

UNIVERSITY OF ALBERTA
School of Business

BUEC 663 – NRE Capstone

Sustainability of Coalbed Methane

(Within the Context of Environmental Challenges and Policy Development in Alberta)

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1.0 Executive Summary

In Alberta, one of the most recent energy plays is the development of an unconventional source of natural gas known as coalbed methane (CBM). Differentiated from conventional natural gas pools, which are found in deep porous rock (sandstone or limestone) formations, CBM is associated with Alberta's shallower coal seams. Rather than existing as a free pool, CBM is bonded to the coal seam and is released through the depressurization of the coal. With an estimated two trillion tonnes of coal suitable for CBM exploration, it is estimated Alberta has 14 trillion cubic meters (500 tcf) of CBM. With declining conventional natural gas reserves, optimists forecast that Alberta will see 50,000 CBM wells drilled over the next decade.

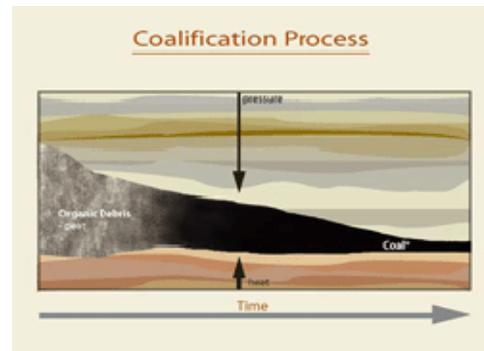
In many respects, Alberta is at a crossroads. While CBM offers a new source of natural gas that can contribute to Alberta's growth and prosperity, CBM exploration has linkages to negative externalities (environmental degradation) such as water contamination, and air/noise pollution. CBM wells produce only a fraction of natural gas compared to conventional wells. The cumulative effects of a higher density of CBM drilling/compressor stations/pipeline infrastructure/roads can also have serious irreversible long term impacts to land owners, wildlife habitat, and even the existence value that citizens place on knowing a healthy ecological landscape exists.

Granted jurisdictional power over natural resources, and the ability to influence economic activity, clearly the Alberta Government has a major role to play in balancing long-term economic prosperity against the sustainability of the province's ecosystems.

Figure #1

2.0 Introduction

Coalbed Methane (CBM) is natural gas found in coal seams. The formation of coal is the result of carbon rich plant materials (peat) that accumulated in swamps and was subsequently buried by ongoing geological processes.



Over millions of years, with the increasing depth of burial, the plant material undergoes coalification (Figure #1¹) from high-pressure and heat. The result of this process releases volatile matter (i.e. water, carbon dioxide, light hydrocarbons, and methane) as it begins to transform into coal. Natural gas is stored in coal as an adsorbed component on or within the coal matrix, as free gas in micro-pore structures, or in cleats (tiny cracks and fractures) found in the coal bed. Held in place mainly by overburden pressure, reducing the pressure (i.e. drilling a well) allows the gas to be released from the coal.²

2.1 Characteristics of Coalbed Methane

Characteristics of Alberta’s unconventional CBM is summarized below³:

- Natural gas found in coal is “sweet” not “sour” as it typically does not contain hydrogen sulphide; “Considered to be Alberta’s cleanest burning fossil fuel” (Table #1⁴)
- Generally greater than 90% methane with only small amounts of carbon dioxide and nitrogen;
- Generally of near-pipeline quality when produced and requires minimal processing;
- Generally produced at lower pressures than conventional natural gas;
- Can be associated with dry coal seams, freshwater coal seams, and saline-water coal seams;
- Found in high-ranking coal, such as bituminous coals found at greater depths and towards the Rocky Mountains.

Table #1	Southern Alberta Coalbed Methane	Southern Alberta Sweet Shallow Gas
Methane	97.19	95.31
Nitrogen	2.2	3.76
Ethane	0.35	0.44
Carbon dioxide	0.11	0.18
Hydrogen)	0.09	0.01
Propane	0.04	0.08
Helium	0.01	0.12
IC4	0.01	0.03
NC4	0	0.02
IC5	0	0.02
NC5	0	0.01
C6+	0	0.04

¹ Alberta Department of Energy “Natural Gas in Coal Orientation: page 1 <http://www.energy.gov.ab.ca/332.asp>

² AEUB – Coal Maturation and Coalbed Methane (CBM) Generation http://www.ags.gov.ab.ca/activities/CBM/coal_and_cbm_intro2.htm

³ Alberta Department of Energy “Natural Gas in Coal Orientation” page 2 : <http://www.energy.gov.ab.ca/332.asp> -

