



# The Canadian Oil and Natural Gas Industry

## *Competitive Considerations in CO<sub>2</sub> EOR*

Canadian Association  
of Petroleum Producers

**CAPP**

[www.capp.ca](http://www.capp.ca)



# *Canada's Crude Oil and Natural Gas Industry*

- World's 3rd largest natural gas producer
- World's 13th largest crude oil producer
- Oil & gas trade surplus accounts for:
  - Close 50% of Canada's trade balance
- Employment near 500,000 in Canada
- Invest close to \$25 billion in 2000
  - Largest single private sector investor in Canada



# *Year 2000 in Review*

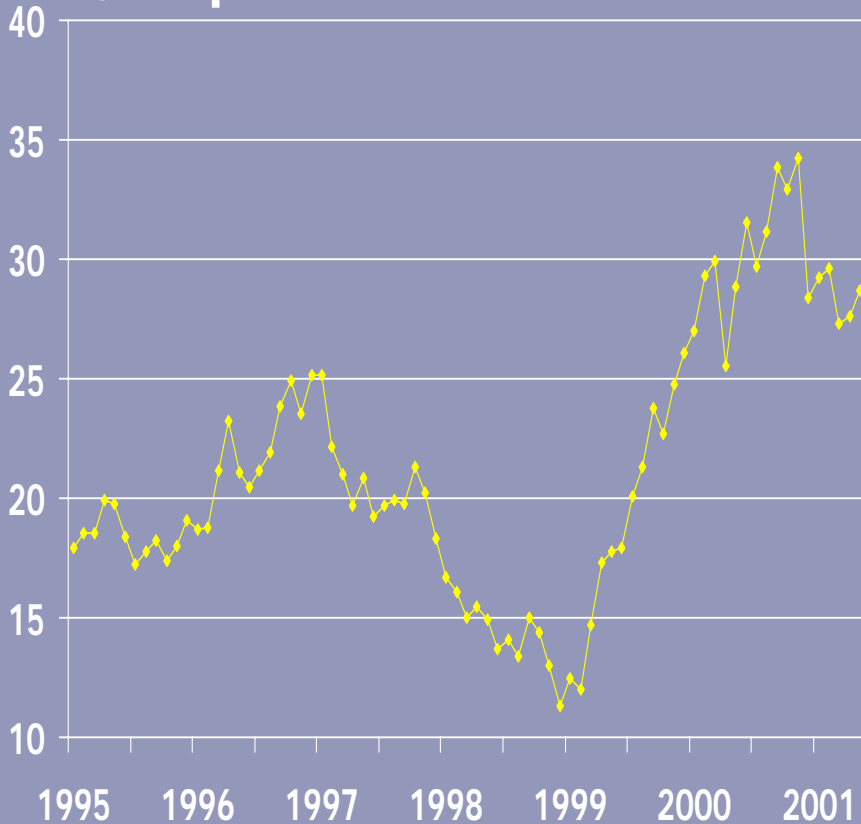
- **Production:**
  - ↗ **Crude oil: 2.2 million barrels per day (record)**
  - ↗ **Natural gas: 6.3 trillion cubic feet per year (record)**
- **Exports:**
  - ↗ **Crude oil: 1.4 million barrels per day**
  - ↗ **Natural gas: 3.5 trillion cubic feet per year**
- **Drilled: 17,500 wells in Canada**
- **Capital investment: C\$25 billion**
- **Payments to governments: \$15 billion**



# Crude Oil and Natural Gas Prices since 1995

## Crude Oil Prices (WTI NYMEX)

\$US per barrel



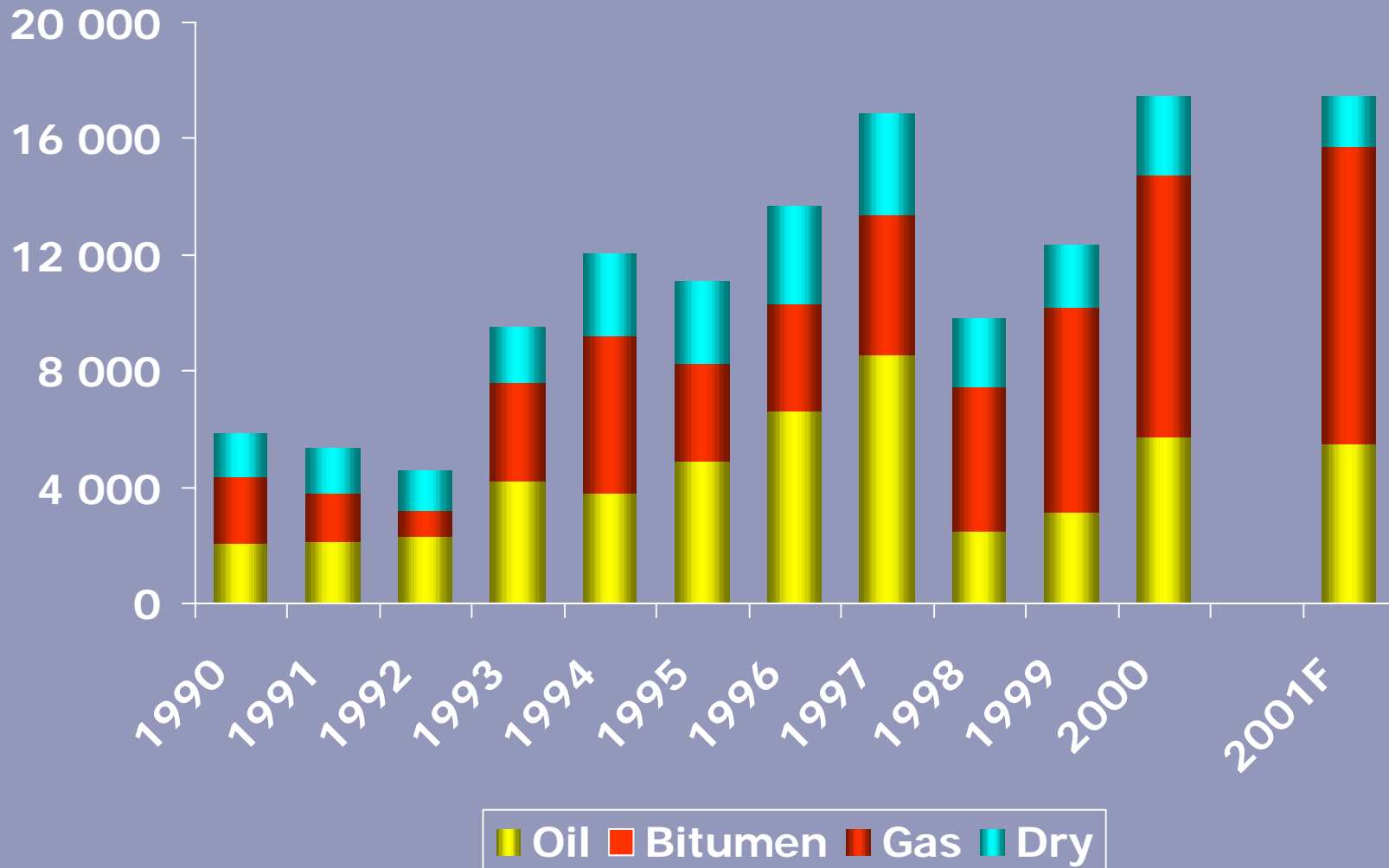
## Natural Gas Price (AECO Daily Spot Price)

