

# Industry Perspectives on Hydraulic Fracturing

*David Pryce, VP Operations  
IOGCC Midyear Meeting  
June 5, 2012*

# Presentation Outline

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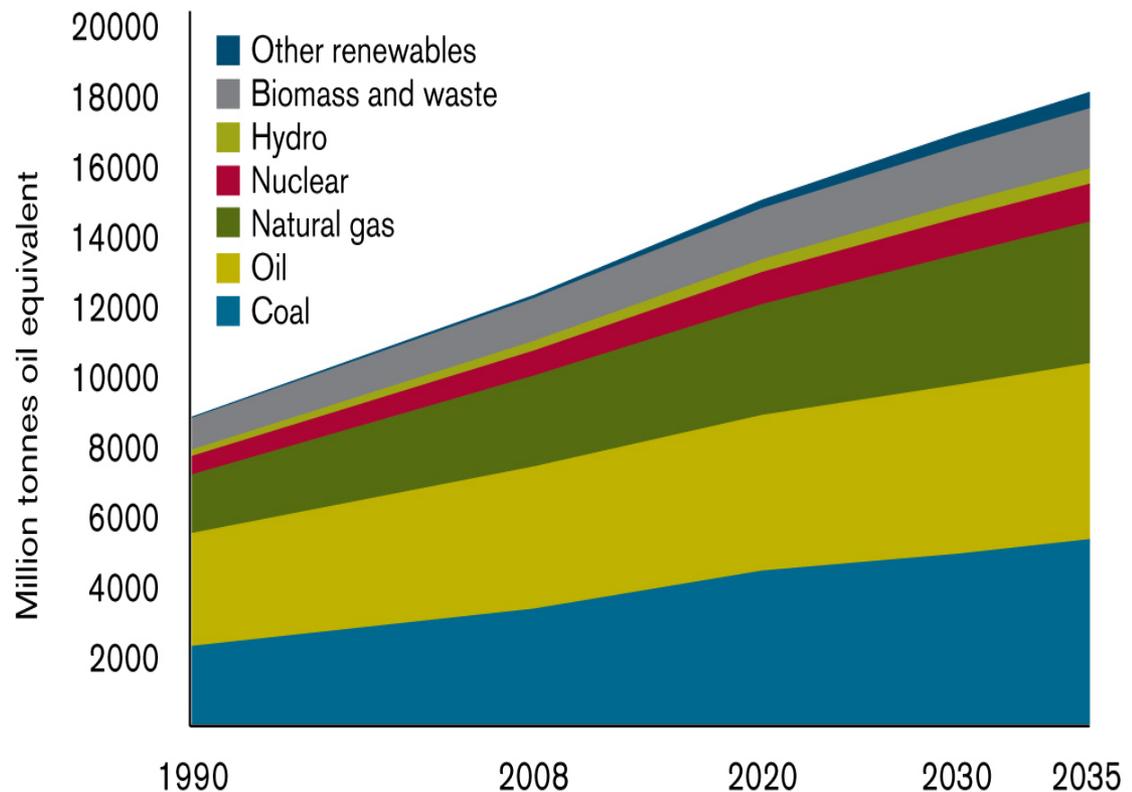
- **About CAPP**
- **Natural Gas Supply and Demand**
- **Markets and Production**
- **Public Concerns About Shale Gas**
- **CAPP Guiding Principles and Operating Practices**
- **Implementation Status of Practices**
- **Supporting Industry Research**

# Canadian Association of Petroleum Producers

- **Large and small producer member companies**
- **Explore for, develop and produce natural gas, natural gas liquids, crude oil, and oil sands throughout Canada**
- **Members produce more than 90 per cent of Canada's natural gas and crude oil**
- **Part of a national industry with revenues of about \$100 billion per year**
- **Associate members provide a wide range of services that support the upstream crude oil and natural gas industry**
- **CAPP's Mission Statement:**
  - To enhance the economic sustainability of the Canadian upstream petroleum industry in a safe and environmentally and socially responsible manner, through constructive engagement and communication with governments, the public and stakeholders in the communities in which we operate.