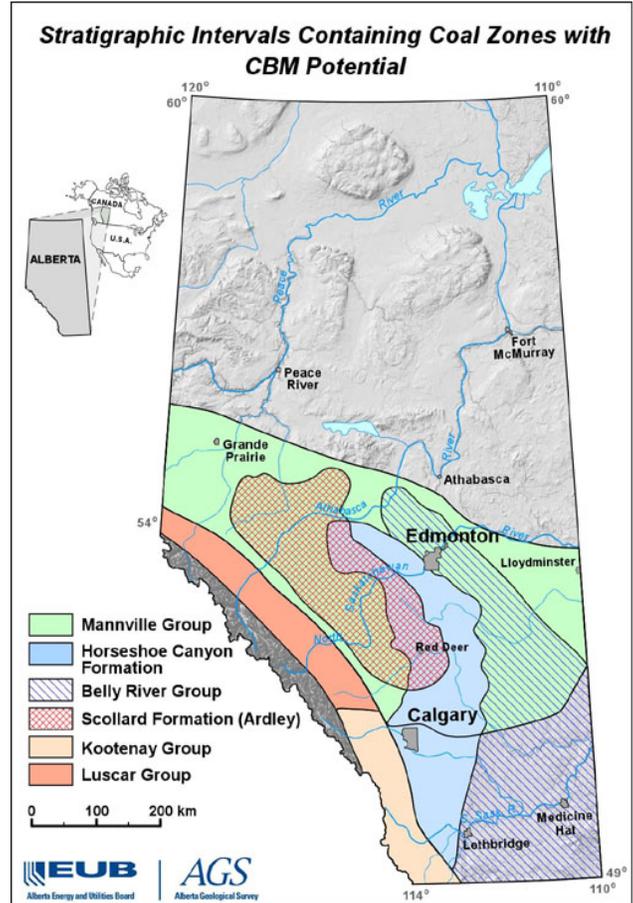
⁴ Encana Corporation “Typical CBM Well from Horseshoe Canyon Formation” www.encana.com/media/canadaindex.htm

2.2 Alberta's CBM Resources

As illustrated in Figure #2⁵, Alberta's coal-bearing strata are located in the south half of the province gently dipping westward near the Rocky Mountains where the coals are folded towards the surface and exposed in the Foothills. The Alberta Energy and Utilities Board (AEUB) estimates that there are 91 billion tonnes of coal suitable (depths of 150 to 1600 meters deep) for mining. Associated with the coal, is an estimated 14 trillion metres³ (500 tcf) of methane gas.⁶

Alberta Plains: The oldest and deepest coals (800 to 2800 metres deep) belong to the Lower Cretaceous Mannville Group. While Mannville coals contain some of the highest gas content within Alberta, CBM extraction is often associated with saline-groundwater; notwithstanding higher drilling and extraction costs. To date, CBM drilling has been focused in the Horseshoe Canyon and Ardley formations where coal seams are shallower (300 to 700 meters), relatively thick seams (10 to 25 meters), and are often associated with dry coal, non-saline or only marginally saline water.⁷ Alberta Foothills: Coals of the Luscar and Kootenay groups occur

Figure #2:



⁵ EUB - Alberta Geological Survey - "Coal Zones with CBM Potential: http://www.ags.gov.ca/activities/CBM/unconventional_gas_oil_sand.html

⁶ AEUC "Alberta Coal and CBM Exploration Areas Exploration Areas: http://www.ags.gov.ab/activities/CBM/coal_and_cbm_intro.shtml

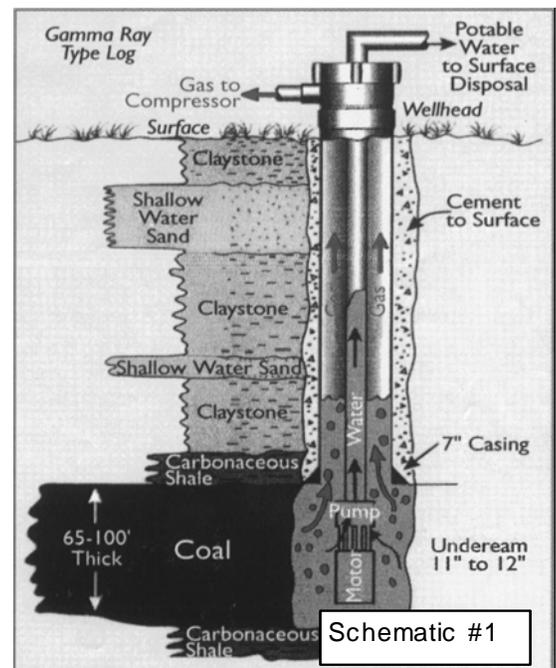
⁷ Ibid

throughout the Foothills and Mountains. Although these coals generally have greater CBM content than Plains coals, the coal seams tend to be deformed which can disrupt continuity and thickness. Combined with the environmental sensitivities of drilling in the foothills, there has been limited exploration in these areas.⁸

2.3 CBM Extraction

Similar to techniques used to identify conventional energy resources, the initial extent of a coal seam is usually identified by a seismic survey. Fortunately, coal seams are so well defined in Alberta that the primary exploration of CMB usually involves obtaining a lease/permit to drill a series of exploratory wells to ascertain the permeability of the coal seam and the quantity of methane gas that may be recoverable.⁹

Well drilling and completion depends on the nature of the coal formation. Shallow CBM wells are typically drilled as vertical wells, (Schematic #1¹⁰) to maximize the recovery of natural gas. For deeper CBM wells, or where multiple coal seams are to be perforated, directional drilling or slant drilling technologies allow for more than one well to be drilled from a single location (Schematic #2¹¹). Non-toxic muds are used during the drilling phase for groundwater protection,



