CANADIAN ASSOCIATION OF PETROLEUM PRODUCERS

Northern Oil & Gas Research Workshop
Mackenzie Delta and Beaufort Sea
Future Directions
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Inuvik NWT

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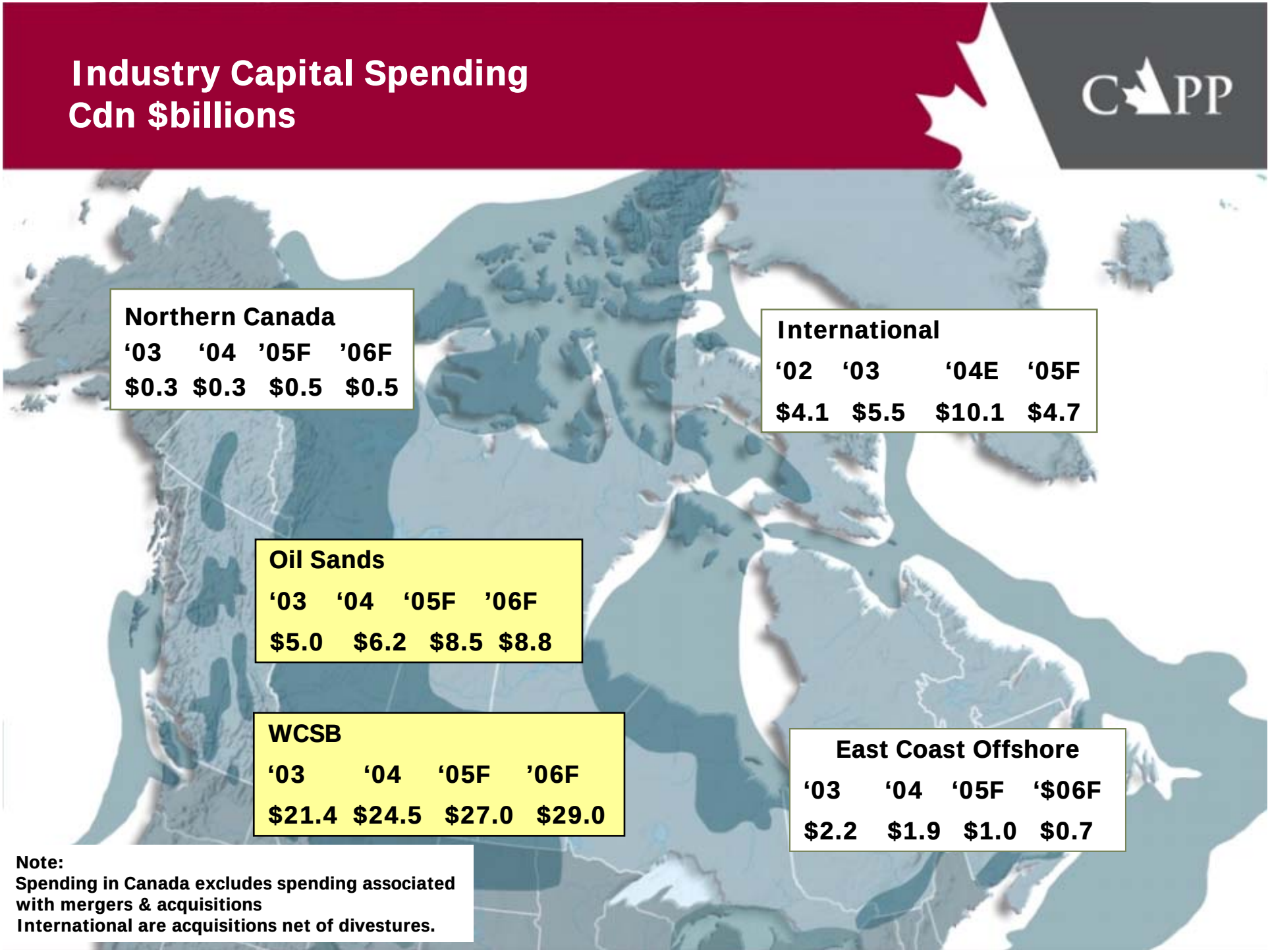
Outline

- **Who is CAPP?**
- **The Northern setting**
- **Industry Perspective on R&D**
  - Engagement
  - Limitations
  - Direction
- **Conclusion**

Who we are

- **CAPP represents Upstream industry : Exploration, development and production of Canada's petroleum resources**
  - Companies locate, drill for and recover oil and natural gas
  - 150 producer member companies produce more than 98 per cent of Canada’s natural gas and crude oil
    - Natural gas, natural gas liquids, crude oil, synthetic crude oil, bitumen and elemental sulphur throughout Canada
  - 125 associate members provide a wide range of services that support the upstream crude oil and natural gas industry