\$Cdn/mcf





# Wells Drilled in Canada



# Ultimate Potential of Natural Gas

North of 60  
175 Tcf

Other Frontier\*  
89 Tcf  
includes other  
regions offshore  
east coast & west  
coast

■ Remaining  
■ Produced

British  
Columbia  
50 Tcf

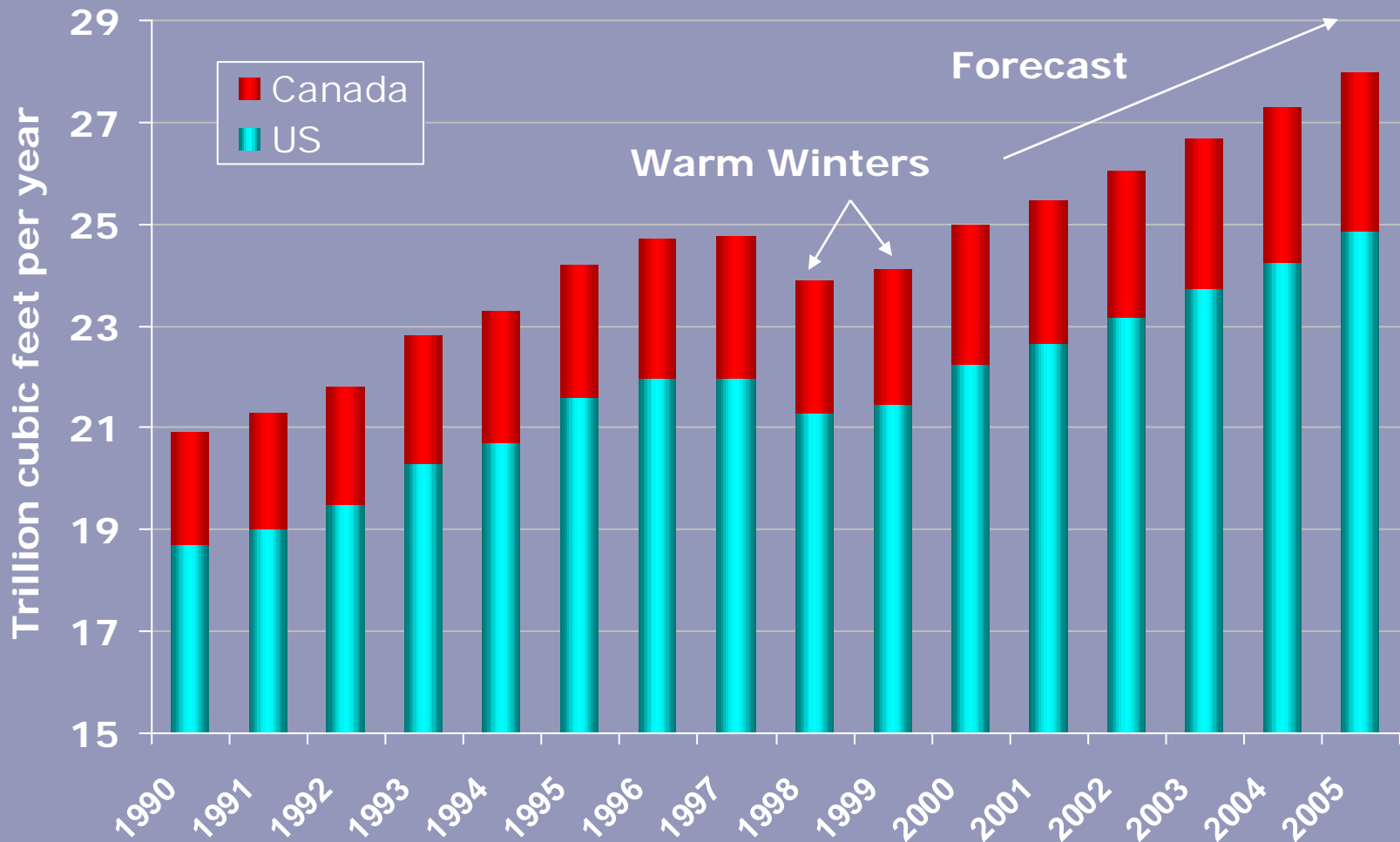
Grand Banks  
and Scotian Shelf  
63 Tcf

