



Department  
of Energy &  
Climate Change

# **CCS in the UK**

## **Government response to the CCS Cost Reduction Task Force**

16 October 2013



# CCS in the UK - An update

**The CCS Cost Reduction Task Force published their final report in May 2013. This publication responds to the major recommendations from that report, and updates on some key policy developments since publication of the UK's CCS Roadmap in 2012.**

## Introduction

Carbon Capture and Storage (CCS) has the potential to play a critical role in our future low carbon energy mix. It is the only set of technologies that can turn high carbon fuels into genuinely low carbon electricity, and crucially it is the only approach available to decarbonise many energy intensive industries such as steel and cement. CCS projects are major infrastructure developments which can also bring investment and growth, and analysis suggests the technology could cut the annual cost of meeting our carbon targets by up to 1% of GDP by 2050.<sup>1</sup>

The Government believes that CCS can make an important contribution to the UK's secure, affordable, low carbon future and to global efforts to combat climate change. It is therefore committed to encouraging the development of cost-competitive CCS in the UK and abroad. CCS has the potential to develop as a thriving industry with widespread deployment in the 2020s, but only if the technology can be deployed cost effectively at scale. The recent work of the industry-led Cost Reduction Task Force indicates this is possible and recent modelling conducted for the Government's EMR Delivery Plan included scenarios of up to 12GW of CCS by 2030, with an industry appetite for even more.

Last year we published the UK's CCS Roadmap setting out our programme to develop the industry with an objective of cost competitive CCS in the 2020s.

Our approach is focussed on reducing the cost of CCS so that it can compete effectively with other low carbon technologies. Our £1bn CCS Commercialisation Programme Competition is intended to bring forward the first commercial scale projects in the UK to help realise the commercial potential of this technology. Beyond this we want CCS to develop into a strong industry and would like to see further phases of projects coming forward. These projects could benefit from lower costs associated with use of existing infrastructure, lower costs of capital and potentially synergies with Enhanced Oil Recovery (EOR).

The Government has a role in supporting CCS and other promising low carbon technologies to a state of maturity where decisions about deployment can be taken by the market. The Government's role therefore is to help overcome first of a kind obstacles; to help overcome barriers that hinder projects coming forward independently and providing the right incentives and environment for the industry to develop in competition with alternatives.

Our continuing focus is to deliver support in a way that facilitates the wider development of the CCS industry, particularly ensuring that the support made available now to early projects has a beneficial impact on the pace and cost of future CCS deployment. For

<sup>1</sup> [http://eti.co.uk/downloads/literature/Ecofin\\_CCS\\_Report.pdf](http://eti.co.uk/downloads/literature/Ecofin_CCS_Report.pdf)

example, as part of the White Rose CCS project we are exploring the option for a Front End Engineering Design (FEED) study into a large capacity 'Yorkshire / Humber CCS Trunkline' to support the work National Grid is already undertaking as part of its EEPF funded activities. Such a pipeline could encourage development of further CCS projects in the area.

The multi-million pound FEED studies that will be undertaken as part of the Competition will not only provide the technical and financial information Government and bidders need to take final investment decisions, they will also provide a wealth of information for the wider industry and academic community and will be freely disseminated through our Knowledge Transfer Programme.

We also recognise that CO<sub>2</sub> Enhanced Oil Recovery (EOR) could play an important role in the development of some CCS projects, as has been the case in North America. However, offshore conditions in the UK may be quite different to the onshore experience in North America. Therefore we want to work with both the CCS and Oil & Gas industries to investigate this area further and have begun this process with a workshop to review the potential for EOR in the North Sea and the linkage between these opportunities and the UK's CCS policy.

The CCS Cost Reduction Task Force has provided a useful insight into the conditions necessary for CCS to become a viable low carbon electricity generation technology, and the benefits this could bring. We hope that industry and the wider CCS community will work together, and with Government, to collectively examine the challenges identified and develop solutions.

Effective dialogue between industry and Government will be critical in tackling these challenges, and therefore we have asked Michael Gibbons OBE to take the position of industry co-chair for a renewed CCS stakeholder engagement forum.

This report presents an overview of key actions and policy developments since publication of the CCS Roadmap last year, and also sets out a response to the main 'next steps' attributed to Government in the Task Force's final report.

## Developments since the CCS Roadmap

The innovative UK CCS Roadmap, published in April 2012 set out the Government's approach to the development of the CCS industry in the UK.

The full publication and supporting annexes are available at:

<https://www.gov.uk/government/publications/the-ccs-roadmap>

The five key components outlined in the Roadmap are:

- The CCS Commercialisation Programme with £1bn in capital funding and additional operational support available through Contracts for Difference (CfDs).
- A £125m, 4-year, co-ordinated research and development (R&D) and innovation programme and a new UK CCS Research Centre.
- Development of a market for low carbon electricity through Electricity Market Reform, including availability of Feed-in Tariff Contracts for Difference for low carbon electricity.
- Commitments to working with industry to address other important areas including developing the CCS supply chain, addressing regulatory barriers and assisting the development of CCS infrastructure.
- International engagement focused on sharing knowledge generated through the UK programme and learning from other projects around the world.