Industry Capital Spending
Cdn $billions



Northern Canada

'03	'04	'05F	'06F
$0.3	$0.3	$0.5	$0.5

International

'02	'03	'04E	'05F
$4.1	$5.5	$10.1	$4.7

Oil Sands

'03	'04	'05F	'06F
$5.0	$6.2	$8.5	$8.8

WCSB

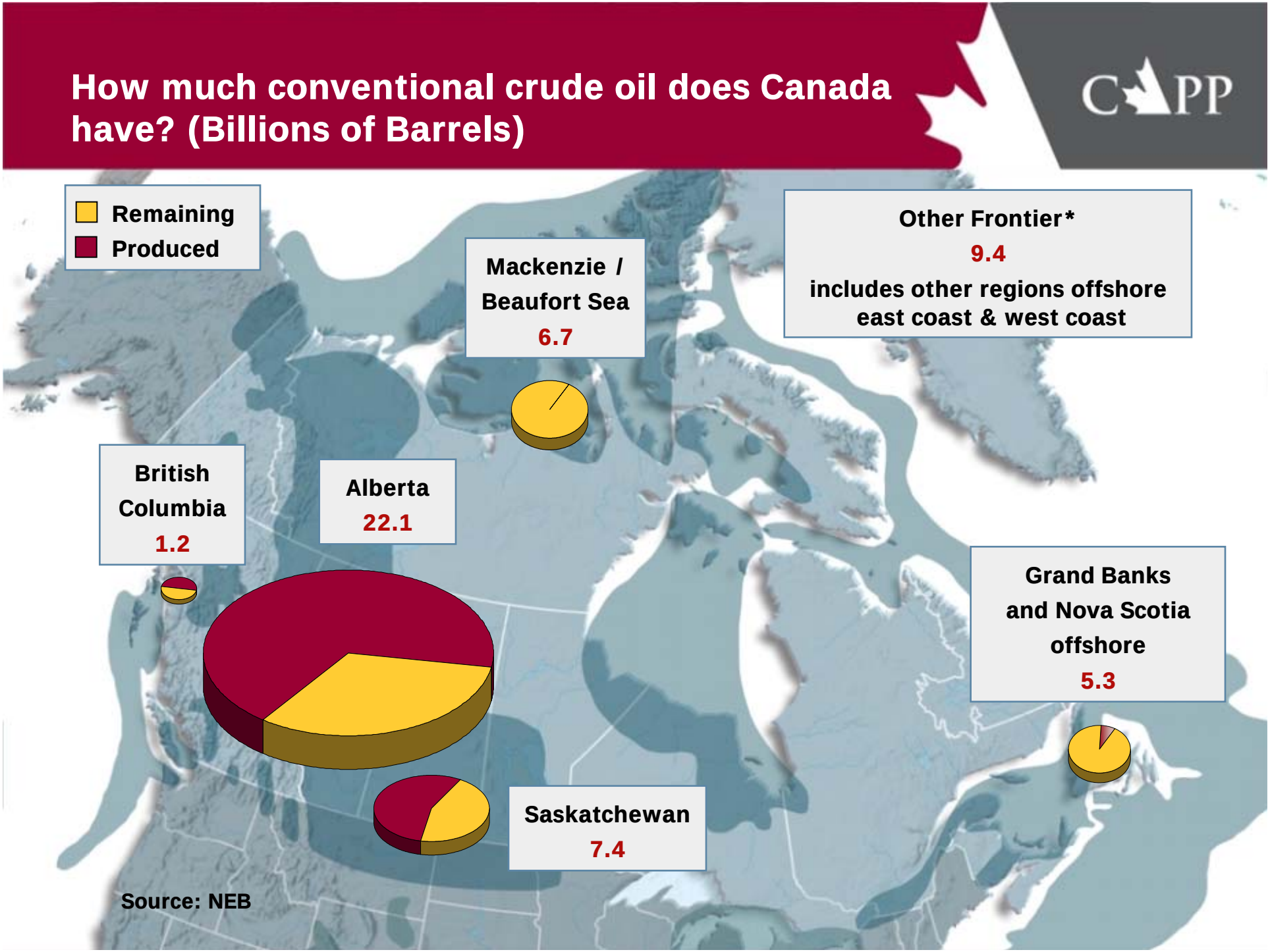
'03	'04	'05F	'06F
$21.4	$24.5	$27.0	$29.0

East Coast Offshore

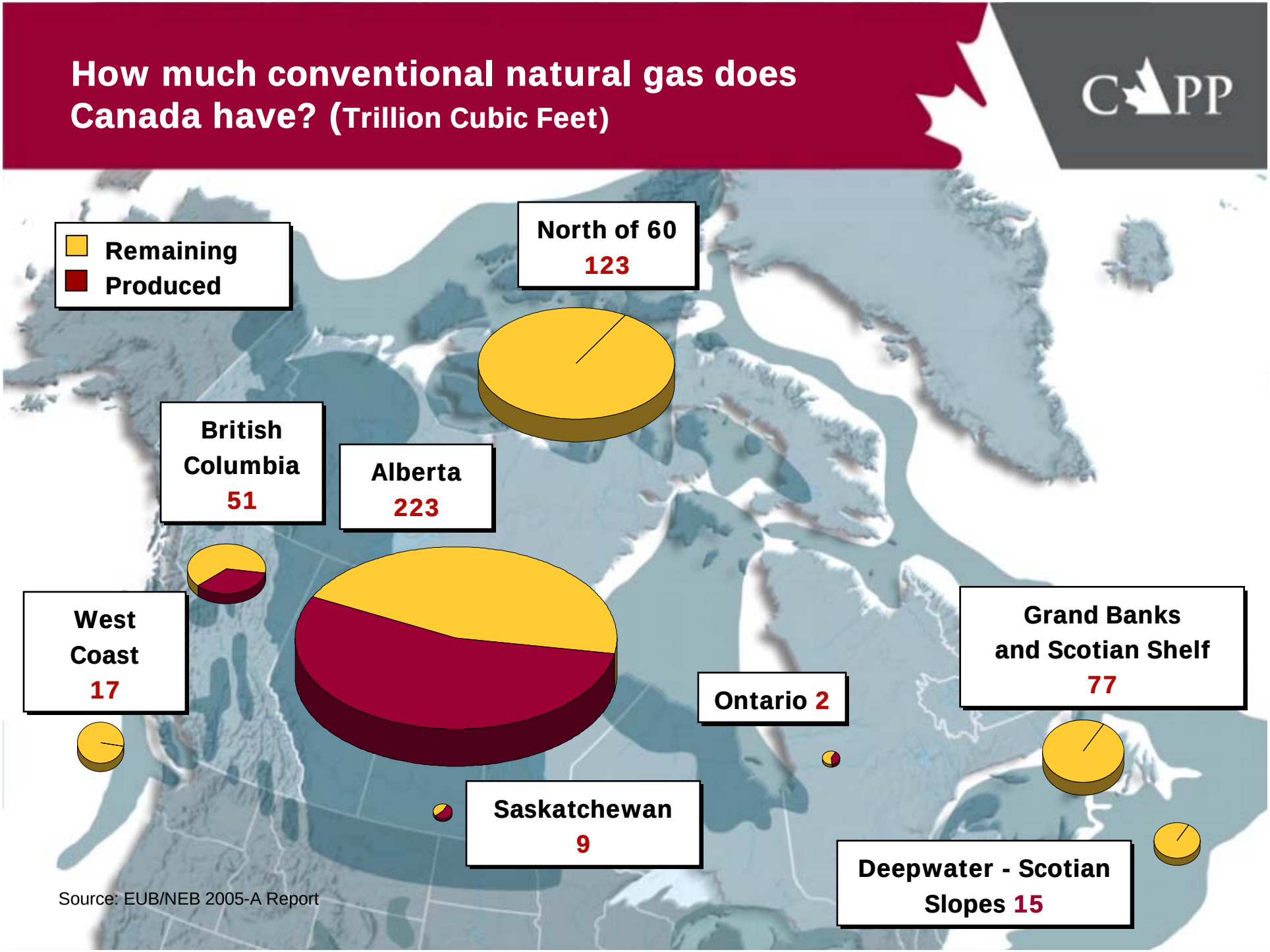
'03	'04	'05F	'$06F
$2.2	$1.9	$1.0	$0.7

Note:
Spending in Canada excludes spending associated with mergers & acquisitions
International are acquisitions net of divestures.

