The drive towards zero emissions in energy production

Technological developments and joint projects

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The global drive for economic growth means that global energy demand is always increasing. Given the inevitable public concern about any massive increase in nuclear generation capacity, and the small market penetration of renewables, there is no viable alternative to fossil fuels at present.

Fossil fuels are non-renewable resources, and they produce the greenhouse gas carbon dioxide when burnt. As a result the energy production industry has always been in the spotlight in the climate debate and subject to intense scrutiny by environmental activists, mainly because of negative images such as oil tanker spills, sulphur and carbon dioxide emissions. Some of these companies are opposed to any further regulation of greenhouse gas emissions. However, several companies today are at the cutting edge of advances in technology to produce energy with fewer emissions and many success stories remain unknown to the wider public

The coal industry world-wide is intensifying its efforts to reduce methane emissions from coal production. Coal naturally contains methane, which is adsorbed onto the macerals which form the solid part of coal, and is held in place by electrostatic forces. These bonds break when the pressure on the coal is reduced during the mining process and large amounts of methane are desorbed from the coal. A 5 – 15 per cent mixture of methane in air is explosive. Consequently in very gassy mines, the methane has to be drained off the coal via a series of boreholes and piped to the ground surface to prevent it mixing with the mine air. When it is brought to the surface, the methane can be utilised as a fuel if it is sufficiently concentrated and there is a nearby domestic market. If not, it is commonly emitted to the atmosphere, where it acts as a powerful greenhouse gas. The BGS has recently been involved in a pre-feasibility study for the Asian Development Bank to identify sites for utilisation of coalbed methane in the People's Republic of China. At Yangquan Coal Mining Administration (CMA) in Shanxi province, North China, the local coal mines produce so much methane that the local domestic market is more or less saturated, and some 50 million m^3 of surplus methane are emitted annually from mine methane drainage schemes. The gas emerging from the methane drainage system is around 40 per cent methane mixed with air, so it is a valuable fuel. Yangquan CMA appears, at first sight, to be an ideal site for the generation of electricity from this coalbed methane. Utilising the surplus methane is a win-win situation; greenhouse gas emissions are reduced and a valuable resource is captured and utilised. Degasification of coal seams in advance of mining, via boreholes drilled from the surface, is also taking place at Yangquan CMA.

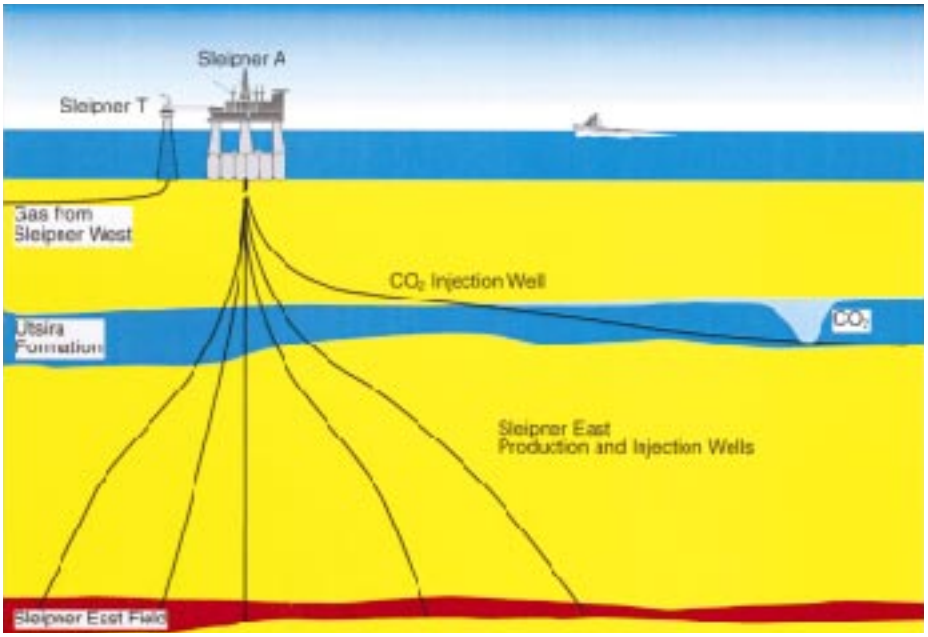
The petroleum industry has already taken significant steps towards reducing its carbon emissions as well as its methane emissions. Statoil and partners are disposing of around 1 million tonnes of carbon dioxide per year into a

Sleipner West. (Photo courtesy of Statoil).

sandstone reservoir beneath the North Sea. This carbon dioxide, which occurs naturally mixed with the methane and other hydrocarbon gases in the Sleipner West gas field, would otherwise be emitted to the atmosphere. The BGS and IKU Petroleum Research are involved in a project, the 'Saline Aquifer CO_2 Storage Project,' to learn as much as we can from this activity and produce a best practice manual for the underground disposal of carbon dioxide. This project is partly funded by Statoil, BP, Mobil, Norsk Hydro, Saga and the Swedish electricity utility Vattenfall, partly by national funding from the UK DTI amongst others, and partly by the EU Thermie programme.

It may not be long before electricity generation from fossil fuels with near zero emissions becomes a reality. The Norwegian company, Norsk Hydro, is considering bringing natural gas onshore from the North Sea and splitting the methane into hydrogen and carbon dioxide. The hydrogen would then be used for electricity generation with near zero emissions and the carbon dioxide would be sent to a North Sea oilfield for enhanced oil recovery. If this proposal is brought to fruition, it will mark a giant step on the road towards a hydrogen economy. Furthermore, it will mark the beginning of enhanced oil recovery using carbon dioxide in the North Sea.

Concern over greenhouse gas emissions is moving steadily up the political agenda. The introduction of carbon emissions trading, likely in the next few years, can only help make a business case for carbon dioxide disposal in the North Sea. It may give value, as storage space, to previously useless subsea reservoirs which don't contain any oil or gas but which are filled with highly saline groundwater. The expectation is that the next century will see the expansion of carbon sequestration from the first steps outlined above to sequestration of carbon separated from the flue gases of fossil fuel fired power plant. It is hoped that we will see major pipelines taking carbon dioxide from fossil fuel fired power plant all over mainland Europe and delivering it to the North Sea. There it can be returned to the sedimentary rocks from which it came, and be used to energise by then depleted oil fields.



CO_2 injection project at Sleipner West. (Image courtesy of Statoil).

Right *Boreholes drilled for degasification of coal seams at Yangquan CMA.*

Below *Energy and the global drive for economic growth.*