



CASE STUDY: AUSTRALIAN COAL BED METHANE VS. UNITED STATES SHALE GAS – A COMPARISON OF MANAGEMENT

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This case study is based on the research of the Shale Innovation Project at Ohio University. The Shale Innovation Project is an interdisciplinary collaboration between the Russ College of Engineering and Technology, the Voinovich School of Leadership and Public Affairs and the College of Arts and Sciences examining the impact of shale development on businesses and communities in Ohio's shale region. This project is generously supported by a three-year Innovation Strategy Award from the Ohio University Research Division.

Abstract

Both the United States and Australia have experienced increases in unconventional energy production in recent years. For the U.S., technological advancements and favorable economic conditions have led to increases in natural gas production from shale gas reserves, and in Australia production of coal-bed methane (CBM) has increased, due in part to a reduction in conventional gas reserves. From decades of economic development research, it is known that the volatility of natural resource extraction industries presents challenges for regions hosting oil and gas industry activity. Recent scholarship suggests that localities which establish strong institutions for managing these impacts may be likely to fare better in the long-run. Thus, understanding how Australia has managed CBM production with respect to local impacts may provide key lessons for policymakers in U.S. regions hosting shale gas production. This case study explores the state of CBM production in Australia, with an eye toward policies and programs established to proactively and effectively manage it.

What is Coal Bed Methane?

Coal-bed methane (CBM), also known as coal seam gas (CSG), is a hydrocarbon-rich gas found naturally in coal seams. CBM has been produced in the United States since the 1980s, and in Australia since the 1970s. In the United States, CBM is primarily produced in the western states of Colorado, New Mexico, and Wyoming, which produced a combined 943 billion cubic feet (bcf) in 2015. Production also takes place in Alabama, Arkansas, Kansas, Montana, Oklahoma, Pennsylvania, Texas, Utah, Virginia, and West Virginia (U.S. Energy Information Administration, 2016). In comparison, CBM production in Australia primarily comes from two sources, both in the State of Queensland: the Surat Basin and the Bowen Basin¹ (Geoscience Australia). From these basins, Australia produced 270 bcf of CBM in 2014 (International Energy Agency).

Similarities to U.S. Shale Gas

Similar to U.S. shale gas production, Australian CBM production has been increasing in recent years, starting to climb in 2005 (International Energy Agency). As with the rise of unconventional energy production in the US, the State of Queensland expects continual increases in CBM production, and commensurate increases in CBM exports in the form of liquid natural gas (LNG), primarily to Asian markets². According to Towler et al. (2016, p. 249), “Queensland expects to produce more than 1800 BCF/annum, of which about 1400 BCF/annum will be exported as LNG.”

Likewise, the State of Ohio is contributing to a similar national LNG export strategy, along with Pennsylvania and West Virginia, which together lie within the Marcellus and Utica shale play boundaries. As the United States prepares to become a top natural gas exporter, pipeline infrastructure investment in these states has increased, to bring natural gas produced in Ohio, Pennsylvania, and West Virginia to both domestic markets and export terminals. According to the U.S. Energy Information Administration (EIA), “Since 2015, [Ohio] has produced more natural gas than it consumes, and the natural gas leaving Ohio is sent on to Kentucky, Michigan, and Indiana.”

¹ Proven CBM reserves also exist in the state of New South Wales, particularly the Clarence-Moreton, Gloucester, Gunnedah, and Sydney basins (Geoscience Australia).

² Asian markets include Japan, China, South Korea, Taiwan, India, Vietnam, Malaysia, Indonesia, Thailand, Philippines, Singapore (The Australian Petroleum Production & Exploration Association, 2016).

(U.S. EIA, 2017, par. 8). While infrastructure projects that would retain natural gas within this three-state region have been proposed - like ethane crackers which convert natural gas into the building blocks for manufactured petrochemical products, and natural gas storage hubs which would retain the gas for value added use in the region – exports out of the region currently remain the dominant fate for natural gas produced there (U.S. Department of Energy, 2017).

