Carbon Capture and Storage: HM Treasury Consultation on Barriers to Commercial Deployment

A submission by the UK Offshore Operators Association

May 2006

Contents Page

1. Summary

The UK Offshore Operators Association (UKOOA) provides the following in response to HM Treasury Consultation on the commercial barriers to Carbon Capture and Storage (CCS). This report expands on our earlier submission to the DTI Energy Review which also addressed this subject, albeit more briefly.

i) The UK, with its mature offshore oil and gas province is uniquely positioned to foster the development of Carbon Capture and Storage (CCS). Offshore oil and gas companies recognise that they have an important role to play in this emerging business. However, this must not conflict with the imperative of maximising the economic recovery of oil and gas reserves from the UK Continental Shelf (UKCS). In addition HM Treasury should be clear that the principal role for CCS is likely to be in electricity generation and that the role of the UK offshore oil and gas industry would be to facilitate the long-term storage of CO_2 captured from this sector.

ii) As the government addresses the issues raised by this consultation into CCS, it should continue to promote an environment which encourages the maximisation of domestic production as its first priority. HM Treasury should carefully test any measures taken to promote CCS against this priority.

iii) CCS has the potential to deliver significant reductions in carbon emissions at a scale that competing technologies cannot provide. It has a role to play alongside other renewable technologies as society develops a low carbon future. The challenge is however to realise as much of this potential as is commercially viable.

iv) All the technologies required to implement CCS already exist and have been proven in a range of industries, though the costs of carbon capture from electricity generation remain too high for CCS to be economic on its own merits at this time. A further challenge is to link these diverse technologies together to create a viable business.

v) Currently there is no standard business model regarding CCS. A limited number of schemes have been proposed, however, it is clear that without government support none of these have robust economics.

vi) CCS should be regarded as a means of producing low carbon electricity and should be treated on a similar economic basis to other forms of low carbon renewable generation:

- Any measures taken to promote CCS should remain in place for the life of the project to provide a clear business framework for investment,
- The EU ETS monitoring and reporting regulation needs to be changed to recognise that these carbon emissions have been avoided through CCS,
- Companies wishing to undertake CCS projects should be given credits under the EU's Emissions Trading Scheme. This includes CCS projects developed through the so-called CDM (Clean Development Mechanism) process.
- The stability of the existing renewables obligation mechanism should be ensured.

vii) It should not be assumed that the use of CO_2 for Enhanced Oil Recovery (EOR) will be sufficient to promote the wide spread development of this technology. The UKCS is a mature province and other means of EOR have already been widely employed offshore.

- CCS may provide tertiary recovery in some instances although the retrofitting of this technology on mature oil fields may be prohibitively costly,
- CCS will not enhance the recovery of hydrocarbons from gas fields particularly in the Southern North Sea.

viii) Existing offshore oil and gas fields, pipelines and infrastructure have not been designed to accommodate CCS. The costs and complexity of retrofitting CCS capability on ageing facilities may prove excessive and instead require substantial rebuild which would probably prove to be similarly costly.

ix) Over the long term, the traded carbon market should emerge as the commercial driver for investment in CCS.

- The current traded carbon market is insufficiently mature at this time to drive investment in CCS (this was further emphasised by the recent halving in the price of carbon in the traded market),
- Current indications are that a stable carbon market with a traded price several times higher than recent prices of €20 - €30 will be required before CCS using current technology is commercially attractive.

x) Any large scale program of CCS in the UK would require a number of major on-shore CO_2 producers becoming linked to a number of offshore storage reservoirs and, potentially, CO_2 EOR projects. There would be a need to ensure that CO_2 transport infrastructure takes advantage of economies of scale for this to become commercially viable.

xi) CCS must be developed within a stable fiscal and regulatory regime for the UKCS, which is currently lacking. Certainty is required regarding the treatment of decommissioning liabilities for the UKCS, without which offshore operators may not be able to contemplate the re-use of facilities for CCS. This must be addressed within the separate consultation into the offshore fiscal regime by HM Treasury.

xii) The CCS business model will inevitably span onshore and offshore fiscal regimes; clarity must be provided on the activities which are inside and outside the offshore ring-fenced fiscal regime.

2. Introduction

Recent increased focus on carbon abatement technologies is driven both by a growing awareness of climate change, and the provisions of the Kyoto protocol. Carbon capture and storage (CCS) is one such abatement technology, which has the capability to reduce substantially emissions from the use of fossil fuels. It involves three separate stages: capture, transport and storage.