Alberta  
270 Tcf

Saskatchewan  
9 Tcf



# North American Natural Gas Demand



Source: U.S. D.O.E./EIA



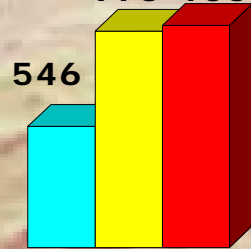
# Gas Drilling - Western Canada

399 580 742



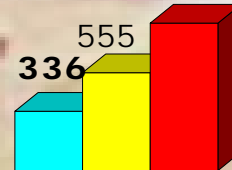
N.E. BC

975 1068

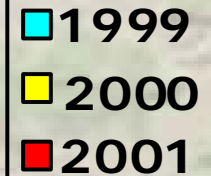


N.W. Alberta

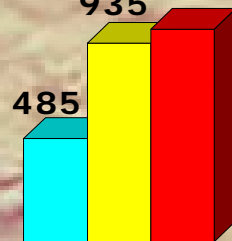
839



N.E. Alberta



1051

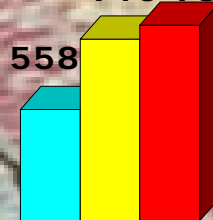


Central  
AB



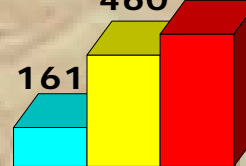
Central Sask.

910 981



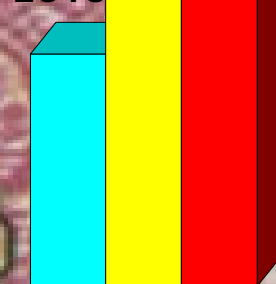
Foothills  
Front

545



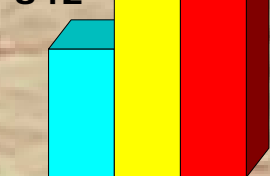
East  
Central  
Alberta

3350 3709



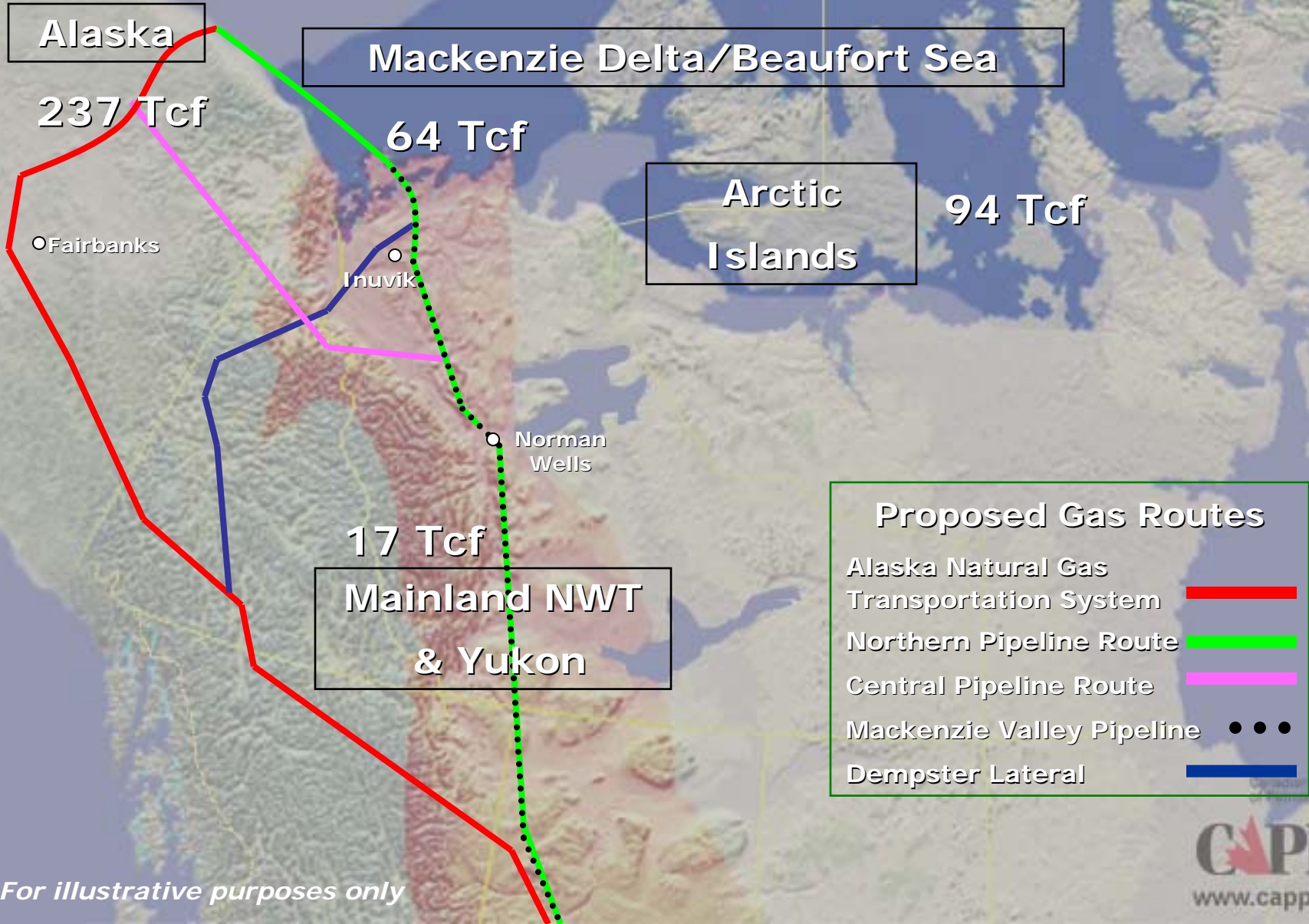
S.E. Alberta

1300 1528



S.W. Sask.

