

Overview of Underground Coal Gasification

01 UCG Series



This information sheet provides an overview of the Underground Coal Gasification (UCG) process.

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What is gasification?

Gasification is the conversion of coal to a gas (called synthesis gas or syngas) through a series of reactions involving oxygen (or air), heat, pressure, coal and water.

Coal gasification is not new. It has been used since the 1800s to supply heating gas to cities and towns, generate electricity from gas turbine power stations, and to produce synthetic liquid fuels.

Syngas contains hydrogen and methane and can also be used to produce chemicals such as ammonia, methanol and dimethyl ether.

What is Underground Coal Gasification?

Underground Coal Gasification (UCG) is the process of gasifying coal in-situ, that is, within an underground coal seam.

This process eliminates the need for mining the coal and processing it through a surface gasification plant. UCG has been utilised in both commercial and trial scales since the early 1900s.



Figure 1: Overview of the UCG process.

In its simplest form, the UCG process works like this:

1. Vertical wells are drilled into the coal and linked together horizontally.
2. The coal seam is ignited and air or oxygen is pumped into a well (the injection well) to allow for combustion of the coal.
3. Combustion produces heat, carbon dioxide and some syngas through partial combustion.
4. Through a series of chemical reactions involving pressure, heat and carbon dioxide from combustion, steam (generated from water in the coal) and carbon from the coal, syngas is produced.
5. The syngas flows from the gasification chamber through the horizontal connection in the coal seam and flows to the surface through another well (production well).

The composition of the gas produced depends on many factors including coal type, operating pressure and temperature, water ingress to the process, and the type of oxidant used (air or oxygen).

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Benefits of UCG

UCG offers the potential to use the energy stored in coal deposits that are uneconomic to mine by conventional methods. The use of UCG could potentially increase global coal reserves from 900 billion tonnes to 1.5 trillion tonnes¹.

Other benefits of UCG include:

- No need to mine the coal or build a surface plant for gasification
- Elimination of the safety hazards associated with underground coal mining
- The syngas product can be used in a variety of industrial processes including power generation, liquid fuel production and chemical manufacture
- Significant environmental benefits, such as reduced surface disturbance and land use conflicts (compared with coal mining and oil and gas operations), avoidance of greenhouse gas production associated with coal mining and a relatively small physical footprint for large amounts of energy extraction. UCG technology could also be regarded as an enabling technology for carbon capture since it has the ability to deliver an enriched CO₂ stream suitable for carbon capture and storage. For example if the syngas is to be used as a feedstock

for a GTL process, then the sequestration of CO₂ from the gas is a necessary step in the process.

- With an approximate 21 per cent reduction in greenhouse gas emissions,^{2,3} UCG is a lower carbon emitting technology⁴ for power generation (compared to coal-fired power stations)

What makes Linc Energy different?

Linc Energy is striving to be the first company to commercially produce high quality synthetic liquid fuels using syngas produced from UCG.

All other operations around the world that use syngas to produce liquid fuel rely on mining the coal and gasifying it through surface plants.

Linc Energy is pursuing a lower cost, lower environmental impact solution for alternative fuel production by combining two proven technologies.

- 1 World Energy Council, 2007.
- 2 Life cycle emissions compared to the most efficient pulverised fuel supercritical Australian coal-fired power stations using mined coal. Not including sequestration.
- 3 BHP Billiton, 2002. Case Study B20: Electricity Production Using Underground Coal Gasification (UCG). Newcastle, Australia.
- 4 UCG, when used for power generation, is a clean coal technology by definition. Clean Coal Technology Special Agreement Act 2007 (Qld): Clean Coal Technologies means "technologies that have potential to facilitate substantial reduction of emissions of Greenhouse Gas to the atmosphere from the use of coal".

About Linc Energy

Linc Energy is a globally focused, diversified energy company with a strong portfolio of coal, oil and gas deposits. Linc Energy's purpose is to unlock the value of its resources to produce energy to fuel the future. A public company, Linc Energy is the global leader in UCG, delivering synthesis gas for commercially viable energy solutions (electricity, transport fuels and oil production), via gas turbine combined cycle power generation, Gas to Liquids processing and Enhanced Oil Recovery.

Related information sheets

- UCG Explained
- UCG, GTL and the Environment
- Modern UCG Practices

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