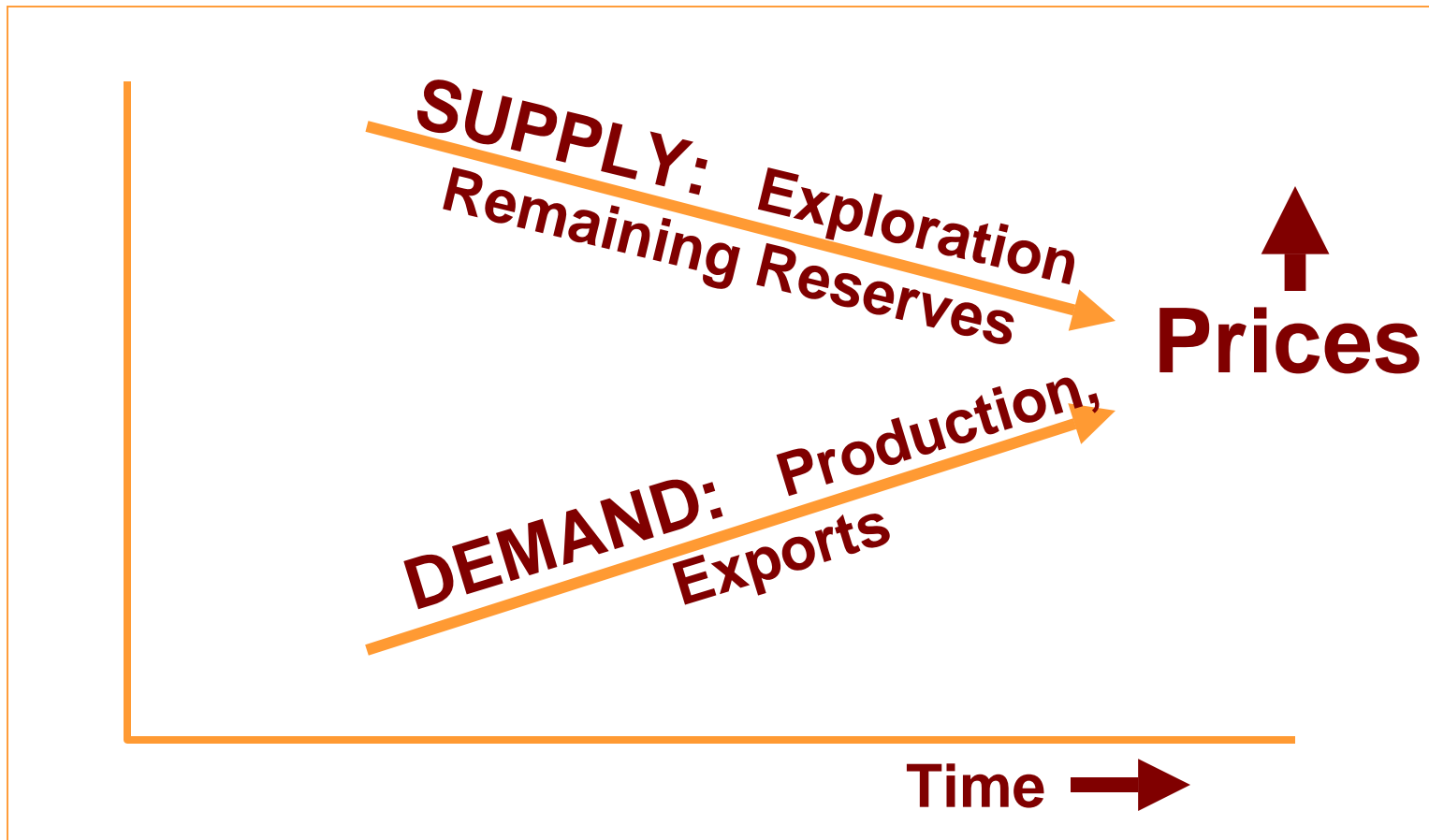
Predicting the Future

Dave Russum
Geo-Help Inc
June 2003

Natural Gas In Canada – Where are we going?