# Ultimate Potential for Northern Natural Gas



For illustrative purposes only

Labrador  
Sea

# Eastern Canada Development

St. Anthony  
Basin

Jeanne  
d'Arc  
Basin

○ *White Rose*

Late 2004

St. John's *Hibernia*

*Hebron*

○ *Terra Nova*

Sable Offshore Energy Project  
530 mmcf/d - 2000  
630 mmcf/d - Tier 2 (2004)

Hibernia  
150,000 b/d - 2000  
150,000 b/d - 2001

Terra Nova  
start up - 2001  
129,000 b/d - 2002

Anticosti  
Basin

Scotian  
Basin

Magdalen  
Basin

Pt. Tupper

Deep Panuke  
400 mmcf/d - 2005

**Oil Fields**

**Gas Fields**

*Sable*

Halifax

*Cohasset/  
Panuke*

Site of recent  
PanCanadian  
gas discovery

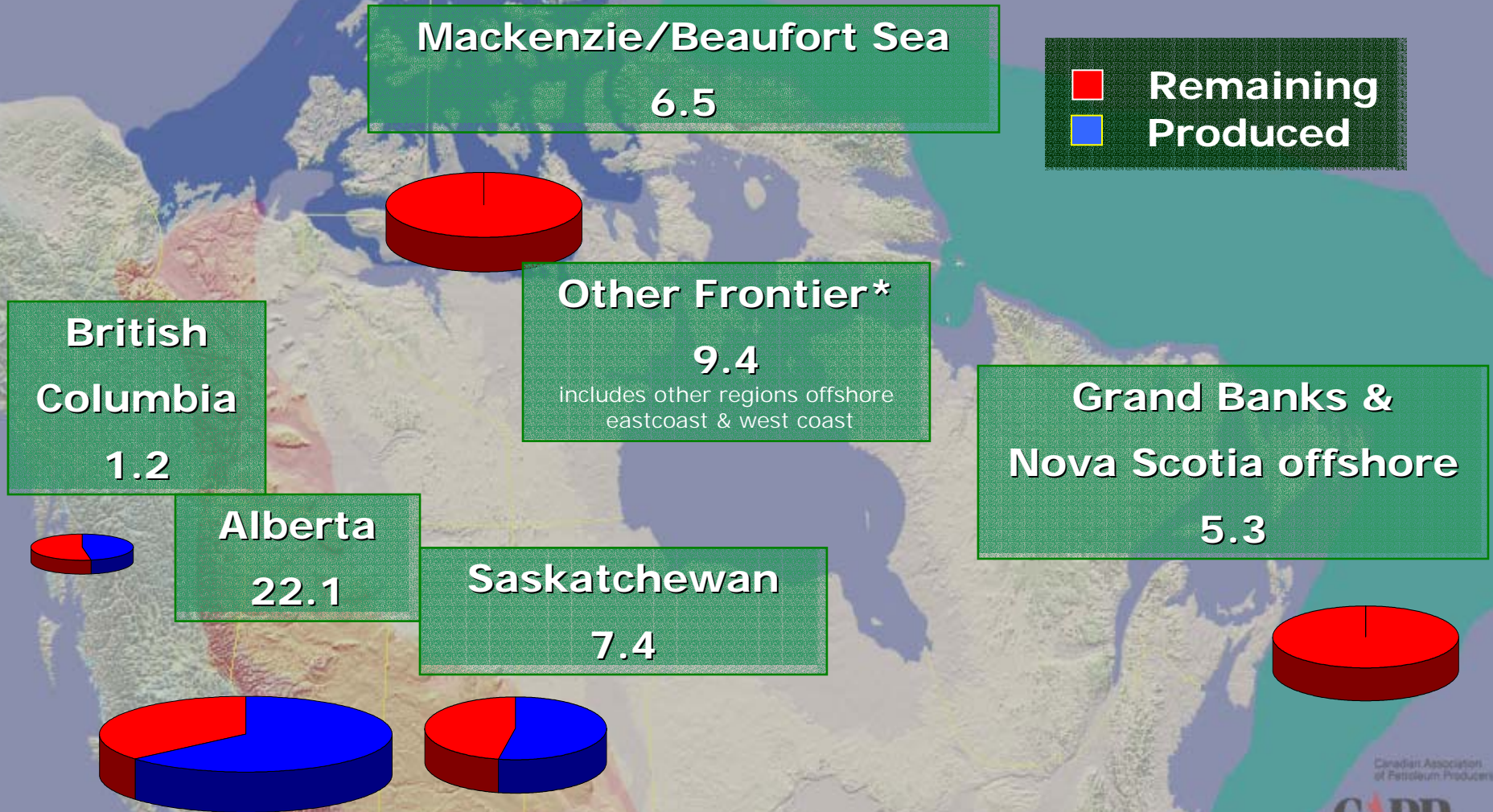
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# *Crude Oil*