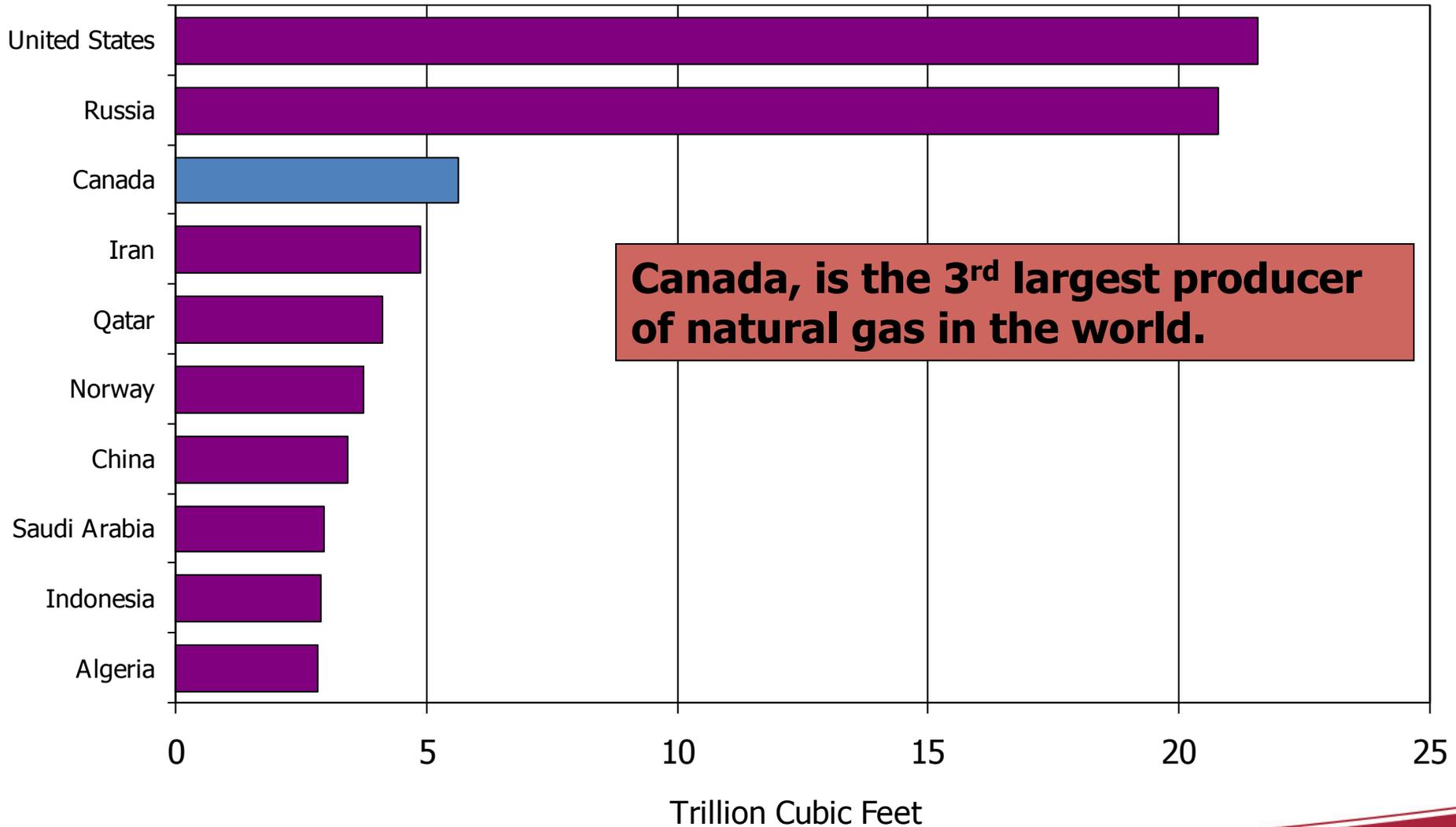
# Global Demand for Oil and Gas is Increasing

- **Significant energy demand growth:**
  - Growing populations and economies
  - Increasing standards of living
- **Need all forms of energy:**
  - Increasing role for renewables
  - Continuing reliance on hydrocarbons
  - Increasing role for unconventional oil & gas
- **Technology is a key lever for continued responsible growth**

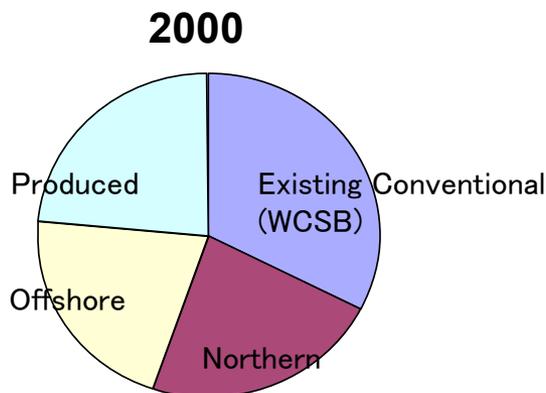


Source: IEA World Energy Outlook 2010

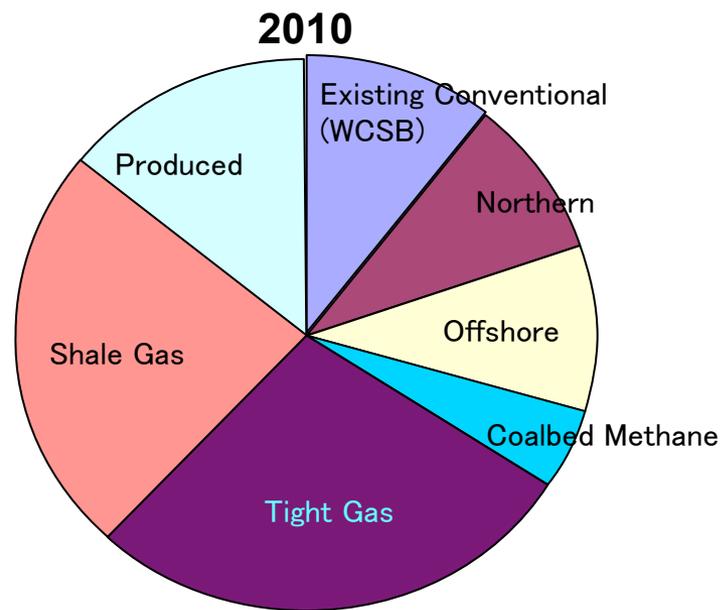
# Top 10 Natural Gas Producers in 2010



# Canadian Resource Picture Has Grown Significantly and Rapidly



**390 TCF\***  
**70 years of supply**



**700 - 1300 TCF\***  
**100+ years of supply**

- Technological advances have “unlocked” vast unconventional gas resources.
- Resource assessments are ongoing (GSC, NEB, and others) in many new areas, and new opportunities continue to emerge (Eastern Canadian shale gas etc.)