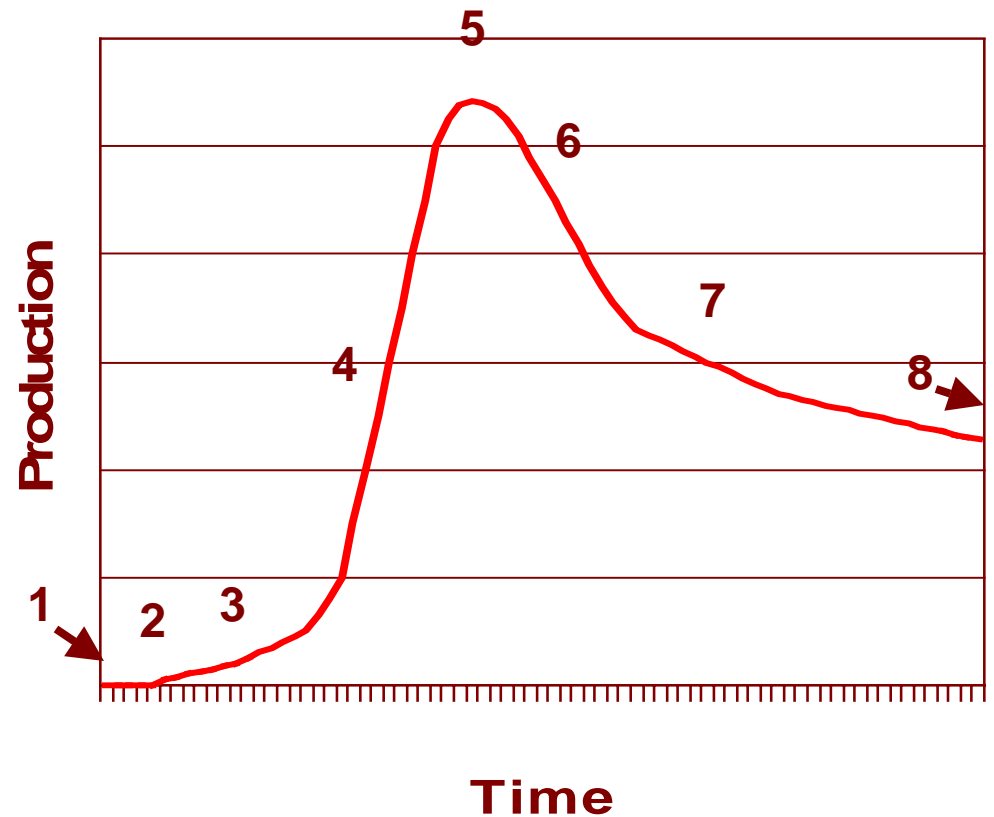
GLOBAL
FUTURE?

Kyoto?
El Nino?
NAFTA?
OPEC?
LNG?
Politics?
Terrorism?
N.Am
Economy?
Energy
alternatives
?



Resource Development Model (RDM) – 8 Stages

- Discovery
- Evaluation
- Development
- Growth
- Peak
- Decline
- Reality
- Abandonment



Knowing current stage of project can better predict future

Canada's Hydrocarbon Stages

Stage	1 Disc	2 Eval	3 Dev	4 Grow	5 Peak	6 Dec	7 Real	8 Abn
AB Gas								
BC Gas								
Sask. Gas								
E. Coast Gas								
Mackenzie Gas								
Coalbed Methane								
Shale Gas								
Gas Hydrates								
AB Oil - Light								
AB Oil - Heavy								
Tar sands - surface								
Tar sands – in situ								



?

?