Similarities exist between the two regions in environmental and social matters, as well. Both U.S. shale gas and Australian CBM production have raised concerns regarding water contamination, methane leakage, and air pollution. Both landscapes also experience concerns regarding landowner disputes, wealth retention in areas of production, impacts to public infrastructure, and social impacts typical of an energy boom (e.g. rising housing and rental costs³). Similar to in areas hosting U.S. shale gas production, increased CBM industry activity provides windfall revenues from industry-related taxes and royalties, the distribution of those revenues is a concern for local citizens of CBM-producing areas (Towler et al., 2016).

Differences to U.S. Shale Gas

Both shale gas and CBM are produced by setting-up drilling rigs and capturing hydrocarbons to pipe to the surface, yet there are some subtle differences between the two processes. First, while shale gas is found in shale formations that are relatively deep within the earth, CBM is found in coal seams that are shallower at around 300 – 1500 meters deep. CBM drilling and drilling for shale gas are very similar processes – both case wells with steel and cement, both use some form of stimulation to open pores in the coal or shale formation, and both compress the gas captured and pipe it downstream. However, CBM production typically uses only a single vertical well unless the geology allows for horizontal drilling, and gas and water rise to the surface through separate pipes. Water is generally piped to a treatment plant, where its end use is later determined, and gas is piped to either storage or processing plants (Commonwealth Scientific and Industrial Research Organization, 2014). After capturing it, CBM is primarily used as a fuel to generate electricity, but it has other uses as well, including: cooking; heating buildings;

³ See Stewart et al., 2015.

heating water; used (in a compressed form) as a transportation fuel; and as feedstock to produce plastics, polymers, paints, and dyes (Australian Petroleum Production and Exploration Association).

Regarding produced water, the State of Queensland has a CBM water management policy that seeks “to encourage the beneficial use of [CBM] water in a way that protects the environment and maximizes its productive use as a valuable resource” (Department of Environment and Heritage Protection, 2016, par. 7). According to this policy, water from CBM wells is to be first considered for reuse in some form that is productive (e.g., irrigation of crops, dust suppression, coal washing, etc.). If a productive use is not viable, then the water is to be disposed of in a way that minimizes impacts on the environment. In the U.S., depending on state regulations, wastewater from shale drilling operations is either treated and reused, treated and discharged into surface waters, or re-injected deep into the earth (Drouin, 2014). A key difference between U.S. shale and CBM in Australia is the prevalence of hydraulic fracturing to capture gas from wells. According to Tsuey Cham at Commonwealth Scientific and Industrial Research Organization, “In Australia, hydraulic fracturing – a technique that increases the rate of gas flow for extraction – is used in [CBM] production 20-40% of the time, whereas in shale gas production it’s used every time” (Cham, 2014, par. 5).

While the outputs of CBM production – water and gas – are primary and important considerations on the impact of the industry to a host community’s economy, the impact of the processes required to produce these outputs themselves is also an important consideration. The establishment of drilling rigs, and other natural gas infrastructure (e.g. pipelines, storage units, and processing facilities), has been found in numerous studies⁴ to have impacts on economic and social facets of the region hosting industry activity. While the aggregate results of these studies are mixed, some do find negative impacts associated with increases in oil and gas industry activity, such as increased strain on public infrastructure, slower than average long-run economic growth, and strained social capital. Contrary to these studies, recent Australian CBM production differs in that it has had a net positive impact

⁴ See Christopherson & Rightor, 2011; Fernando & Cooley, 2016; Goldenberg et al., 2010; Randall, 2011; Small et al., 2014; and Stewart et al., 2015.

on employment, income, and in measures of community well-being⁵. A study by Fleming and Measham found that from 2001-2011 regions with CBM production had higher income growth compared to regions without CBM production, and that positive job multipliers existed for construction and professional services in regions with CBM production, though jobs in agriculture decreased (Fleming & Measham, 2014b). Similarly, while other studies have found evidence of negative social impacts from extractive industry development, Fleming and Measham found, in a separate study, evidence of CBM development “mitigating and reversing rural community decline” (Fleming & Measham, 2014a, p. 376). Understanding how Australia has successfully managed CBM production with respect to the impacts on host communities may be a key lesson for policymakers in regions hosting shale gas production.