How much conventional crude oil does Canada have? (Billions of Barrels)

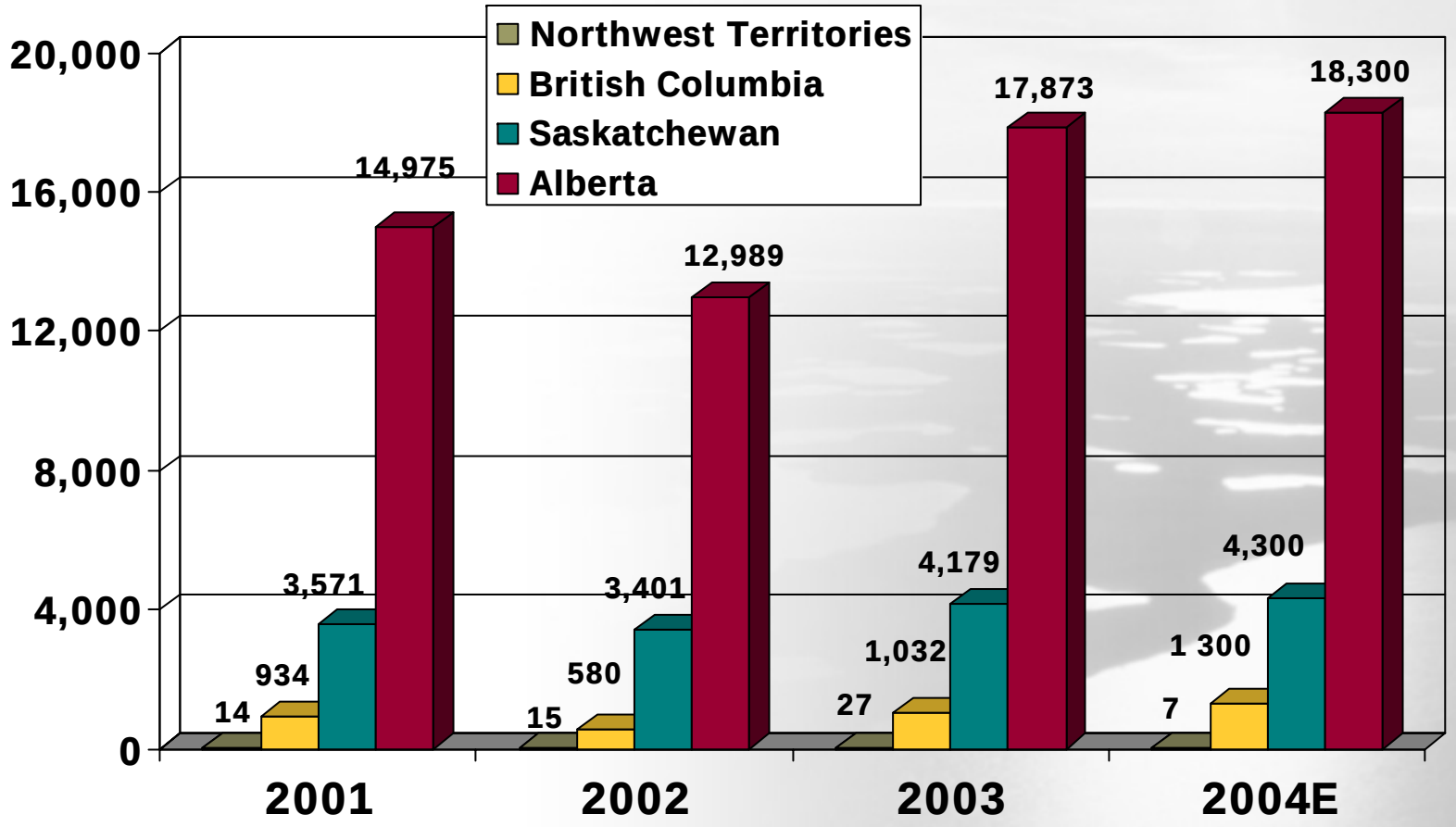


How much conventional natural gas does Canada have? (Trillion Cubic Feet)