The CO_2 from large industrial or power generation sources is first captured using a combination of physical and chemical processes, then transported to a storage location and finally stored in a geological structure such as an aquifer or a suitable mature oil or gas reservoir. Europe is believed to have extensive CO_2 storage capacity, predominantly located beneath and around the North Sea.

CCS has the potential to enable low carbon electricity production and provide an environmentally attractive method of disposing of CO_2. The Energy Review identified a role for carbon abatement technologies such as CCS within the nation's energy strategy. In parallel, HM Treasury has launched a consultation on barriers to commercial deployment of CCS which correctly identifies that the lack of economic incentive is the single biggest issue to be addressed, if CCS is to be pursued in and around the North Sea.

The extensive list of consultees approached by HM Treasury recognises that this is still an emerging business and will involve a range of industries if it is to become commonly employed. In its response to this consultation, UKOOA takes the opportunity to expand on its earlier response and address the business drivers for CCS and the role of the offshore oil and gas industry within this emerging technology.

HM Treasury has also launched a separate consultation on the fiscal regime for the UKCS. UKOOA's response on the CCS consultation addresses issues which are relevant to the wider fiscal consultation and will also be reported in that context.

3. Key Issues Regarding Commercial Deployment of CCS

This consultation raises five core issues regarding the commercial deployment of CCS which are addressed in UKOOA's response and specifically seeks advice on whether there is a case for economic incentives for CCS;

- Potential for CCS to deliver carbon reductions
- Technology
- Engineering and Manufacturing Capability
- Regulation, durability and public acceptance
- Cost

i) Potential for CCS to deliver Carbon reductions

CCS has the technical potential to deliver significant reductions in carbon emissions at a scale that other carbon abatement technologies may not be able to provide. The British Geological Survey has estimated the potential capacity under the whole of the North Sea at around 20 billion tonnes of CO_2 in oil and gas fields, with an additional 20–70 billion tonnes in confined aquifers. This compares favourably with the UK's current emissions of around 560 million tonnes CO_2 per year.

Clearly, the potential for carbon storage in the North Sea presents a substantial opportunity, given that the UKCS is a mature province with a large number of fields approaching the latter stages of their productive life. This opportunity seems even more compelling if it can be linked to enhanced oil recovery; however, as will be shown, the reality is rather more challenging.

CCS projects can make a material impact. If we take as an example a 500MW on-shore electricity generating station with offshore CO_2 storage, this would deliver an annual reduction of between 1.5 and 3.0 million tonnes CO_2/year depending on the primary fuel used, equivalent to 0.25% and 0.5% of the UK's CO_2 emissions (560 million tonnes CO_2/year in 2005 according to DEFRA). Such a project, would actually deliver as much carbon abatement as is offered by the total amount of wind power currently generated in the UK today. Thus, the need to replace some 20GW of power stations between now and 2015 would provide an opportunity to capture a significant proportion of UK emissions if the new power stations were to be fitted with capture equipment.

Both the UK and Norwegian governments have recognised the potential for CCS offered by the North Sea; the challenge therefore is to realise as much of this potential as is commercially viable. To aid this, the North Sea Basin Taskforce on Carbon Capture and Storage was launched in 2005 by the two governments with the aim of developing common principles on the regulation and management of CO_2 storage under the North Sea. If successful, the taskforce should ease many of the shared regulatory issues which currently exist.

ii) Technology

Technology is not a barrier, in and of itself. The technologies required to implement CCS already exist. Though they have been proven in a range of industries, it is clear that cost is a major issue, particularly for carbon capture. A further challenge lies in linking these diverse technologies together to create a viable business for CCS.

R&D must continue in this area in order to develop breakthrough technologies that can lower the cost of large scale carbon capture. Power generation companies can provide the core competencies in electricity generation. The oil and gas industry collectively has the appropriate knowledge base regarding the capture in certain circumstances, transportation and storage of CO_2, and can provide the requisite chemical, offshore and reservoir engineering and geological expertise. Between the power generation companies and offshore oil and gas companies all the key technologies required to execute such projects have been addressed.

Another challenge to be faced is how we can integrate the different industries within a new business model which will co-join industries with very different business drivers. As example, utility companies operate in a very different commercial environment with a different risk/reward balance from companies which operate on the UKCS.

