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COAL BED METHANE OFFERS A FUEL SOURCE WITH THE POTENTIAL TO DELIVER ZERO GREENHOUSE GAS EMISSION POWER

Coal bed methane (CBM) is natural gas extracted from coal seams. Innovative drilling methods have been successfully developed to the extent that CBM is now a proven and reliable source of competitively priced natural gas for power generation or for supply to industrial and residential markets. Where the CBM is used for electricity generation, the carbon dioxide (CO_2) produced by the combustion of the gas may be captured and sequestered into the same coal seams from which the CBM was extracted. Theoretically, coal seams can absorb more than twice as much CO_2 (by volume) as the methane extracted from them, offering a unique way of reducing greenhouse gas emissions from electricity production.

We are investigating the prospects for CBM-fired power generation to become a significant low greenhouse gas emissions energy source, with potential application in Australia, the United States, Europe and China.

Power is generated from CBM in much the same way it is from natural gas. When the methane is combusted in the power plant, CO_2 and water are produced. The unique concept we are proposing uses a process known as sequestration, which means reinjecting the CO_2 back into the seam from which the methane was extracted initially – thereby essentially having a form of power generation with zero greenhouse gas emissions.

The potential application of CBM-fired power generation has several dimensions:

- The development of new techniques for drilling methane-rich coal seams, in which BHP Billiton has played a leading role, has meant that CBM has become a competitive alternative to conventional natural gas in North America and Australia.
- In these countries, existing electricity transmission infrastructure extends into the coalfields where a number of existing coal-fired power stations are located. The same infrastructure could service new power stations situated on top of CBM fields and fuelled by CBM.
- The CO_2 from CBM-fired power stations could be 'captured' and sequestered into the same coal seams from which the CBM was extracted.

In Australia, CBM is expected to supply 15 per cent of eastern Australia's expected gas demand in 2005, a significant proportion of which will go into power generation. The potential recoverable CBM from eastern Australian coal basins has been estimated to be 100 trillion cubic feet, representing 200 years of current gas demand in Australia.

BHP Billiton is a part owner of a major CBM project called the Moranbah Gas Project that will supply gas for use in a high-efficiency power station in Townsville, Australia, by 2005. The power station will produce up to 1.5 million megawatt-hours annually, equivalent to the energy needs of a town of 200 000 people

Research has been undertaken to find suitable locations for carbon dioxide sequestration. In Australia, the research[1] suggests that the CO_2 storage potential of major coal basins – including the Bowen and Galilee Basins in Queensland, the Cooper Basin in South Australia, and the Sydney, Gunnedah and Clarence-Moreton Basins in New South Wales – is equivalent to 45 years of current CO_2 emissions from electricity generation. Importantly for the permanence of sequestration, the study focused on coal seams that are too deep or too high in ash content to be economic for coal mining. It is estimated that coal basins in North America and China also have a significant sequestration potential.

The injection of CO_2 into coal seams is being trialled, both as a means of enhancing the recovery of CBM and for permanent CO_2 storage. Research suggests that CO_2 injected into coal seam reservoirs can displace the methane embedded in the coal and thereby enhance its extraction, theoretically allowing recovery of all of the methane in place. Early results from the first multi-well pilot test in the San Juan basin of New Mexico indicate that such CO_2-enhanced CBM recovery is technically feasible.

In another project, permanent underground CO_2 storage is being trialled by Consol Energy, a large US coal mining company with significant coal seam gas operations. In conjunction with the US Department of Energy, Consol embarked in 2002 on a seven-year project to demonstrate drilling techniques to permanently sequester CO_2 into unminable coal seams. US$9.2 million is being invested in the project.

While the technology exists to sequester CO_2 in coal seams, there are major technical issues to be addressed. First, the ability of the coal to adsorb the CO_2 without swelling and becoming impermeable needs to be demonstrated in the field with injection tests; permeability is important to enable the CO_2 adsorption potential of the coal seam to be fully realised.

Second, the long-term integrity of the sequestration process needs to be demonstrated; that is, that the same geological mechanisms that trapped the methane in the coal seams will ensure permanent sequestration of the injected CO_2.

These issues could be addressed within two years (with monitoring over a longer period), and a full-size demonstration project of a CBM-fuelled power station with sequestration of the captured CO_2 could be operational within five years.

The economic outlook for CBM-related sequestration also seems positive. Research[2] suggests that this technology has the scope to deliver sequestration at a cost of less than US$8 per tonne of CO_2. This compares with an average price per tonne of CO_2 of US$10 for carbon credits traded in Europe over the six months to May 2004. The difference suggests that it makes business sense to pursue CO_2 sequestration options.

For further information, the Company's Position Statement on Climate Change is available on our website at www.bhpbilliton.com/bb/sustainableDevelopment/environment.jsp.

[1] Australian Petroleum CRC's GEODISC research paper entitled Carbon Dioxide Sequestration Potential of Australia's Coal Basins (Sept 2000).

[2] CO_2 Injection for Enhanced Coal bed Methane Recovery: Project Screening and Design by Scott H. Stevens, Advanced Resources International. Presented at the International Coal Bed Methane Symposium, University of Alabama, Tuscaloosa, May 3–7, 1999.

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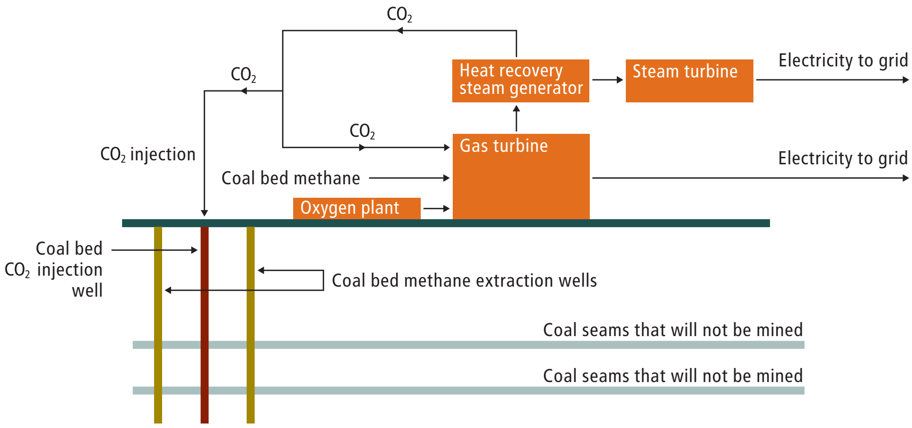
ENVIRONMENT 13

COAL BED METHANE continued

Coal bed methane and zero carbon power



With coal bed methane mixed with oxygen as fuel for the gas turbine, the flue gas becomes pure carbon dioxide (plus water and NO_x)