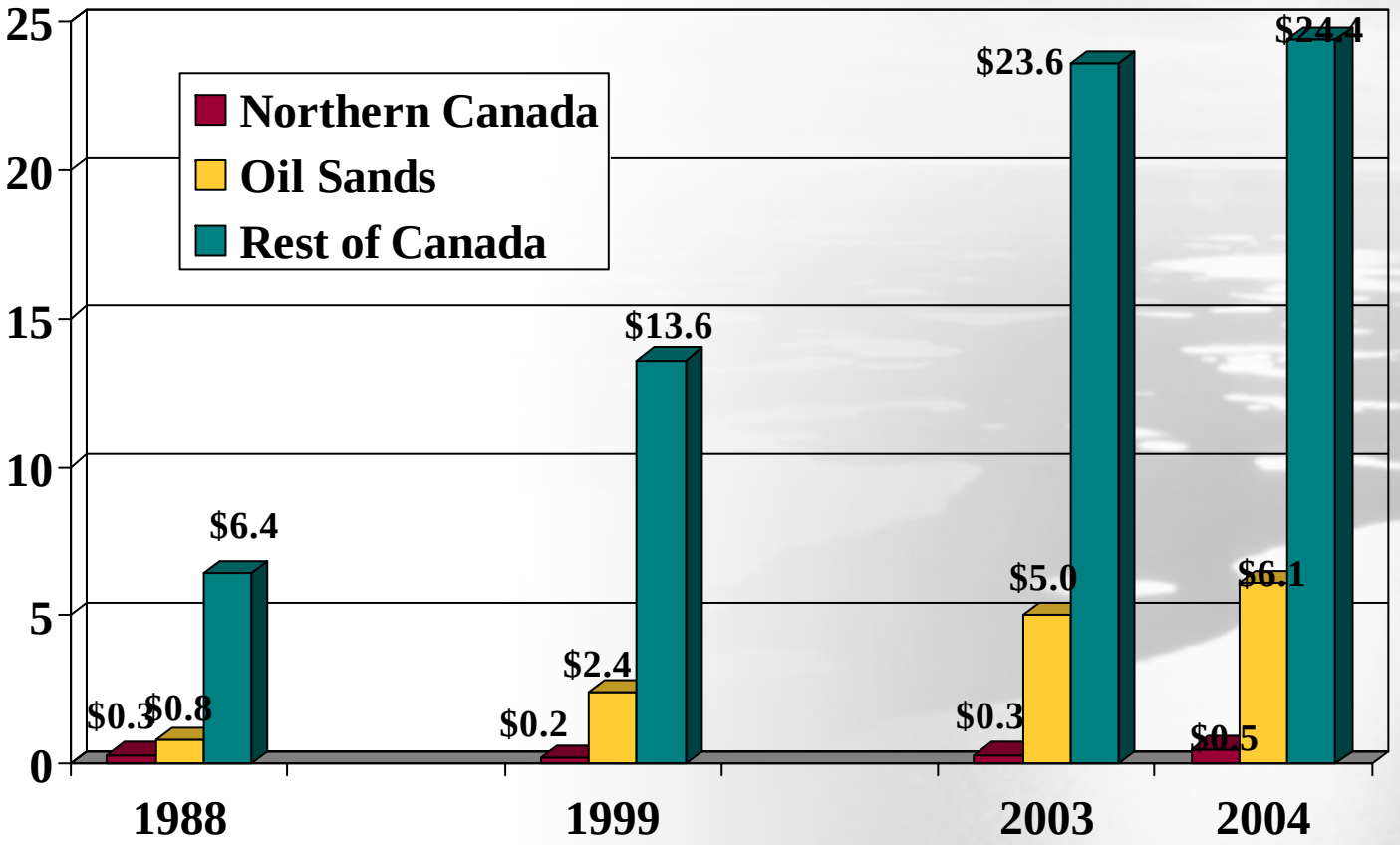
Source: EUB/NEB 2005-A Report

Wells Drilled in Western Canada & Northern Canada



Sources: CAPP, Northern Oil & Gas & Nickle's

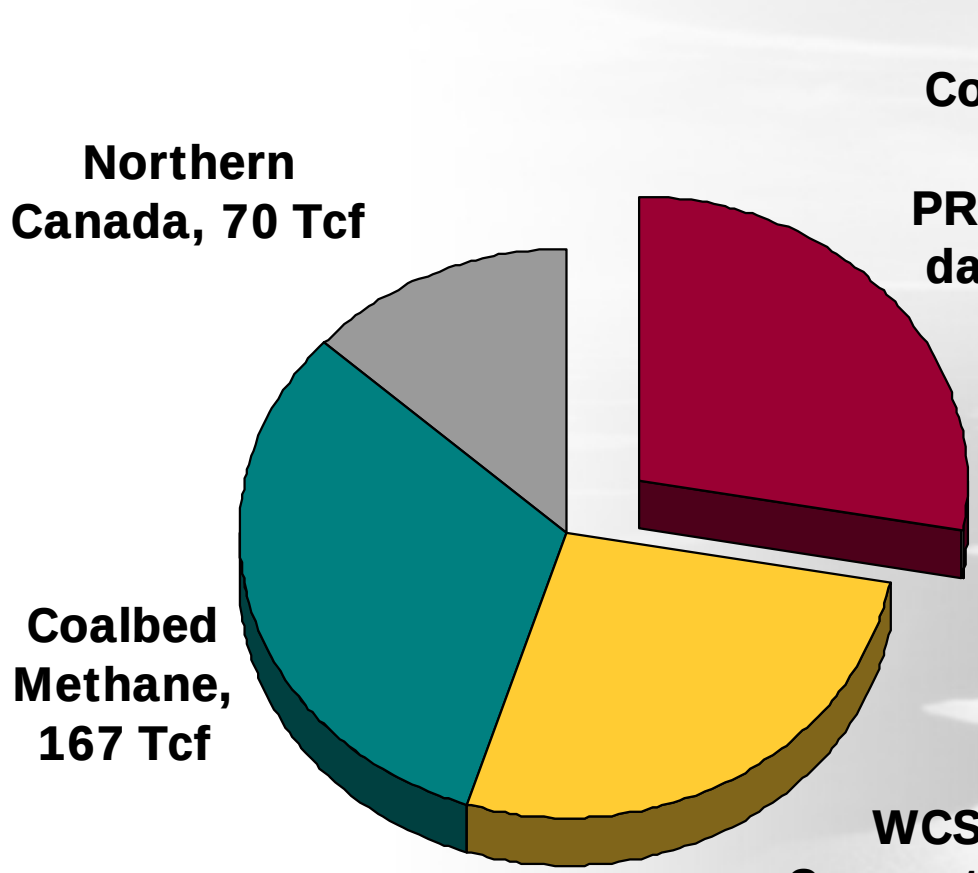
Trend in Investment Spending in Canada (billion dollars)



What is Driving Exploration & Production?

- **Strong Demand**
- **Limited Availability**
  - Conventional deposits declining
  - Looking to the **North**, unconventional sources, East Coast
- **Rising Price**
  - Strong price signal and cash flow
  - Makes new ventures profitable
- **Technology**
  - New technology allows access to new areas and reduced footprint