In the last year we have been taking forward these measures and can highlight some key developments since publication of the Roadmap.

## Commercialisation Programme

The CCS Competition aims to support practical experience in the design, construction and operation of commercial scale Carbon Capture and Storage. £1bn capital funding is available, and uniquely the UK is also making available operational support designed to provide investor security by stabilising revenues.

The Competition received a substantial level of interest from developers with eight bids submitted when the competition closed in July 2012. Following detailed analysis, four bids were taken forward into a bid improvement phase in late 2012. The Chancellor announced our two Preferred Bidders in his 2013 Budget Statement - the White Rose coal project and the Peterhead gas project, and we are currently negotiating contracts for FEED studies with these two bidders.

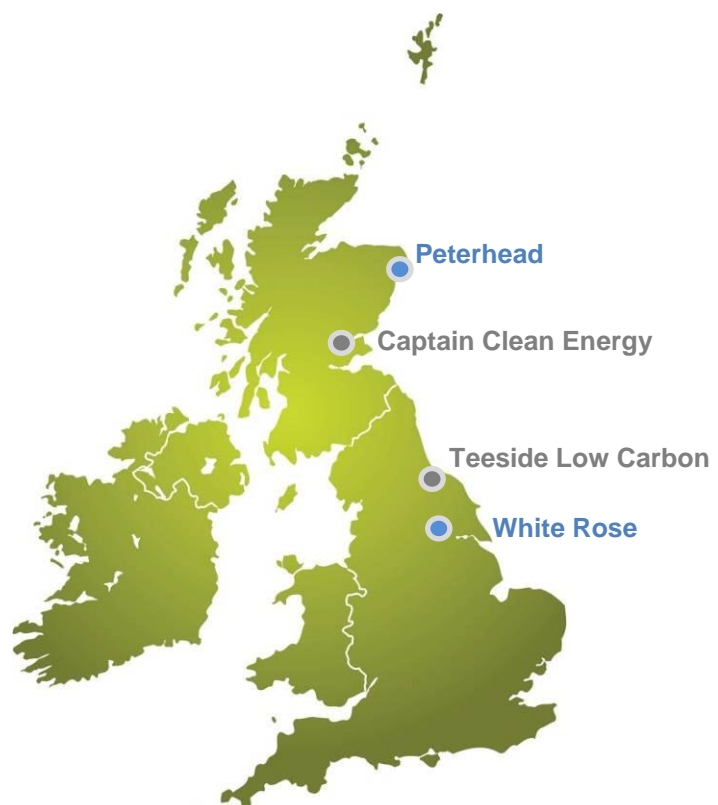


Figure 1: Preferred and reserve bidders in the UK's CCS Competition



An Oxyfuel capture project at a proposed new 304MW fully abated supercritical coal-fired power station on the Drax site in North Yorkshire.

Led by Alstom and involving Drax, BOC and National Grid Carbon.



A 340MW Post-combustion capture retrofitted to part of an existing Combined Cycle Gas Turbine power station at Peterhead, Scotland. Storage offshore in Goldeneye depleted gas field.

Led by Shell and SSE.

These FEED studies are essential for providing the technical and economic certainty necessary to progress to construction, but also for the detailed information they provide to wider industry and academics through our knowledge dissemination programme.

CCS is a complex process involving multi-billion pound integrated investments at geographically dispersed sites both onshore generation and offshore storage. Whilst much of the technology that can be deployed in CCS is commercial, there is less experience integrating this technology into an efficient reliable process, and developing the commercial relationships that underlie the CCS value chain. Bringing forward these large infrastructure projects is a complex process, requiring development of innovative solutions to issues that have prevented widespread deployment to date. The FEED studies will inform final investment decisions, expected in 2015.

The White Rose project has also been put forward for funding through the European Commission's NER300 second call, the only CCS project in Europe to be included in this scheme.

The Captain Clean Energy and Teesside Low Carbon projects, were appointed as reserve bidders in the Competition.

## Electricity Market Reform

Projects that succeed in the competition, and the ones that follow, will benefit from the reform of the electricity market being implemented by the Government through the Electricity Market Reform (EMR) programme.

EMR is a central component of the Energy Bill currently being considered by Parliament. It is designed to address the need to attract unprecedented levels of investment in the UK electricity sector over the coming decades as we replace our ageing energy infrastructure with a diverse mix of low-carbon generation, and meet the expected increases in electricity demand as sectors such as transport and heat are electrified.