Australian Management Strategies

Environmental Impacts

As noted, CBM production in Australia is subject to similar concern for environmental impacts as shale gas production in the U.S. To properly address these concerns and ensure best practices for protecting environmental amenities, the Queensland government has taken a few notable measures. First, the government established the Office of Groundwater Impact Assessment (OGIA) under the Water Act 2000, which is responsible for monitoring impacts to groundwater from CBM and other resource extraction operations. Queensland has also established the CSG Compliance Unit under the Department of Natural Resources and Mines as an official body to monitor CBM companies’ compliance to environmental rules. Finally, similar to the U.S., resource extraction operators must be granted approval before they can begin production. One form that must be submitted in Queensland is an Environmental Impact Statement (EIS), in which the operator lists potential environmental impacts from the CBM activity (Towler et al., 2016).

⁵ Measures of community well-being include retention of youth population, maintenance of human capital, and reductions in poverty (Fleming & Measham, 2014a).

Social Impacts

The introduction of CBM production can create concern among residents of CBM-rich regions. A host of research on “boomtowns” and the impacts of energy development on a community illustrates the cause for this concern: energy booms can increase transient populations, contribute to increases in crime, and put stress on existing social dynamics⁶. Therefore, Queensland has taken several measures to facilitate communication between CBM companies and communities. For instance, in addition to monitoring environmental compliance, the CSG Compliance Unit also addresses community concerns and complaints by placing government staffers in host communities. In the Surat Basin, the Surat Basin Engagement Committee was formed for a similar reason, to create a link for communication between communities and CBM companies. Further, the government created GasFields Commission Queensland through the GasFields Commission Act 2013 to obtain and make information about CBM industry activity publicly available, to improve transparency of operations. The GasFields Commission Queensland’s mission is to help ensure that the industry, landowners, and communities coexist. Finally, the EIS previously noted includes a Social Impact Assessment (SIA), which requires operators to list all potential social impacts of CBM production to a community (Towler et al., 2016).

Landowner Rights

Regarding landowner rights and access by CBM companies, Queensland has established a Land Access Code. The Land Access Code puts forth mandatory requirements with which CBM companies must comply when operating on private land. Additionally, the Land Access Code provides best practices for operators and landowners in communication and negotiation. This piece of legislation was developed with the intent to protect private landowners while also promoting good relations between them and CBM companies (Towler et al., 2016). Comparatively, in the U.S., private land access by oil and gas firms is generally guided by state laws and is typically governed by individual contracts agreed upon by both the firm and the original landowner.

⁶ See Christopherson & Rightor, 2011; Fernando & Cooley, 2016; Goldenberg et al., 2010; Randall, 2011; Small et al., 2014; and Stewart et al., 2015.

Taxes & Royalties

While no federal severance tax exists in the U.S., one does exist in Australia. In 1987, the Commonwealth of Australia established the Petroleum Resources Rent Tax, which taxes the production of resources, including CBM, on profits earned above an assumed rate of return. In addition, CBM operators may be subject to state land taxes and transfer duties, as well as local land-use taxes. As for royalties, the State of Queensland imposes a fee at 10% of the wellhead value of CBM produced (Towler et al., 2016). Comparatively, in the U.S., taxes and royalties are determined by each state separately, which may introduce state-based competition. For example, Ohio levies a \$0.025 tax per MCF of natural gas produced, and a \$0.10 tax per barrel of oil produced (Ohio Department of Taxation, 2015). One of Ohio's neighboring states, Pennsylvania, charges no severance taxes on oil and gas produced; it only charges an impact fee for new wells drilled within the state by oil and gas firms (Pennsylvania Public Utilities Commission). Both states lie within the Marcellus and Utica shale plays, and these differences in taxation may drive interstate competition, but further research is required to determine the existence and extent of this competition.

