Low Carbon Power with Carbon Capture and Sequestration - a world first for the UK

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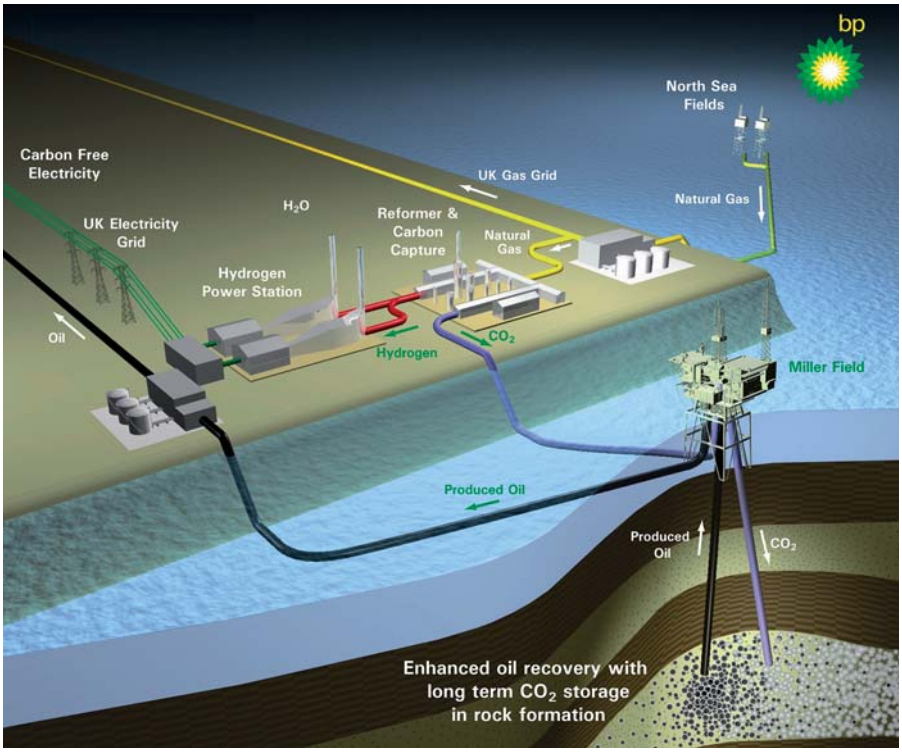
At the end of June last year BP announced plans for the world's first industrial scale hydrogen power project with carbon capture and sequestration. The power plant would be built at Peterhead alongside an existing Scottish and Southern Energy (SSE) power station and take natural gas from North Sea fields which would be put through a reformer to convert it into hydrogen, a clean burning gas, and carbon dioxide (CO_2).

SSE is BP's partner in this project which would use the hydrogen to produce 475MW of low-carbon electricity in a new power station – enough to power some three quarters of a million homes. The process will capture 1.8 million tonnes of CO_2 per year that will be transported some 240km via an existing pipeline to the Miller field where it will be injected 4km underground into the oil and gas reservoir. It will enable production of some 57 million barrels of oil that would not otherwise have been recoverable – more than the size of an average new field discovery in today's North Sea – extending the life of the field by about 15-20 years. The CO_2 will remain permanently stored in the reservoir rock which has a natural impervious cap and has naturally held gas, with a large proportion of naturally occurring carbon dioxide for many millions of years. If the project is not able to proceed now, the Miller field will have to be decommissioned, as originally scheduled, next year and this opportunity to kick-start carbon capture and sequestration (CCS) will be lost.

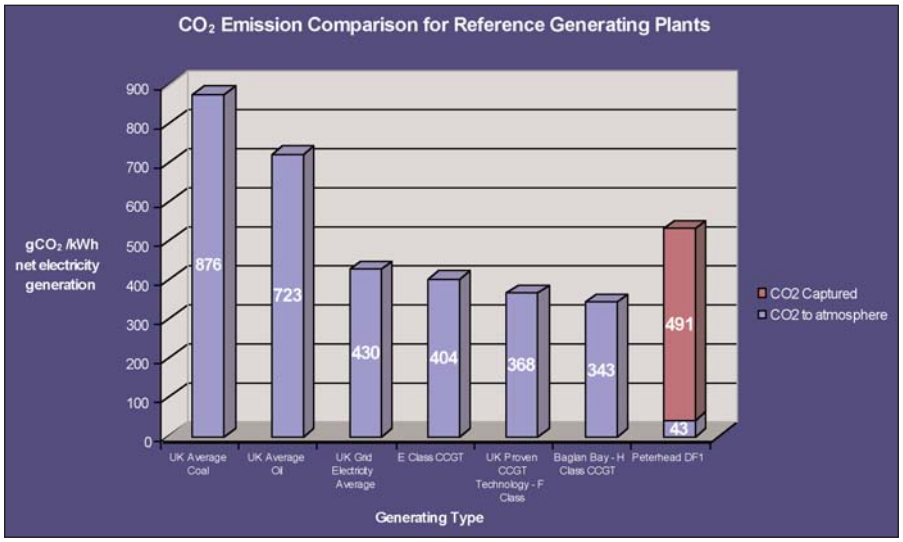
The global power sector accounts for some 40% of all man-made CO_2 emissions and as such is a natural industry to target to make substantial reductions in emissions



of this greenhouse gas. The enclosed graph demonstrates exactly how radical a step the Peterhead plant will represent in enabling a move to a low-carbon future. Recent generations of gas fired turbines – the cleanest fossil fuel – have been making incremental reductions in the amount of CO_2 emitted per unit of electricity generated such that a modern 'F' class turbine emits some 368g CO_2/kwh net electricity generated. However, Peterhead is expected to emit just 43g CO_2/kwh net electricity generated – 90% less than the current average for UK electricity, even after taking renewables and nuclear into account.