⁸ AEUC “Alberta Coal and CBM Exploration Areas Exploration Areas”:

http://www.ags.gov.ab/activities/CBM/coal_and_cbm_intro.shtml

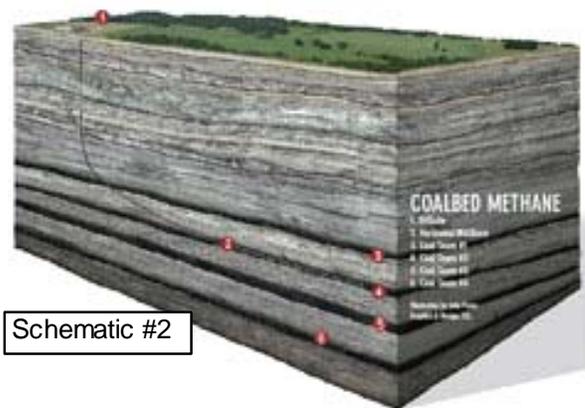
⁹ Griffiths et. Al. Pembina Institute – “Unconventional Gas” June 2003 page 22 www.pembina.org

¹⁰ Skinner & Reddy “CBM Product Chemistry in three Wyoming Watersheds” Journal of the American Water Resources Association – June 2003 Pg 577

¹¹ Rig Zone Magazine - http://www.rigzone.com/magazine/unconvGas/insight.asp?i_id=229

with steel casings cemented in place to ensure a stable and protective well completion that eliminates the potential co-mingling of groundwater aquifers.¹²

Depending on the well classification, logging of the drilling lithology, including sampling, is mandated by regulation and submitted to the AEUB and Alberta Environment (AENV) for future reference.¹³ If water is encountered in the coal seam, it must be pumped out to reduce the reservoir pressure before the methane gas is available. All water samples must be tested to



determine their level of salinity as defined by Alberta Environment.¹⁴ In Alberta, saline water is defined as water containing over 4,000 milligrams of total dissolved solids (TDS) per litre.¹⁵ As illustrated in Schematic #1, separate piping is used to isolate the water from the methane gas. Water that is saline will be disposed of by deep well injection to underground formations that have similar characteristics as defined by a groundwater diversion permit issued by AENV.¹⁶ Although, water below 4,000 Mg/L TDS is considered non-saline, AENV has further regulations regarding its use for watering livestock, irrigation, or for human (potable) consumption.¹⁷

¹² Canadian Association of Petroleum Producers “Best Management Practices – Natural Gas in Coal” May 2006 pg 46-47. http://www.capp.ca/default.asp?V_DOC_ID=6

¹³ Ibid

¹⁴ Griffiths et al. Pembina Institute – “Unconventional Gas” June 2003 page 24 www.pembina.org

¹⁵ Alberta Water Act, Water (Ministerial) Regulation, Alberta Regulation 205/98, section 1(1)(z): http://www.qp.gov.ab.ca/documents/Regs/1998_205.cfm?frm_isbn=077971384

¹⁶ Canadian Association of Petroleum Producers “Best Management Practices – Natural Gas in Coal” May 2006 pg 26. http://www.capp.ca/default.asp?V_DOC_ID=6

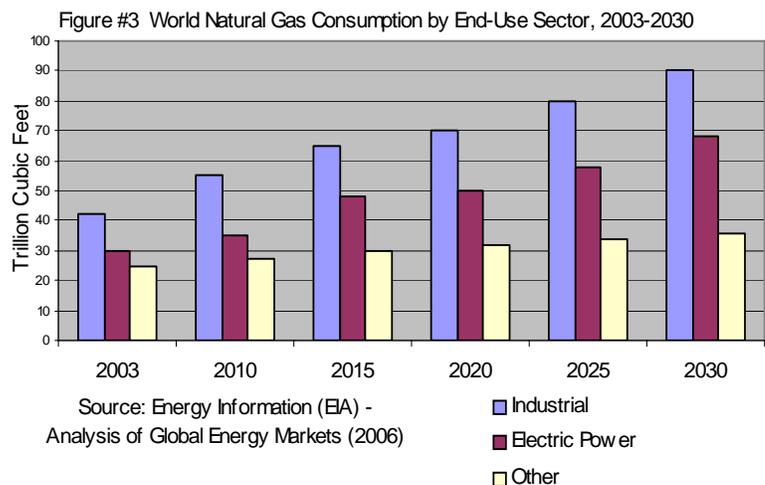
¹⁷ Alberta Water Act, Water (Ministerial) Regulation, Alberta Regulation 205/98, section 1(1)(z): http://www.qp.gov.ab.ca/documents/Regs/1998_205.cfm?frm_isbn=077971384

Initially, CBM wells typically produce insufficient gas until the coal seams have been stimulated (fractured) and/or de-watered. Unless there is an existing pipeline infrastructure to tie-into, drilling companies may apply for a permit from the EUB to vent the methane to the atmosphere. Fracturing involves pumping a fluid under pressure into the coal seam to create fractures to intersect the gas-bearing cleats. Fracturing fluids may be water-based mixtures, acids with small quantities of hydrocarbons, or even inert gases such as nitrogen or carbon dioxide.¹⁸

3.0 Fiscal Drivers of CBM Expansion

While the Energy Information Administration (IEO 2006) predicts that the annual consumption growth rate for coal (2.5%) will be slightly higher than natural gas (2.4%), there is no doubt natural gas, a more environmentally attractive energy source, will remain the fuel of choice for many regions of the world. Although demand for oil and natural gas (a high price for both, making coal a more economical fuel source) will continue to be correlated to price, the IEO is forecasting that the natural gas share of total world energy consumption will increase from 24% in 2003 to 26% by 2030.¹⁹ Worldwide, the industrial and electrical power sectors are the largest consumers of natural gas (Figure #3).