Predicting the future

Resource Development Model

+

Current Production*

+

Decline Analysis*

+

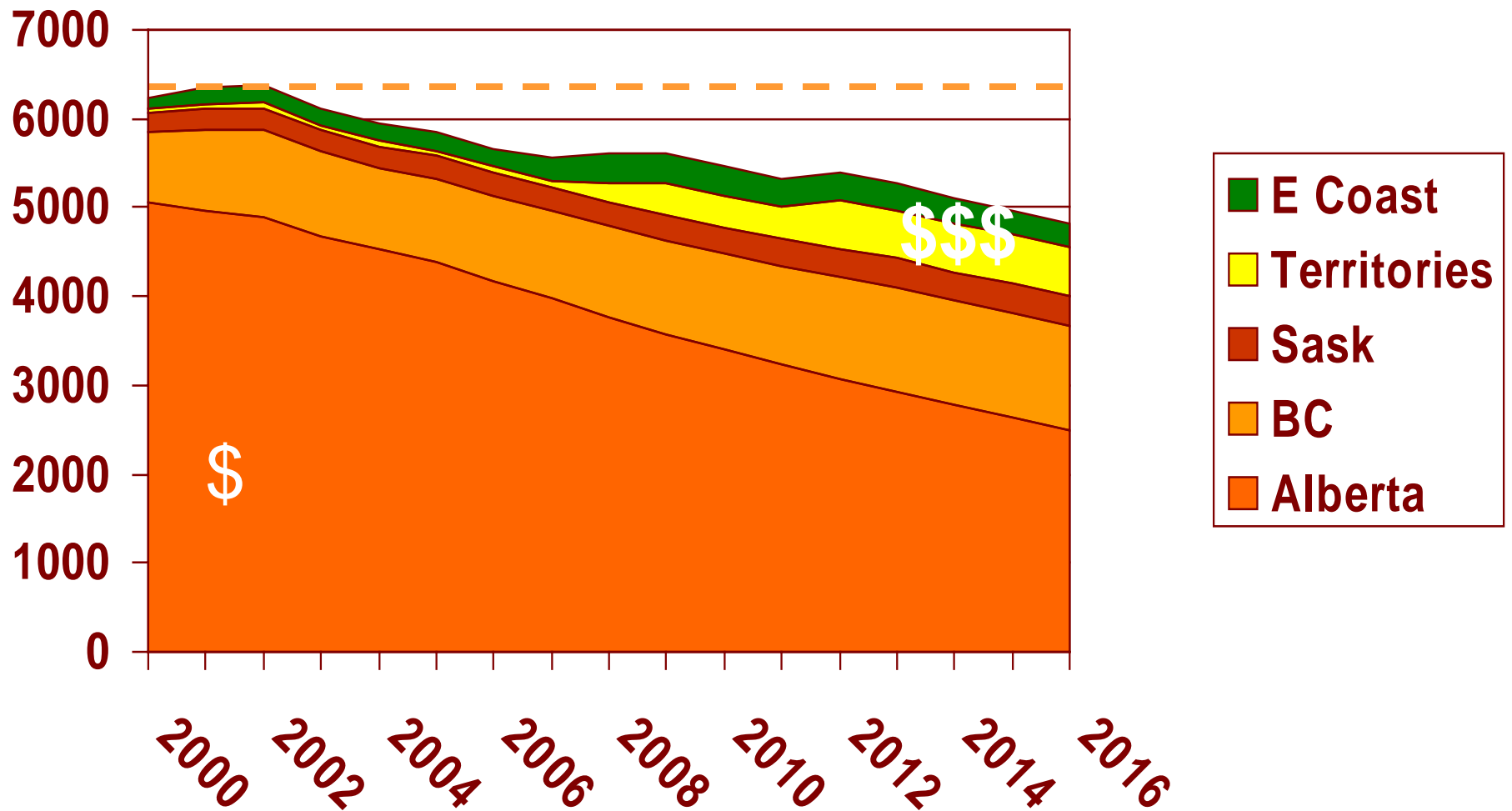
Investment/Exploration/Drilling/Technology trends