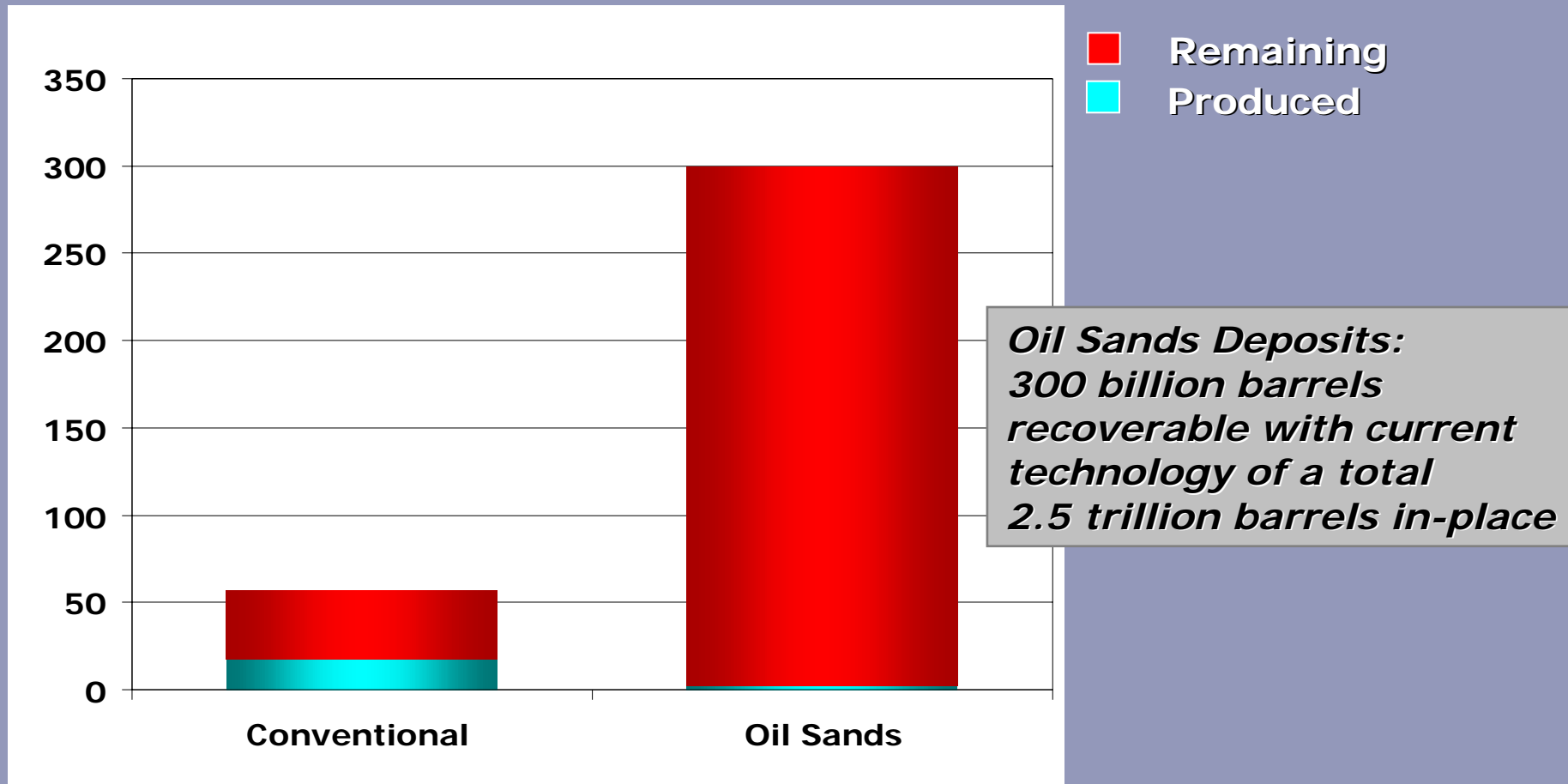
- **Maturing basin being extended by technology**
  - **Horizontal drilling**
  - **3D Seismic**
  - **New drilling/recovery technology**
- **Emerging basins**
  - **Oil Sands**
  - **Offshore East Coast**
- **Technology is key**

