Appendix 6. Engineering Energy: Unconventional Gas Production

Introduction

World demand for natural gas is expected to increase over the first half of the 21st century, primarily due to industry's demand for electricity. Australia is already a major producer of conventional gas and coal seam gas. As technology and geological knowledge develop, it could be in a position to produce shale gas. The success of an Australian shale gas industry will require consideration of scientific, social, community, technological, environmental and economic issues and impacts. It will require human and financial capital and careful management of impacts on ecosystems and natural resources. It will also need informed and supportive communities, and transparent and effective regulations and codes of practice.

Drawing on an interdisciplinary panel and the authors' expertise in engineering, geology, petroleum, hydrology, physics, social science, public policy and economics, the report by the Australian Council of Learned Academies (ACOLA), SAF06 *Engineering Energy: Unconventional Gas Production* (http://acola.org.au/wp/project-6/) provides an impartial, dispassionate and evidence-based review of shale gas. It fills knowledge gaps, identifies and considers community concerns, and addresses opportunities and challenges that might arise. It saw no insurmountable technical barriers to producing shale gas.

Shale gas availability, technology, and economic feasibility

Natural gas occurs in sedimentary basins. The geological setting and the manner in which the gas is trapped defines whether it is 'conventional' or 'unconventional'. Most gas produced in Australia (and globally) to date has been conventional gas, but coal seam gas (CSG) is produced in large quantities in Queensland. Unconventional gas includes shale gas, tight gas, CSG and methane hydrates.

Shale gas and shale oil occur typically at depths of 1000 to 2000 metres or deeper, in fine-grained, low-permeability sediments, such as shales and silty mudstones. In Australia there is significant potential for shale gas in parts of Western Australia, Queensland, South Australia and the Northern Territory. In remote regions, the shale gas industry may develop slowly due to limited access to water and the lack of road and gas pipeline infrastructure, but any infrastructure that is developed may assist other local industries. Because of its established infrastructure, shale gas in the Cooper Basin could be the first to be developed at a large scale. Some shale gas resources may occur in parts of south-east Queensland, western Victoria and south-western Western Australia.

Undiscovered shale gas resources in Australia may be large compared to conventional gas, but as yet there are no identified economic shale gas reserves in Australia. More information and exploration and favourable economics are required to turn the prospective resource estimates into proven reserves.

The shale gas 'revolution' in the United States has rejuvenated industry, as a result of new technology converting what was previously an uneconomic resource into a reserve of great commercial and national and international significance.

Technologies such as horizontal drilling and hydraulic fracturing (fracking) are applied now in Australia. However, production costs to produce shale gas are likely to be significantly higher than those in North America, and the lack of infrastructure will further add to costs. Shale gas will not be cheap in Australia, but it could to be plentiful and it has the potential to be an economically important energy source.

The extent to which Australia's shale gas potential is realised will be highly dependent on the price of shale gas compared to the cost of other energy sources. In Australia, shale gas will require a price of the order of $6–9 a gigajoule to make its production and transport profitable. By comparison, the Australian east coast wholesale gas price (at the time of publication of the report in 2013) was about $6 a gigajoule.

Environmental and community impact of shale gas

Increased use of shale (and other) gas in place of coal for Australian electricity generation could significantly decrease greenhouse gas emissions, provided emissions associated with shale gas production are minimised. Increased exploration and production of shale gas could adversely impact landscape, ecosystems (including vegetation, flora and fauna species and soils), surface water supplies and groundwater, and communities, and may result in habitat fragmentation and some environmental contamination. However, if best practice is followed, these problems can be avoided. Induced seismicity is unlikely to be a significant issue.