Western Canadian Gas Resources
Conventional and New Sources



Source: Alberta Energy & Utilities Board / National Energy Board, CERI

Business Case For R&D

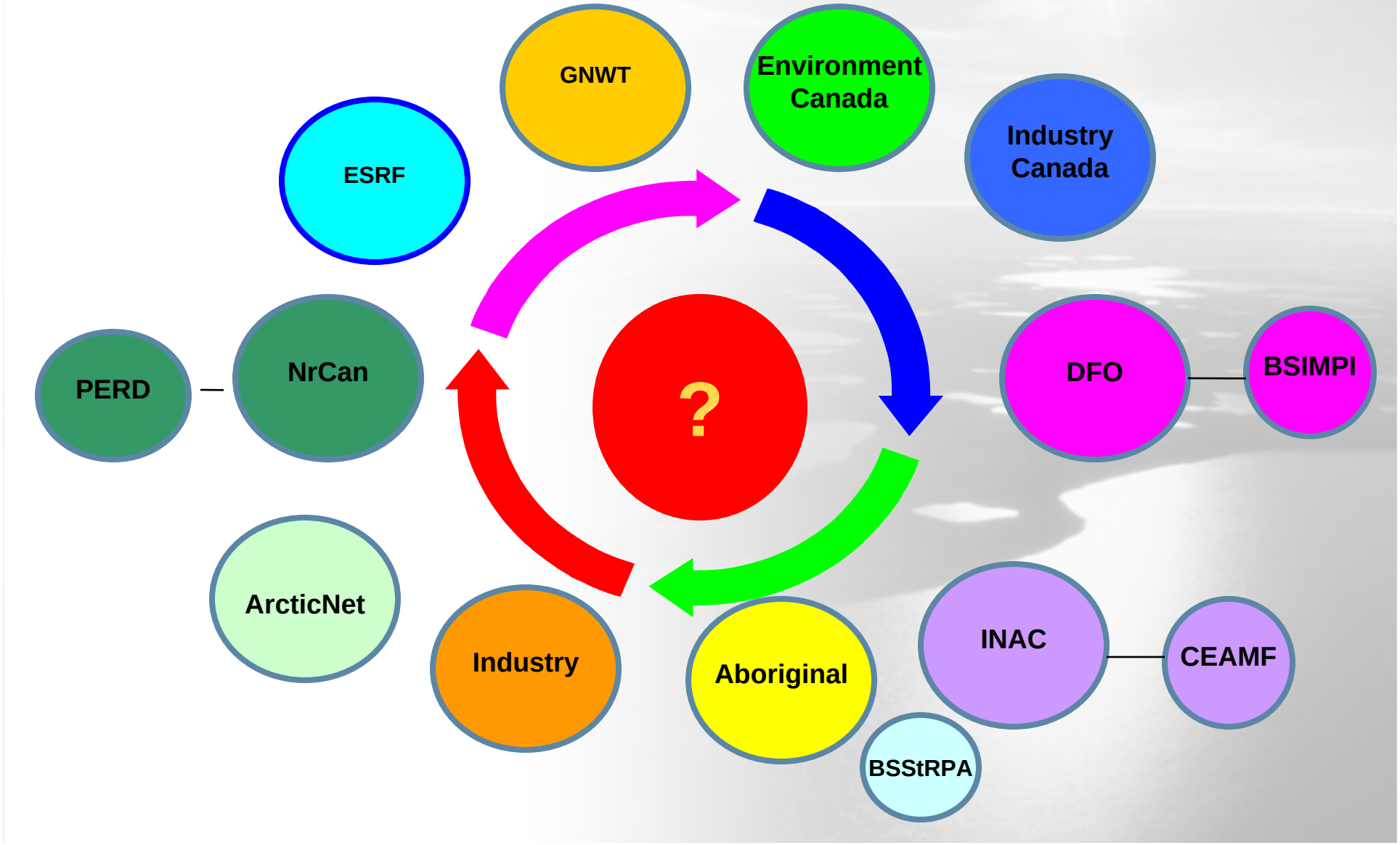
- **The Objective - Find and develop more hydrocarbons in a cost effective manner with lower financial risk, less environmental impact and improved levels of safety**

- **Why we should do it in Canada?**
  - Relatively Stable Environment (geopolitical, regulatory, policy)
  - Want certainty of regulatory processes
  - Developed Infrastructure
  - Pool of expertise and skilled labour
  - Proximity to market

R&D – Limitations for Industry

- **Complex and disparate R & D "Landscape"**
  - Many agencies, different goals, no obvious connections
    - Multiple administrative structures
    - Fragmentation among governments, industry and research providers

R & D Coordination – Who is in charge?



R&D – Limitations for Industry

- **Two types of research**
  - Research to address “perceived” problems
    - Governments good at this
    - Environmental
    - Regulatory
    - No innovation
  - Research to address “technical” gaps
    - Industry good at this
    - Innovation

R&D – Limitations for Industry

- **Limited strategic direction - no overarching vision**
  - Prioritization not necessarily based on broad view/future needs (more reactive/ project-by-project)
  - uncoordinated funding pots
- **Project-driven research**
  - Generally short-term industry thinking

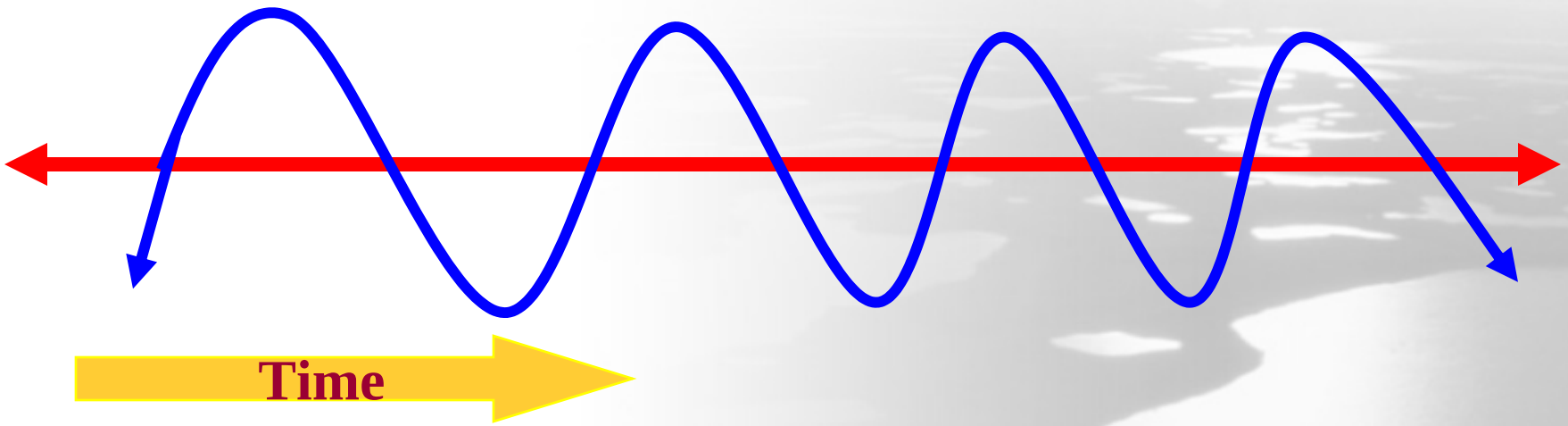
R&D – Limitations for Industry

- **Funding**
  - Government funding available, but...
    - Looking for strategic input from industry
    - Need to justify $ contributions to “big oil” with voters (i.e., what are the public benefits)
- **Legislative / policy**
  - Can limit innovation
    e.g. NWT Water Act
- **Fiscal regime**
  - Create artificial needs