\*Estimated Recoverable Marketable Gas

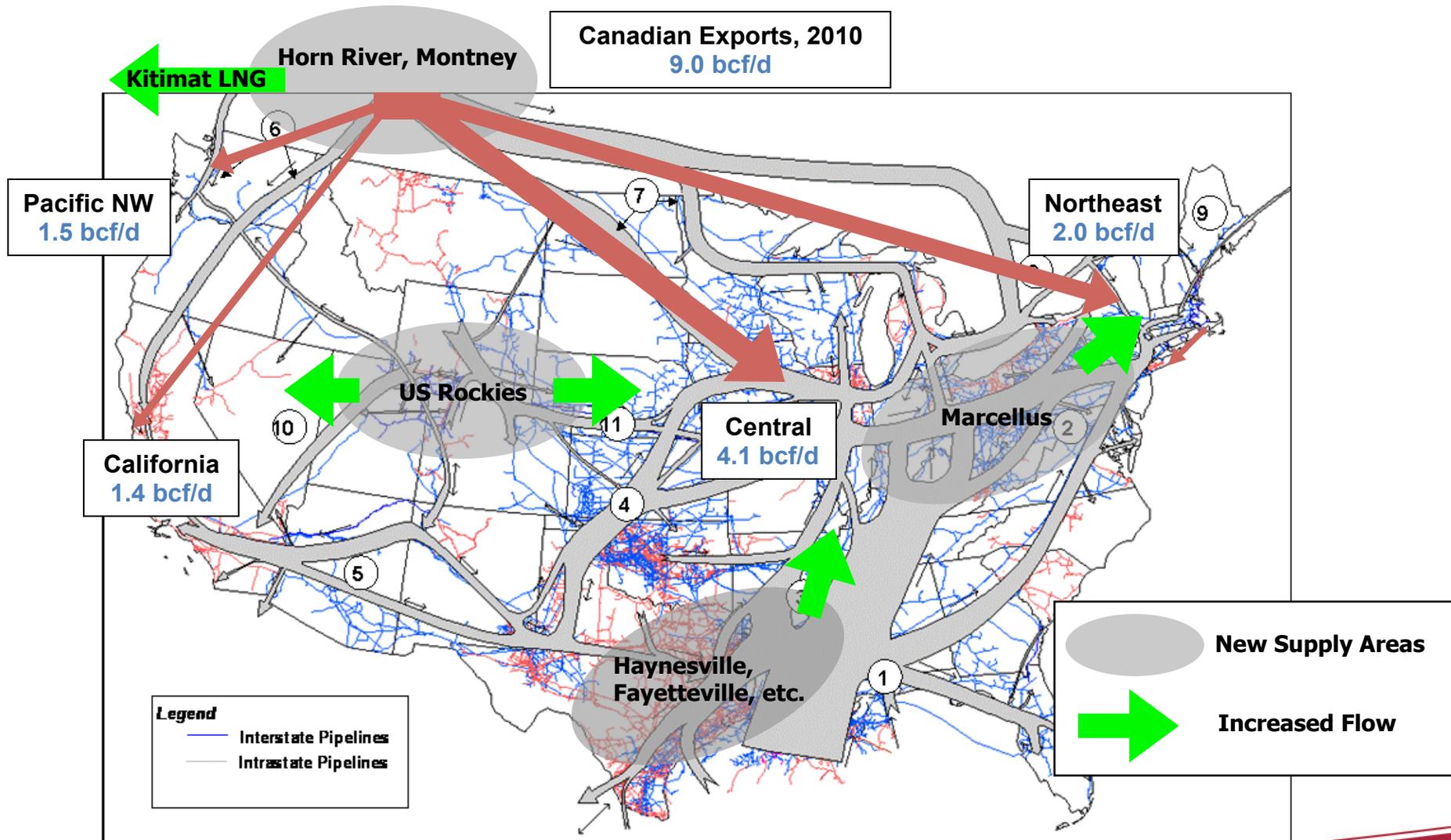
# North American Shale Gas Basins

- 28 shale basins
- 56 identified shale plays
- Canadian shale gas plays (Developing):
  - Horn River (BC)
  - Montney (BC, AB)
- Evaluating/ Future Potential
  - Utica (QC)
  - Colorado Group (AB, SK)
  - Horton Bluff (NB, NS)
- North America has a surplus of natural gas



