Low Carbon and Energy Seminar Series- jointly sponsored by the Low Carbon Society Initiative, WISER and the WBS Global Energy Initiative

4.30-6pm, February 18th 2009
Warwick Business School, Lecture theatre B3.20
To register: http://www2.warwick.ac.uk/fac/cross_fac/low_carbon/activities/ccs

---

Can we bury CO_2 while getting secure energy?
Professor Peter Styles

Professor of Applied and Environmental Geophysics

Keele University

Geological formations can, under the right conditions, trap fluid and gas for hundreds of millions of years; the presence of hydrocarbon in reservoirs testifies to this fact. Because of the technological advances associated with oil exploration we understand these processes and geological conditions very well and can discover, extract and in some cases re-inject hydrocarbons for storage while simulating and monitoring reservoir conditions both onshore and offshore.

This makes geological strata strong candidates for the eventual storage by sequestration of carbon dioxide for very long periods of geological time. There are several ways in which this can occur; by injection into ageing oil fields to increase their useful life, by disposal in deep, saline, unexploitable aquifers such as the Utsira formation in the central North Sea where the CO_2 simply resides in the porosity of the rock and will eventually dissolve in the groundwater, by absorption into mineral phases such as serpentinite where it becomes tightly bound as magnesite and by sequestration into unmineable coal seams where it is robustly trapped by chemi-sorptive processes. Research in the UK and Europe, to date, has been inclined towards disposal in saline aquifers because oil-field technology has been available to carry out these experiments. However, the cost of capture and transport of carbon dioxide produced in the UK and Europe to these sites is significant and no added-value by-product is associated with this process.

The UK is now a net importer of natural gas and recent years have seen enormous fluctuations in price with the associated impact on industry and mounting concerns about security of supply while at least 30% of the onshore UK is underlain by coal and much more lies beneath the North Sea.

The rapidly developing world has enormous reserves of coal, especially China, which is building at least 1 new coal-burning power station every week and currently produces about 6 Billion Tonnes of CO_2 per year, predicted to rise to greater than 10 Billion Tonnes p.a. by 2020. India and the rest of the developing world show similar rises in coal usage and CO_2 production. These mines also release enormous quantities of methane, an extremely potent greenhouse gas (at least 20 times worse than carbon dioxide) into the atmosphere in a poorly controlled manner from the mine environment. In order to provide the energy which these countries see as their right while mitigating global greenhouse gas levels a solution must be found which provides energy from coal while simultaneously capturing and sequestering carbon dioxide.

CO_2 has a preferential absorption rate in coal which is twice that of methane and so the sequestration of carbon dioxide in unmineable coal seams can release methane for use as a fuel. Enhanced Coal bed Methane (ECBM), a technique which produces methane by pumping ground-water to reduce the partial pressure until methane is desorbed, while simultaneously sequestering CO_2 has much promise to power gas-fired power stations or local CHP plants. Underground Coal Gasification (UCG) , a process of gasification by controlled combustion underground within the seam, can produce syngas a mixture of Carbon Monoxide, Hydrogen (for fuel cells or transport) and Methane for energy and simultaneous sequestration either in the zone of char surrounding the burn or in overlying seams makes this a very low carbon technology.

Significant research must be done in order to understand the scientific and economic issues associated with these techniques but as a contribution to global mid-term energy demands, a potentially major contribution to global carbon storage and more parochially a significant and secure supply of gas for power stations in the UK, coal-based carbon capture and storage solutions deserve a much more significant research and demonstration platform than they have presently.