Even though Figure #4 suggests new sources of natural gas continue to be found,



¹⁸ Griffiths et al. Pembina Institute – “Unconventional Gas” June 2003 page 22 www.pembina.org

¹⁹ Energy Information Administration – “International Energy Outlook 2006” – Chapter 4, pg 37 <http://www.eia.doe.gov/gove/iea>

Figure #5, reinforces that much of the world’s natural gas reserves are considered stranded due to: 1) geopolitical risk; 2) located in areas too far away from pipeline infrastructure and/or population centers for transportation to be economical. For example, Non-OECD countries in Europe, Eurasia and the Middle East account for three-quarters of the world’s natural gas reserves.²⁰ In 2006, the natural gas reserves of Russia, Iran and Qatar combined for almost 60% of the world’s natural gas resources.²¹

Currently, Canada is the source of almost 90% of U.S. imports of natural gas. While technology exists to increase gas exports in the form of liquefied natural gas (LNG), particularly from Africa (Algeria, Nigeria, Libya), geopolitical risks in the producing regions, a “NIMBY Syndrome” (not-in-my-backyard) relating to locating re-gasification terminals, suggest the U.S. will continue to look towards Canada to supply a majority of its natural gas.

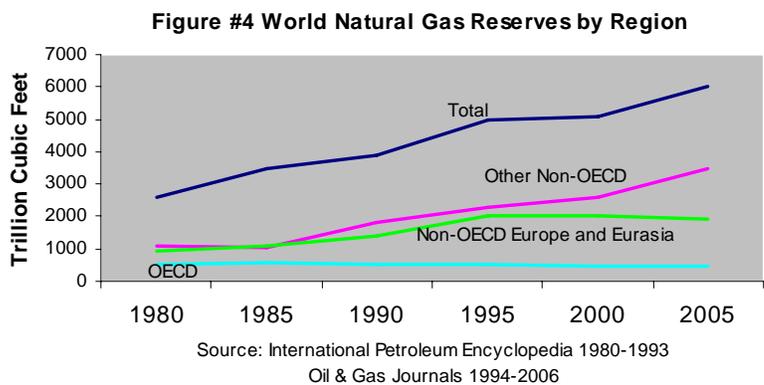
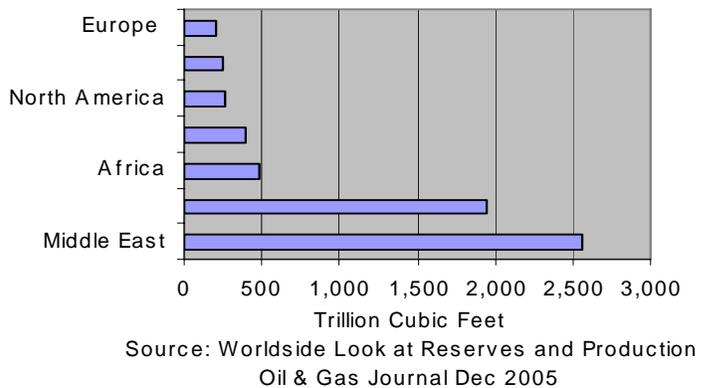


Figure #5: World Natural Gas Reserves by Geographical Region as of January 2006

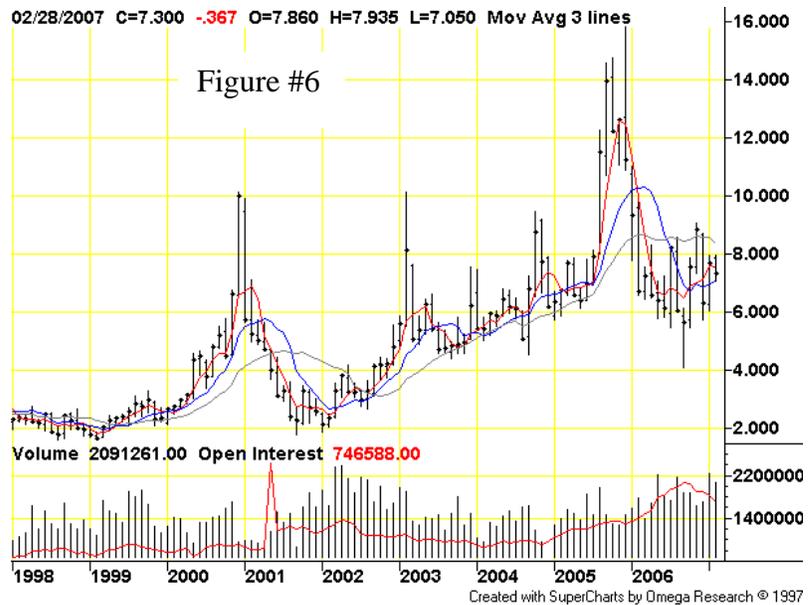


²⁰ Energy Information Administration – “International Energy Outlook 2006” – Chapter 4, pg 39

<http://www.eia.doe.gov/gove/iea>

²¹ Ibid

As illustrated in Figure #6²², while many predict that record high natural gas prices will discourage construction of new natural gas-fired electrical generation plants²³, recent environmental lobbying to reduce carbon emissions suggest demand for natural gas (i.e. electrical generation and industrial use) will remain strong. Compounded against the decline in Canada's conventional natural gas production from its Western Canadian Sedimentary



Basis, unconventional natural gas resources (i.e. Alberta's CBM Reserves) are expected to play an increasing role in satisfying North America's thirst for a cleaner energy source.

