An Overview of Underground Coal Gasification (UCG)

What is UCG?

UCG is the process of gasifying coal in situ, that is, where it is lying under the surface, so that it can be used as a fuel or chemical feedstock. This process eliminates the need for mining the coal and processing it through a surface gasification plant. It also enables the extraction of energy from coal which is uneconomic to mine or inaccessible due to depth, geology or for other mining and safety reasons.

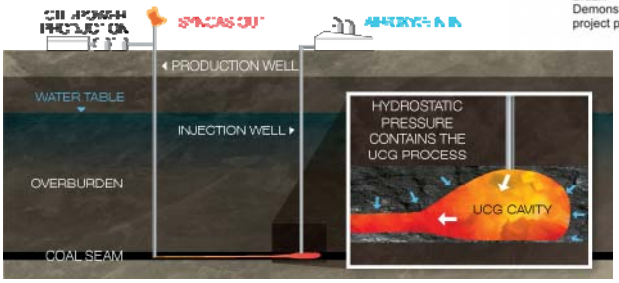
What is the UCG process?

An injection well is drilled from the surface deep underground until it reaches the coal seam. A further hole is drilled at a distance away from the first, also into the coal seam. The two are connected by either fracturing or directional drilling. The coal is ignited to create heat and air or oxygen and steam is injected into the process.

Reactions then take place which convert the solid coal into gas. The gas is brought to the surface through the production well which results in a consistent and steady flow of gas.

The gas created by the process is known as syngas which is rich in hydrogen and can be used in power generation, the production of plastics, explosives and transport fuels.

The process is extinguished by shutting off the supply of air or oxygen so that gasification cannot continue.



UCG process: Image courtesy of Linc Energy

How is UCG water managed?

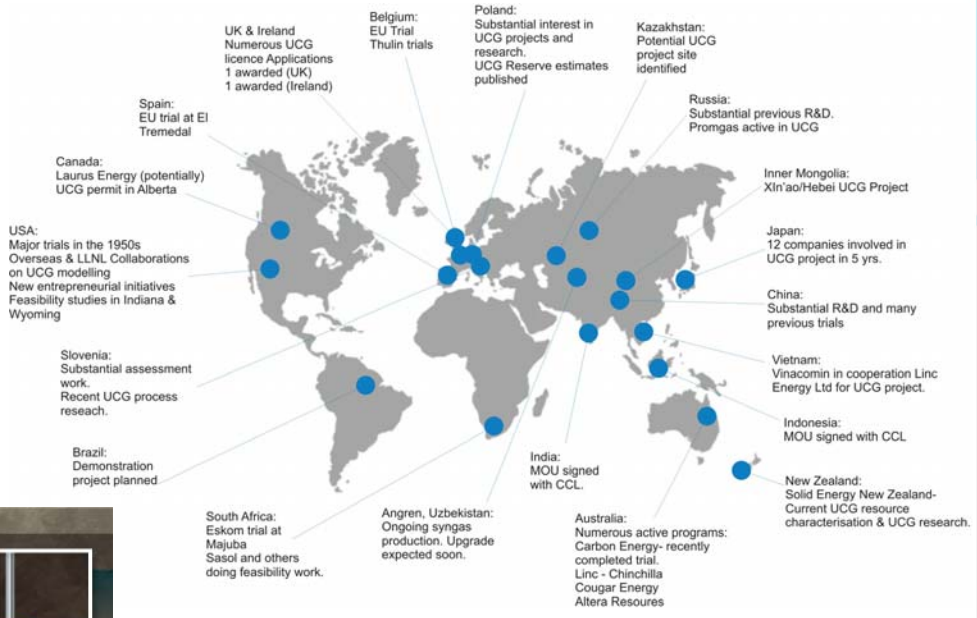
Some groundwater is needed for UCG and is drawn into the UCG process. This is used in the gasification reactions. The extent of the draw down needs to be managed through the selection of appropriate sites, water monitoring, and an effective water management and recycling process.

Any gas lost needs to be managed to avoid potential contamination of groundwater. Effective controls need to be in place to prevent migration of contaminants away from the cavity area.

What is Gas to Liquids (GTL)?

GTL is a process that converts syngas into liquid fuel. After refining the products, high quality diesel can be used worldwide as a transport fuel. By producing liquid fuels domestically, there is less of a dependence on imported fuels.

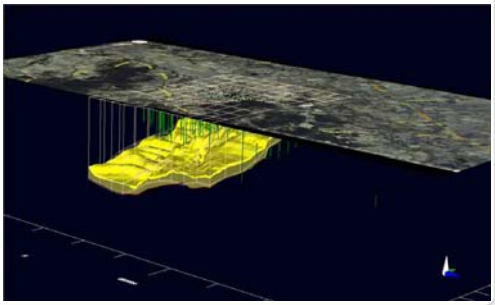
UCG worldwide



Source: Clean Coal Ltd via UCG Partnership

UCG in Queensland

Trials of UCG are underway in Queensland near Chinchilla and Kingaroy in southern Queensland. The pilots will convert coal seams into synthetic gas for power generation, industrial heating, diesel fuel and ammonia.



Regional groundwater model Chinchilla Image courtesy of Linc Energy

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Why use UCG?

- UCG uses energy stored in coal deposits that are uneconomic to mine by unconventional methods.
- The underground process eliminates the need for a surface gasification plant.
- Syngas can be used for a variety of purposes including power generation, liquid fuel production and chemical manufacture.
- UCG reduces surface disturbance with the soil and land profile remaining intact for ease of rehabilitation and future land uses.

The Majuba UCG Project in Mpumalanga, South Africa, is producing high-quality syngas for power generation. This photo shows the first flare on January 20, 2007, when the UCG plant successfully started operations. Image courtesy of Ergon Energy.

What are the issues around UCG?

- Any gas lost needs to be managed to avoid potential contamination of groundwater.
- To maintain environmental performance, regular monitoring of data in and around a UCG site needs to occur.
- Subsidence of the land may occur.
- Lowering of the water table may occur.
- UCG generates greenhouse gas emissions.

Interesting UCG Facts

- Lamp lighters in the 1800s made their rounds in many large cities lighting streetlights fuelled by 'town gas' the product of early and relatively crude forms of coal gasification
- China has been developing UCG technology since the 1980s. It currently has the largest operational UCG program and uses abandoned tunnels in conventional mines.
- Modern geological modelling tools now allow for rapid analysis of suitable UCG coal seams. From there the characteristics of the coal seam and other surrounding geological formations can be determined.

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