

# Coal seam gas

CSIRO is working on a range of research projects to enhance the characterisation, production and stimulation of coal seam gas reservoirs and address the environmental impact of coal seam gas production.

As Australia makes the transition to a reduced carbon economy, unconventional gas resources will contribute a significant share of our energy supply.

Unconventional gas, such as coal seam gas (CSG), shale gas, tight gas and basin-centred gas, is generally produced from complex geological systems that require innovative technological solutions for extraction.

By providing optimal technologies for characterising and producing unconventional gas, CSIRO aims to accelerate the deployment of gas production for local domestic use and international export.

## Coal seam gas reservoir characterisation

For a number of years CSIRO has been carrying out research, development and application projects on CSG reservoir characterisation in the areas of geological/rock framework, stress, geologic structures, gas content and composition, coal characterisation, permeability, hydrology and water chemistry.

The overarching objective is to improve evaluation of CSG resources and its production using specialist expertise and techniques for integrated resource characterisation. Research and development priorities include the assessment of:

- ♦ reservoir compartmentalisation relative to geologic structures and in situ stress
- ♦ variations in gas content and coal composition, including the causes for variation
- ♦ permeability behaviour during gas desorption and pressure drawdown
- ♦ fracture stimulation of coal for enhanced gas production
- ♦ the effects of coal properties on reservoir characteristics and resource delineation
- ♦ the role of microbial gas generation on the resource.

## Water management

Large-scale recovery of CSG often leads to production of considerable volumes of water.

CSIRO is assessing the environmental impact of CSG production through projects on monitoring water production, aquifer characteristics and water quality.

## Microbially enhanced gas

CSIRO is conducting research to enhance the production of CSG by increasing and stimulating natural microbial activity. Through an industry consortium project, CSIRO is investigating the viability of using micro-organisms to optimise methane generation.

Ultimately microbial technologies and applications may enable the conversion of carbon dioxide (CO<sub>2</sub>) to methane, providing additional capacity for the geological storage of CO<sub>2</sub>.



The triaxial stress rig is used for integrated characterisation of coal permeability behaviour with effective stress and gas adsorption.

## Reservoir engineering

Reservoir engineering work at CSIRO involves research into the gas storage and migration processes that affect CSG production and the technologies needed to characterise these reservoirs. Recent work has considered the following problems:

- ♦ development of laboratory experiments to characterise coal reservoir permeability during matrix shrinkage with gas desorption

## Case study

CSIRO has developed technologies to help with the removal of brine from untreated CSG water. The Ozone Foam Fractionator Column is a technology developed by CSIRO and commercialised through Impulse Hydro Pty Ltd. The column is part of a desalination process to remove brine from CSG water. CSIRO has also developed a salt management system, Mechanical Vapour Recompression (MVR), which is very tolerant to Total Dissolved Solids (TDS) and produces an output of almost pure water. We are currently looking at hybridising reverse osmosis and MVR technologies to make a desalination plant that is tolerant of variable TDS with lower energy demands.



- ♦ experimental characterisation of multi-component adsorption in coal seam reservoirs
- ♦ stimulating microbial gas generation in coal seam reservoirs
- ♦ enhanced recovery of coal seam gas.

This work is performed with support from various industry sponsors including Santos, Arrow Energy, Origin Energy, Shell, and Queensland Gas Company.

## Hydraulic fracturing

Hydraulic fracturing is widely used to stimulate CSG wells and enhance gas drainage.

To stimulate gas drainage rates from the seam, hydraulic fracturing is used to place sand proppant into the coal from horizontal gas drainage boreholes in coal mines. The gas can then be more completely and quickly drained (often more than 10 times faster), allowing more efficient mining at reduced costs. A similar stimulation process can be applied to surface in-seam CSG wells.

New models are being developed to predict the growth of complex fractures, as well as improved calculations of fluid loss from stress and permeability interactions around fractures.

## Alternative forms of unconventional gas

In order to evaluate resource potential and assess long term sustainability, CSIRO aims to characterise and improve understanding of all Australia's unconventional gas resources including tight gas, shale gas and basin-centred gas, as well as continuing and expanding the research on CSG.

## Getting involved

CSIRO collaborates with industry, research groups, universities and government organisations, developing close partnerships to meet challenges in CSG production. Diverse capabilities are also integrated from numerous divisions within CSIRO for research in CSG.

Australian and international industry and research partners have the opportunity to work with CSIRO via:

- ♦ strategic alliances
- ♦ project investment in research projects through:
  - joint industry projects
  - exclusive research projects and services
  - development of new facilities.



Models are being developed within the hydraulic fracturing team to treat nonlinear fluid loss and predict growth of T-shaped and offset fractures.

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