It is estimated that up to £110 billion of investment is needed in electricity infrastructure between now and 2020. CCS is expected to be amongst the technologies competing for a share of this investment and could potentially play a significant role in the supply of low carbon electricity in the UK and beyond.

One of the key elements of EMR is the introduction of Feed-in Tariff Contracts for Difference (CfDs). CfDs will provide incentives to bring forward investment in all forms of low carbon generation – including CCS.

Since the summer we have published a suite of documents on EMR for consultation. These provide key detail on the policy

proposals including draft terms of contracts and are available on the DECC website<sup>2</sup>.

The UK is unique in creating a mechanism to provide operational financial support for CCS projects, through CfDs. Whilst this will be used as a funding mechanism for projects within the Competition it will also provide a route to market for early projects that are not part of that Programme. Further details are set out later in this document.

## R&D and Innovation



**Figure 2: CCS Research Facilities – The PACT Carbon Capture Plant in Sheffield**

Research and development in CCS is crucial to increase efficiency, reduce costs and reach the deployment ambitions set by Government and industry.

Based on the experience of other technologies, R&D in CCS could reduce the currently high energy and capital costs

associated with CO<sub>2</sub> capture, as well as transportation and storage costs.

In the Government's view this will be essential if CCS is to be cost competitive with other forms of low carbon generation, and if CCS is to fulfil its potential as the only technology which can to reduce emissions from many industrial sectors. R&D could also bring forward new ground breaking technologies which increase deployment opportunities and competitiveness.

The UK has a world class CCS research base, and across the current spending review the Government and its partners<sup>3</sup> are delivering a £125m CCS R&D programme to support:

- Fundamental research and understanding at our universities and research organisations.
- The development of better, cheaper components and processes.
- Pilot scale projects to bridge the gap between lab-scale research and commercial scale deployment.

In total, around 100 separate projects are being funded through this programme. A full list of these and an overview diagram are available on our website<sup>4</sup>.

The CCS Roadmap is also committed to supporting the establishment of a UK CCS Research Centre<sup>5</sup> (UKCCSRC). The Centre was officially launched in September 2012. It brings together around 200 UK-based academics and provides a national focal point for CCS R&D.

As part of the UK CCS Research Centre, EPSRC and DECC have funded the Pilot-

<sup>2</sup> <https://www.gov.uk/government/consultations/consultation-on-the-draft-electricity-market-reform-delivery>

<sup>3</sup> The Research Councils, Technology Strategy Board and Energy Technologies Institute

<sup>4</sup> <https://www.gov.uk/government/publications/cross-government-carbon-capture-and-storage-r-d-programme-2011-2015-list-of-projects>

<sup>5</sup> <http://www.ukccsrc.ac.uk/>

scale Advanced Capture Technology<sup>6</sup> (PACT) facilities. These facilities are some of the most advanced university research facilities for CCS and combustion technologies in Europe.

### Intervention to address key barriers

The Roadmap recognised that having people with the right skills and supply chains capable of providing the required goods and services will be essential for the widespread deployment of CCS.

We are working with EEF (The Manufacturers' Organisation) and other partners to ensure UK companies are aware of the potential supply chain opportunities from the proposed projects and the future CCS industry. We are planning to hold a series of supply chain events to raise awareness of opportunities following successful signature of FEED contracts in the CCS Competition.

As detailed in the Electricity Market Reform consultation, launched in October 2013, projects seeking a CfD will be required to produce a Government approved supply chain plan before they are eligible to enter the CfD allocation process. This will apply to all low carbon generation projects above a 300MW capacity.

The Roadmap also recognised the importance of facilitative legislation. The UK already has one of the most complete regulatory frameworks for CCS anywhere in the world. An initial review in 2008 identified areas where regulatory cover was incomplete and a programme has been implemented to fill the gaps. We will continue to monitor and address regulatory issues as they emerge. We will also continue to engage on the development of international and European policy, including

any review of the CCS Directive undertaken by the European Commission.

Alongside enabling CCS through EMR, the Government is regulating to provide long term signals about the direction of UK policy. We have introduced a 'Triple Lock' of policies through the National Policy Statements for Energy, the Carbon Price Floor and the Emissions Performance Standard to make clear the Government's position on 'no new coal without CCS' and the future requirements for CCS.

### International Collaboration

The final component of the Roadmap is international collaboration. Our international engagement is focussed on promoting knowledge sharing between projects and countries to help cost reduction and to support the deployment of CCS.

Our commitment to knowledge sharing is best illustrated by the steps we took under our first CCS competition where we made the FEED studies for Longannet and Kingsnorth freely available worldwide to support development of CCS<sup>7</sup>. We remain committed to these principles and have designed the current competition with knowledge transfer at its heart in order to maximise the benefit to the development of the CCS industry. We also welcome and support knowledge sharing by other countries and projects.

