

Gunnedah Basin Gas

INTRODUCTION TO COAL SEAM GAS

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An Australian energy pioneer since 1954, Santos is one of the country's largest gas producers, supplying Australian and Asian customers.

Santos is one of Australia's largest domestic gas producers, providing gas to customers in all mainland States and Territories and is currently exploring in the Gunnedah Basin to determine the potential of the coal seam gas resource in the region.

Coal seam gas (CSG) is a significant energy resource that can be used for the same domestic and industrial purposes as other natural gases used in Australia at the moment. Approximately 30% of Eastern Australia's gas supplies now come from CSG.

CSG is increasingly being used as a cleaner-burning fossil fuel in the United States and Canada. Gas-fired electricity generation releases over 60% fewer greenhouse gas emissions and uses 99% less water than conventional coal-fired generation.

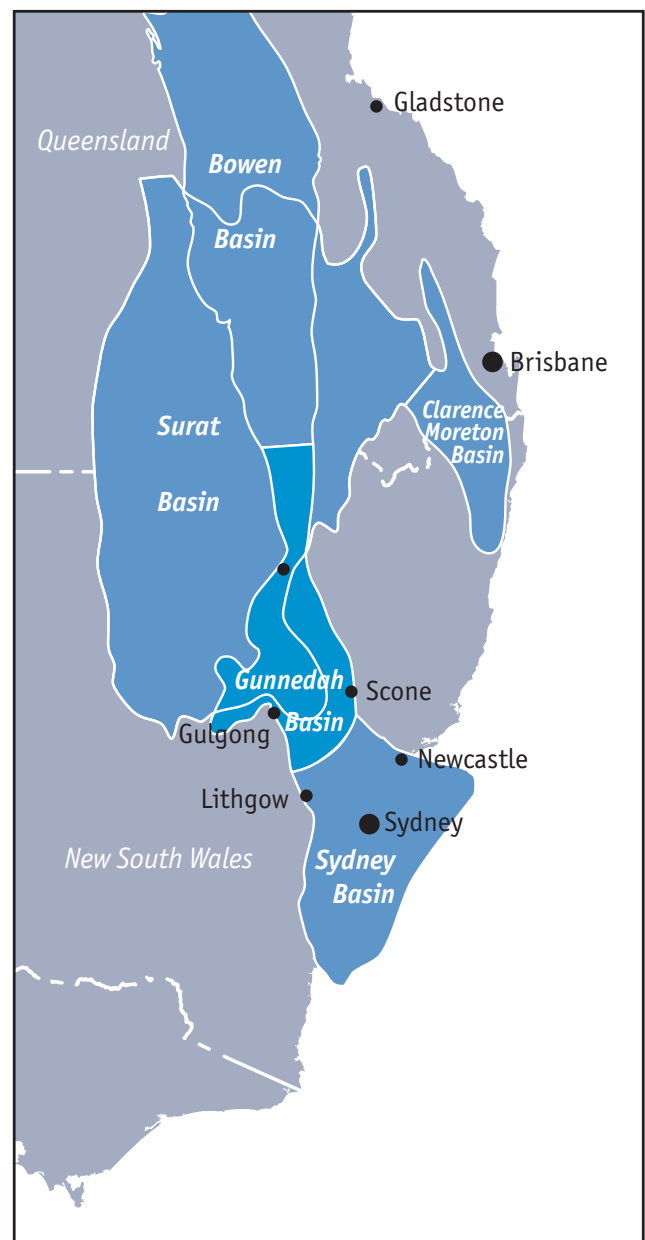
The exploration and production process is less invasive than coal mining. Land disturbance is significantly less, and transportation of the gas to processing and distribution facilities has no impact on road and rail networks.

CSG is predominantly methane gas, formed as part of the processes that produce coal over millions of years. The amount of gas contained in a coal seam depends on the thickness and depth of the seam, and the structure of the coal. It is held in the coal seams by water in the seam. CSG is recovered by leaving the coal in the ground, but reducing the water pressure. Continual improvement in technology is making extraction of CSG easier.