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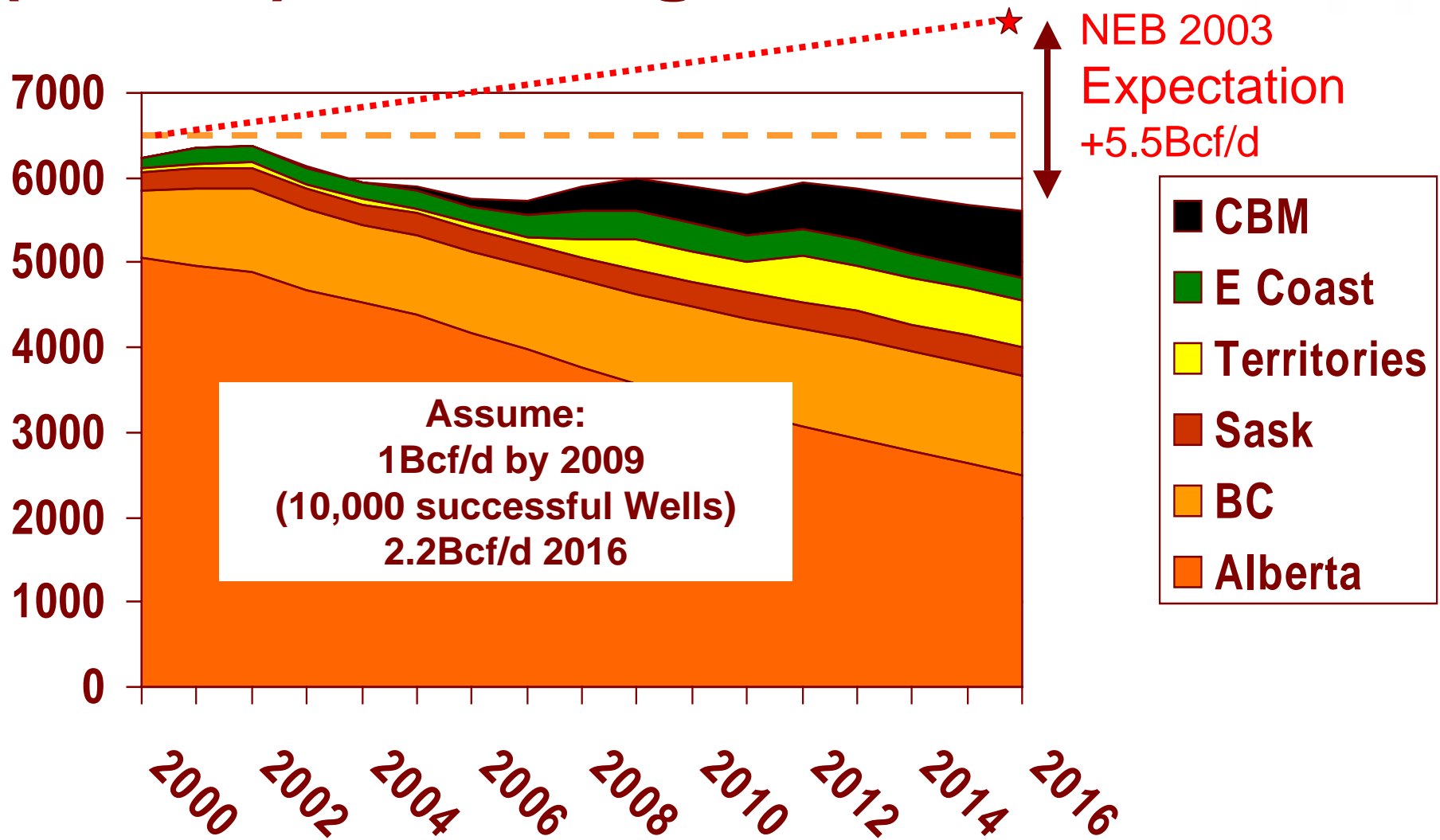
Accurate prediction of future production

* Data from PetroCube a new product from AJM Petroleum Consultants

Future Conventional Marketable Gas Prediction (Bcf/Yr)