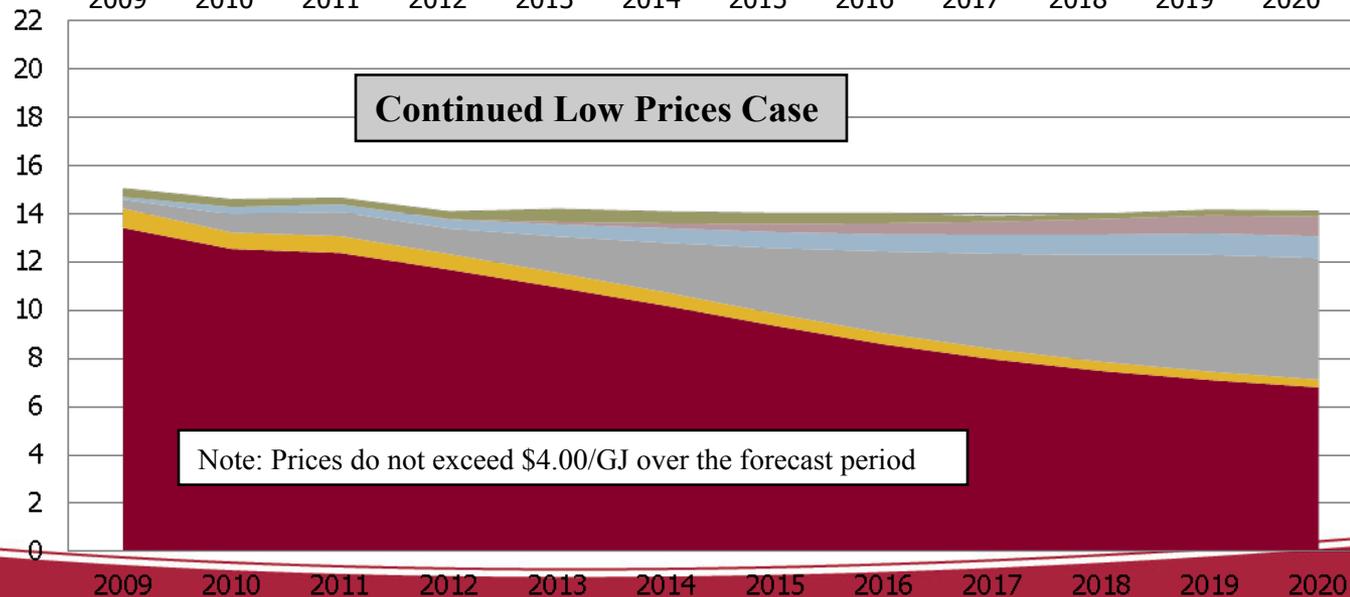
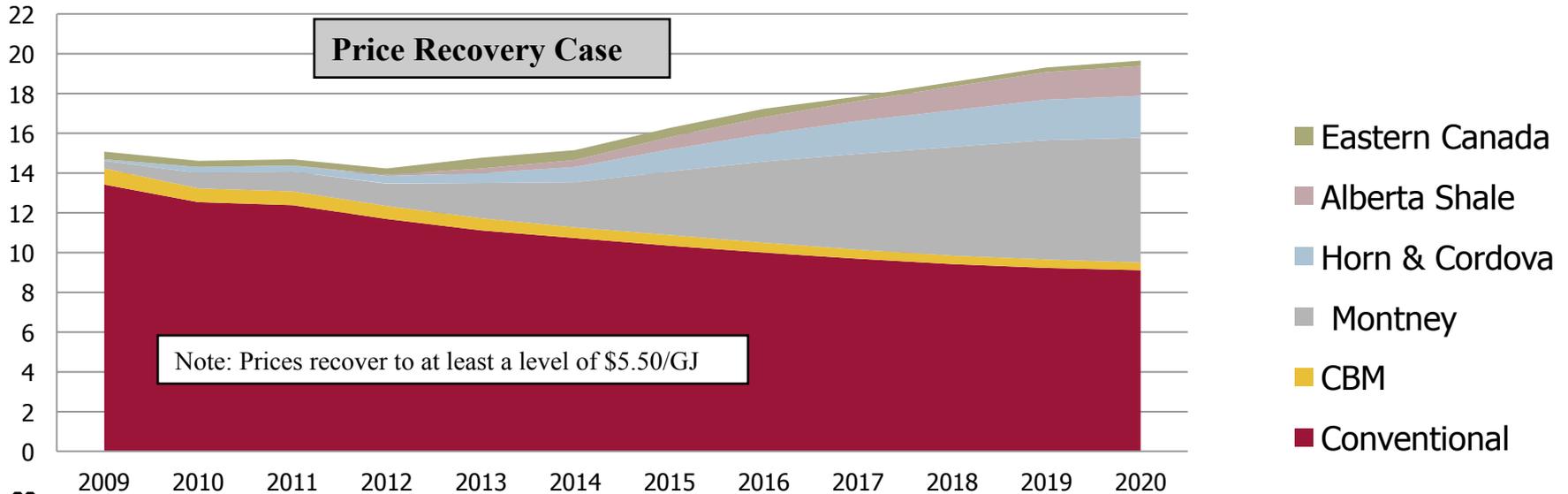
# Canadian Natural Gas Exports, 2010

## Potential Effect of New Shale Gas on Gas Flow



Source: Energy Information Administration, Office of Oil and Gas, Natural Gas Division, GasTran Gas Transportation Information System.  
 Source: National Energy Board

# Canadian Natural Gas Production – Two Price Scenarios (bcfd)



# Public Concerns About Shale Gas

- **People**

- Health effects of hydraulic fracturing chemicals

- **Land**

- Surface footprint
- Induced seismicity
- Wildlife disruption

- **Air**

- Air quality during extraction, processing, delivery and end-use

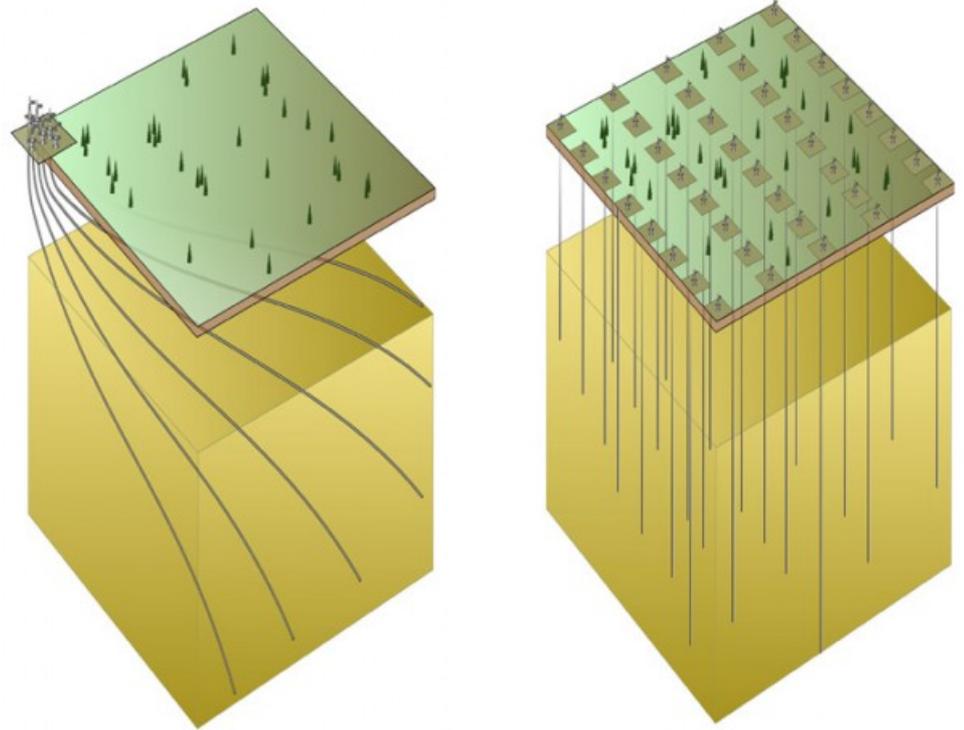
- **Water**

- Groundwater contamination – migration of methane gases and fracturing chemicals
- Large volumes of water used
- Handling and disposal of fluids