3.1 Provincial Royalties

In Alberta, the Department of Energy is responsible for the administration of mines and minerals and sets out criteria for the responsible development of the province's non-renewable resources. Alberta owns 81% of its subsurface mineral rights.²⁴ Exploration/Production companies are granted the right to explore and develop oil/gas/coal resources in exchange for a series of fees: lease tenure rights, rents, bonuses, taxes, and royalties (based on volumes of resources sold). Alberta Energy states that its royalty regime has three main objectives:²⁵

²² Omega Research Charts "Natural Gas Prices": <http://futures.tradingcharts.com/chart/NG/M>

²³ Energy Information Administration – "International Energy Outlook 2006" – Chapter 4, pg 42
<http://www.eia.doe.gov/gove/iea>

²⁴ Government of Alberta, Alberta Energy: "About Royalties": <http://www.energy.gov.ab.ca?317.asp>

²⁵ Ibid

1. *To extend the economic life of mature pools to maximize recovery of energy resources.*
2. *To promote the development of new and more efficient technologies.*
3. *To promote the exploration and development of new reserves while providing the province a fair share of the value of its resource.*

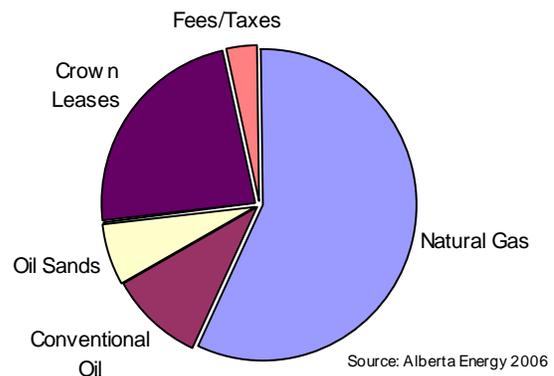
3.2 Classification of Royalties

Oil and natural gas reserves are classified by “vintage” for royalty calculation purposes. Vintage refers to the date of discovery of the energy resource from which production occurs. Royalty rates of newly discovered resources are normally set lower (i.e. CBM) to reflect the average higher exploration and production costs associated with smaller and/or unconventional energy pools compared to those found prior to the 1970’s. Alberta has two vintage classes for natural gas: 1) “Old” Gas – up to December 1973; and, 2) “New” Gas – after December 1973. The Natural Gas Royalty Rate is determined by the following:²⁶

- When the gas pool was discovered (“vintage”).
- The inflation adjusted price of natural gas less certain cost allowances (for gathering, compressing, and processing).
- Whether the well is a low producer.

In 2005-2006 Alberta’s non-renewable energy royalty revenue totaled \$14.3 billion. Natural gas contributed approximately 57% of this amount (Figure #7).²⁷ Obviously, with conventional natural gas revenue “pools” drying-up, combined with a disproportionately

Figure #7: Province of Alberta Non-Renewable Energy Royalties 2005-06



discounted royalty regime for the capital-intensive oil sands, the provincial government has a

²⁶ Government of Alberta, Alberta Energy: “About Royalties”: <http://www.energy.gov.ab.ca?317.asp>

²⁷ Ibid

vested interest in promoting unconventional natural gas plays as a means of sustaining royalty revenues.

4.0 Regulatory Regime

In consort with the Energy Resources Conservation Board (ERCB) and the Alberta Department of Energy (Energy), the EUB regulates CBM extraction with the same practices and policies that relate to conventional natural gas activities. Relevant acts and regulations are found under the Energy Resources Conservation Act, the Gas Resources Preservation Act, the Oil and Gas Conservation Act, and the Mines and Minerals Act.²⁸ As previously mentioned, an exploration company must also obtain an approval or license from AENV for the disposal of saline groundwater.

Figure #8

It should be noted that under the Mines and Minerals Act, natural gas and coal are treated as distinct substances and leases sold separately. As such, a lessee of a coal lease would have to make a separate application to the ERCB in order to recover natural gas contained in the coal seam.²⁹



Since the Crown (Provincial Government) owns the majority of the mineral rights in Alberta, landowners are as a rule, required to grant (as specified under the Surface Rights Act)

²⁸ EUB – “Coalbed Methane Regulation”:
http://www.eub.ca/portal/server.pt/gateway/PTARGS_0_0_260_222_0_43/http/extconte

²⁹ EUB – “Facts Facts Coal Development in Alberta”:
http://www.eub.ca/portal/server.pt/gateway/PTARGS_0_0_260_222_0_43/http/extconte

access to the minerals of an exploration company (Figure #8³⁰) that has obtained a license.³¹ Nonetheless, the EUB does require that a company wishing to conduct exploration activities consult with the landowner (s) and, in some cases, notify neighboring residences within a specified distance. If the company and landowner cannot reach an amicable agreement on development, the AEUB utilizes an established arbitration process³²

Under the auspices of protecting Alberta's freshwater groundwater aquifers, if coal seam dewatering produces potable water, an AENV permit may still be required to withdraw large volumes of water under the Ground Water Development Act and the Water Resources Act.³³

As outlined by EUB's "*EnerFAQ's No. 10: Coalbed Methane*" specific regulations are in place and summarized as follows³⁴:

Water Production: Both non-saline and saline waters associated with CBM production are regulated by EUB/ANEV under a permit system, which is of public record. This includes water volume and chemical analysis to provide baseline water quality. Well completions (i.e. cementing the casing) must be constructed in such a way to ensure there is no co-mingling of distinct water aquifers or the migration of water/methane gas associated with the coal seam.

