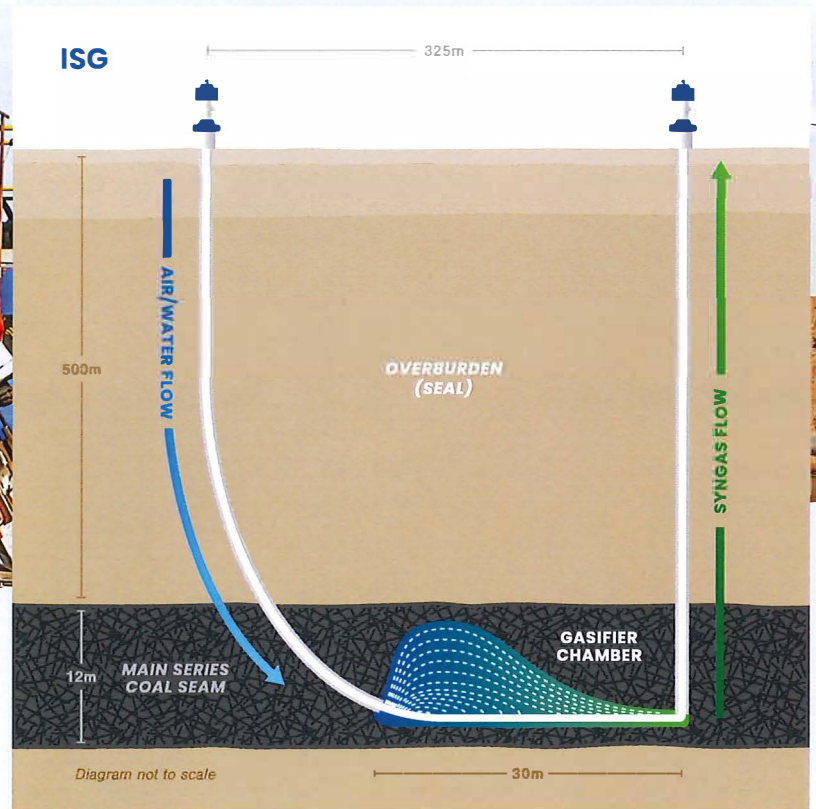


ISG and CSG Comparison



Leigh Creek Energy's in situ gasification (ISG) demonstration project sits within the Telford Basin of the Leigh Creek Coalfield.

Both ISG and coal seam gas (CSG) rely on coal, however are entirely different extraction processes, and both use different technologies.

How are they different?

The two processes and their products are vastly different. While ISG and CSG both produce gas, the product gases are very different and applied to different end uses.

ISG uses air and water to control the chemical reaction in the coal seam and allow synthesis gas (syngas) to flow to the surface, whereas CSG depressurises the

coal seam allowing the gas in the pores of the coal to be released and flow to the surface. Hydraulic fracturing can also be used by CSG to relieve pressure allowing naturally occurring methane to flow out of the well.

To put it simply, CSG takes the gas out of the coal and ISG converts the coal into gas.

The in situ gasification (ISG) process

For the ISG demonstration project, two wells were drilled into the coal seam at depths over 500 metres.

Both wells were drilled vertically down to the coal seam, however the inlet well was then steered horizontally across the coal seam to meet the outlet well and create a direct link.

To start the gasification process, a heating device was placed down the inlet well to heat the coal underground. Following this, the

addition of air and water created a series of chemical conversions which transform the solid coal into syngas.

A small amount of coal is consumed at the start of the gasification reaction; however, the coal seam is never on fire.

The process is controlled by using the inlet and outlet wells to manage the flow of air and water in the gasifier chamber. The process can be stopped at any time by turning off the air and water supply from the inlet well.

The coal seam gas (CSG) process

There are different ways of extracting natural gas from coal seams, including vertical drilling and horizontal or directional drilling.

The CSG process depressurises the coal seam, allowing the gas in the pores of the coal to be released and flow to the surface.

The gas and liquid are brought to the surface via a pipe which is encased in layers of concrete and metal to prevent any leakage into permeable layers, including aquifers. On the surface, the gas is separated from the water.

Hydraulic fracturing (fracking or fraccing) is sometimes used to release gas from a coal seam.

Hydraulic fracturing has been used by the oil and gas industry since 1948. In Australia, the practice can be traced back over the past 40 years where it was used in the production of energy resources including conventional natural gas. Hundreds of natural gas wells in South Australia's Cooper Basin have been fracture stimulated since the 1970s.

In situations where the fracturing process is used, fluid is pumped under pressure into the coal seam to open up fractures.

The fluid is typically a mixture of sand, water and minor additives that open up cracks in the seam to create a path for water to flow back to the surface.