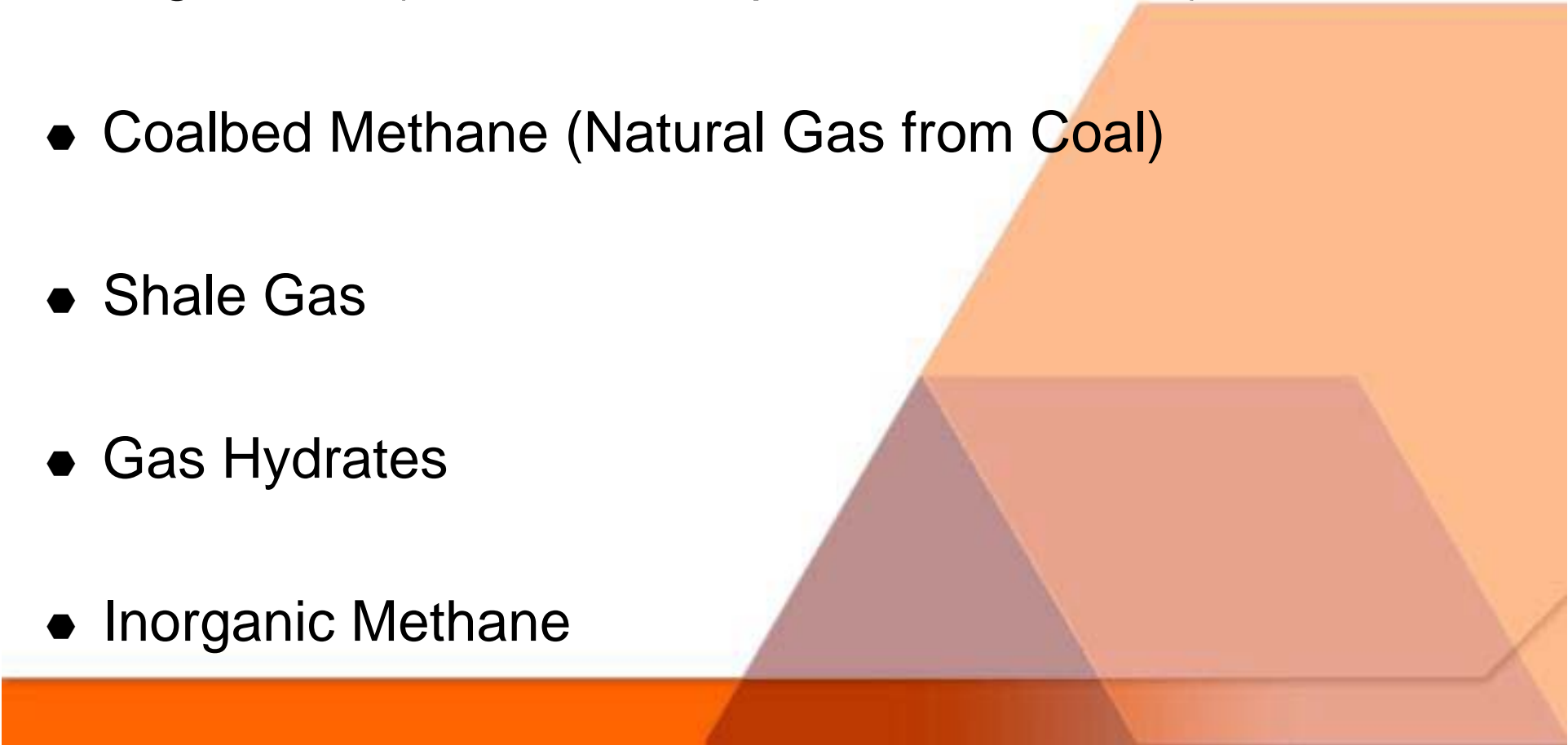
Future Marketable Gas Prediction (Bcf/Yr) Including Unconventional



Unconventional Gas

- ◆ ‘More Challenging to extract’:
 - Low permeability
 - Low productivity, often low decline rates
 - Source rock and reservoir closely related
 - Large resources, recovery factors low
 - Require greater drilling density
 - Environmental issues
 - Area and resource specific solutions
 - Low risk once specific solutions identified
 - Relatively high cost

Types of Unconventional Gas

- ◆ Shallow Biogenic Gas
 - ◆ 'Tight' Gas (includes Deep Basin and BCG)
 - ◆ Coalbed Methane (Natural Gas from Coal)
 - ◆ Shale Gas
 - ◆ Gas Hydrates
 - ◆ Inorganic Methane
- 

Unconventional Gas Opportunities

	Status USA	Resource in Canada	Status Canada
Shallow Biogenic Gas	On-going Production	Large	Production since 1905
Tight Gas	Growth Opportunity	Large	Production since 1976
Coalbed Methane	On-going Production	Large	Production since 2002
Shale Gas	On-going Production	Large?	Experimental activity
Gas Hydrates	Experimental Research	Very Large	Experimental Research
Inorganic Gas	?Theoretical	?	?Theoretical