Shallow Fracturing: A prohibition on fracturing within 200 meter radius of water wells whose depth is within 25 meters of the proposed well. Drilling companies are required to submit a comprehensive fracturing program design prior to conducting fracturing operations

³⁰ Encana Picture Archives "Coalbed Methane Drilling Site – Southern Alberta" <http://www.encana/picture/archieves/com>.

³¹ Rutlund, Stan – University of Alberta "Natural Resources and Environmental Law. Class Lecture December 2004

³² Griffiths et al Pembina Institute – "Unconventional Gas" June 2003 page 26 - www.pembina.org

³³ EUB – "Coalbed Methane Regulation": <http://www.eub.ca>
http://www.eub.ca/portal/server.pt/gateway/PTARGS_0_0_260_222_0_43/http/extconte

³⁴ EnerFacQ's No. 10 "Frequently Asked Questions on the Development of Alberta's Energy Resources – Coalbed Methane" – Fact Sheet Published January 2004 - <http://www.eub.ca>

Surface Disturbance: Although the standard natural gas well spacing is limited to one well per section, given the nature of low producing CBM volumes, drillers can apply to the EUB for a special permit to increase well density up to eight wells per section subject to providing full disclosure and communication of the project details, and potential impacts.

Flaring and Venting: Flaring (burning of natural gas) is controlled and reviewed under Directive 060 of the EUB. Where produced gas volumes are too low to burn, venting is permitted under controlled circumstances that comply with ambient air quality standards.

Compression and

Noise:

Compression is required for most gas production to keep it flowing in pipeline infrastructure. Since most CBM wells are produced under low pressure, noise associated with compression is regulated under Directive 038 of the EUB.

Excerpts from the EUB approval of Encana's 15 CBM wells in the Torrington Area (October 31, 2006) illustrates some of the regulatory rules in practice:³⁵

- *Encana must submit fracturing operational data to EUB/Intervenors within five days of fracturing operations*
- *Encana must install groundwater-monitoring wells to determine, if any, impacts on aquifers in proximity to CBM operations*
- *Encana must demonstrate that night-time noise from compressors is at or below 25 decibels at one of the intervenors' homes as well as meeting regulated noise levels at all other times*
- *EUB has committed to undertake coordination of a third-party report to address using surface water for drilling operations as well as reporting on its on-going groundwater monitoring program*

As of December 2005, the EUB claims that of the 7,764 CBM wells drilled in Alberta since January 2001, it has only received 43 complaints relating to CBM development.³⁶ It should also be noted that while the province is the major regulator of CBM activities, the federal government maintains the regulatory power for CBM activities in national parks, military reserves and on Aboriginal/Treaty lands.

³⁵ EUB – News Release “EUB Approves Encana Coalbed Methane Project with Conditions”
http://www.eub.ca/portal/server.pt/gateway/PTARGS_0_0_260_222_0_43/http://extconte

³⁶ EUB “Facts Sheet Coalbed Methane (CBM) Development in Alberta”
http://www.eub.ca/portal/server.pt/gateway/PTARGS_0_0_260_222_0_43/http://extconte

5.0 Environmental Challenges of CBM Extraction

Despite decades of knowledge and experience from thousands of conventional oil and gas well completions, many concede that Alberta's CBM industry is still in its infancy with many of its future externalities unknown. And, while CBM activity has grown exponentially since 2001, drilling activities have been concentrated in dry coal seams, rather than the higher gas content Mannville coals, which are often associated with deleterious saline groundwater.

Far from being considered a mature industry, the U.S. has a solid decade head start in its experience with CBM activities. Although high natural gas prices and improved technologies make U.S. CBM resources a target of interest, outstanding lawsuits, unknown compensation awards, and legislature regulatory delays, continue to plague the industry. As noted in a study conducted by the U.S. Environmental Protection Agency (EPA), the following are documented water quality and other issues encountered after CBM extraction:³⁷

- *Explosive levels of hydrogen sulfide and methane under buildings and inside homes;*
- *Death of vegetation (possibly due to seepage of methane and decreased air in the root zone);*
- *Increase concentrations of methane and hydrogen sulfide in domestic water wells;*
- *Cloudy well water with increased sediment concentrations following hydraulic fracturing;*
- *Strong odors and black coal fines in water wells;*
- *Decrease in well water levels and surface water flows following hydraulic fracturing;*
- *The discharge of produced water creating new ponds and swamps that were not naturally occurring in the region and are saline.*

Even though geological differences between Alberta and the U.S., make direct inferences to Alberta's CBM suspect, irreversible environmental damage in the U.S. (Figure #9: saline

³⁷ Energy Justice Network "Coal-bed Methane (CBM) – http://www.energyjustice.net/natural_gas/cbm/

laden watercourse from CBM dewatering³⁸) suggests much can be learned from our southern neighbors.

