Coal Bed Methane
in
Alberta
Buec 560
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1. Gas use and the industry in Alberta

Alberta’s gas industry is a highly profitable and active sector of the economy. It provides large revenues both for the provincial government and for the producing companies. As with many natural resources produced in Alberta, not all of the production is destined for use within the province. A significant amount is exported to other areas of Canada and the United States. The number exported to the United States in 2003 was 103,292,063.1 meters cubed at fifteen degrees Celsius\(^1\).

Within the Alberta market, natural gas has many uses. It is used by many homes and businesses for heating, and as a fuel source for power generation. It also has industrial uses, such as in heavy oil production to provide a higher quality product to ship to market. There are also chemical industries which are based (in large degree) on chemicals which are stripped from oil and natural gas prior to them being pipelined out of province. There are new pipelines (eg the Alliance pipeline) which do not strip these chemicals out, and this is a cause for concern in some in Alberta’s chemical industries.

Obviously, natural gas is not an unlimited resource, and it cannot be produced indefinitely (i.e. it is a non-renewable resource). Given the importance of natural gas revenues to Alberta as a province, and the profitable nature of the commodity to companies, there is great interest in trying to increase our reserves through the use of alternative technologies and sources. In the provincial revenue streams, natural gas is perhaps the single most lucrative area. In recent years it has contributed large volumes of revenue in recent years. For example, in 2001 an estimated $7,199,916,000 was received from gas royalties\(^2\). The loss of this revenue stream would have serious consequences for the Alberta government and economy. There are many


minor natural resource companies who are focused on natural gas in Alberta. The depletion of
the resource would impact the government revenues both through the royalties brought in and the
loss of employment and associated taxes of companies who might leave the industry. So there is
a great deal of interest on both sides to try and to expand the resource life and its potential within
the province. The label which has been applied to projects which are trying to increase reserves
through exploitation of different sources of natural gas is categorized as unconventional gas.
There are a number of technologies which are included under this label. But the process which
currently seems to be generating the most amount of press is Coal Bed Methane (CBM). CBM is
seen as a potentially excellent way to substantially increase natural gas reserves in the province.

2. How could CBM impact the Alberta Market?

CBM will have the effect of adding between 100 to 400 TCF of natural gas reserves to the
Alberta economy. These increased reserves mean that there will be revenue which can be
generated from natural gas for some time (and energy and gas for us to use as well). The impact
on revenues is obviously considerable, although it is not absolutely certain. This uncertainty is
due in part to two major factors. The first factor is obviously the uncertainty in recoverable
reserves (which will be discussed in the section dealing with geological circumstances). The
second factor is the royalty regime under which CBM will be judged. Currently, CBM falls
under the same royalty scheme as conventional natural gas. But there has been some discussion
of creating a separate tier of royalties for CBM gas due to differences in the production methods
from conventional natural gas. Some consideration is being given to shifting the royalty scheme
for CBM to something similar to schemes for heavy oil projects like SAGD. This would

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recognize the higher level of initial investment, as well as the slower payoff rate. There is some discussion of leaving the royalty regime the same, but offering more incentives for various phases or possibilities in development (like CO2 enhanced recovery credits)\(^5\).

Overall, the vast potential of Alberta’s CBM, Alberta sits atop large quantities of coal in various beds throughout the province, which makes it an attractive target for development from an industrial and government point of view. Both parties can see how CBM can be beneficial to them. One of the potential problem areas which must be considered is the cost, both initial and ongoing, involved in the development of the resource. CBM is more difficult to produce than conventional gas, and is also somewhat more expensive. This difference in ease of production is potentially an important factor, since it will affect a company’s costs. This means that a different (higher) minimum price of natural gas is required for companies to consider investing in CBM projects. Admittedly, natural gas prices have generally been on the rise in recent years (and will likely remain on the rise); the possibility of a price drop must be factored in to planning.

3. What is Coal Bed Methane?

So, what is CBM and what are the conditions in which it occurs?\(^6\). The name of the process, does, in fact, give a concise summary of what the situation is. Methane gas (natural gas) is trapped/bonded to coal in coal seams. This trapping is the reason why the gas is not migrating elsewhere in the coal seam and surrounding rock units. Conventional gas production relies on pools of natural gas which have migrated along geological strata until reaching a point (trap) where the conditions are right for a buildup of gas because there is no escape, due primarily to the structure of the surrounding units. With CBM there are a number of factors which are

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\(^5\) Ibid
important for the production potential in every case; one of the most important is the thickness of the coal seam(s). This is an area where Alberta’s CBM potential is different from the majority of CBM developments elsewhere, in that the majority of our coal seams are much thinner than those used in other areas\(^7\). So what is the procedure for recovering this trapped gas? In a conventional well, tapping into the trap is often enough, with the pressure of the reservoir expelling the gas. Conventional wells begin to lose pressure as their contents are depleted, then other fluids can be injected to increase pressure and bring recovery levels up again. Recovery of methane from coal seams is not as simple. The gas in coal seams must be liberated from its bond with the coal before it is able to be recovered. This generally requires at least some initial injection to begin the process, and then a consistent high level of pressure must be maintained throughout the recovery area in order to promote the liberation of the gas. Multiple wells are used to maintain the pressure in the formation. And smaller spacing units than are generally allowed for gas wells are used/required for the injection and building of pressure. In the process, there is a lag time (sometimes up to two years)\(^8\) between when the process begins, and when actual production, is available. A fair amount of time is needed to bring the conditions up to the point of truly efficient production. The method of recovery and production does also have a number of issues which will be dealt with more in the section dealing with environmental consideration and regulation. These issues include the compressors/compression stations (which tie in to noise regulations), the land spacing/use, and then there are also concerns about the byproducts of the process, such as water and methane seepage\(^9\).