The Government is engaging through regional, bilateral and multilateral relationships to collaborate and help overcome the challenges of commercial-scale CCS deployment. We participate in a number of bilateral relationships as well as through international fora such as the Carbon Sequestration Leadership Forum,

<sup>6</sup> <http://www.pact.ac.uk/>

<sup>7</sup> <https://www.gov.uk/uk-carbon-capture-and-storage-government-funding-and-support#ccs-commercialisation-competition>



the North Sea Basin Task Force, the Clean Energy Ministerial and the 4 Kingdoms CCS Initiative; working with countries facing similar challenges to the UK.

We're also engaging with individual countries and supporting international collaboration on R&D. For example in Canada we have supported the UK CCS Research Centre to establish a research exchange and sign a Memorandum of Understanding (MOU) with Sask Power.

Similarly in China Energy and Climate Change Minister Greg Barker recently signed a Joint Statement with the Governor of Guangdong on low carbon cooperation, including CCS. This has been complemented by the creation of an MOU between the UK CCS Research Centre, Guangdong Electric Power Design Institute and the Clean Fossil Energy Development Institute on developing CCS.



Figure 3: Sask Power's Boundary Dam CCS Facility in Saskatchewan, Canada

## CCS Cost Reduction Task Force: Key next steps to support the large scale development of power and industrial CCS in the UK

The Government wants a competitive low carbon energy market providing secure and affordable energy for consumers. Therefore for CCS to fulfil its potential and play a significant role in the supply of secure low carbon electricity it must be able to compete on cost. To help achieve this Charles Hendry, as Energy Minister, convened the CCS Cost Reduction Task Force to advise on how best to reduce the costs of CCS so that projects are financeable and competitive with other low carbon technologies.

The Task Force comprised of 30 members from the engineering, hydrocarbon, finance, project developer and academic sectors, representing a broad spectrum of UK and international organisations with experience in all aspects of CCS. They were tasked with investigating opportunities for cutting costs right across the CCS chain, from generation and capture through to transport in pipelines and storage. In May 2013 the Task Force produced their comprehensive Final Report<sup>8</sup> setting out the opportunities available and providing recommendations for next steps.

The Government welcomes the Task Force's report, which contributes towards our understanding of the measures that will be needed if CCS is to play an important role in meeting the UK's low carbon energy objectives and contribute to growth.

Analysis undertaken by the Task Force has found that UK gas and coal power stations equipped with carbon capture, transport and storage have clear potential to be cost competitive with other forms of low-carbon

power generation, delivering electricity at a levelised cost approaching £100/MWh in the early 2020s

To achieve this outcome, the Task Force recommended seven key steps and a variety of supporting steps for industry and Government. It also recommended the establishment of three leadership groups to ensure their recommendations are implemented. The Government is committed to actively working with these groups as their work develops. Full details of these are available in their report and further information on the actions attributed to Government is set out below.

### CRTF Recommendation #1: Ensure optimal UK CCS transport and storage network configuration

We welcome the creation of a Storage Development Group and the lead role they are expected to play in ensuring that the key actions in this area are implemented. We will continue to engage closely with this Group to address issues and take forward work in this area.

In the Government's view one of the main messages from the work of the Task Force is that for CCS to fulfil its potential there will need to be significant investment in pipeline and storage infrastructure. The Government believes that developing practical steps to address the challenges of attracting such investment and early development of suitable storage sites should be a key issue for the Storage Development Group going forward.

The Government has already introduced a number of measures to help address this problem, including creating a regulatory basis for encouraging the joint development and use of transport networks and storage sites.

<sup>8</sup> <https://www.gov.uk/government/policy-advisory-groups/ccs-cost-reduction-task-force>

Building on this, we specifically welcomed projects with clustering potential to bid in our CCS Commercialisation Competition. For example one of our preferred bids, the White Rose project, is located in the Yorkshire / Humber area with a dense concentration of power plants and industrial emitters, offering potential to develop a cost effective CCS cluster.

To make the most of this potential and to support the work National Grid is already undertaking as part of its EEPF funded activities, the Government is exploring an option to support a FEED study (as part of the White Rose project) for a CO<sub>2</sub> pipeline with capacity in excess of that required for the Competition project alone. The pipeline, a 'Yorkshire / Humber CCS Trunkline', has the potential to support a number of CO<sub>2</sub> emitters through the provision of transportation facilities and access to CO<sub>2</sub> storage.

By its nature, clustering involves bringing together a wide range of parties from across the CCS chain. It is therefore likely to be facilitated by local initiatives, to help interested parties connect with a view to developing projects. The Government has already supported a number of initiatives to encourage local development of the common infrastructure for CCS deployment. We will continue to do so where benefit can be demonstrated. We will discuss this with industry as part of the re-invigorated CCS Development Forum, further details of which are set out later in the document.