Figure #9



Similarly, given the inconsistency in Alberta's geological formations, many are concerned that improper drilling, well completions, or hydraulic fracturing can allow fracturing substances and/or methane/saline groundwater associated with coal to migrate into non-saline

aquifers. There have also been documented cases where landowners have been able to light their well water on fire due to methane gas migrating from a nearby coal seam.³⁹ With more than 90% of rural Alberta's relying on groundwater for livestock watering, crop irrigation and household use, clearly risk adverse regulatory procedures should be developed to protect Alberta's groundwater resources.⁴⁰

Figure #10



Long a criticism of the oil and gas industry as a whole, the need for a higher well density, associated access roads, compressor stations, and pipeline infrastructure for CBM development, has fuelled the "Cumulative Effects" (Figure #10⁴¹) argument regarding serious long term impacts to land owners,

³⁸ PowderRiverBasin.org "Encouraging Responsible Development today" - Eastern Wyoming.

www.powderriverbasin.org/press_releases/swartz_testimony.shtml

³⁹ Pembina Institute "Coalbed Methane in British Columbia" Fact Sheet October 2006 – www.pembina.org

⁴⁰ Eggen, David "Moratorium on Coal-bed Methane Drilling Needed to Cool Frenzy" Edmonton Journal December 22, 2006, Section A18

wildlife and a pristine ecological landscape.

Besides high volumes of equipment traffic during the construction phase of development, land disturbance can also destroy surface vegetation, which may result in the introduction of non-native species. With new roads and cleared areas, more people can access the land for both work and recreation, which can put increasing pressure on wildlife due to hunting and fishing.⁴² This is exacerbated by the “fragmentation effect” since wildlife tend to congregate along the edge of forested areas. Noise, combined with the loss of wildlife habitat, can also have serious impacts on herd size and reproductive rates, notwithstanding potential disruptions to landowners who live in proximity to CBM activities.

As noted above, it may take several weeks or months for a CBM well to produce significant quantities of methane gas. Due to this initial phase, exploration companies may release methane gas through venting or flaring. Venting of methane gas or through incomplete combustion from flaring causes air pollution (greenhouse gas) which contributes to Climate Change.

6.0 Stakeholder Viewpoints

Given identified negative externalities experienced in the U.S., combined with a predicted 50,000 CBM wells to be drilled in Alberta in the next decade, many environmental stakeholders are calling for a moratorium on activity until the government has completed a

⁴¹ Pembina Institute “Cumulative Effects of Oil and Gas Development” Fact Sheet October 2006
Picture Credit: Wayne Sawchuk – www.pembina.org

⁴² Pembina Institute “Cumulative Effects of Oil and Gas Development” Fact Sheet October 2006
www.pembina.org

baseline water quantity/quality study as well as develop a rigorous risk-adverse regulatory regime. David Eggen (Alberta's NDP Environmental Critic) states:⁴³

“We need a vision for an environment worthy of our children and grandchildren. This means we must develop only what we can properly manage. Alberta Environment must be given the resources and regulator muscle to study the cumulative effects of coalbed methane activity, over a wide area and over a long period of time. A moratorium on new coalbed activity should be imposed until a proper management framework is in place.”

Mary Griffins and others at the Pembina Institute (an environmental think-tank) suggest that the explosion in CBM drilling activity should not be allowed to proceed until EUB and AENV have fully consulted with the public and new guidelines and regulations are in place that are specifically designed for CBM development.⁴⁴ Coalbed development has the potential to irreversibly impact Alberta's water, landscape and ecology:

*“The onus of proof should be on the industry to determine the impacts of CBM development and to mitigate those impacts where possible. It should not be necessary for a landowner to prove that there will be negative impacts.”*⁴⁵

As a key spokesman for the upstream petroleum producers, the Canadian Association of Petroleum Producers (CAAP) states that their industry is applying proven technologies and practices that have been developed over decades through their conventional oil and gas activities.⁴⁶ Even the EUB reinforces CAAP's claim stating: *“CBM is nothing more than natural gas contained in coal; it is subject to the same production, and operational requirements and regulations as other natural gas.”*⁴⁷

⁴³ Eggen, David “Moratorium on Coalbed Methane Drilling Needed to Cool Frenzy” Edmonton Journal, December 22, 2006 Section A18

⁴⁴ Griffiths and Severson-Baker Pembina Institute – “Unconventional Gas” June 2003 page 47 www.pembina.org

⁴⁵ Ibid

⁴⁶ CAPP “Best Management Practices – Natural Gas in Coal (NGC/Coalbed Methane (CBM))” http://www.capp.ca/default.asp?V_DOC_ID=6

⁴⁷ EUB “Across the Board – Busting the Myths Behind CBM” Fact Sheet March 2006 pg 1 <http://www.eub.ca>

With all the focus on the migration and/or disposal of saline water, CAAP indicates they are committed to protecting non-saline ground and surface waters and continue to adhere to strict regulations outlined and enforced by EUB/AENV. Whereas the disposal of saline water is a significant obstacle to achieving economic results from the Mannville coals, one approach being considered is to establish water pipelines along existing gas pipeline corridors to transport saline water to a central location where it will be eventually re-injected into deep disposal wells.⁴⁸ In addition, EUB Directive 027 states companies can only use non-toxic fracture substances when CBM activities are above shallow groundwater aquifers.⁴⁹