R&D – Industry Spending

- **Natural resource sectors deal with cyclic commodity prices & are often unable to commit to long term R&D projects**
  - All businesses face challenges with commitments to fundamental research
- **Entrepreneurial behavior has economic equivalency to traditional R&D spending**

Industry vs Government



Industry

Government

R&D – Industry Spending

- Resource-based companies often obtain most of their technology through the acquisition of knowledge/equipment from suppliers, rather than developing it directly themselves
- Global industry – mix of technology adoption and absorption with domestically grown ideas
- Scientific Research & Experimental Development Tax Credit (SRED)

R&D – Industry Challenges

- **Many factors determine research needs**
  - Scenario - onshore vs landfast ice vs offshore
  - Activity - exploration vs production vs abandonment
  - Timeframe - summer vs winter
  - Regulatory issue vs technical issue

Onshore Challenges

- **Identify and Acquire Future Long Lead Environmental Baseline Data**
  - Consistent Data
  - Consistent Validated Data Acquisition Methodology
  - International Collaboration
- **Common Environmental Database**
- **Environmental Contaminants:**
  - Baseline Concentration and Effects Monitoring for Offshore Arctic Species
  - Tracking of Source and Subsequent Movement
  - Establishment and Validation of Emission Limits

Onshore R&D Opportunities

- Improved Wildlife Population Monitoring for Harvested Species
- Effect of Aircraft Traffic On Wildlife
- Establish Standards/Alignment of Regulations
- Climate Change
- Coastal Erosion Monitoring
- Oil Spill Clean-up in Broken Ice

Exploration Activities in Shallow Water / Landfast Ice Zone

Assumptions: In the short to medium term….

- **Seismic activities will be conducted from vessels in the open water season**
- **Drilling activities will be conducted in the winter from bottom-founded platforms**

- **Longer operating season (same season relief well capability)**
- **Water depths too shallow for drill ships**

Environmental Assessments

2001-2002

- **Environmental screening for a 3D marine seismic program**

2002-2005

- **Comprehensive Study for an offshore drilling program (El 420)**

Assessment process involved:

- Gap analyses
- Issues identification through extensive consultations (meetings, presentations, workshops and TK study)

Seismic: Main Issues

Seismic Project:

- The effect of noise on marine mammals and harvesting activities (aircraft, vessels and seismic noise)
- Response in the event of a spill in open water

Conclusions:

- Most issues could be mitigated (e.g. transportation corridors)
- Data obtained on the effects of sound on marine mammals
- Effects were detected but largely mitigated by employing best management practices

Drilling Issues

Devon collected baseline data on:

- Air quality
- Chemical oceanography
- Coastal processes
- Fish, benthos and plankton
- Geotechnical conditions
- Ice and physical oceanography
- Marine mammals and birds

Conclusion:

The resultant body of data was adequate to support a credible environmental impact assessment which lead to a positive decision on the project (i.e. no significant adverse affects provided appropriate mitigation methods are employed and monitoring is undertaken).

Baseline Data Requirements

- Air quality
  - limited data
- Chemical oceanography
  - limited baseline data and dated standards
- Coastal processes
  - reasonable understanding; local gaps
- Fish, benthos and plankton
  - data are available but dated; winter fish populations
- Geotechnical data (sediments, permafrost, hydrates, etc.)
  - relatively good regional data; project-specific issue
- Ice and physical oceanography
  - changing ice conditions, ice and rubble interactions with structures
- Marine mammal & birds
  - Beluga movements (spring), effect of spills on birds