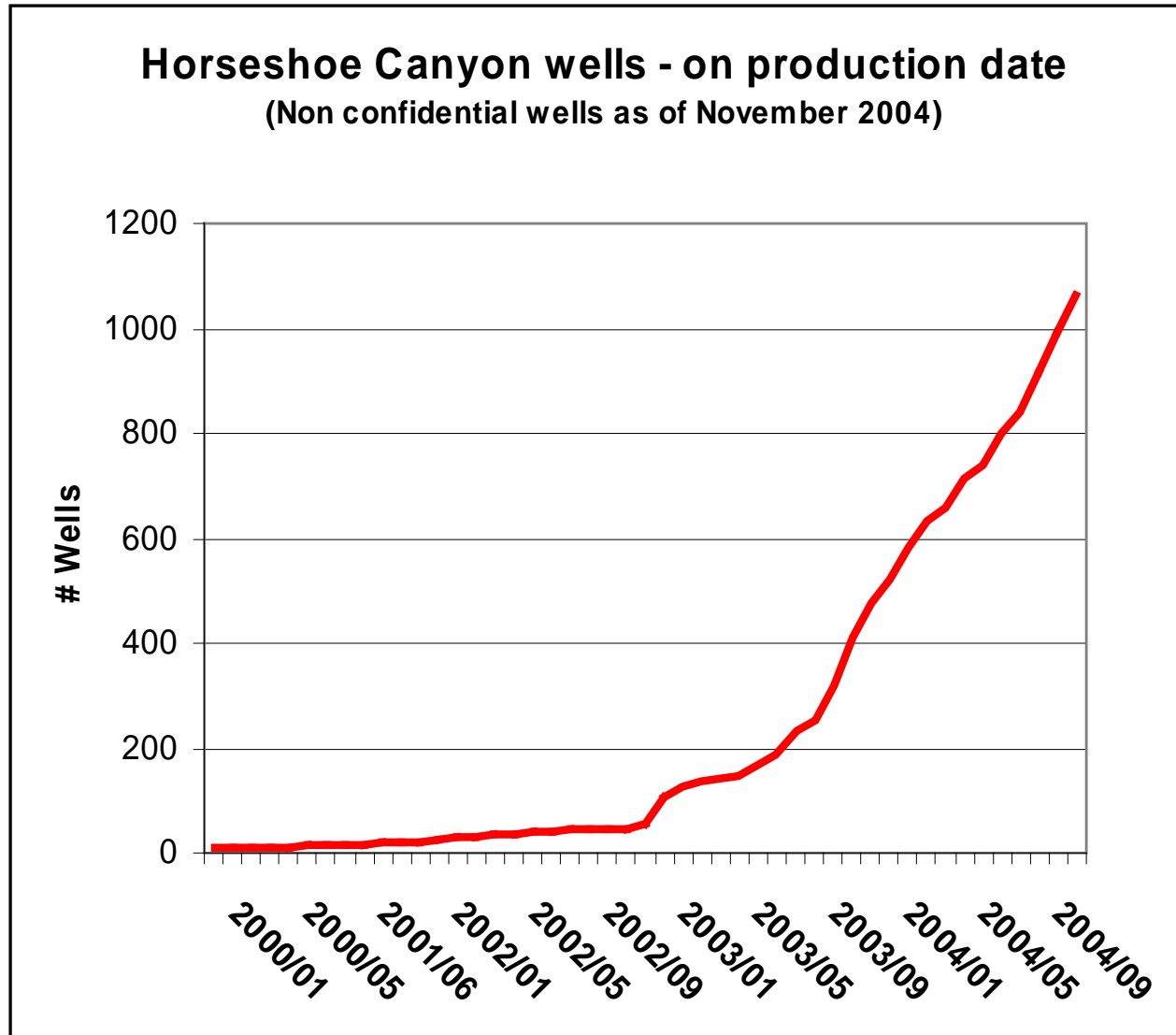
Canada's CBM Opportunities

- Significant coal bearing basins from Vancouver Island to Nova Scotia
- Best opportunities in WCSB especially where infrastructure available and environment familiar with gas activity
- 4 primary coal intervals identified:
 - **Ardley Coals**, Scollard Formation, Upper Cretaceous/Tertiary
 - **Horseshoe Canyon Coals**, Edmonton Group/Belly River Group, Upper Cretaceous
 - **Mannville Coals**, Lower Cretaceous
 - **Kootenay Coals**, Lower Cretaceous/Upper Jurassic
- Major challenge is finding sufficient permeability