The Government is committed to the development of CCS for both the power sector and energy intensive industries. It is the only way for several important industrial sectors to decarbonise and is therefore likely to become critical to their competitiveness in the future. This is why both DECC and BIS are working with industry and academics on a techno-economic study on industrial CCS, further details of which are set out in recommendation seven.

## CRTF Recommendation #2: Incentivise CO<sub>2</sub> EOR to limit emissions and maximise UK hydrocarbon production

CO<sub>2</sub> Enhanced Oil Recovery (EOR), has potential to play an important role in the development of some CCS projects, and also in extending the life of some North Sea fields. EOR could reduce the cost of transport and storage, thereby offsetting the costs of deploying CO<sub>2</sub> capture technologies. The infrastructure laid down for EOR, and the experience gained in injecting CO<sub>2</sub> could also be of benefit to other projects and the wider development of the industry.

EOR has worked successfully in onshore oil fields for many years and there is a growing market for CO<sub>2</sub> to supply CO<sub>2</sub>-EOR projects in the USA and Canada. CCS projects in North America are taking advantage of this demand, with projects such as Kempler County in Mississippi and Boundary Dam in Canada intending to utilise captured CO<sub>2</sub> to drive enhanced recovery projects in nearby oil fields.

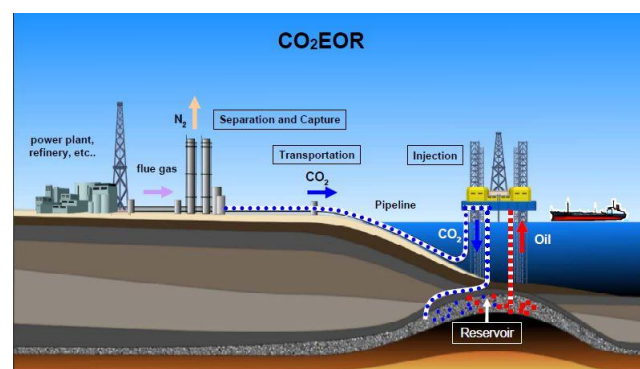


Figure 3: Graphic representation of EOR<sup>9</sup>.

However, it is not yet clear to what extent the North American experience can be replicated in the UK. There are significant differences between the US experience and potential application in the UK such as the

<sup>9</sup> Graphic representation of EOR created for ADNOC and JOGMEC CO<sub>2</sub> EOR study in lower Zalew oil field.

onshore location of US sites compared to the application offshore in the UK.

To further investigate this, DECC has undertaken a comprehensive mapping exercise on a field-by-field basis to develop an estimate of the remaining EOR potential in the North Sea. This has identified that CO<sub>2</sub> and related miscible gas injection EOR potential in the North Sea is substantial. It is also encouraging that there is an established track record of success in similar EOR projects like Magnus and Ula (Norway).

DECC is exploring with industry the extent to which CO<sub>2</sub>-EOR could play a significant role in the UK's CCS Strategy and help extend the life of the North Sea. DECC held a Miscible Gas EOR workshop in early October with 40 invited experts from North Sea oil & gas operators, CCS Developers and other key stakeholders to explore the remaining CO<sub>2</sub>-EOR potential of the North Sea. We will use the outputs from the workshop to shape a joint industry - Government work programme to evaluate these North Sea CO<sub>2</sub>-EOR opportunities in more detail.



**Figure 4: BP's Magnus Platform - a major gas injection EOR project in the North Sea.**

## Wood Review

The UK's oil and gas industry is of national importance. It plays a vital part in our economic life and makes a substantial contribution to our energy security. While investment levels are rising and the near-term prospects for the UK Continental Shelf (UKCS) are strong, it is one of the most mature offshore basins in the world, and therefore faces unprecedented challenges that require new thinking.

The Secretary of State has invited Sir Ian Wood to lead a review of these challenges. Sir Ian will work with leaders across industry, Government and elsewhere to produce robust analysis, conclusions and recommendations for improving future economic recovery of UKCS oil and gas, including how issues such as Enhanced Oil Recovery can best be driven through to early implementation. While the Review will not make recommendations on taxation, its conclusions may nevertheless be drawn upon in future tax policy considerations by HM Treasury.

We expect emerging conclusions from the review to be published in the autumn and the final report and recommendations to be published in early 2014.

### **CRTF Recommendation #3: Ensure funding mechanisms are fit for purpose**

The Government accepts that if CCS is to be developed and deployed then funding and market mechanisms must be fit for purpose. This is particularly important for the second phase of CCS projects we want to bring forward, as set out under Recommendation five.

In creating a framework that encourages the market to bring forward investment in low carbon technologies, the Government must also ensure it does so in a way that benefits the economy and offers value for money.

We accept that the first commercial scale CCS projects will require significant capital support to offset the risk these plants will not operate as anticipated, as well as revenue support to offset the additional cost of CCS compared with alternatives. We also recognise the importance for industry and investors of a pathway from these first CCS projects to full commercialisation, and that support may be required beyond the Commercialisation Programme to help mature the technology to the point where it can compete with other low carbon alternatives.