A separate factor, which relates both to the geology and the technology, is the relationship of recoverable reserves to the total volume of gas which is present. Only a portion

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of the total contents of any pool or seam are able to be recovered. The limits on this level of recovery relate both to the size and pressure of the pool, as well as other geological conditions. And the level to which we can exploit this is also dependent upon the technology which is used for the process. With increases in technology, there is potential in many areas (not just CBM) to recover more than was possible with earlier methods and designs.

4. Environmental Considerations and Regulations

It is always important to note who controls and enforces regulation. Regulation in Alberta comes from two primary sources: Alberta Energy (AE), and the Alberta Energy and Utilities Board (EUB). AE is the body which is responsible more for examining royalty structure and the economics of activities, while the EUB is tasked with monitoring companies’ compliance with current provincial regulation. There are also federal bodies, like Natural Resources Canada, but the majority of regulation in the province is done by the Alberta bodies. This situation of control and enforcement will likely be continuing in the foreseeable future, although there may be changes to regulations and policies. Specifically, changes could be made to those regulations and policies governing non-conventional production sources, like SAGD and CBM.

The difference in land spacing has been mentioned earlier, in the section describing the production methods of CBM. This is an issue due to current regulations governing natural gas well spacing units. As the regulations currently stand, there is only one natural gas well allowed per section per pool (compared with four oil wells per section, i.e. one per quarter section). CBM obviously requires a greater density of wells than the standard in order to achieve pressures sufficient for production. There is a form which must be submitted in accordance with guide 65
to the EUB for any wells beyond the current spacing limits. These forms are supposed to be considered on an individual basis, and decisions then rendered upon them. Obviously this issue also causes some concerns for surface title holders who still wish to utilize areas where the wells will be located for their traditional employment, as well as concerns about the total amount of land which will be used for CBM (see photo 1).

Another issue which must be addressed is water. There are a number of concerns about water. One of the first concerns is the issue of where the water that is being used in the injection process will be coming from. Some groups, both private and public, have expressed concern about potable water being injected into these wells. The water being taken out of the water supply has been lost to both natural cycles and other projects and purposes which individuals and communities might have for it.

Later in the production phase, the concerns shift to the water being produced from the coal seams, as the CBM process is largely a dewatering process. Water from these coal seams will often be unfit for consumption or agricultural purposes due to the salinity and/or other contaminants in the water. There have been incidences in CBM development elsewhere where damage has been done to surrounding areas through contaminated runoff from CBM projects. And, although we are told that most Alberta CBM are in fact quite dry, this is not entirely accurate. While some shallower coal seems are “dry”, there have been deeper CBM projects drilled which produce the same saline brines as are similarly encountered in other areas, such as the U.S., which have developed CBM.

So, proper disposal becomes a key issue in the development of CBM. Obviously, one method of dealing with produced water is re-injection into a coal seam or other deep saline

aquifer. But care must be taken when disposing of this water, because improper disposal could contaminate an area or an aquifer containing potable water. Another option which has been touted is atmospheric disposal. This method sees water vaporized and sent into the atmosphere. While it is most likely one solution, it can also run into difficulties (see photo 2). Another issue dealing with water is water quality. Concerns have been voiced about the potential for contamination of aquifers overlying the coal seams which are to be used in CBM. The concerns relate to problems occurring with seepage of natural gas into aquifers containing potable water. Due to the increased pressures utilized in the CBM process, there is a chance of fracturing surrounding rocks, leading to seepage out of the coal seam into surrounding strata. Inclusion of methane in water obviously constitutes a severe risk to health and wellness, especially if the water is destined for consumption by humans or livestock. This issue is important to people who rely on these aquifers for their drinking water, or who use the water for agricultural purposes. Also present in this case, are the inherent risks of uncontained, uncontrolled natural gas. This issue has been seen in the United States with CBM projects developed there\textsuperscript{13}.

Flaring and venting are obviously issues concerned not only with CBM, but with the whole oil and gas industry. Flaring is a situation where excess natural gas is burned. While venting is classified as gas release into the atmosphere, where flaring or conserving are not practical\textsuperscript{14}.