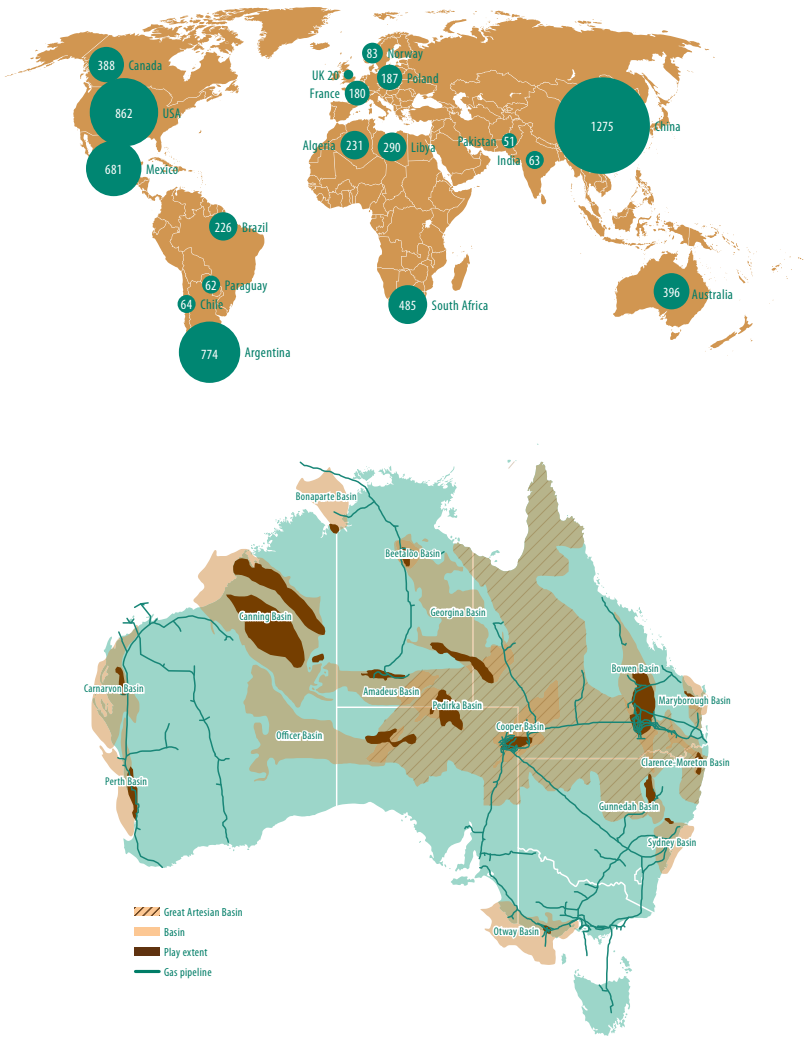
Water will need to be managed, to minimise water extracted from the surface and groundwater resources. Additionally, there will be a need to minimise water with contaminants being discharged into streams and groundwater aquifers.

While the economic and other opportunities generated by the development of shale gas reserves will be widely welcomed, there are likely to be concerns about potentially adverse impacts. Governments and industry must address these concerns while exploration is at an early stage, by engaging with affected and interested parties, building confidence in the science and technology, and demonstrating a preparedness to adopt and enforce strong regulatory and internal controls.

Regulations

Given that shale gas developments are likely to cross state boundaries, it is necessary for state and federal governments to seek to harmonise regulations. A shale gas industry in Australia is not starting out with a blank sheet of paper as far as regulations are concerned. Overall, existing regulations for conventional gas production work well; however, the level of community opposition to some CSG developments suggests that there are issues to be addressed in the current approvals process.

If the shale gas industry is to earn and retain the social licence to operate, it is a matter of some urgency to have a transparent, adaptive and effective regulatory system in place, backed by best practice monitoring, and credible and high-quality baseline surveys. Most if not all of the potential negative impacts could be minimised if these are in place. Robust and transparent regulation, underpinned by effective and credible monitoring, is key to public acceptability.



World (top) and Australian (bottom) shale gas resources. (Source: (top) IEA (2012) *World Energy Outlook 2012*, International Energy Agency, Paris; (bottom) Geoscience Australia (2012) *Groundwater: Sedimentary Basins*. Geoscience Australia, Canberra.)

Conclusion

There are no profound gaps in technological knowledge relating to shale gas exploration and production. However, research requirements to ensure confidence among the regulators, community and industry include:

1. baseline data against which to measure change;
2. knowledge to be able to predict change before it happens;
3. using data and knowledge together to effectively deal with a minor impact before it has significant consequence;
4. making data used and knowledge gained transparent and readily available; and
5. transparent, adaptive and effective regulatory systems, backed by careful monitoring, to achieve social licence to operate.

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