# Comparative Conventional Oil Resources (Billions of Barrels)



Source: NEB

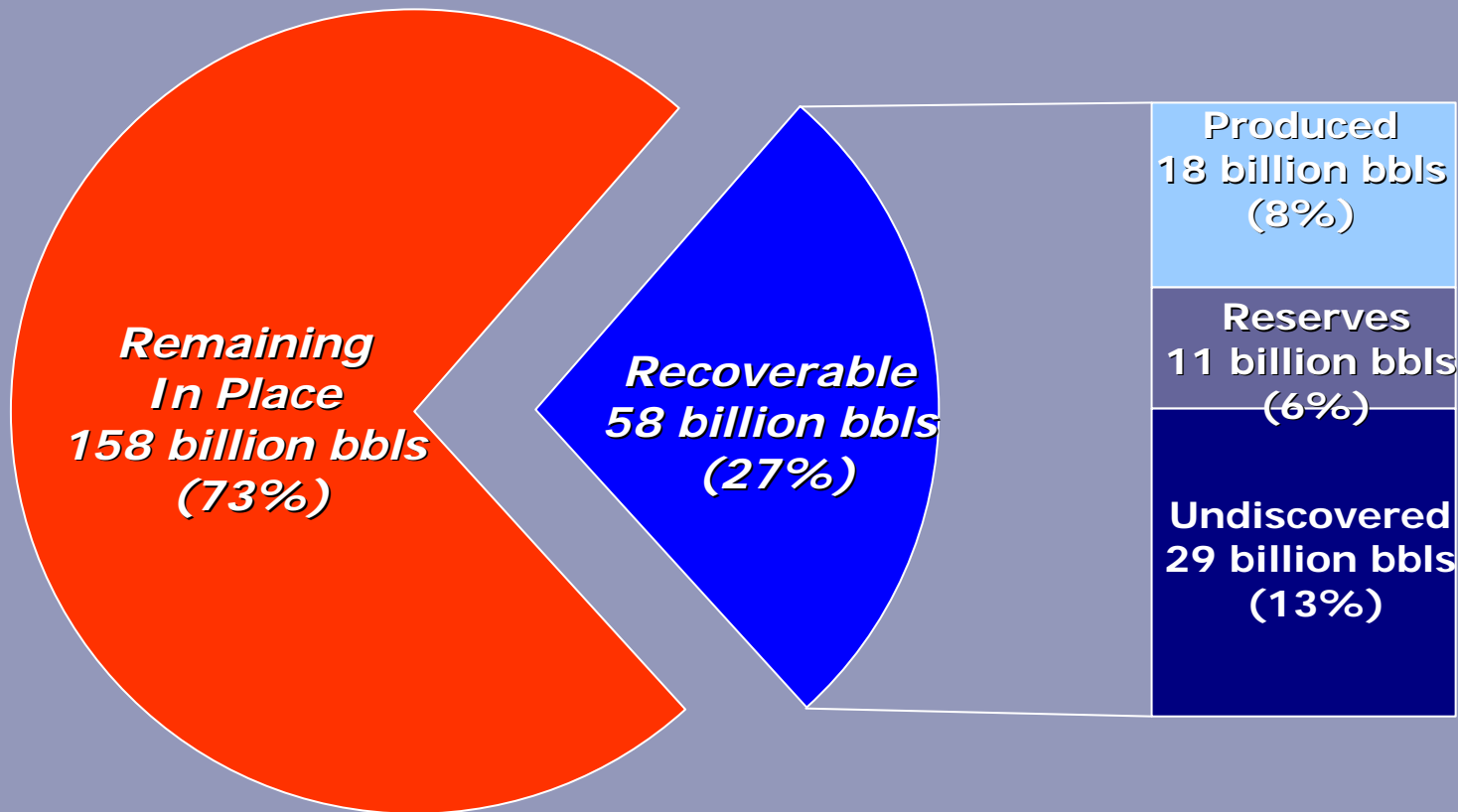
# Comparative Oil Resources (Billions of Barrels)





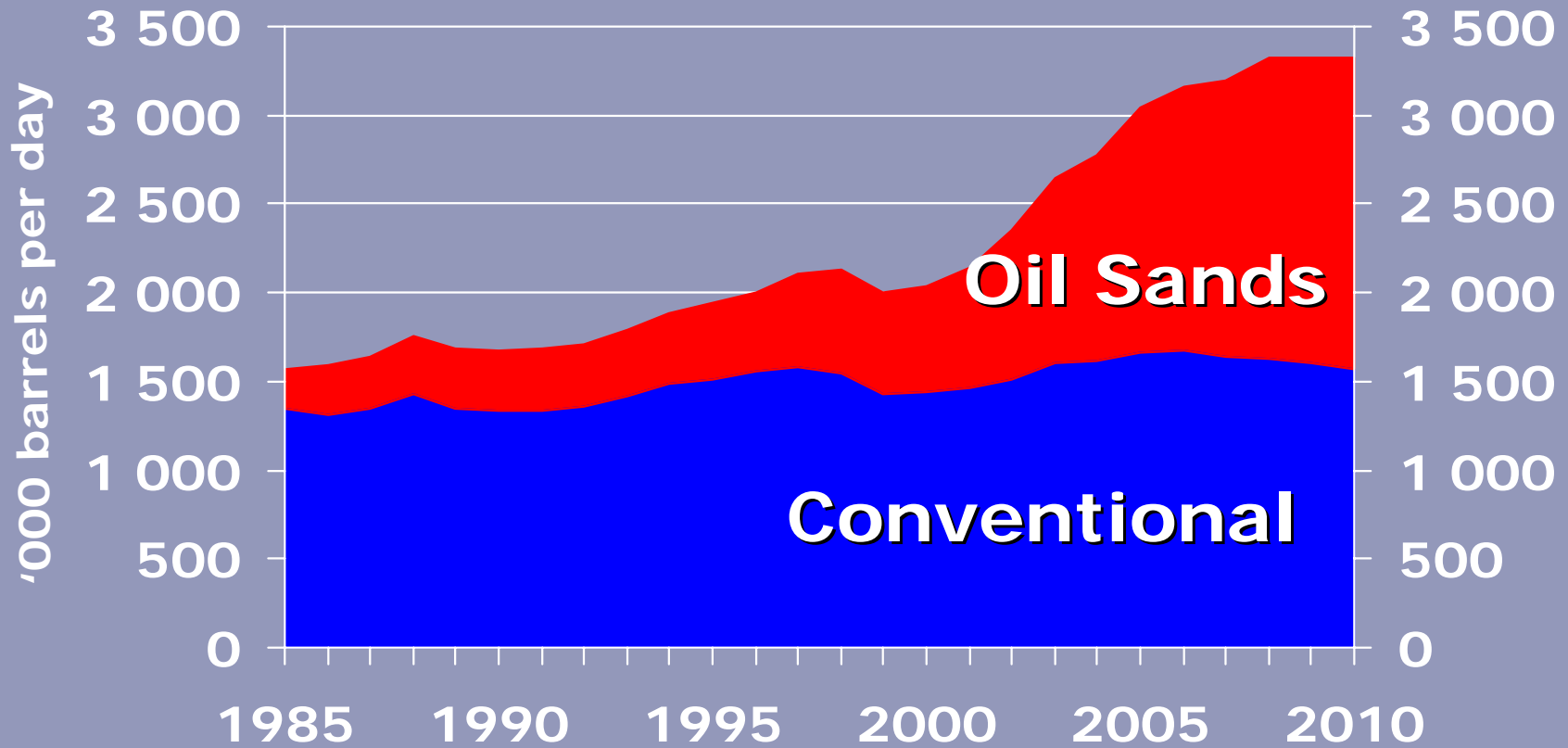
# *Opportunity for Recovery Technology*

- With current technology and economics, only 27% of Canada's total conventional oil in place (216 billion barrels) is recoverable.*