Our approach to supporting the development of CCS reflects this strategy, as set out under recommendation five.

The CCS Commercialisation Programme expects to make available up to £1bn of capital grant plus revenue support through a CfD to bring forward the UK's first commercial scale full chain CCS projects.

CfDs are funded through the Levy Control Framework (LCF), which has a budget of £3bn today, increasing annually to £7.6bn in 2020 – its last budgeted year. A draft Delivery Plan setting out details was published in July 2013 for consultation. This describes possible scenarios for the deployment of low carbon technologies to 2030, which would in-turn enable the Government to meet its objectives of:

- Ensuring a secure electricity supply, by incentivising a broad range of generation technologies and demand side approaches;
- Ensuring sufficient investment in sustainable low-carbon technologies to put us on a path consistent with our EU 2020 renewables targets and our longer term target of reducing carbon emissions by 80% by 2050;
- Maximising benefits and minimising costs.

Each of those scenarios envisages a role for CCS, with deployment of up to 12GW by 2030 where CCS costs and deployment circumstances are favourable.

We are progressing the following areas of work in order to encourage development of these 'phase 2' projects:

- During the remainder of this year, we will engage further with the wider industry in determining the allocation arrangements for CCS;
- Documents relating to EMR published in December 2011, set out a process – often referred to as Final Investment Decision enabling (FIDe) – for projects which needed to take such decisions in advance of the CfD mechanism being implemented. We are in active discussions with early stage CCS developers who qualified under this process the terms needed to bring their projects forward.
- We will also work with CCS project developers outside of these specific arrangements in order to encourage new projects to come forward for investment. The nature of those discussions will be tailored to each project's requirements, including its commercial and technical maturity.

These discussions will be held in good faith but with no actual or implied commitment at this stage from either DECC or the Developers.



**Figure 5: Ferrybridge CCS Pilot**

#### **CRTF Recommendation #4: Create bankable contracts**

One of the main recommendations in this section concerns the design of the CCS CfD. Work in hand to address this is described in the previous section. It is also possible that early stage projects will set a precedent for the commercial relationships between the companies in each part of the chain, and also between the project and Government, that will need to develop if the CCS value chain is to be implemented effectively. The Government has a limited role in establishing these models, but we will ensure that the commercial models used by consortia supported through the Commercialisation Programme are made publicly available so that others can build on these.

There are a number of commercial challenges to developing a functioning CCS chain at scale. This is particularly the case for early projects where there are risks and uncertainties. We recognise it is challenging for the market to establish this alone. This is one of the reasons why we developed the CCS Commercialisation Programme and will work closely with bidders to develop and demonstrate successful contracts between the various elements of the CCS chain for

the benefit of the wider industry and finance community.

We welcome the establishment of the Commercial Development Group and the research it has committed to undertake in this area. We will closely engage with the group and intend to share relevant experience wherever possible from the CCS Competition and related FEED studies.

DECC is also investigating other ways we can help, for example drawing out best practice from abroad through our programme of international engagement.

#### **CRTF Recommendation #5: Create a vision for CCS**

Although all parts of the CCS chain have been tested elsewhere, it is the full chain - and the commercial arrangements around it - which need further development. This is the focus of the Government's Commercialisation Programme.

The potential for CCS is clear. Recent DECC scenarios<sup>10</sup> show that up to 12GW of CCS could be deployed by 2030 and modelling for the Gas Generation Strategy suggests CCS could contribute up to 40GW by 2050. The CCS industry has stated an appetite for even higher deployment.

We anticipate that deployment could come forward in a series of phases:

- (i) The first phase of CCS projects in the UK are the first-of-a-kind projects being taken forward under the Commercialisation Programme. In recognition of the challenges these initial projects face, the Government will provide both capital support, and operational support through

<sup>10</sup> Available from:  
<https://www.gov.uk/government/consultations/consultation-on-the-draft-electricity-market-reform-delivery>

CfDs which will also enable developers to make a return by which to recoup their portion of capital investment. These projects will be critical in establishing CCS infrastructure in the UK and significantly reducing the risks and barriers faced by subsequent projects.

(ii) The second phase of CCS projects, possibly developed on a similar timeline, as well as subsequent to, the Commercialisation Programme projects, may still face some of the challenges of early projects. These projects may include capturing CO<sub>2</sub> emissions from either power stations or industrial facilities. While we expect that they may be able to benefit from infrastructure established under the Commercialisation Programme, or enhanced oil recovery to strengthen their business case, they may still require support from Government until the technology is mature enough to compete with other low carbon alternatives.

Our approach to providing support to these early projects includes our electricity market reforms as set out in recommendation three. We are also working with industry to investigate the opportunities EOR may present as set out in recommendation two, and looking at CCS on emissions from industrial sources, as set out in recommendation seven.