Hydraulic Fracturing

1. Fracturing fluid is injected into well
2. Small fractures open within the coal
3. Sand particles keep fractures open (mm)
4. Fluid is released from fractures (mm)
5. Gas flows into well
6. Water is pumped to surface
7. Gas sent to processing plant
8. Water treatment or disposal

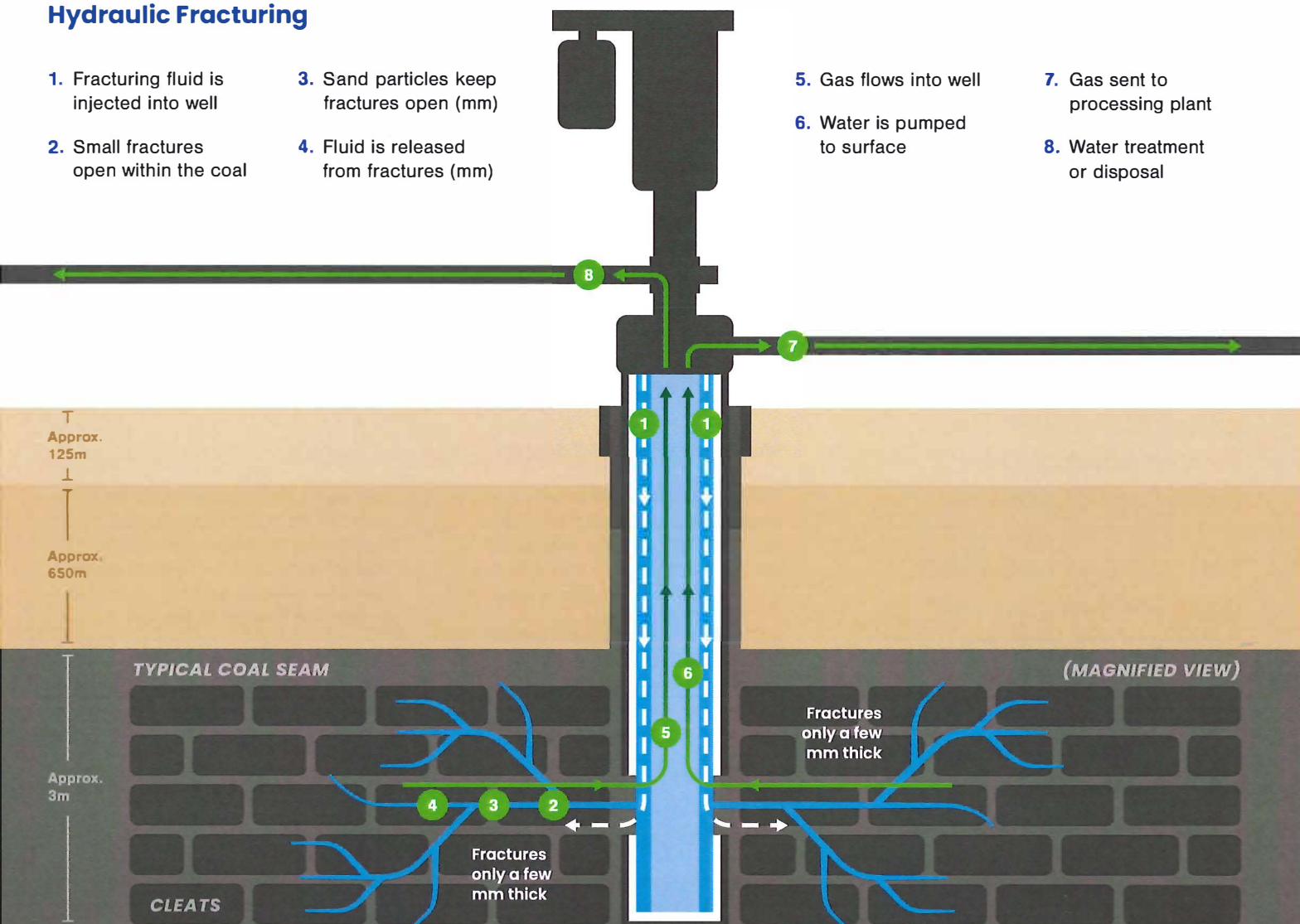


Diagram not to scale.

Source: NSW Government Planning & Environment Resources & Energy, How is coal seam gas extracted
<https://www.resourcesandenergy.nsw.gov.au/landholders-and-community/coal-seam-gas/the-facts/how-is-coal-seam-gas-extracted>

To obtain information for the design for a commercial facility, Leigh Creek Energy successfully constructed, operated and decommissioned a small-scale ISG demonstration plant during 2018/19. This demonstration facility involved the construction of an above ground plant (and associated service infrastructure) and the establishment of a below ground single ISG gasifier chamber. The demonstration plant successfully produced syngas, proving that the technical and environmental performance of the process can be confirmed at Leigh Creek.

Leigh Creek Energy acknowledges and respects the Adnyamathanha people, the Traditional Owners of the land on which our operations occur and pays our respects to their Elders past and present.

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