# *Western Canadian Crude Oil Production*



Source: CAPP

# Oil Sands Projects in Three Deposits



Syncrude ✕  
 Albian (Shell) ✕  
 TrueNorth (Koch) ✕  
 Japan Canada Oil Sands ✕  
 ExxonMobil ✕  
 Pan Canadian  
 Deer Creek

Suncor ✕  
 Gulf ✕  
 PetroCanada ✕  
 Northstar ✕  
 CNRL ✕  
 Opti ✕  
 SynEnCo ✕

Alberta Energy  
 Cdn Natural Resources (CNRL)

Shell

Imperial Oil  
 Alberta Energy  
 Cdn Natural Resources  
 Petrovera  
 BlackRock

Koch  
 Murphy  
 Suncor  
 Husky  
 Numac

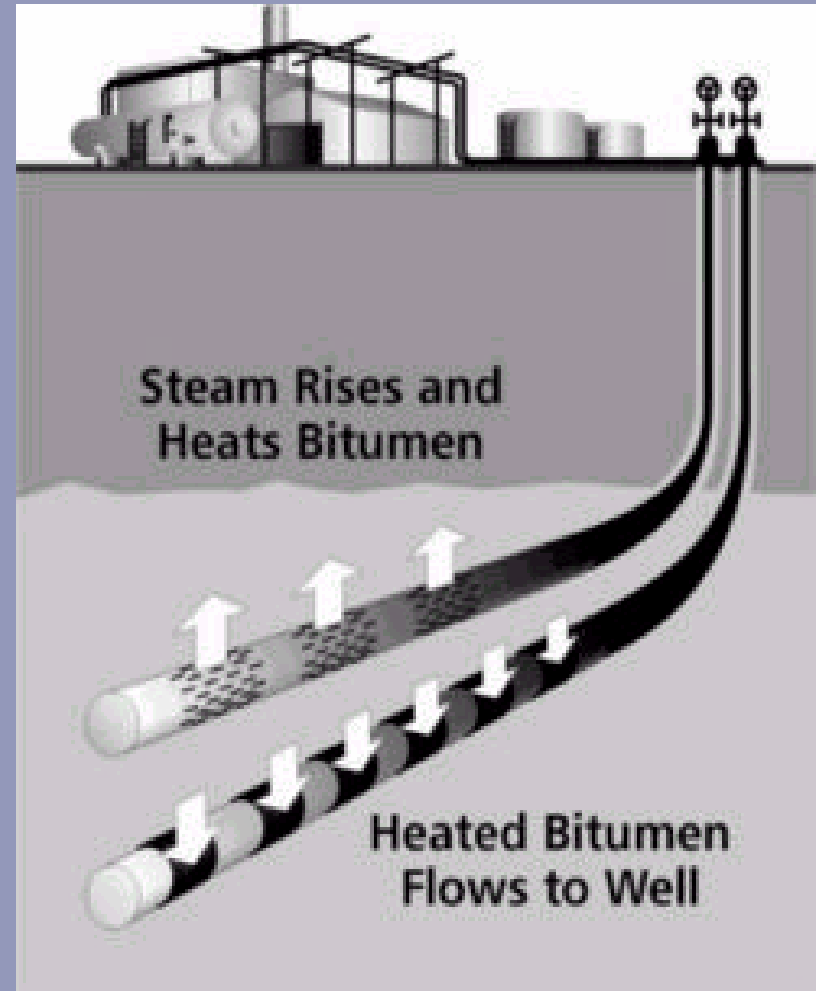
✕ Mining; Others "InSitu"

- Current production 580,000 bbls per day.
- \$21 billion (Cdn) commercially approved - \$11 billion "in the ground".
- \$30 billion additional potential announced - risk evaluations underway.

Source: AOSD

# Oil Sands - In Situ

- 80% of 300 billion barrel resource
- Current production of 260,000 b/d + diluent for pipeline
- Too deep to mine
- New technology developments:
  - Primary production
  - Cyclic steam
  - Steam Assisted Gravity Drainage
  - VAPEX