Most CBM wells producing low volumes of water should be able to have limited durations of initial flaring. Wells with higher volumes of water production will likely lead to longer durations of initial flaring. In some cases, testing into pipelines may be possible. Venting is obviously a strictly controlled process in Alberta, and venting from CBM is expected to be

\textsuperscript{13} Ibid.
minimal. Flaring from CBM fields is expected to decrease as more wells are added to CBM fields, or areas are declared uneconomic. The methods used to assess flaring are covered in the EUB’s Guide 60, which has most recently been updated for stakeholder’s in 2003.

Another concern which has been voiced regarding CBM is the compressor stations used in the process and the noise associated with them. Noise levels are always a concern in the development of industrial projects. Most gas wells, at some point in time, do require compressor stations to ensure there is enough pressure for a steady flow of gas to reach the pipeline; this is especially true later in the production cycle. CBM requires almost constant compression due to its method of production. For guidelines on the noise associated with compression EUB guide 38 contains the relevant details.

5. Experiences

Alberta also has the advantage of not being the first locale where CBM will be produced or developed. This gives us the opportunity to learn from problems and issues which have arisen in other locations which have developed CBM. The experiences will vary with the individuals/groups who are asked. But each viewpoint has its own merits that should be considered. CBM has been used in both the United States, as well as having been used in India. Unconventional gas is beginning to supply a greater portion of the U.S.’s total production, as time goes on and as conventional sources are being depleted. Current statistics estimate that roughly 1.2 trillion cubic feet were produced in 2001 in the United States, accounting for over 6% of the total natural gas produced in that country. Obviously, the process has proven profitable for industry, or they would have discontinued the practice long ago. In fact, CBM

production has exceeded all expectations in the different basins in which it is produced in the U.S. But the developmental stages of the technology did have problems. A great deal of the growth in the CBM arena was prompted by events which affected the American industry over a twenty year period, such as the need to develop alternative sources during the Arab oil embargo and the introduction of tax credit programs initiated recently. As with the introduction/development of any new system or technology, CBM was not without its hiccups. There were obviously some areas where the new process had unfortunate side effects. And these side effects were often of a negative nature to individuals affected by them. A number of these concerns and problems are documented by groups of people who are now interested in presenting some of the dangers of CBM use to others. Websites of some of these groups are www.powderriverbasin.org & www.savethegrandmesa.com. These people offer a different view from both industry and government, and care should be taken to try to ensure that difficulties like these people encountered are not seen in Alberta.

To date, Alberta’s experience/exposure to CBM has been fairly small. Most of it has been with pilot and test projects to date, and the total number of wells has been relatively small. But most of the companies involved have said that the CBM will play a larger role in their future development. Many of the main concerns (from the government’s perspective) with regards to the development of CBM relate to issues regarding water, especially in the dewatering of coal seams leading to the production of highly saline water. This is the issue which will likely prove

17 Ibid.
18 Ibid.
19 Ibid
most problematic to the development of CBM, although other issues, such as the land spacing, will be important as well\(^\text{20}\).

In Alberta, most of the activity still seems to be in the preliminary stages, before all out development of CBM begins. But, if the market stays fairly constant, we will likely see a great deal of CBM development in the near future.

This background information should help Alberta in forming its goals and ideas for how to proceed with CBM. But we also have to look at actions which have already been taken or are ongoing in Alberta. These developments are what will ultimately have great influence on CBM in Alberta.

### 6. Assessment and Conclusions

So, looking back, we can see a number of the key challenges related to the successful development CBM in Alberta. These challenges come in a number of different forms. These challenges can be in the geology and the needs of production. The needs of production could be one of the most challenging issues for the development of CBM. Specialized technologies may have to be developed with the specific conditions present in Alberta, or the technology may have to be adapted in order to allow for conformance with standards set in place by and for Alberta and its citizens. Challenges can also be in the need to abide by current (and future) regulations which are required of all oil and gas projects. Changing technologies and variances in the standards held by the majority of people (which are a major driver for acceptable policy) could lead to changes in the assessment as to the viability of oil and gas projects in Alberta. The challenges could also deal with modifying current methods and practices to recognize CBM as a

\(^{20}\) Ibid.
new process which will have great impact on Alberta if it is fully adopted. This is an important step, as changes in the manner in which we recognize investment and royalties from CBM could have a major impact on how and when the industry will decide to develop CBM in Alberta.

Based on possible responses to these challenges, we can define, hopefully, the best way to move forward with CBM development in Alberta. We must try to find a way to move forward which addresses the concerns of all the involved parties. There are great benefits which can be reaped from the development of CBM in Alberta. The obvious benefit is the extended period of energy and gas which will be able to be brought to market for the future. The royalties generated by the gas production from CBM would also be of great importance to the province. Companies within the oil and gas industry would also welcome the income which could be generated through CBM in Alberta. And there would also be the benefits to the Alberta economy which would come from the employment of people in the oil and gas industry for some time to come. These people would not only be earning a wage (thus paying taxes to the government), but they would be spending the majority of that money in Alberta, causing a general increase in the economy due to their purchases being present.

So the movement should hopefully proceed into the future, bearing in mind both the potential risks and benefits to Alberta and other participants in the development of CBM.
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