Most of the business models for CCS which have been produced so far use power generation as the primary source of the CO_2. However, it should be realised that other large scale industrial sources of CO_2 may also be suitable candidates for this technology. Each CCS related project will differ, depending both on the type of 'input' fuel (natural gas, coal etc.) as well the nature of the industrial or generation process providing the CO_2. Given the lack of a standard business model, a variety of means of encouragement may be required if CCS is to attract investment.

iii) Engineering and Manufacturing Capability

The UK Offshore sector has been a technical innovator and leader throughout its life. When the offshore industry first emerged it attracted skills and engineering capability from other sectors, then over time it has developed its own high-tech manufacturing and skills base. It continues to invest in the people and the skills to sustain the UK oil and gas industry. With the UKCS approaching a mature phase, the manufacturing and skills base is broadening to make the UK a global exporter of oil field goods and services; it is also diversifying into new industrial sectors such as renewables. The emergence of CCS will offer a very real opportunity for further diversification and further global growth to the benefit of the UK economy and to the UK oil and gas supply chain.

It should be recognised that the UK Offshore Sector has a competitive edge with the expertise to support the advent of CCS technologies. The UK offshore sector has a strong record of manufacturing capability; many projects within the renewable energy industry have originated from companies whose expertise originally centred around platform fabrication on the UKCS. Though timing is an obvious issue the actual construction of any

required 'new build' offshore infrastructure, or retro-fit of an existing platform can in theory, be easily accommodated by the well-skilled UK construction sector.

However, although the skills base is broad at present, there may be a lack of cohesion between existing knowledge and eventual application; it is likely that re-skilling of personnel or a crossover of existing skills will be required in order to take full advantage of the opportunity available to the UK. As the number of fields in production declines, there will be yet further competition for the highly skilled workers within the offshore sector; so the timing of a build-up of workers with skills for a CCS industry needs to be timed carefully to avoid a skills shortage by the time CCS projects come into operation. It will be essential to identify any gaps in knowledge and skills that will need to be addressed in order for the UK to move successfully forward with CCS implementation, and sustain its competitive edge.

iv) Regulation, Durability and Public Acceptance

Aspects of the legality of CCS offshore are currently in question. CO_2 is officially designated a waste product and injection offshore is only allowed under International law (the London and OSPAR Conventions) providing that it is associated with EOR. It is understood these Conventions are being reviewed with the intent of permitting CCS offshore, independent of EOR. Until the Conventions can be amended, it will only be possible to carryout carbon storage offshore as a means of providing EOR, which limits the candidate reservoirs and may constrain the development of this business.

The UKCS is a mature oil and gas province with rapidly ageing infrastructure. The future decommissioning of offshore platforms and pipelines is already factored into many companies' plans. Whilst the re-use of offshore oil and gas fields for CCS has the potential to extend the life of facilities and may delay decommissioning, it may be difficult to achieve. With producing fields approaching the end of their life, so too is the infrastructure.

Any unforeseen or forced delay in decommissioning increases the fiscal and regulatory risks perceived by offshore operators. Fiscal and regulatory certainties are required now regarding the future treatment of decommissioning liabilities for the UKCS. Without this clarity, offshore operators may not be able to consider the re-use of facilities for CCS, if applicable. This is a significant issue which UKOOA will also address within the separate Treasury Consultation into the offshore fiscal regime which is currently ongoing.

CCS will inevitably cross the onshore and offshore fiscal regimes. Investors will require clarity on the activities which are inside and outside the offshore ring-fenced fiscal regime prior to any investment decision being made.

The long term liabilities associated with the storage of carbon in offshore reservoirs must also be addressed now. It is understood DTI is considering an approach which will ensure that operators carry out a 4-step CCS process for any candidate project. This is to be sure

that all the technical risks have been addressed before, during and after cessation of the storage process. Providing all exceptions have been met during that process, UKOOA believes the liability for the long term surveillance, monitoring and integrity of the storage site should swiftly revert to the Government once storage is complete.

Public awareness of CCS is growing rapidly from a low base. Whilst many people are supportive of the idea, it needs to be communicated that what is a simple concept misses the fact that developing CCS in a mature province with ageing infrastructure is a complex operation. For successful implementation of projects, well informed public support is crucial.

v) Cost

The costs of installing CCS offshore may still prove prohibitive in some cases. It has taken nearly four decades to develop the existing offshore infrastructure. Similarly it should be recognised that it will take time to develop CCS infrastructure within the North Sea.

Platforms and processing facilities and the offshore pipelines were not designed to export and inject CO_2 offshore into oil and gas reservoirs, but rather import oil and gas ashore. Even if EOR is attractive, the very facilities which might transport CO_2 are actually required to process and transport the oil and gas. As a consequence, it is apparent that CCS will require substantial investment in new infrastructure, both onshore and offshore, including substantial retrofitting of ageing installations offshore, where there are already severe weight and space limitations. Early estimates suggest that retro-fitting existing installations may, in some instances, be more costly than new-build of installations.