# Surface Footprint

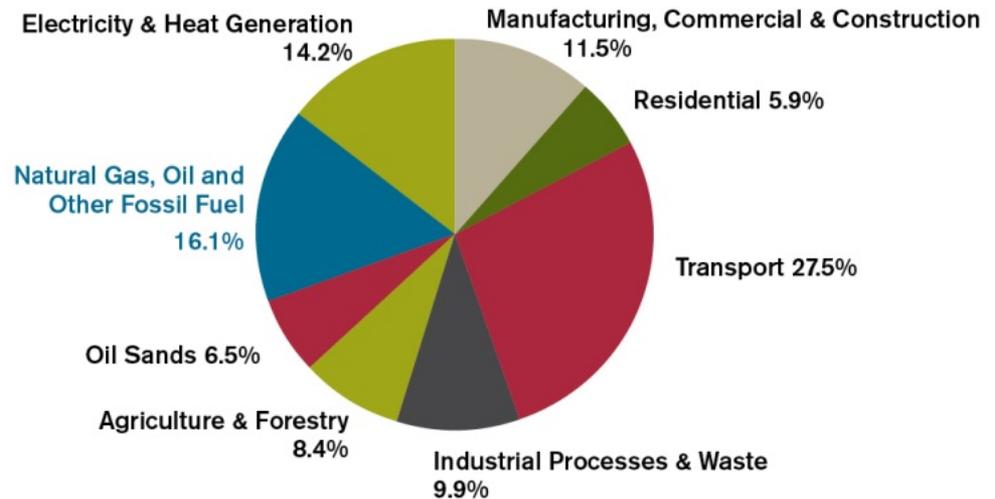
- **Use of horizontal drilling and multi-well pads have greatly reduced land disturbed**
  - 20 horizontal wells can be drilled from one 380-m x 150-m pad
  - 1 vertical well can be drilled from one 100-m x 100-m pad
- **Regulators encourage and, in some cases, require pad development to limit the number of surface sites**



# Greenhouse Gas Emissions

- **Natural gas is the cleanest burning hydrocarbon**
- **Natural gas is a lower GHG emission energy option, such as in the transportation and electricity generation sectors**

Canada's GHG Emissions by Sector – 2009



Source: Environment Canada 2011

# Water Quantity

- **Hydraulic fracturing requires short-term, intensive water use**
  - Montney: 5,000 to 30,000 m<sup>3</sup>/well
  - Horn River: 25,000 to 100,000 m<sup>3</sup>/well
- **Fracturing takes just days or weeks**
  - A well will produce for 20-40 years with no additional water requirements
- **Surface water is primary water source**
  - Fresh water is allocated by provincial governments
  - BC: 2011 actual water withdrawal for hydraulic fracturing was <4 million m<sup>3</sup>
- **Industry is researching ways to reduce fresh water withdrawals**
  - Treating saline groundwater for use
  - Reclaiming municipal wastewater
  - Sharing surplus produced water
  - Increasing recycling/reuse of flowback



# Water Quality

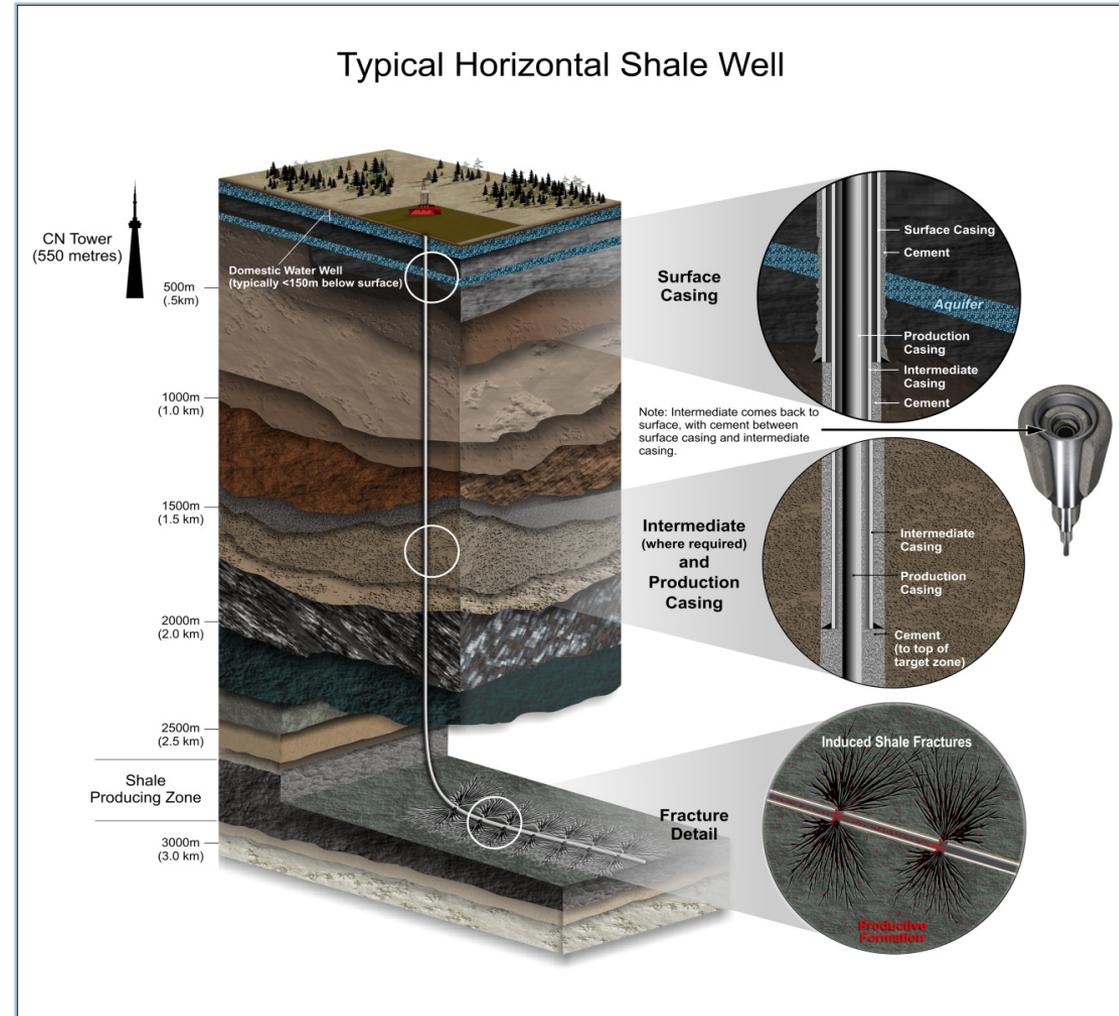
- **Potential Contamination of Drinking Water**