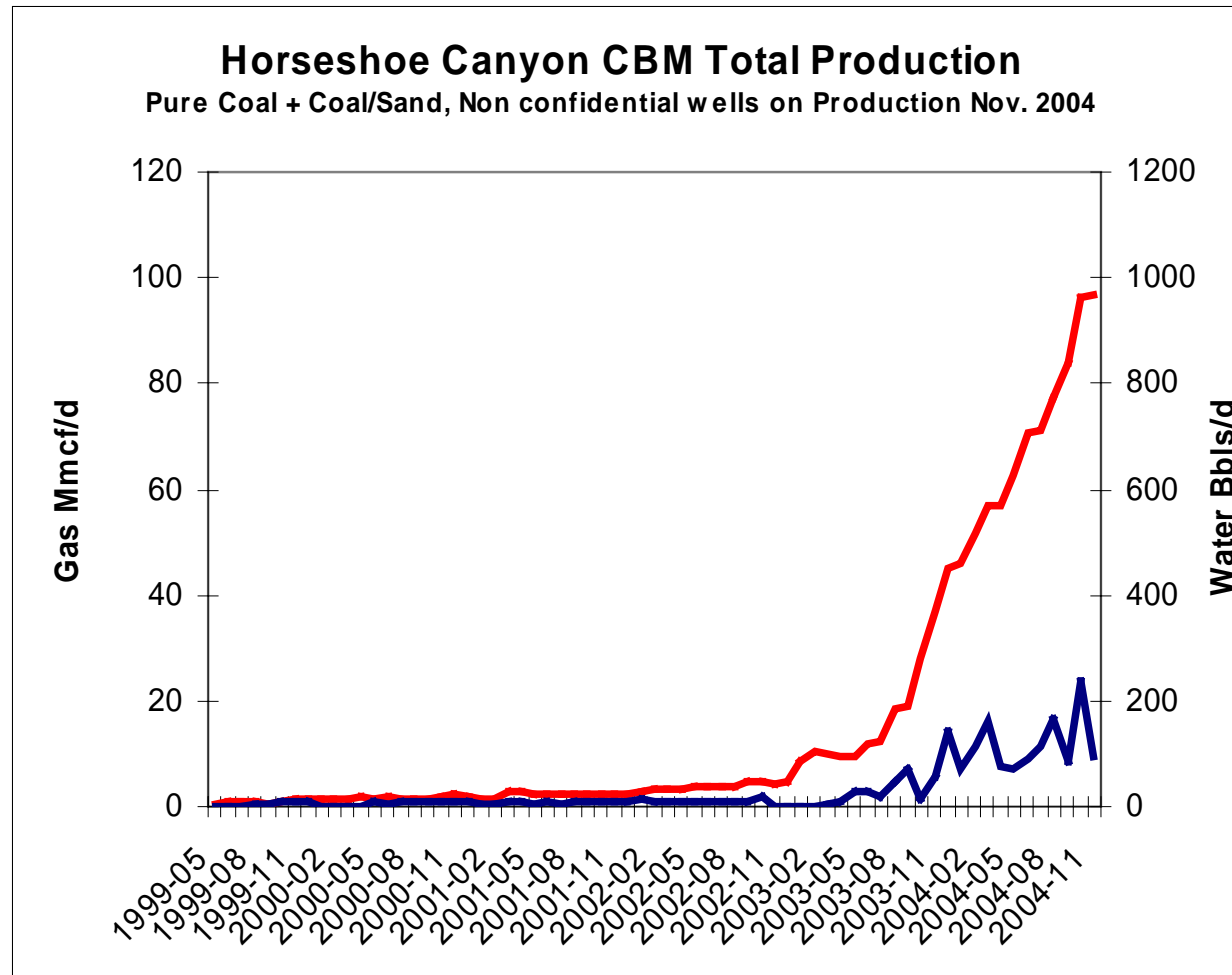
WCSB Coalbed Methane

	Resource Potential	Status	
Ardley Coal WC Alberta	Low/Moderate	Limited activity, Best potential is relatively remote	Red
Horseshoe Canyon Coal	High	Focus of current activity, readily accessible, dry gas	Green
Mannville Coal WC Alberta	Very High	Experimental activity, requires de-watering eg. Trident, Corbert Creek.	Orange
Mannville Coal NE BC	Moderate?	Experimental activity, - 7 permits granted, confidential results	Orange
Kootenay Coal SE BC	Moderate	Experimental , Encana, Devon. Coal continuity and environmental problems	Red

