

Coal seam gas in New Zealand



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Coal seam gas

Natural gas is an important energy source in New Zealand. In the last year, Solid Energy has been investigating the commercial viability of extracting methane gas trapped in deep coal seams as a source of energy.

Solid Energy has joined forces with an independent US oil and gas company, Resource Development Technology LLC to explore the North Huntly coalfield and part of the northern areas of the Rotowaro coalfield, in the Waikato, for coal seam gas under a Petroleum Exploration Permit (PEP) granted to RDT in 2002.

What is coal seam gas?

Coal seam gas (CSG) - also known as coal seam methane, or coal bed methane or coal seam natural gas - occurs naturally in coal beds. CSG is generated either from a biological process as a result of microbial action or from a thermal process as a result of increasing heat as the coal is buried.

During the earliest stage of coalification (the process that turns decaying plant material into coal), methane is produced as a by-product of microbial respiration. This gas is referred to as 'biogenic methane'. These



Solid Energy has been appraising coal seam gas from pilot wells in North Huntly

microbes can live several kilometres deep and in very high temperatures (greater than 100°C). It has been demonstrated that in most sub-bituminous coals, including those in the Waikato, the methane that is present in the coal bed is a result of bacterial action.

What is coal seam gas used for?

CSG can be used for industrial energy, electricity generation and can be injected into gas transmission systems to supplement gas resources. It is largely the

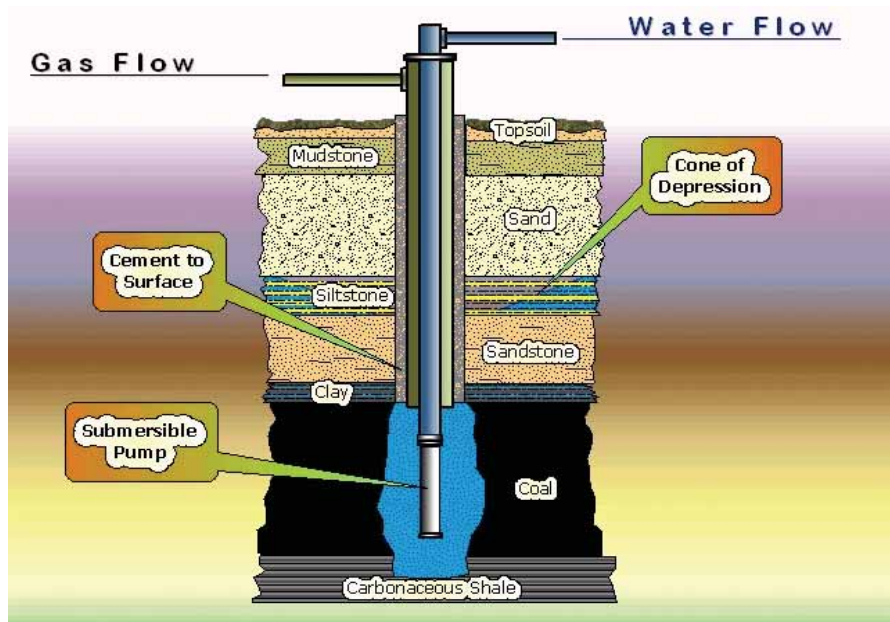
same as 'conventional' natural gas which is found in non-coal rock layers. With the run down of Maui gas and increasing pressure to develop new sources of electricity generation and industrial energy, CSG could make a significant contribution to meeting New Zealand's increasing energy needs in the next five to 10 years.

Initial work has indicated a methane resource in the North Huntly Coalfield could contain gas equivalent to 25 to 200 Petajoules (PJ) of energy. As a comparison, the Pohukura gas field is estimated at 500 - 1200PJ and the Kupe field at 300PJ. The Huntly Power Station, which generates electricity using coal and gas, currently uses around 60PJ of fuel a year and 2-5PJ would be sufficient to meet a small city's (100,000 houses) annual energy requirements.

Where does coal seam gas occur in New Zealand?

CSG can be found in many of New Zealand's coal resources: Taranaki, the West Coast and Southland, as well as the Waikato coalfields. Exploration and evaluation of New Zealand's CSG resources began in the 1980s, but it is only recently that work has begun to prove the commercial viability of this energy resource.