- Methane gas and fracturing fluid chemicals
- >175,000 wells have been fractured in BC and AB with no evidence of groundwater contamination due to hydraulic fracturing
- Impacts to water wells due to improper wellbore construction are rare
- Groundwater protection is regulated at all stages of activity



# Protection of Groundwater

- **Two types of barriers prevent fluid or gas from migrating from wellbore to aquifers**
- **Natural barriers**
  - Typical shale zone ~3 km deep -> typical domestic water well <300 m deep
  - Shale rock has low permeability (i.e., tight)
- **Mechanical barriers**
  - Multiple steel casings cemented in place
  - Wellbore construction is strictly regulated



# CAPP Guiding Principles for Hydraulic Fracturing

1

We will safeguard the quality and quantity of regional surface and groundwater resources, through sound wellbore construction practices, sourcing fresh water alternatives where appropriate, and recycling water for reuse as much as practical.

2

We will measure and disclose our water use with the goal of continuing to reduce our effect on the environment.

3

We will support the development of fracturing fluid additives with the least environmental risks.

4

We will support the disclosure of fracturing fluid additives.

5

We will continue to advance, collaborate on and communicate technologies and best practices that reduce the potential environmental risks of hydraulic fracturing.

# CAPP Hydraulic Fracturing Operating Practices

## CAPP Hydraulic Fracturing Operating Practice: BASELINE GROUNDWATER TESTING

### OVERVIEW

To support CAPP's Guiding Principles for Hydraulic Fracturing, six Operating Practices have been developed in collaboration with CAPP member companies. These Operating Practices strengthen industry's commitment to continuous performance improvement in shale gas and tight gas development.

The Baseline Groundwater Testing and Groundwater Sourcing water for collaboration and to

WHAT DOES THIS PRACTICE MEAN?

CAPP and its member companies are committed to reducing the environmental impacts of hydraulic fracturing fluids. This practice outlines the requirements for testing and managing the potential health and environmental risks associated with hydraulic fracturing fluids with lower risk profiles can be selected.

### WHAT DOES THIS PRACTICE MEAN?

CAPP and its member companies are committed to reducing the environmental impacts of hydraulic fracturing fluids. This practice outlines the requirements for testing and managing the potential health and environmental risks associated with hydraulic fracturing fluids with lower risk profiles can be selected.

Market demand for responsible fracturing fluids leads to the development of sound products. These advances in technology help drive industry improvement. Collaboration is the key to the progression, development and implementation of technologies that will reduce our industry's effect on the environment.

### HOW WILL THIS WORK?

Under this Operating Practice, companies will assess the environmental impacts of hydraulic fracturing fluids and create risk management plans to effectively manage the risks. These plans are publicly available. This assessment includes:

- Identifying chemical ingredients and characteristics of hydraulic fracturing fluids
- Assessing potential health and environmental risks associated with hydraulic fracturing fluids
- Defining operational practices and controls for the hydraulic fracturing process
- Incorporating risk management plans for each well

## CAPP Hydraulic Fracturing Operating Practice: FRACTURING FLUID ADDITIVE RISK ASSESSMENT AND MANAGEMENT

### OVERVIEW

To support CAPP's Guiding Principles for Hydraulic Fracturing, six Operating Practices have been developed in collaboration with CAPP member companies. These Operating Practices strengthen industry's commitment to continuous performance improvement in shale gas and tight gas development.

The Fracturing Fluid Additive Risk Assessment and Management Practice supports the Guiding Principles: "We will support the use of fracturing fluid additives with the least environmental impact and best practices that reduce the potential environmental risks of hydraulic fracturing."

## CAPP Hydraulic Fracturing Operating Practice: WATER SOURCING, MEASUREMENT AND REUSE

### OVERVIEW

To support CAPP's Guiding Principles for Hydraulic Fracturing, six Operating Practices have been developed in collaboration with CAPP member companies. These Operating Practices strengthen industry's commitment to continuous performance improvement in shale gas and tight gas development.

The Water Sourcing, Measurement and Reuse Operating Practice supports the Guiding Principles: "We will safeguard the quality and quantity of regional surface and groundwater resources, through sound wellbore construction practices, sourcing and recycling water alternatives where appropriate, and recycling water for reuse as much as practical"; "We will measure and disclose our water use with the goal of continuing to reduce our effect on the environment"; and "We will continue to advance, collaborate on and communicate technologies and best practices that reduce the potential environmental risks of hydraulic fracturing."

### WHAT DOES THIS PRACTICE MEAN?

CAPP and its member companies recognize that water is a resource we all share. We put great emphasis on the need to use and manage water responsibly in our operations. For shale gas and tight gas development, water is typically required for well drilling and completion and not for the actual production of gas. Some of the water injected during fracturing operations is recovered with the gas, and is either recycled for reuse in another operation or disposed of according to regulations. This practice requires companies to evaluate available water supply sources, measure water use and reuse water as much as practical in hydraulic fracturing operations.

