

What is CSG?

Coal Seam Gas is the name given to any naturally occurring gas trapped in underground coal seams by water and ground pressure. The most common gas found in coal seams is methane which was formed millions of years ago as part of the burial of peat to form coal. The gas lines the open fractures between the coal and the inside of the pores within the coal. Coal seams store both gas and water. The water, which is under pressure from the weight of overlying rock material, holds the gas in place. CSG can be captured for use as an energy source for power generation or it can be processed into liquefied natural gas (LNG) for export and use worldwide. Natural gas is a low-emission alternative to coal when used to generate electricity. With the increasing demand for gas-fired electricity generation and a less carbon-intensive future, Australia's abundant supplies of CSG will ensure the industry will continue to grow.

How is CSG produced?

CSG is produced by the drilling of wells from the surface into the coal seam. In the extraction process, the water pressure is reduced when a well is drilled into a coal seam and the water is gradually pumped out of the seam. This allows the gas to flow to the surface of the well.

As water production declines, gas production increases. In some cases, a process known as hydraulic fracturing is used to create passageways into coal seams to allow trapped gas to flow more easily out of coal seams.

The gas from several wells is collected and passed to a central compressor station, from where it is added to a pipeline network for delivery to users including LNG processing plants.

How is CSG water managed?

The amount of water from CSG operations can be significant with the water quality varying from drinkable to salty. The water extracted must be handled in an environmentally

sound manner. Water can be treated through desalination or other processes and reused in a variety of ways such as in irrigation for farming land, and to top-up local water supplies. The water could also be injected into deeper aquifers, or allowed to flow into natural drainage. The means of disposal of this water may vary, subject to current environmental laws and regulations in the jurisdiction concerned.



CSG Operations
Image courtesy of Santos



Compressor station
Image courtesy of Santos

For example, water from CSG operations in Queensland can be used for irrigation purposes once approvals have been granted by the state government and the water is treated if required.

How is CSG used for Power?

CSG can be mixed with conventional gas and coal seam gases from different fields and then piped directly to users or it can be used to fuel gas turbines for mine sites as well as for urban electricity generation. Growing gas demand globally for electricity generation and industrial development are encouraging further exploration.

Where are CSG deposits in Queensland?

The Permian to Triassic Bowen Basin was the birthplace of the CSG industry in Queensland with the first commercial production commencing in 1996. Recently the Surat Basin in southern Queensland has grown in importance as a source of CSG. Further exploration continues to be focussed on the Bowen and Surat Basins, although all coal-bearing basins in Queensland are a potential source of CSG.

In the Surat Basin in south-east Queensland, coal was not buried as deeply as coal in the Bowen Basin and, hence, it has lower gas content. This is compensated by its proximity to infrastructure and markets, and lower drilling costs, making these deposits potentially economic.

Queensland's coal seam gas industry has grown rapidly. The annual number of wells drilled has increased from 10 in 1990 to 600 in 2010-2011. Coal seam gas production in 1998-1999 was 4 petajoules (PJ), in 2005-2006 it was 63 PJ and in 2010-2011 it was 234 PJ.¹

There is also increasing interest in using Queensland's CSG resources to produce liquefied natural gas (LNG) for export. Three export LNG projects are under construction on Curtis Island near Gladstone with the first cargoes expected late 2014. These projects will pipe the gas from the CSG fields of inland Queensland to the port city of Gladstone. Plants at Gladstone will chill to -161°C , liquefying the gas so that it contracts to fill just one six-hundredth of the space occupied by the gaseous form. The LNG can then be exported to Asian markets by purpose-built tankers. As almost 80% of China's and 70% of India's electricity is currently generated from coal, the export of LNG into Asia offers a significant opportunity to reduce greenhouse gas emissions since gas-fired power stations emit up to 70% less greenhouse emissions than coal-burning plants.²

Why use CSG?

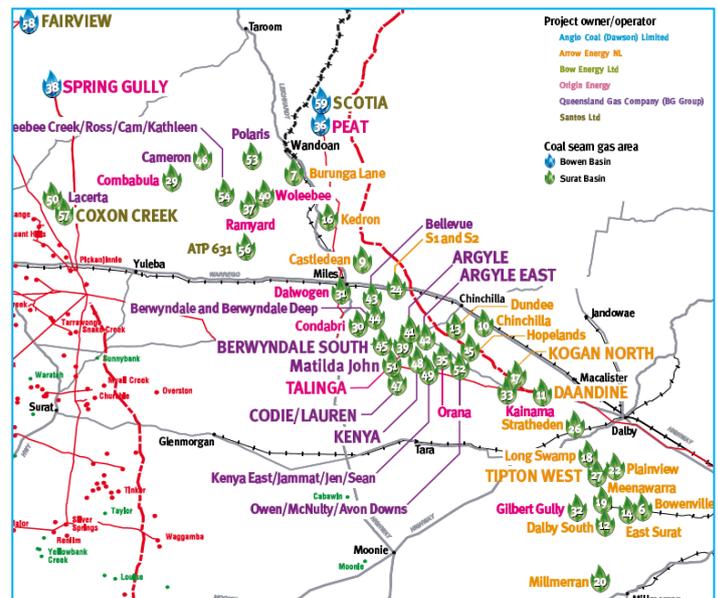
- Methane gas is a useful energy source that can be used close to its extraction point or can be piped to homes and industry.
- It can also be piped to a liquefied natural gas plant (LNG) where it can be processed into LNG for export worldwide.
- It produces 50% lower greenhouse gas emissions compared to black coal and 70% less than brown coal.

What are the issues around CSG?

- Water extracted in the process requires careful procedures and controls to minimise environmental risk.
- Land where gas deposits are located can have multiple land uses. The use of this land needs to be managed following input from all stakeholders.
- Greenhouse gases are produced as a result of CSG extraction.

Interesting CSG Facts

- Traditionally CSG has been extracted from coal seams during mining operations for safety reasons with the potentially explosive gas vented to the surface to reduce the serious safety hazard it poses in underground mining operations.
- Australia's CSG supplies already make a significant contribution to powering industries and households – CSG comprises 90% of Queensland's gas production.
- One petajoule (PJ) of gas is the equivalent heat energy content to about 43 000 tonnes of black coal or 29 million litres of petrol.
- Geoscience Australia estimates Queensland's coal seam gas resources at around 150 trillion cubic feet: enough to power the whole of Queensland for more than 1000 years.
- In Queensland proved and probable coal seam gas reserves as at June 2009 were 18,289 petajoules (PJ)¹.



Source: Department of Energy and Water Supply.

For more information: Queensland Department of Natural Resources and Mines – **Gas in Queensland**, – **Coal Seam Gas**.

CSG Groundwater Portal in the Surat and Bowen Basins

Last Updated February 2013

¹ www.mines.industry.qld.gov.au

² www.appea.com.au