Source: Suncor



# ***Oil Sands - Mineable***

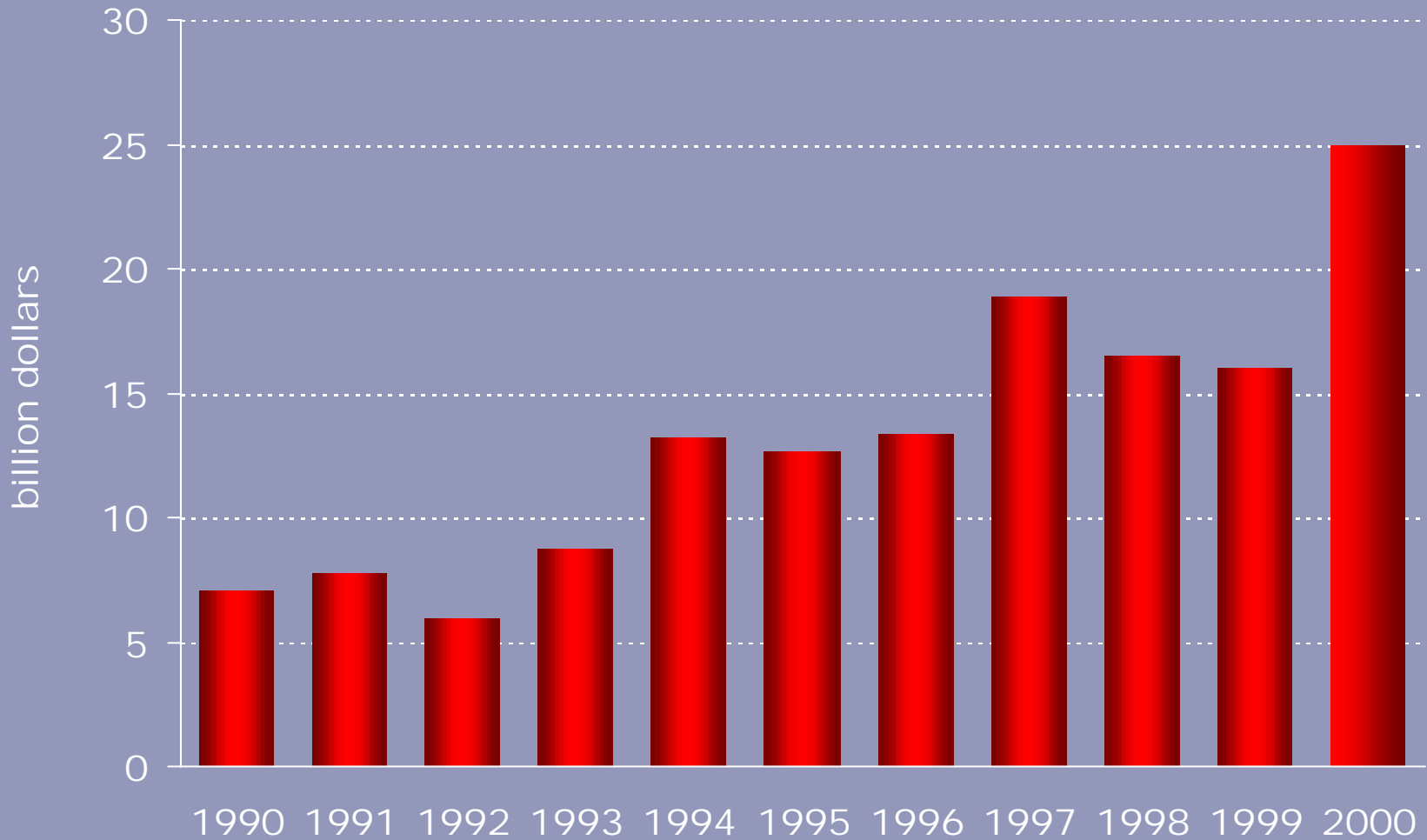
- 20% of 300 billion barrel resource
- Current production of 319,000 b/d
  - **Syncrude**
  - **Suncor**
  - **Albian (2002)**
- **New technology developments:**
  - **Low temperature extraction**
  - **Hydro-transport**



*Source: Syncrude*



# *Upstream Oil and Natural Gas Capital Spending in Canada*



# Industry Capital Spending (\$Billions)

## International

'99	'00	'01F
\$1.7	\$2.1	\$3.5

## Northern Canada

'99	'00	'01F
\$0.2	\$0.3	\$0.4

## Oil Sands

'99	'00	'01F
\$2.4	\$5.0	\$5.0

## WCSB

'99	'00	'01F
\$10.7	\$14.0	\$17.5

## East Coast Offshore

'99	'00	'01F
\$2.7	\$1.8	\$1.5

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# *CO<sub>2</sub> EOR Economics*

- **CO<sub>2</sub> Costs & EOR Netback:**
  - ↗ **Relatively large scale single project (over 50 mmcfd or 2,600 tonnes/day CO<sub>2</sub>)**
  - ↗ **No cost for raw purchased CO<sub>2</sub> stream**

- **CO<sub>2</sub> Costs :**

<u>\$/mcf CO<sub>2</sub></u>	<u>Low Gas Price</u>	<u>High Gas Price</u>
Purification (Amine)	0.76	1.76
Compression	0.50	0.77
Dehydration	0.10	0.21
Transportation	0.41	0.41
Total	1.77	3.15



# ***CO<sub>2</sub> EOR Economics***

- CO<sub>2</sub> Unrisked Cash Flow :**

<u>\$/bbl oil</u>	<u>Low Gas Price</u>	<u>High Gas Price</u>
Gross Oil Revenue	40.00	40.00
Purchased CO2	(13.28)	(23.57)
Recycled CO2	(2.08)	(3.68)
Oil Opex	(3.00)	(5.00)
Other Capex	(6.00)	(6.00)
Cash Flow before Tax & Royalty	15.64	1.75



# ***CO<sub>2</sub> EOR Competitive Considerations***

- **Competitive Investment Opportunities:**
  - **Natural Gas - Conventional, East Coast, Northern, Coal Bed Methane**
  - **Oil - East Coast, Oil Sands**
  - **International E&D**
- **Investment Decision Criteria :**
  - **Rates of Return competitive with other E&D opportunities, including adjustment for risk**
  - **One analysis shows netbacks can be extremely volatile**
- **Fiscal Structure**
  - **Net profits royalty regimes have spurred significant investment in new areas with significant risk - e.g. Oil Sands, East Coast**

The logo consists of the letters 'C', 'A', and 'P' in a serif font, with a stylized white maple leaf shape integrated into the 'A'. The 'P' is also in a serif font. The entire logo is white and centered on a dark red background.

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OF PETROLEUM PRODUCERS