Wealth Retention

Noting the volatility of commodity-based resource extraction industries, the State of Queensland has taken measures to invest the royalty revenues mentioned above into long-term infrastructure projects. In 2012, the state established the Royalties for the Regions program, which ran until 2014. The purpose of this program was to capture tax and royalty revenue from resource industry activity and invest it into infrastructure projects within the impacted communities. From 2015 to 2016, the program continued under a different name: Royalties for Resource Producing Communities. Since then, the project has continued under the title Building our Regions, a 375 million (in Australian Dollars) (\$293,692,500 USD) investment project that has allocated 225 million Australian dollars (\$176,229,000 USD) to 174 projects within the state. These projects each fall within one of the four funds that are part of the program: the Regional Capital Fund, the Royalties for Resource Producing Communities Fund, the Remote and Indigenous Communities Fund, and the Transport Infrastructure Development Scheme. Taken together, these four funds aim to “provide funding for critical infrastructure in regional areas of the state, while also generating jobs, fostering economic development and improving the livability of regional communities” (Department of State Development, 2017, par. 1). In comparison, Ohio does not have a similar investment

program⁷. Rather, investment into communities where industry operations take place have come from public-private partnerships between oil and gas companies and the locality in which they operate. Perhaps the most common of these partnerships is a contract called a Road Use Maintenance Agreement (RUMA), in which the oil and gas company agrees to bear some or all the costs of road repair and maintenance from damage caused by oil and gas industry vehicles. In addition to such partnerships, Ohio collects a property tax and severance taxes on both oil and gas production, the revenues of which are appropriated to the state-run Geological Mapping Fund and Gas Well Fund (Brown, 2013). Two recent reports by the Ohio Oil and Gas Association and Energy in Depth highlight the contribution that the oil and gas industry has made to county-level economies at the heart of industry activity. The reports estimate that the oil and gas industry contributed about \$43 million USD in property taxes to these counties from 2010 to 2015, and the industry contributed about \$300 million USD in the form of improvement and maintenance of roads and bridges within the same region from 2011 to 2017 (The Ohio Oil and Gas Association & Energy In Depth, 2017a, 2017b).

Conclusion

The Queensland government has, what appears to be, a heavier hand in managing the impacts to regions hosting unconventional energy production. Compared to the State of Ohio, some similarities exist in environmental regulation and taxation, yet Queensland differs in the extent to which it guides operator-landowner interactions, as well as in how it collects and invests tax and royalty revenue. Like Ohio and other U.S. states, Queensland has both benefited from and been challenged by unconventional energy development. While the type of fuel is different, similarities in the impact of development between the two regions exist. This case study has presented several measures that Queensland, and the Commonwealth of Australia, have taken to leverage the benefits of resource booms and mitigate the negative impacts of resource busts. While the political, economic, and social contexts in Australia are certainly different than that of the U.S., regions like the Appalachian Basin which are hosting shale gas production may benefit by knowing how Queensland has managed impacts similar to the ones they are experiencing. Finally, while this case study does not present enough evidence to determine the efficacy

⁷ Some states do have similar funds which invest oil and gas tax and royalty revenue for local development projects, including Alabama, Alaska, Louisiana, New Mexico, North Dakota, Texas, West Virginia, and Wyoming. See Saha & Muro, 2016.

of public policy approaches to governing natural gas production in either region, it is a question worth examining. Further comparative analysis into the impacts of these policy decisions, such as the association between infrastructure investment using resource tax and royalty revenues and change in economic conditions over time, may serve to inform such an argument.

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