(iii) A third phase of projects will complete the transition to fully commercial, cost-competitive CCS in the 2020s.

Our policies are designed to help bring CCS to this third phase - the point where it can compete with other low carbon technologies. Our objective is a competitive low carbon energy market, with different technologies competing on price and providing the best value for money for the consumer. That's why the work of the Cost Reduction Task Force, and the newly created leadership groups is so important.

The Government is keen to work with these groups, and the wider industry to further

develop this vision for CCS deployment in the UK.

### **CRTF Recommendation #6: Promote characterisation of storage**

The UK has some of the best storage potential in the world, as shown by the world leading research into mapping that resource. 'CO<sub>2</sub> Stored'<sup>11</sup> is a new storage database and mapping system covering nearly 600 offshore UK storage sites with store-by-store data, launched by the Crown Estate and British Geological Survey in June 2013. The UK is the first country with a comprehensive assessment, database and online map of national offshore CO<sub>2</sub> storage capacity – a crucial first step to informing CCS investment decisions and wider deployment in the UK. The database is an output from a 3 year, £4m study by the Energy Technologies Institute which showed the UK has offshore storage capacity potential of c70Gt, in both depleted oil and gas reservoirs and saline formations for future CCS deployment.

The Aquifer Appraisal Project undertaken by National Grid and the Energy Technology Institute (ETI) builds on this by focusing on saline aquifer capacity. Supported by funding from the European Commission, National Grid successfully completed test drilling of a storage site 65 kilometres off the Yorkshire coast in August 2013 – a major milestone in delivering a storage solution for CCS. Early indications are that the undersea site is viable for carbon dioxide storage and will be able to hold around 200 million tonnes permanently. This is equivalent to taking ten million cars off the road for 10 years. The test drilling has provided additional data to confirm the volume that the site can permanently hold and the rate that CO<sub>2</sub> can be injected.

<sup>11</sup> <http://www.co2stored.co.uk/>

We agree with the Task Force's main conclusion in this area - that if storage is not to become a significant impediment to the development of CCS then investment in the characterisation of sites is necessary well in anticipation of its use. In the Government's view this should be an important part of the Storage Developments Group's work going forward and we look forward to receiving its detailed recommendations in this area in due course.

A joint Industry-Government steering group has been established to guide this work, which expected to be completed in spring 2014.

### **CRTF Recommendation #7: Create policy and financing regimes for industrial CCS**

Applying CCS to industrial sources of CO<sub>2</sub> offers the potential to reduce emissions from energy intensive industries, and at the same time make most efficient use of the infrastructure being laid down by CCS in the power sector.

CCS is currently the only large-scale mitigation option available to make deep reductions in emissions from industrial sectors such as cement, iron and steel, chemicals and refining. Industrial emissions represent one-fifth of total global CO<sub>2</sub> emissions and this is projected to grow over the coming decades. The IEA estimate that almost half (45%) of all emissions reductions will need to come from industrial applications.

CCS on industrial sources is less developed than on power sources so the Government has committed in the recent DECC publication 'The Future of heating: meeting the challenge'<sup>12</sup> to a techno-economic study to help better understand the necessary industrial carbon capture technologies and costs.

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<sup>12</sup> <https://www.gov.uk/government/publications/the-future-of-heating-meeting-the-challenge>



## CCS Cost Reduction Task Force: Recommended supporting actions

In addition to the Key Next Steps, the Task Force also identified a range of supporting steps which would help mitigate risks and underpin successful development of follow-on and future CCS projects.

Many of these supporting steps are for industry, but there are areas where Government can help take actions forward.

### Continue R&D funding for future technologies

As set out above, the Government is committed to supporting research, development and innovation in CCS. Nearly 100 projects are being supported under the Government's current four year (2011-2015) £125m programme and we have established the UK CCS Research Centre. Typically funding has been awarded to projects which came forward to open calls for proposals, thereby reflecting the areas deemed important by academia and industry.

The 2012 CCS Roadmap contained a table of research needs, and we expect the Advanced Power Generating Technology Forum (APGTF) in consultation with the UKCCS Research Centre, to publish an updated analysis later in the year. We will consider this when developing future policy in this area.

### Develop spatial planning and consenting regimes for the CCS industry

This action notes that 'development of CCS could benefit from a planning and consenting framework that has an assumption that CCS will be needed, rather than that CCS might be needed'.

The National Policy Statements for energy infrastructure<sup>13</sup> (NPSs) set out national policy against which proposals for major energy projects will be assessed by the Major Applications and Plans Directorate (MAP) within the Planning Inspectorate who make recommendations on those proposals to the Secretary of State.

The NPSs contain a clear assumption that energy infrastructure (including CCS) is needed and the Overarching National Statement for Energy - EN1 demonstrates the need case for the infrastructure and the urgency.