Economies of scale will ultimately need to be accessed for this technology to have an impact. A large scale program of CCS implementation in the UK would require a number of major on-shore CO_2 producers becoming linked to a number of offshore storage reservoirs and, potentially, EOR projects. Such developments would almost certainly have to evolve from the piecemeal development of individual CCS opportunities.

4. The Case for an Economic Framework for CCS

Experience to date has shown that there is no standard business model which can be applied to CCS. If we are to foster an investment environment which promotes CCS, offshore oil and gas companies must be confident that Government's priority is to maximise the economic recovery of oil and gas reserves. The fiscal and regulatory regimes should then provide clarity on the interfaces and applicability of onshore and offshore regimes across the various elements of the CCS business model.

The following is based on a business model centred on power generation, with CO_2 removal from the fuel supply (pre-or post combustion) and CO_2 transport and storage with or without EOR. CCS will be employed as a means to reduce the carbon impact of the electricity produced by the generator.

Current projects demonstrate that a robust business case has still to be established for CCS offshore. CCS will provide tertiary oil recovery, as enhanced oil recovery techniques such as water and gas injection have already been employed on the majority of the UK's oil fields. Indeed, in many cases, even if the CO_2 is used for EOR, the benefits are anticipated to be insufficient to render a project commercially viable. Additionally it should be noted that CCS will not enhance the recovery of hydrocarbons from gas fields, particularly in the southern North Sea. That being said, gas fields in the southern North Sea may still be suitable candidate fields and are closer to shore and possibly cheaper to redevelop for CCS than fields in the central and northern sectors of the North Sea.

In the broad terms CCS should be regarded as a means of producing low carbon electricity. It is possible to make a case that CCS should be treated on a similar basis to other forms of renewable power generation. If such an approach is not taken CCS is likely to remain an unattractive commercial proposition until such time as advances in technology bring down the cost of carbon capture substantially. Given the limited potential from EOR and the uncertainties on the fiscal and regulatory regimes offshore, there will remain few drivers to encourage offshore oil and gas operators to consider participating in CCS projects unless such encouragement is considered. Any measures taken to promote CCS should remain in place for the life of the project to provide a clear business framework for investment.

The current EU ETS scheme should recognise the emergence of CCS and there are positive signs that HM Government and the European Union are addressing this issue. Monitoring and reporting guidelines under the scheme need to be changed to recognise that these carbon emissions have been avoided through CCS. Consideration should also be given to provide companies wishing to undertake CCS projects with credits under the Emissions Trading Scheme to acknowledge the environmental benefits of this technology. In particular, there are opportunities for so-called CDM (Clean Development Mechanism) projects that incorporate CCS to generate carbon credits that can be transferred into the EU ETS.

In the longer term, if CCS is to emerge as a commercially viable form of carbon abatement, one of the drivers underpinning investment will be the traded price of carbon. Current indications are that the traded price of carbon in the EU ETS must be several times higher than recent prices of €20 - €30 before projects using current technology for carbon capture start to become commercially viable. Investors will have to begin to gain confidence in the carbon price and the liquidity and depth of the carbon market before investing in CCS.

The current volatility of the traded carbon market demonstrates that the market is insufficiently mature at this time to drive investment in CCS and it may take many years before sufficient experience is available. The recent drop in the traded price of carbon, which saw prices halve, only serves to emphasise the volatility of the market. Until this market attaches a sufficiently high value to carbon, the UK will need to consider its own means of incentivisation if this potentially significant industry is to develop.

Appendix

UK Offshore Operators Association (UKOOA) is the representative organisation for the UK offshore oil and gas industry. Its members are companies licensed by HM Government to explore for and produce oil and gas in UK waters.

UKOOA's Members

The following companies are members of UKOOA.

a) Members
Amerada Hess
Apache North Sea
BG Group
BHP Petroleum
BP
Centrica
Challenger Minerals (North Sea)
Chevron Upstream Europe
CNR International (UK)
ConocoPhillips (UK)
Dana Petroleum
E.ON Ruhrgas
ENI (UK)
ExxonMobil International
Gaz de France Britain
Lundin Britain
Maersk Oil (UK)
Marathon Oil UK
Newfield Petroleum UK
Nexen Petroleum (UK)
Noble Energy (Europe)
OILEXCO North Sea
OMV (UK)
Perenco (UK)
Petro-Canada
Premier Oil
RWE Dea UK
Shell UK Exploration and Production
Statoil (UK)
Talisman Energy (UK)
Total E&P UK
Tullow Oil UK
Venture Production

b) Associates
Aker Kvaerner Operations
Bluewater
Maersk Contractors
North Sea Production Company
Petrofac Facilities Management