The Ministry of Economic Development has allocated PEPs in all of these regions. A PEP must be held to explore for CSG. If the



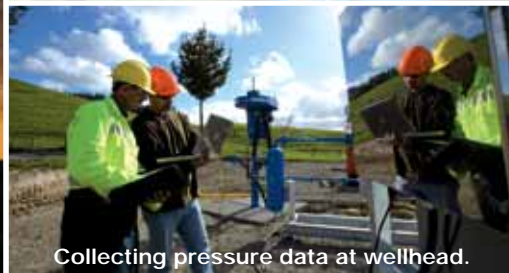
Simplified coal seam gas well



Coal seam gas began flowing in December 2007



Data logger at wellhead.



Collecting pressure data at wellhead.



Collecting data on gas volumes.

results of Solid Energy's exploration programme in the Waikato are positive, a further permit would be required as the company entered into long-term production.

Though not as well known in New Zealand, exploration and mining of CSG is well established in Australia and the United States and is being developed extensively in China, India and South East Asia.

Why the Waikato?

Several crucial geological conditions are needed for CSG to occur and then to be developed:

- coal buried at sufficient depth
- gas formation (in this case through biogenic processes) to a significant degree to allow commercial development
- presence of a reservoir seal – this keeps the gas from migrating out of the coal and becoming dispersed in low quantities in other rock types
- permeability – a measurement of how easily a fluid or gas can move through a solid material. If permeability is not high enough, then the flow of gas will never be at a rate high enough for commercial development.

Waikato coal beds meet the criteria for all these attributes. Several market options exist in the Waikato with the Huntly Power Station, small industry, direct electrical generation or the North Island gas pipelines.

How is CSG extracted?

CSG is extracted through wells which are similar in design but much smaller than those used in

the petroleum industry. The well is 5 metres (m) by 7m, though it is encompassed by a concrete pad that covers an area of 20m by 20m.

The wells are drilled and the casing is set to the top of the targeted coal seam. A submersible pump moves the water up the tubing and gas separates from the water as the pressure is reduced. The gas is passed to a central compressor station, where it is measured and then added to a pipeline network for delivery. The technology of moving natural gas from its original source to the market is well known and safe.

Production wells run for approximately eight to 12 years, after which the surface facilities are removed and the hole is cemented to prevent even very small amounts of gas leaking out. All land is rehabilitated.

What effect might this have on water tables and water disposal?

Unlike traditional natural gas, CSG is recovered by pumping water from the coal seam horizon, thus reducing water pressure in the reservoir. This allows the gas to be released from the coal and move up the gas well. Because of the low permeability of the rocks overlying the coal seams in the Waikato, removing the water from this coal will have no effect on any other rock layers; that is, ground water will not be affected in any way from CSG production.

Significant volumes of water are normally removed to produce the gas. The quality of this water can vary from drinkable to saline, reliant on several factors. Depending on the water quality it may be dispersed directly into

existing waterways and catchments, or held in settling ponds before discharge, or treated in mobile treatment plants prior to release. Initial tests indicate that water quality is good which would allow it to be discharged locally. There may also be considerable irrigation potential for this water.

What do we now know about coal seam gas in the Waikato?

Exploratory work returned sufficient positive results to Coal Bed Methane Ltd, the Solid Energy-RDT joint venture company, for it to proceed to the next stage of drilling. Although there is still considerably more to learn about this energy resource, what this information showed was that there is the quantity and quality of gas for a viable commercial gas field.

Where to now?

In December 2007, Solid Energy's North Huntly pilot wells yielded New Zealand's first significant flows of coal seam gas. Subsequent analysis showed that gas to be 98% pure methane, with only 1% CO₂. Gas was produced throughout 2008 to help understand the characteristics of the gas reservoir and to calculate the likely productivity of future wells. This data is helping to determine if large quantities of coal seam gas can be extracted economically from the coalfield. Early in 2009, Solid Energy will complete its feasibility work and make a decision on the next stage of commercial development. If it goes ahead, this would involve drilling new wells to look at commercialising coal seam gas across the wider Huntly coal field.