

Developing the shale gas potential

A significant level of research and development (R&D) is needed to develop the potential of the industry. This fact sheet outlines areas for R&D growth and some of the issues which need to be understood and addressed for the sustainable development of our shale gas resources.

Exploration: understanding and characterising the resource

One of the primary objectives of this emerging industry is to obtain a better understanding of shale gas plays. Although shale gas is an established resource in the United States, characteristics of shale gas in Australia have not been firmly established in order to determine its feasibility in Australia's geological and environmental settings. Comprehensive knowledge and characterisation of shale reservoirs is imperative for:

- ♦ evaluating the size and volume of the resource,
- ♦ better understanding gas migration and behaviour to identify sweetspots for production and improve production forecasting.

Production infrastructure and drilling

Research opportunities exist for reducing the size and amount of infrastructure in order to decrease the footprint of shale gas production. This includes limiting the number and spacing of production wells as well as the infrastructure footprint for gas processing.

Determining and optimising long-term well bore integrity and stability is crucial for reducing the potential for groundwater contamination from well leakage. The design of superior materials to line and case wells that can withstand temperatures and pressures and reliably act as barriers to protect aquifers will greatly contribute to ensuring well integrity.

Cost effective technologies for drilling and completing the complex gas shale wells is another area that benefits from continual research. Drilling equipment and techniques are constantly being redesigned and improved for better precision in drilling direction, accuracy and efficiencies. This is particularly important for drilling in 'soft sediments' such as shales.

Water usage

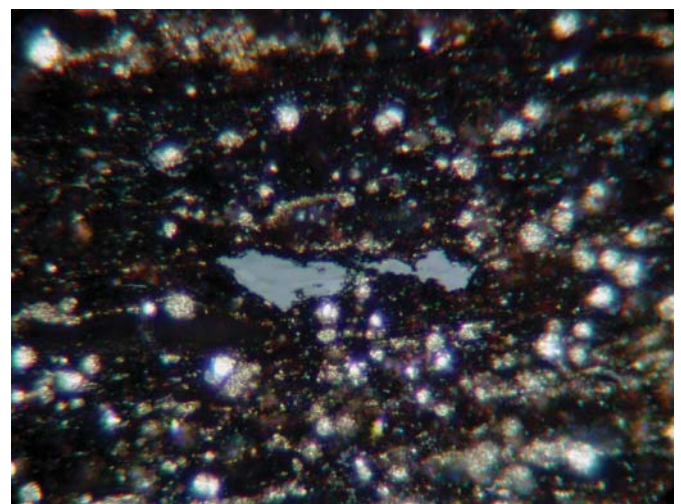
Minimising the amount of water required for reservoir stimulation and how to best source, recycle and treat the quantities of fracturing fluids that the process generates is one of the greatest challenges in shale gas production and will require ongoing research investment.

In addition, identifying and characterising aquifers and their connectivity and recharge in relation to shale gas production, is imperative to protect our valuable water commodities and reduce any potential impacts on them.

Production, processing and transport

There are a number of areas in shale gas production which require R&D support in order to build a sustainable shale gas industry and incorporate the energy resource in an already highly competitive market. These include:

- ♦ developing improved and new technologies to enhance production
- ♦ reducing the number of wells (and ultimately their required footprint) by optimising their efficiency
- ♦ improving the accuracy of models for predicting production
- ♦ developing suitable, site specific monitoring methods.
- ♦ evaluating storage and transportation options to ensure economical delivery of the gas
- ♦ improving gas processing technologies (e.g. gas-to-liquids and liquefied natural gas) to increase efficiency and to maximise utilisation potential of the gas.



Microscope photograph (field width ~0.3mm) showing grey disseminated organic matter in a gas shale from northern Perth Basin. Research on this shale was done to determine how much the shale has been heated, which relates to the amount of gas that can be produced from it.

Hydraulic fracturing

The technological aspects of hydraulic fracturing are well established as it has been used for many decades by the oil and gas industry. However, continual research is needed to improve the technology to stimulate the reservoir uniformly and reduce near well flow restrictions.

While fracturing is specifically designed and controlled to confine fractures to targeted areas, current research focuses on more accurately predicting and monitoring fracture growth and their interactions using stress measurement, well logging, and remote monitoring. As well as stimulating the reservoir more efficiently, controlling the development of fractures will reduce any potential for a fracture to grow into an aquifer or other unwanted areas.

Environmental and social issues

As with the establishment of any petroleum production activities, comprehensive environmental site assessments need to be performed on a case by case basis and developing and employing safe and proven operating and monitoring techniques is imperative. Land use between industry, wildlife habitat, recreation and agriculture amongst some, needs to be optimised to balance competing needs, particularly in relation to water use. Ongoing research is needed to assess the potential environmental and social impacts of shale gas production and develop improved site evaluation and selection tools, monitoring and land management methods, and comprehensive mitigation plans to address them.

Carbon footprint

The carbon footprint of shale gas compared to other unconventional and conventional gas employment is not yet well established. Evaluating the fugitive and lifecycle emissions associated with shale gas exploration, production and transport would require improved measurement methods for monitoring any gas leakage and using these data as critical inputs for lifecycle analyses.

CSIRO research

CSIRO has been conducting research in the energy sector and working with industry, government and the community for over 80 years. Much of CSIRO's expertise and capability in both geological and engineering aspects of natural gas, coal seam gas and shales as sealing rocks, can be applied to the complete value chain, including reservoir characterisation, drilling, well stimulation, production, gas processing, water management, greenhouse gas emissions and social aspects.

CSIRO's shale gas research program aims to characterise and improve the understanding of Australia's shale resources to evaluate their potential and assess their long term sustainability. The research program develops techniques to help reduce exploration risk, enhance recovery of the gas and assess the impact on the environment. CSIRO's breadth of expertise and capabilities in environmental and social

research, lends itself to understand, measure and monitor land use and impacts, and to develop management tools to balance economic development with ecological preservation in the Australian context.

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