EN1 also advises that given the level and urgency of need for energy infrastructure, the Planning Inspectorate should give substantial weight to the contribution which projects would make towards satisfying this need when considering applications for energy Nationally Significant Infrastructure Projects (NSIPs).



We believe the NPSs are functioning well at present, facilitating the prompt determination of NSIP applications. However, the NPSs will be subject to review by the Secretary of State in order to ensure that they remain appropriate. Information on the review process is set out in documents available on the Government's website<sup>14</sup>. Any review

<sup>13</sup> <https://www.gov.uk/consents-and-planning-applications-for-national-energy-infrastructure-projects>

<sup>14</sup> Annex A, Paragraphs 10-12:  
[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/7989/091109-Letter\\_to\\_Chief\\_PlanningOfficers\\_-\\_National\\_Policy\\_Statements.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/7989/091109-Letter_to_Chief_PlanningOfficers_-_National_Policy_Statements.pdf)

would take account of developments in the CCS industry and lessons learned from other industries.

The projects taken forward as part of the CCS Competition will demonstrate the planning and consenting process in practice for CCS projects, reducing risk and providing a useful example for subsequent projects. We will also investigate the development of a guide for prospective projects, drawing on the experiences of the Competition projects.

### **The value of CCS flexibility to the power sector**

We share the Task Force's interest in the extent and value of flexibility that CCS might bring. Flexibility could be of particular value in a future low carbon energy mix with large proportions of intermittent or inflexible generation.

We believe further research on this could be important for both the UK and also international CCS development. Therefore we have proposed a study on this topic to the IEAGHG programme which they have agreed to take forward.

### **Facilitate potential CO<sub>2</sub> injection into multiple stores**

This action is focussed on considering how to ensure contracts and licences can be structured flexibly enough to allow CO<sub>2</sub> to be injected into alternative stores by agreement between store owners.

The Government believes this issue is primarily a matter for resolution between those parties directly involved in a CCS project. However we are keen that Government regulations or support do not stand in the way of injecting carbon dioxide into multiple storage sites provided this can be done safely and securely. We are not aware of any such problems at the moment,

but we are willing to work with the industry to resolve any specific concerns.

### **Increase scale and generation of capture plant**

This action recognises that constraints and limitations on plant size can restrict developers' ability to make the most economic choices for their site. The Government agrees with the importance of allowing developers to make the most appropriate choices for their sites and does not intend to introduce any constraints on size of plant. Similarly, the Government has adopted a technology and fuel neutral approach in its CCS policy, leaving the choice to the developers who are best placed to make these decisions.

### **Continue to develop a UK CCS policy and regulatory framework**

The Government is committed to providing a facilitative environment for projects to develop. Together with the Carbon Capture and Storage Association (CCSA), we have conducted a CCS regulatory and consents mapping exercise to identify any impediments to the development of projects. These have been dealt with as they arise such as amending the Petroleum Act to facilitate the reuse of existing infrastructure, but for a new purpose - CCS.

The projects taken forward as part of the Commercialisation Programme will also test the policy and regulatory framework and we will address any issues that arise as part of this process.

We will continue to engage with industry and the finance community to ensure the future development of the policy and regulatory regime is suitable to deliver CCS projects. We also expect to fully engage with any review of the European CCS Directive.

## Industry engagement

The Cost Reduction Task Force recommended the creation of three leadership groups which would take forward the recommendations and report to industry and Government on progress. These were:

- UK CO<sub>2</sub> Storage Development Group
- UK CCS Commercial Development Group
- UK CCS Knowledge Transfer Network

The Government welcomes the creation of these groups and the leadership role industry is taking in these areas.

The CCS Cost Reduction Task Force was an excellent example of Industry and Government working together and we intend to build on this positive experience by renewing our formal stakeholder engagement forum, which had been paused during the commercially and legally sensitive early stages of the Commercialisation Programme and Competition. Drawing on best practice from industrial engagement across Government, and striving to maintain the momentum and engagement on the part of industry created by the CRTF, the new forum will be smaller, more focussed and will be co-chaired with industry.

The Energy Minister, Michael Fallon, has asked Michael Gibbons OBE, Chair of the CCSA, to be the industry Co-Chair in recognition of his extensive experience in working both with the CCS industry and with Government.

The forum will focus on delivery - driving forward actions and resolving issues that the leadership groups bring to the table. But it will also have a strategic function, allowing Government and Industry to discuss the development of the wider industry and longer term planning.

We believe the forum can make a valuable contribution to the achievement of our shared objective – a strong and competitive CCS industry.

### Photographs:

Front cover - New PACT CCS research facilities. <http://www.pact.ac.uk/>

Back cover - The Energy Endeavour rig which has completed successful test drilling in the North Sea for National Grid <http://www.nationalgrid.com/>



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