With EUB amending its CBM well density up to eight wells per section, CAAP has countered that new horizontal drilling technologies can facilitate multiple subsurface well spacing from a single surface location that offers the opportunity to minimize surface disturbance.⁵⁰

As for water and methane gas contamination (migration), CAAP argues its well drilling and completion (cemented casing) techniques are proven technology. EUB Bulletin 2006-15 reinforces that drilling companies are required to complete groundwater baseline testing and on-going monitoring through a series of observation wells located in proximity to CBM activities. This on-going testing program includes both quantitative and qualitative analysis.⁵¹

⁴⁸ CAPP “Best Management Practices – Natural Gas in Coal (NGC/Coalbed Methane (CBM) –May 2006 pg 11 http://www.capp.ca/default.asp?V_DOC_ID=6

⁴⁹ EUB “Across the Board – Busting the Myths Behind CBM” Fact Sheet March 2006 pg 4 <http://www.eub.ca>

⁵⁰ CAPP “Best Management Practices – Natural Gas in Coal (NGC/Coalbed Methane (CBM) – May 2006 pg 21 http://www.capp.ca/default.asp?V_DOC_ID=6

⁵¹ CAPP “Best Management Practices – Natural Gas in Coal (NGC/Coalbed Methane (CBM) – May 2006 pg 29 http://www.capp.ca/default.asp?V_DOC_ID=6

In terms of public consultation, CAAP suggests its members go well beyond EUB's Guide 056 - Public Involvement Program Requirement – by encouraging upstream operators to share business planning and operational requirements with landowners, municipal governments and other stakeholders, to help ensure the community is aware of incremental CBM development.⁵²

In part, developed from a multi-stakeholder advisory committee, in May 2006, the Alberta government introduced a new CBM regulatory regime. While coalbed methane drilling was essentially given the “green-light” for development, the government indicated that water protection and improving communications with affected stakeholders was a priority; including provisions for recourse in the event water contamination occurs. Nevertheless, recent comments made by two key provincial cabinet ministries: (Environment): “*remains unconvinced that coalbed exploration is the cause of water problems in some parts of Alberta*” and (Energy): “*dismissed concerns that Alberta could suffer from some of the same salt-water contamination that have plagued Wyoming – citing stricter regulations*” – suggest the government has a bias for CBM development.⁵³ One member of the advisory committee contradicted the government's position by signaling that the new regulations lack specifics on how the rules will be enforced: “*the problem rarely relates to an absence of law, but usually stems from lack of enforcement.*”⁵⁴

With recent polls indicating that the environment is the single most important issue for Canadians, and critics claiming the provincial government is rubber-stamping oil and gas

⁵² CAPP “Best Management Practices – Natural Gas in Coal (NGC/Coalbed Methane (CBM) – May 2006 pg 37 http://www.capp.ca/default.asp?V_DOC_ID=6

⁵³ Baxter, James “Coalbed-Methane Drilling get OK” Edmonton Journal May 12, 2006 Section B5

⁵⁴ Ibid

development approvals, the Alberta government may have to stop thinking in four-year election cycles (positive theory) and start making long-range environment policies that are synonymous with environmental sustainability (normative approach of public policy).⁵⁵

7.0 Recommendations and Conclusions

While there is no doubt that the Alberta government is responsible for protecting provincial water resources and fragile landscapes, industry and other stakeholders must also share in ensuring that CBM activities are balanced against an environmentally sustainable economy. To enjoin community trust, all CBM activities should be of public record, and large scale CBM development subject to an environmental assessment process.

Whereas recent regulatory changes toughened monitoring and enforcement, the basis of these amendments are skewed toward reactionary measures after environmental degradation has occurred – some of which – potentially irreversible. Based on the problems experienced in the U.S., clearly both government and industry need establish a set of pro-active rules and best-management practices that not only maximize CBM development, but also safeguard land, air and water resources.

Although the Canadian Association of Oilwell Drilling Contractors (CAOD) is projecting a 15% decline in CBM drilling activity in F2006-07⁵⁶ (dominated by weather related weaker commodity prices), political un-rest in many parts of the world suggests North American will continue to look to costlier unconventional natural gas plays such as coalbed methane, tight

⁵⁵ Jaremko, Gordon “Alberta on the Hot Seat” Edmonton Journal – April 7, 2007 Section A1

⁵⁶ Herring, Don et. al., Canadian Association of Oilwell Drilling Contractors (CAODC) – “CAODC Releases Forecast of Drilling Activity 2006/07” <http://www.caodc.ca/index.htm>

sands, or shale to make up for declines in conventional gas production. Based on public unrest toward the potential of water contamination, CBM drilling in the next few years will likely remain focused in the dry Horseshoe Canyon coal formations rather than the saline laden Mannville coals.

Though Canada's MacKenzie Delta, United States' Purdue Bay, and LNG imports remain "*x-factors*", that could significantly disaffect interest in unconventional natural gas, geopolitical risk, regulatory challenges, and native land claims all suggest North American is at least a decade away from re-energizing its conventional natural gas resources.