Horseshoe Canyon CBM - Activity



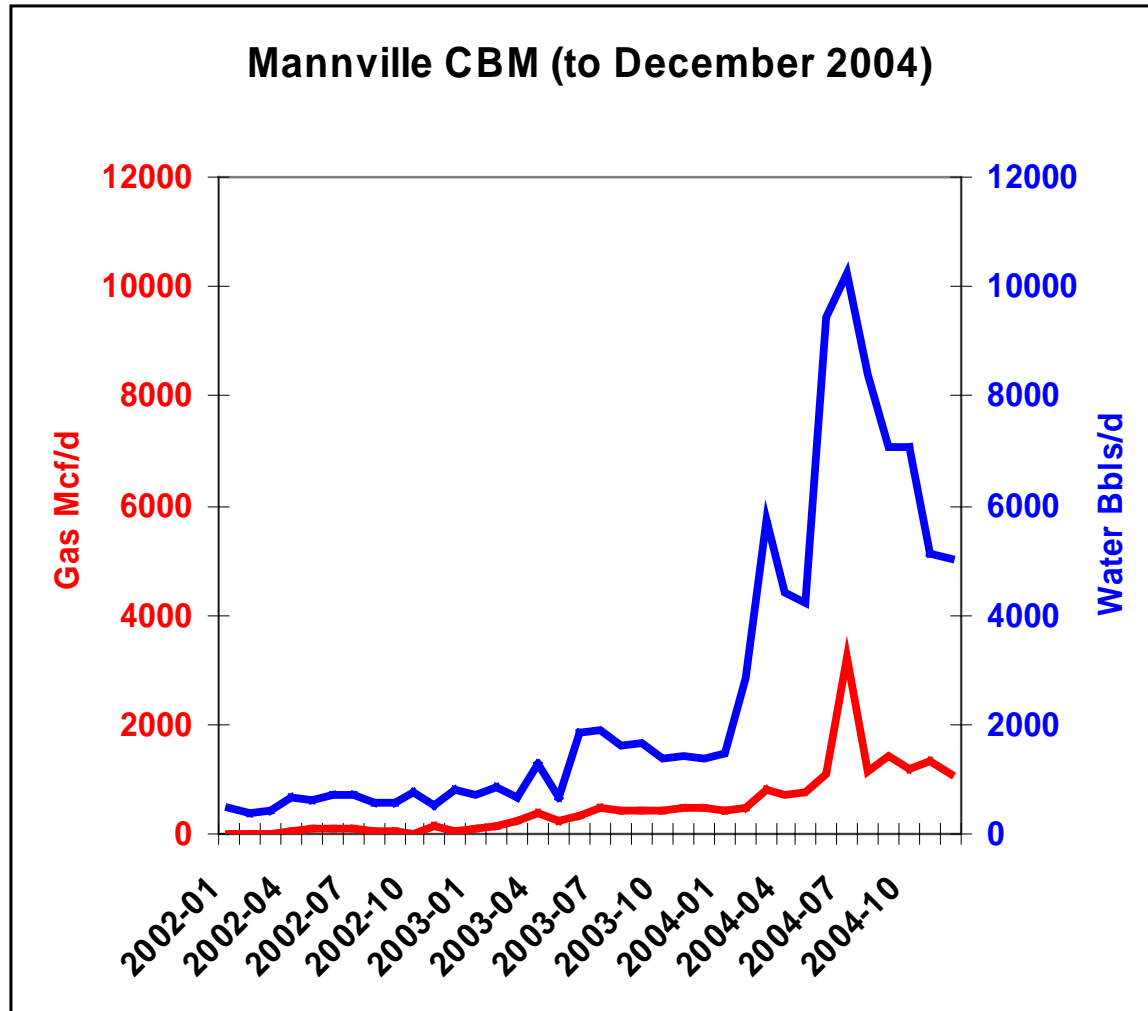
Horseshoe Canyon CBM Production



CBM producing well count: 1061, Water <2bbls/Mmcf

Mannville CBM Production

AJM Database wells producing Dec 2004



CBM producing well count: 59, Water >3000 bbls/Mmcf

Our Challenges in Canada:

- ◆ 'Just in time' Industry focused on short-term results
- ◆ We have become risk averse
- ◆ Not investing in enough research for exploration and extraction
- ◆ Escalating COF&D
- ◆ Governments have taken a hands-off approach to energy (no overall energy management or plan)
- ◆ Obligations to Kyoto and NAFTA
- ◆ Increased demand for energy to extract oil

The Challenge for North America

- ◆ Promote Unconventional resources, alternative energy sources and energy conservation

OR

- ◆ Place our energy destiny in the hands of foreign countries by accepting LNG as the solution

Summary

- ◆ Canada (North America) is not running out of **gas resources**
- ◆ Rapidly depleting our **accessible, low cost gas reserves**
- ◆ Alternatives exist – take research, time and money
- ◆ We need to be very conscious of costs and economic viability in relation to a North American and World market
- ◆ The need for Unconventional gas will be huge – at the right price!

Welcome your feedback

**Contact Dave Russum
Email: daver@ajma.net**

**More Information:
www.ajma.net**

Thank You