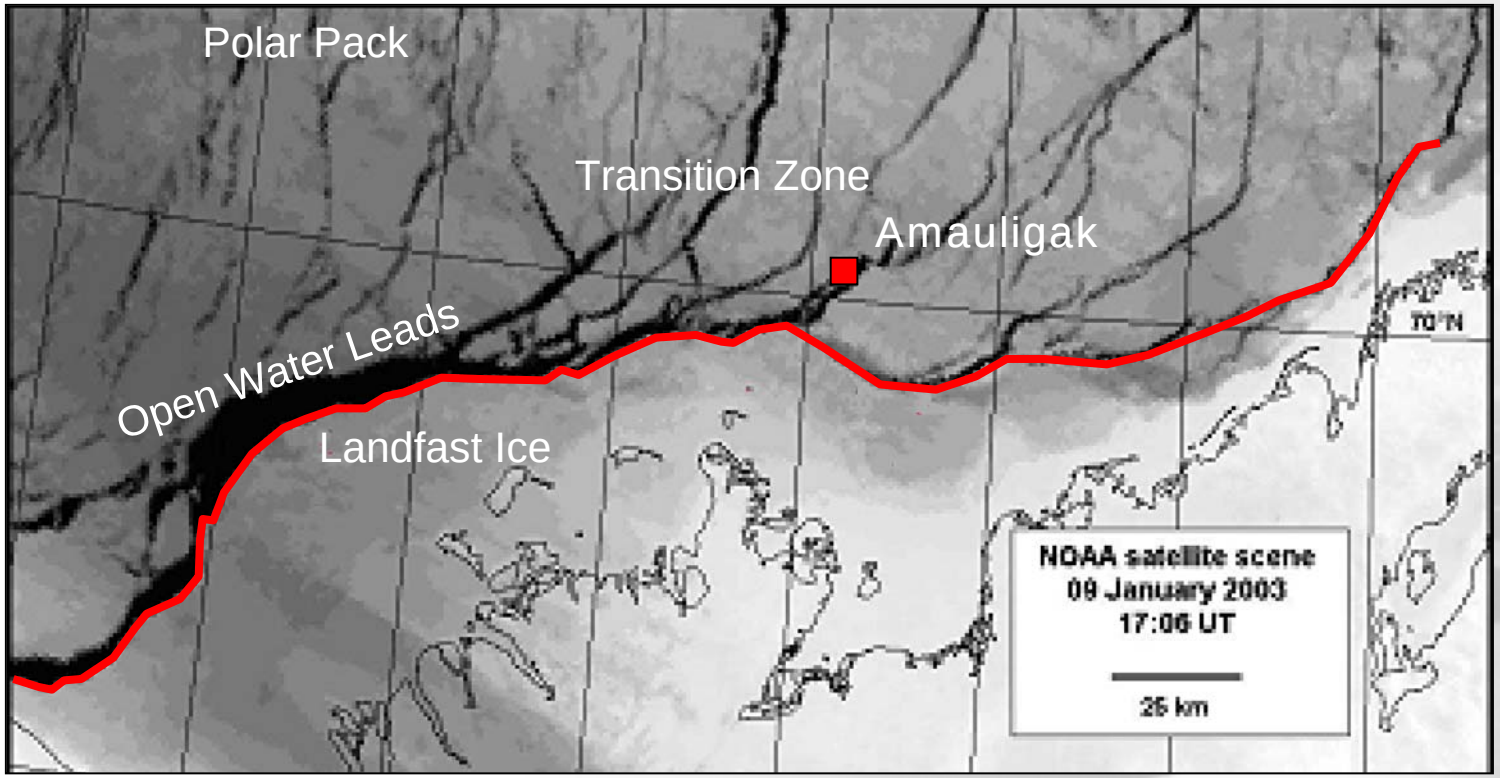
Project Issues: Going Forward

Same season relief well capability

- Shorter season (e.g. climate change?)
- More complex targets

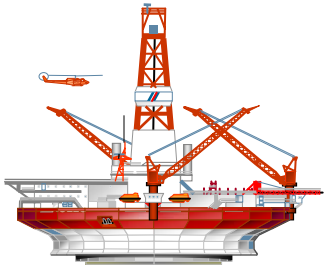
- **Spill response**
  - On-ice vs. open water; landfast ice vs. transition zone
  - Timing (migratory species)
- **Waste management**
  - Best practices/monitoring/risk quantification
  - Exploration vs. development
- **Dredging**
  - Impacts? Current practices?
  - Sensitive habitats?

The Transition Zone



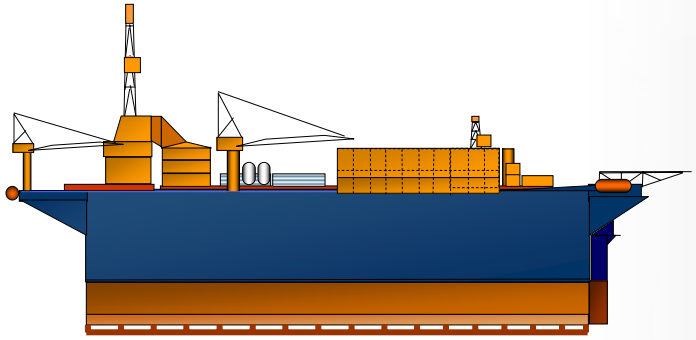
- **The Transition Zone ranges from the edge of the Landfast Ice (~15m) out to the polar pack to the north**
- **The Transition Zone represents an area of continuously mobile ice**
- **Amauligak, the largest field found to date in Mackenzie Delta / Offshore Beaufort Sea is located in the Transition Zone**

The Transition Zone - Exploration Activities



KULLUK

EXPLORER III

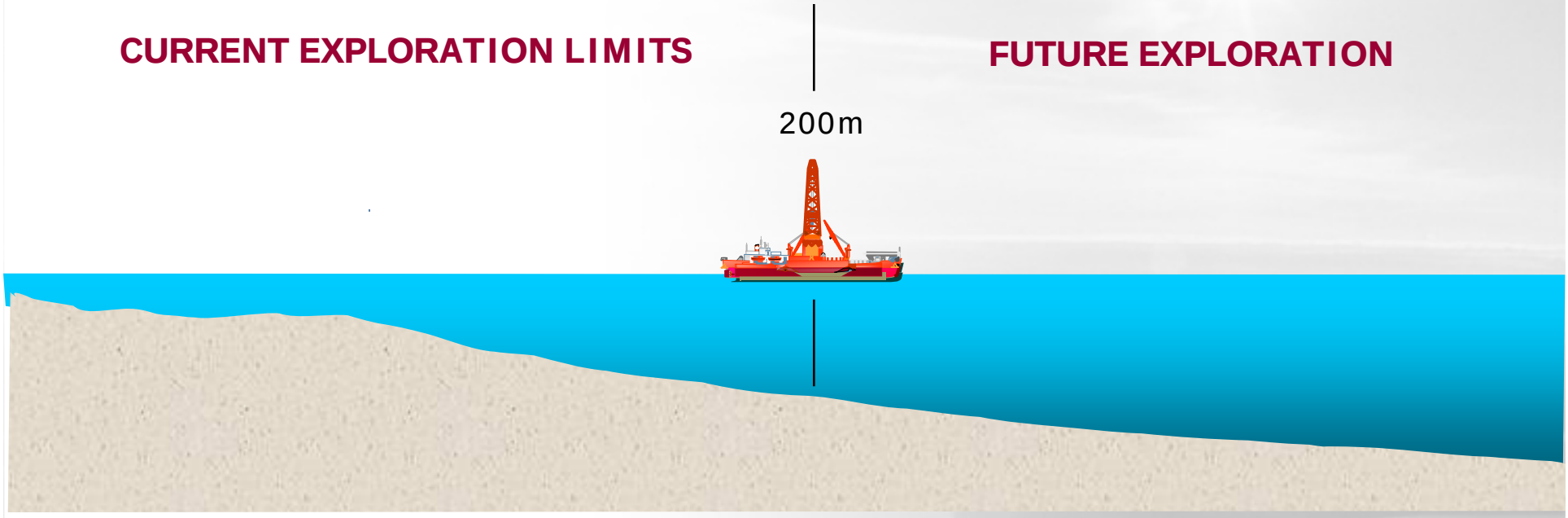


SDC

DRILLING INFRASTRUCTURE

- Only remaining Arctic MODU's
- SDC to drill for Devon 2005/06
- Kulluk mothballed in Canada
- Explorer III mothballed in Singapore
- Significant external interest in vessels
- Departure would impact exploration activity