### HOW WILL THIS WORK?

Under this Operating Practice, companies will safeguard water quantity through assessment and measurement of water sources (including recycled water). As with all industrial operations, the volume of water that can be withdrawn is approved by the provincial regulator to ensure sustainability of the resource. These practices include:

- Complying with withdrawal limits and reporting requirements of water licenses/permits. Also, collecting and reporting water use data through CAPP's Responsible Canadian Energy™ Program.
- Implementing a decision-making framework to evaluate and understand available water sources.
- Monitoring surface water and groundwater quantity data, as required to demonstrate sustainability of the water source; and collaborating with other companies on best practices.

## CAPP Hydraulic Fracturing Operating Practice: FRACTURING FLUID ADDITIVE DISCLOSURE

### OVERVIEW

To support CAPP's Guiding Principles for Hydraulic Fracturing, six Operating Practices have been developed in collaboration with CAPP member companies. These Operating Practices strengthen industry's commitment to continuous performance improvement in shale gas and tight gas development.

## CAPP Hydraulic Fracturing Operating Practice: FLUID TRANSPORT, HANDLING, STORAGE AND DISPOSAL

### OVERVIEW

To support CAPP's Guiding Principles for Hydraulic Fracturing, six Operating Practices have been developed in collaboration with CAPP member companies. These Operating Practices strengthen industry's commitment to continuous performance improvement in shale gas and tight gas development.

## CAPP Hydraulic Fracturing Operating Practice: WELLBORE CONSTRUCTION AND QUALITY ASSURANCE

### OVERVIEW

To support CAPP's Guiding Principles for Hydraulic Fracturing, six Operating Practices have been developed in collaboration with CAPP member companies. These Operating Practices strengthen industry's commitment to continuous performance improvement in shale gas and tight gas development.

The Wellbore Construction and Quality Assurance Operating Practice supports the Guiding Principles: "We will safeguard the quality and quantity of regional surface and groundwater resources, through sound wellbore construction practices, sourcing fresh water alternatives where appropriate, and recycling water for reuse as much as practical"; and "We will continue to advance, collaborate on and communicate technologies and best practices that reduce the potential environmental risks of hydraulic fracturing."

### WHAT DOES THIS PRACTICE MEAN?

CAPP and its member companies recognize that sound wellbore design and construction is fundamental to protecting groundwater resources and to responsible shale gas development. Industry is committed to excellence in the design, installation and maintenance of wellbores. Each wellbore is strictly controlled by cement to prevent any fluids from migrating into groundwater. Wellbore design is strictly controlled by individual provincial regulators, and companies have procedures in place to ensure wellbore integrity prior to initiating hydraulic fracturing operations.

### HOW WILL THIS WORK?

Under this Operating Practice, companies will demonstrate that processes are in place to ensure proper design and installation of the wellbore, and to ensure the integrity of the wellbore prior to initiation of hydraulic fracturing. These processes include:

- Complying with applicable regulatory requirements and using good engineering practice for wellbore design.
- Installing and cementing surface casing to surface to create a continuous cement barrier, which is assessed to ensure integrity of the wellbore.
- Designing wellbore casing to withstand minimum and maximum loads anticipated during hydraulic fracturing, ensuring wellbore integrity with a pressure test where possible.
- Determining the cause and developing appropriate remedial plans to restore wellbore integrity in the unlikely event that it is compromised, such as surface casing vent flow or gas migration.

# 1

## Fracturing Fluid Additive Disclosure

- **Publicly disclose, on a well-by-well basis, the chemical ingredients in additives used**
  - Additive name, supplier, purpose, chemical name & maximum concentrations
  - Where a specific chemical ingredient is considered a Trade Secret, a more general identification is used
- **Supports action by provincial governments to make disclosure mandatory**
  - Increasing transparency

**FracFocus**  
Chemical Disclosure Registry

HYDRAULIC FRACTURING  
THE PROCESS

WATER USAGE  
& PROTECTION

FIND A WELL  
IN YOUR AREA

REGULATION  
PROVINCES & TERRITORIES

### Canada's first hydraulic fracturing registry now online

British Columbia is the first province in Canada to enforce the public disclosure of ingredients used for hydraulic fracturing.

FracFocus.ca - the registry which provides a transparent accounting of B.C. hydraulic fracturing operations - includes a database of the ingredients used to support extensive content about the regulations and safety procedures governing industry activity.

As of Jan. 1, 2012, public disclosure for hydraulic fracturing fluid is mandatory. By law, a list of ingredients used must be uploaded to the registry within 30 days of the point in time when a well is able to produce gas.

Hydraulic fracturing is subject to strict regulations in British Columbia. The Province has instituted laws to ensure the process protects groundwater and the environment from harm to groundwater from hydraulic fracturing within British Columbia.

The Province of B.C. built FracFocus.ca to accommodate future participation by other jurisdictions so there can be one national site for disclosure information.

The FracFocus.ca website delivers on a commitment made by Premier Christy Clark during the B.C. Oil and Gas Conference in Fort Nelson last September, where she increased the transparency of hydraulic fracturing in B.C.

**Contact:**

Sandra Steilo

**Fracfocus.ca, a mandatory chemical disclosure registry for fracturing operations in BC, launched January 1, 2012**

## 2

# Fracturing Fluid Additive Risk Assessment and Management

- **Identify and manage potential health and environmental risks associated with these additives**
  - Builds awareness
  - Selection of fracturing fluids with lower risk profiles, where possible
- **Develop risk management plans for each well fractured**
  - Part of overall corporate risk management program