Coal Seam Gas in the Gunnedah Basin

CSG has the potential to produce much larger amounts of gas for commercial and domestic use in Australia, and CSG reserves are estimated to be several times greater than other natural gas reserves. There are major CSG resources along the east coast of Australia. Major NSW deposits are the Sydney Basin (bounded by Illawarra, Newcastle, the Hunter Valley and Lithgow), the Gunnedah Basin (from Gulgong to Narrabri) and the Clarence-Moreton Basin (in the Northern Rivers area).

Santos is exploring for CSG in a number of Petroleum Exploration Licence (PEL) areas in New South Wales' Gunnedah Basin, covering over 45,000 km² (including joint venture with Eastern Star Gas) and taking in Gunnedah, Coonabarabran, Scone, Quirindi, Narrabri and Boggabri.



CSG Basins Eastern Australia

Santos

(For more information see the Petroleum Licencing in NSW Factsheet)

The Gunnedah Basin could supply locally-sourced gas to NSW, bringing economic benefits to local communities.

From exploration to development

Several years of testing, appraisal and planning are required to determine if CSG production in the Gunnedah Basin is viable. Government approvals at this stage only allow Santos to explore and appraise for CSG. There are three phases in the development of a CSG reserve - exploration / appraisal, development and production.

During the exploration phase, Santos will drill 20-30 coreholes. For each corehole, a 60 by 40 metre area is cleared and fenced. All equipment used for drilling is kept within this area. A corehole between 100 and 300 millimetres in diameter, and up to 1500 metres deep, is drilled. Coreholes are lined with single or double layers of pressure-cemented steel casing. This isolates any aquifers that are intersected during the drilling process.

Solid cylinders of coal and rock, called core, are drawn out of the bedrock and sent for testing. The coal seams of interest lie between 200m and 1000m deep, but Santos is exploring for CSG, not coal. When exploration drilling is finished at a site, the corehole is backfilled with plugs of pressure cement. The area is then rehabilitated in line with statutory requirements. (For more information see the Exploration Drilling and Corehole Design Factsheet)

Seismic survey on roads is also used to map subsurface geological structures that show where CSG deposits may be located. (For more information see the Seismic Testing Factsheet)

When exploration is planned on private property, landholders are contacted by Santos Land Access representatives. The representative will negotiate a mutually agreeable land access agreement with the landholder. Santos has been working successfully with Australian landowners for over 50 years. The company is aware of the needs of landowners and seeks to minimise any exploration impacts. (For more information see the Landholder Factsheet)

Exploration drilling and seismic testing are carried out in line with the requirements of the NSW' Petroleum (Onshore) Act 1991 and in consultation with the NSW Department of Industry and Investment. (For more information see the Environmental and Regulation of Petroleum Activities Factsheet)

If exploration shows that gas is present in commercial quantities, pilot wells will be drilled for appraisal. Five wells are drilled in a pattern that places them half to one kilometre apart. Water is pumped out of the coal seam, releasing gas. Both water and gas are tested.

If the information from the exploration and appraisal phase indicates that the gas resource may be suitable for



Pilot appraisal drilling

commercial production, pilot testing will be carried out. This typically requires the drilling of up to five production-sized wells which are more closely spaced than a normal development. Gas is extracted and tested. Water pumped from the coal seam is also tested for volumes and quality. During this pilot phase, water specialists continue water and aquifer management planning. (For more information see the Water Factsheet)

Finally, production wells are drilled to extract water and gas if exploration and testing show that the gas resource is commercially viable. The distance between wells varies. Typically they are 500 metres to 1.5 kilometres apart, connected by underground gas and water pipelines that resemble irrigation networks. Pipelines are constructed along fence lines and existing tracks whenever possible. The gas is carried to a central compressor station then delivered to markets by a buried high-pressure pipeline. Surface activities are rarely interrupted by CSG production operations.

The water holding the gas in the coal needs to be drawn off before the gas can be extracted. As the amount of water in each seam decreases, the production of gas increases. The amount of water produced declines over time.

The volume and quality of water extracted from coal seams varies. Some CSG fields in Queensland produce no water, others produce over a megalitre a day. Because water quality ranges from drinkable to saline, the ways water is treated and used vary.

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