The Transition Zone - Exploration Activities



- Current exploration limits recommended to be ~ 200m water depth
- Future exploration (> 200m water depth) is feasible with new drilling systems

The Transition Zone - Exploration Activities

MARINE INFRASTRUCTURE

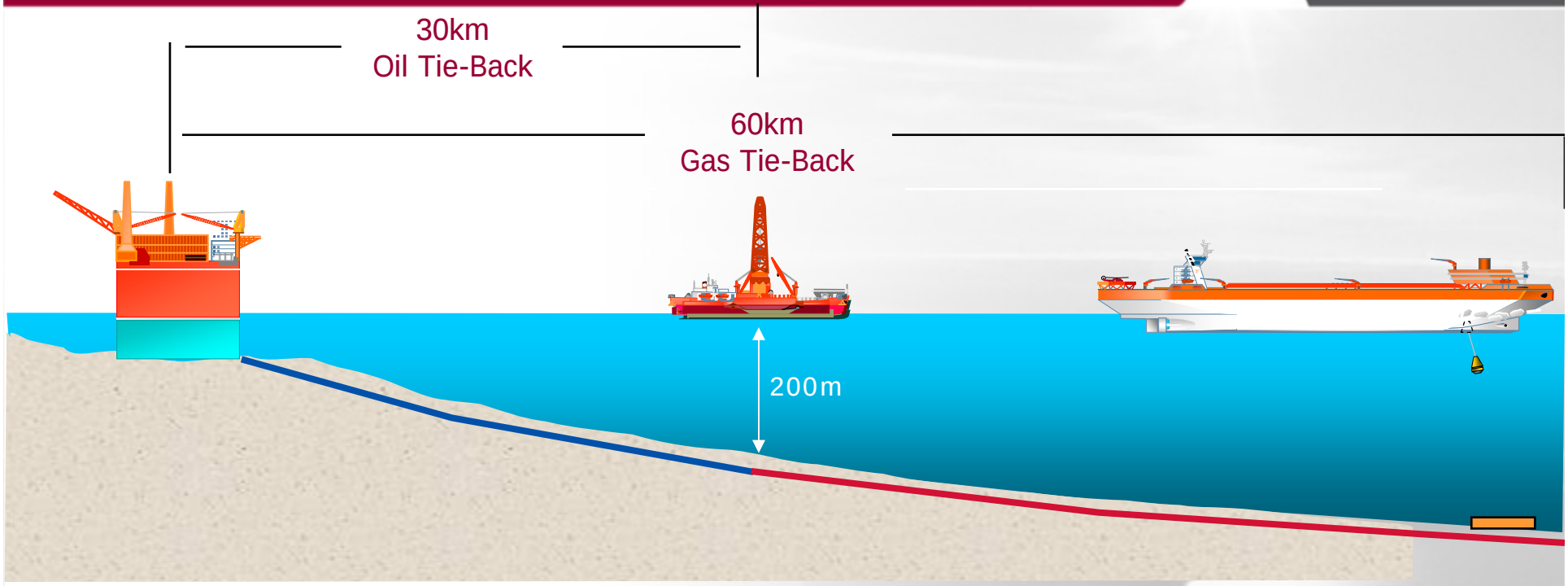
- Strong worldwide demand for ice class marine support, especially in Russia
- Limited availability of ice class support for Beaufort Sea operations
- Majority of icebreaking fleet beginning to age
- Strong ice management component required for Transition Zone operations

The Transition Zone - Exploration Activities

SAME SEASON RELIEF WELL CAPABILITY

- New End of Season guidelines issued by the Beaufort Sea Steering Committee have seriously restricted the available drilling season
- The Devon AWK system represents an excellent start to addressing this problem on a win-win basis for both industry and the environment
- New technology will likely have to be developed for the next round of exploration drilling in the Transition Zone

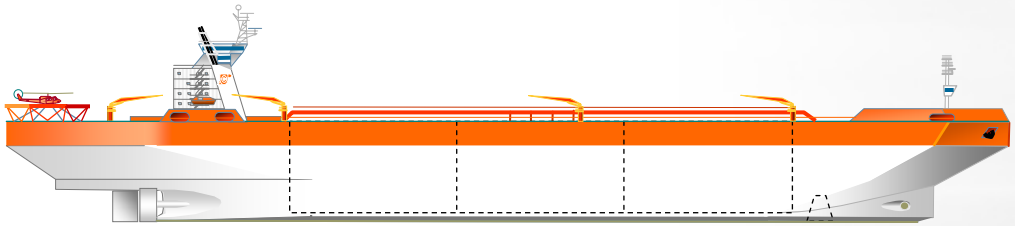
The Transition Zone - Development Activities



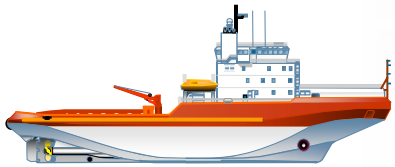
- **Hub & Spoke developments**
- **Large number of small accumulations that will require sub-sea development**
- **Possible use of sub-sea floating production in deeper waters**
- **Dredging & trenching operations required to support tie-back pipelines**

The Transition Zone - Development Activities

Icebreaking Tankers



Icebreakers



Supply Vessels

MARINE OIL EXPORT

- Potential for marine export of oil by purpose built icebreaking tankers
- Strong background in marine ice management and product delivery in Canadian arctic
- Rapidly developing worldwide capability in arctic marine oil export operations
- Strong Canadian experience base in arctic marine operations in support of oil & gas activities

In conclusion

- **The upstream oil and gas sector operates on relatively short cycle times, and is very capital intensive**
- **Historical examples of R&D success & failures**
  - E.g GRI, ESRF, PERD
  - What were the key factors in success and failure
- **The nature of activity in the upstream has high levels of risk/return.**
  - Entrepreneurial behavior is a hallmark of the industry and permeates the pioneering spirit of the West.
- **Encourage government rationalization of R&D structures where appropriate, and coordination of priorities and funding (link to National Energy Strategy)**

Opportunities & Challenges –R&D