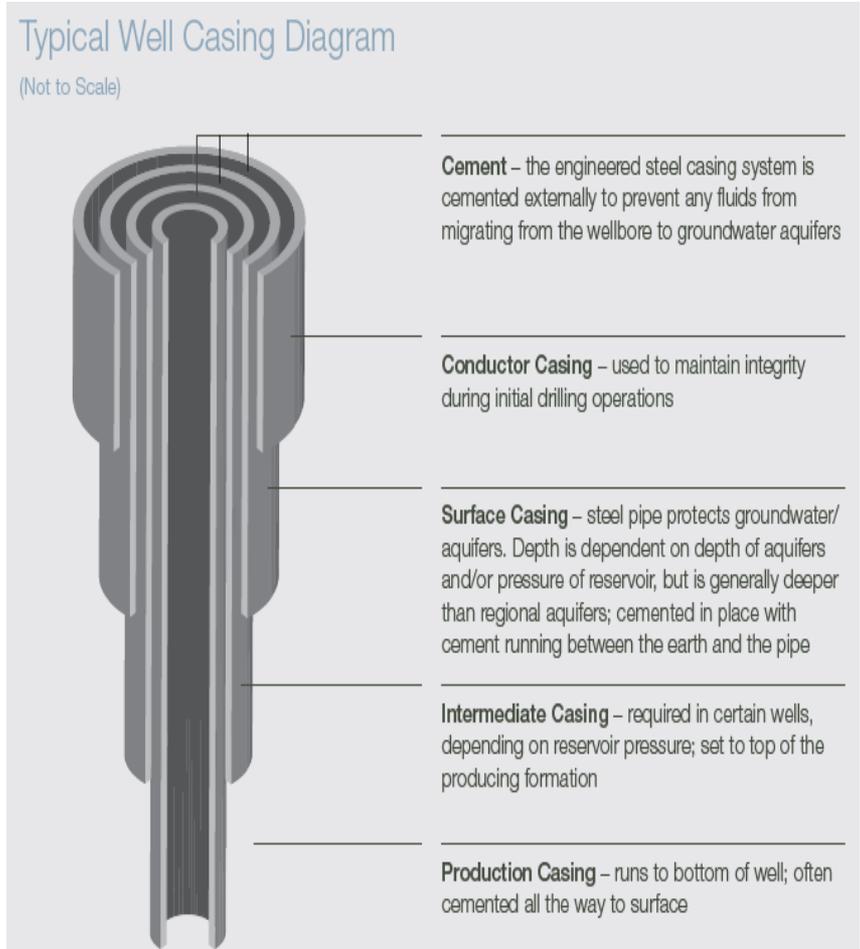
**CAPP is developing a tool to screen chemical additives, which is just one way member companies can meet the intent of this Practice**

## 3 Baseline Groundwater Testing

- **Enable assessment of potential changes in groundwater over time**
- **Test existing domestic water wells within 250 m of wellhead prior to drilling**
  - With landowner consent
  - Establish process for addressing stakeholder concerns regarding water well performance
- **Participate in regional groundwater monitoring programs**
  - Led by government



- **Comply with regulatory requirements and good engineering practices**
- **Confirm wellbore integrity prior to fracturing**
  - Integrity can be evaluated through field inspection and wellbore logging at any point in the life of the well
- **Undertake remedial actions, when required**



## Water Sourcing, Measurement and Reuse

- **Evaluate available water supply sources**
  - Flowback
  - Produced water
  - Saline groundwater
  - Wastewater sources
  - Fresh groundwater
  - Surface water
- **Measure and report water withdrawals**
- **Reuse water as much as practical**



# Fluid Transport, Handling, Storage and Disposal

- **Identify, evaluate and mitigate potential risks of fluid transport, handling, storage and disposal**
- **Fluids refer to:**
  - Fracturing fluids
  - Produced water
  - Flowback
  - Fracturing fluid wastes
- **Enable quick and effective response to spills**



# Implementation of Operating Practices

CAPP Operating Practice	Implementation Status
Fracturing Fluid Additive Disclosure	<ul style="list-style-type: none"><li>• Mandatory disclosure in BC on FracFocus.ca</li><li>• Mandatory disclosure in AB expected this year</li><li>• Advocating for mandatory disclosure across Canada</li></ul>
Fracturing Fluid Additive Risk Assessment & Management	<ul style="list-style-type: none"><li>• Developing CAPP chemical screening tool to increase awareness of risks and drive selection of 'greener' products</li></ul>
Baseline Groundwater Testing	<ul style="list-style-type: none"><li>• New West Partnership overseeing development of regional groundwater monitoring policies/protocols</li></ul>
Well Construction & Quality Assurance	<ul style="list-style-type: none"><li>• Drafted procedures for conformance with the practice, for individual company modification and adoption</li></ul>
Water Sourcing, Measurement & Reuse	<ul style="list-style-type: none"><li>• Procedures to be developed this year</li></ul>
Fluid Transport, Handling, Storage & Disposal	<ul style="list-style-type: none"><li>• Procedures to be developed this year</li></ul>

# Industry Projects Supporting CAPP Practices

- **Completed**

- The modern practice of hydraulic fracturing – a primer for Canadian resources
- Horn River basin water study (Phase 1)
- Montney water study
- Responsible Canadian Energy (RCE) program metrics development

- **In Progress**

- Fracturing fluid water recycling feasibility study and decision tool
- Fracturing fluid additive screening tool
- Determination of surface water flow monitoring standards
- Technologies for produced water treatment and recycle in drilling operations
- Risks to groundwater from oil & gas drilling and completions
- Water well testing prior to drilling (CBM)
- Instream flow needs approaches for northeastern BC
- Targeted regional water inventory project in Alberta's key unconventional oil & gas areas
- Horn River basin water study (Phase 2)

# Industry Projects Supporting CAPP Practices cont'd

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- **Proposed**

- Literature review of regional groundwater monitoring systems
- Effects-based shallow groundwater monitoring program – Horn River, Montney, Cardium and Duvernay plays
- Assessment tool for identifying and evaluation alternative water sources using a life cycle analysis
- Technical and literature review of cross-borehole influences

# Summary

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- **Global energy demand is growing**
  - Canada can supply reliable energy source
- **Highly regulated industry**
  - Shale gas is being developed safely
  - CAPP's principles and practices complement regulations
- **Industry has an excellent environmental track record**
- **We are committed to responsible energy development**
  - Environmental performance improvement
  - Increasing transparency
  - Consulting with our stakeholders

Thank you