Not only is this a step change towards making fossil fuel power generation comparable with renewables in terms of CO_2 emissions it also has a couple of other advantages. It will be base load power which does not have the intermittency of most forms of renewable power and, in a single project, will deliver as much power as is currently generated by all the UK's wind farms.

Significantly, the technologies that are being brought together at Peterhead can be applied to all forms of fossil fuel, including coal. This has obvious implications for the future of coal in the UK which currently emits 876g CO_2/kwh net electricity generated but could also see a similar carbon capture rate. The even greater prize in tackling global climate change is for rapidly developing countries such as India and China which have enormous reserves of coal and are currently opening a new coal fired power station every week. This new approach to power generation enables countries like this to continue their rapid economic development while also taking an active part in the global campaign to tackle climate change.



BP, as an integrated oil and gas company, is one of a few companies that has an understanding and experience of the technology this project calls for. The technologies used in the various steps of the process have been used at scale in different places around the world in different industries but this will be the first time they will be brought together. For instance, the reformer is of a similar size to one BP has in Trinidad; experience of the capture of the CO_2 comes from the In Salah project in Algeria; the company has numerous power generating facilities, including at its refineries; and the turbine vendors have proved and warranted the firing of hydrogen in the turbines. Finally, from the USA, BP brings extensive experience of transporting large volumes of CO_2 and our North Sea assets provide a comprehensive understanding of the Miller field, wells, geology, and the behaviour of both liquids and gases in rock.

BP and SSE currently estimate the cost of the Peterhead project to be approximately £750 million. The reforming of the natural gas, capture of the CO_2, its transportation and storage inevitably mean this is more costly than a conventional gas fired power station. However, the company is sufficiently convinced of the need to move to low-carbon power generation that it is prepared to carry the risk of the novel technology application and to make as substantial investment as this project represents.

As they stand the project economics are competitive with other forms of low carbon, or carbon free, power. These challenging economics include the offshore part of the project where the costs of retro-fitting the platform for its new life are not fully compensated for by the expected revenue from the additional oil that will be recovered. As has been required by other new sources of low carbon power, a power generation industry with CCS needs a policy framework that allows the cost to be spread across the electricity market. To provide the Peterhead project with a rate of return appropriate for the level of capital and technical risk, it needs a level of support equivalent to that provided to renewable forms of energy in the UK through the Renewable Obligation.

The Peterhead project will require that level of support throughout its life because of the technology choices that are made at the outset. Like all new technologies it is expected the costs for subsequent projects will come down with time. We are already seeing that the mere decision to move ahead with a commercial scale project is pushing technology down this cost curve. For instance, the detailed engineering studies that are now under way have already produced greater turbine fuel efficiency and a higher rate of CO_2 capture than was envisaged just six months ago.

BP has analysed a number of different policy support mechanisms, or combination of mechanisms, that the UK Government might consider making available to this first-of-a-kind project to enable it to go ahead. These have included both policy frameworks already in use to incentivise low carbon, or renewable power, as well as analogues of these and new mechanisms. It is also hoped the EU Emissions Trading Scheme will be adapted to recognise carbon capture and sequestration.

BP is largely indifferent as to how this support is provided so long as the total enables the project to proceed with a level of return commensurate with the risk.

Conscious of the lack of knowledge that the novel nature of the project creates and the Government's need to not over-reward the project, BP has provided the Government with a copy of the economic model of the project. It can use this to see what effect any policy framework would have on the project economics. Because of the importance of making substantial contributions to tackling the climate change issue, and of seeing this first-of-a-kind project happen, BP has offered to cap the rate of return on the project. Also, in the event of the project being more successful than is currently anticipated, BP is amenable to some form of claw back mechanism so that the cost to the Government or consumer is reduced.

In announcing plans for this project BP is continuing its commitment to tackling the climate change issue and its leadership role in industry on this issue. It was followed, in November, by the announcement of the formation of BP Alternative Energy, a new business dedicated to low-carbon and carbon-free energy. It brings together BP's gas-fired power generation, wind and solar businesses as well as hydrogen power. It has aggressive growth plans and an $8bn capital investment budget for the next ten years.

BP's commitment has already resulted in the announcement of plans for a second hydrogen power plant with CCS which will be built next to the company's refinery at Carson in southern California. As an indicator of the potential for using coal, this will take petroleum coke, a synthetic form of coal and a by-product of the refining process, as its feedstock. Of many other projects that the company is looking at around the world, several involve coal itself.

The first power plant in the UK with CCS can be built to provide the UK with substantial greenhouse gas emissions reductions in time to help meet the Government's 2010 targets as well as provide the country with a world beating project. BP and SSE will be able to make the final investment decision to build it early next year, provided the policy support is forthcoming by the end of this year.