



*Carbon Capture &  
Storage Association*

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## **CCSA Policy Brief: Retention of Opportunities to Develop CO<sub>2</sub> Transport and Storage Infrastructure**

### Executive Summary

There is a significant, low-cost opportunity to deliver additional value for money from the recently-cancelled CCS Commercialisation Programme. This paper considers the investments made to date in a number of UK CCS 'assets' – including those developed as part of the UK CCS Competition – and recommends that a series of actions are taken to ensure that the short-term future of those assets is secured to create opportunities for the future.

Based on a high-level analysis of the costs and benefits of retaining oil and gas infrastructure at the Goldeneye depleted gas field, the Feeder 10 pipeline and by looking at the current status of the proposed White Rose project infrastructure, the paper recommends that:

1. DECC conducts a cost-benefit analysis (CBA) of the potential short-term ownership models presented in this paper. This should consider all possible sources of public and non-public finance to cover the costs of retaining infrastructure.
2. DECC and the OGA jointly commissions a CBA of delaying decommissioning versus installation of new facilities (e.g. subsea) at Goldeneye, including an assessment of the likely cost and timing implications this could have for projects currently in development, e.g. at Teesside, the Caledonia Clean Energy Project at Grangemouth and the Sargas Power project at Don Valley. In addition, DECC and the OGA should work with industry to assess the readiness of prospective CCS projects to establish how long decommissioning would need to be delayed in order for front-running projects to make use of existing infrastructure.
3. The Secretary of State for Energy and Climate Change should grant the Development Consent Order (DCO) for the proposed White Rose onshore pipeline, removing any obligations for the immediate purchase of land and pipeline easements but retaining the ability for the developer to purchase this land and pipeline easements in the event that the Don Valley and any other relevant project materialises in the life of the DCO.
4. DECC should take the lead in initiating discussions between the CCS industry, the Crown Estate, the OGA and the Pipeline Works Authority to begin identifying potential onshore-offshore 'gateways' for future CO<sub>2</sub> pipelines and supportive framework to secure rights.

### Introduction

The decision to withdraw up to £1 billion of funding for the CCS Competition at the 2015 Spending Review brought to a close a long process of project selection and design, engineering studies (FEED) and commercial negotiations between industry and

Government. The process had been ongoing since April 2012 for the most-recent Competition and since 2008 for previous competitions.

The two preferred bidders in the most-recent Competition – the White Rose and Peterhead projects – were designed to be operating by the early 2020s. Their Transport and Storage (T&S) assets would be sized to allow so-called ‘Phase 2’ projects to come online and use those assets in the mid 2020s, based on CCS CfDs but without further capital grants from the Government. These Phase 2 projects were expected to be able to compete on a level playing field in the market for CfDs against other low carbon technologies such as nuclear and offshore wind.

The Peterhead project planned to repurpose existing infrastructure: to capture CO<sub>2</sub> from one unit of the existing Peterhead Power Station, use the existing Goldeneye depleted gas field, including an offshore pipeline, platform and wells. The White Rose project would have put in place an oversized CO<sub>2</sub> pipeline (subject to final Secretary of State planning approval) to access a saline aquifer store in CO<sub>2</sub> Storage Licence CS001 of the Southern North Sea called ‘Endurance’. The previous CCS Competition (2008-2011) completed FEED on the reuse of the existing Feeder10 natural gas pipeline system for CO<sub>2</sub> transportation from Longannet power station up to St. Fergus and the existing offshore pipeline to Goldeneye, including the existing platform and wells.

With the decision now taken not to proceed with either of the Competition projects, there is a real risk that the investments made in CO<sub>2</sub> transport and storage infrastructure associated with these projects will be lost to future UK CCS projects. This would not only be a waste of public and private funds on project development, it would also further delay deployment of CCS in the UK, potentially costing UK energy consumers an additional £1-2 billion per annum during the 2020s<sup>1</sup>.

Investments made to date in project development have, to a certain extent, helped to de-risk development of CCS projects based on the planned Goldeneye and Endurance stores and associated pipeline routes. In order to retain the option of economic, commercial-scale CCS deployment it is important for Government to recognise that existing infrastructure assets could be a key enabler in realising low-cost CCS projects. This paper sets out a series of recommendations and potential solutions for retaining the option on assets developed with public investment support whilst a new approach to CCS is developed by Government.

### The case for action

Industry and Government have, to date, invested hundreds of millions of pounds in developing commercial scale CCS projects and conducting Front End Engineering and Design (FEED) studies under Government-led competitions, whilst also utilising European funding to good effect. These competitions have aimed to enable investment in a full-chain CCS project, i.e. projects which capture CO<sub>2</sub> from a power station, transport that CO<sub>2</sub> via a pipeline and finally store the CO<sub>2</sub> offshore in deep geological formations in the UK Continental Shelf.

Although the Government decided ultimately not to fund either of the recent Competition projects, the FEED studies conducted in relation to CCS infrastructure – i.e. CO<sub>2</sub> transport and storage aspects – have shown that significant opportunities for other CCS projects could still exist. Whilst the highly favourable geology of the North Sea is not going to change, some of these infrastructure opportunities are time-limited in nature and if not taken, could set CCS back by 5 to 10 years.

- **Goldeneye platform, wells and pipeline.** The depleted Goldeneye gas field is underlain by the Captain Aquifer, 105km off the coast of Scotland, connected by the

hydrocarbon free and CO<sub>2</sub> compatible 20" Goldeneye Pipeline. The Goldeneye Reservoir is part of the best studied and suitable formations for CO<sub>2</sub> storage in the North Sea. According to the 2015 SCCS CO<sub>2</sub>MultiStore Joint Industry Project, at least 360 million tonnes of CO<sub>2</sub> captured over the coming 35 years could be permanently stored using two injection sites in 1/6<sup>th</sup> of the Captain Sandstone. Confidence in the planned operation of two or more injection sites in a storage formation is greatly increased by the use of existing information, knowledge and data acquired during hydrocarbon exploitation. Goldeneye, operated by Shell on behalf of a joint venture consortium, produced natural gas for a relatively short period, from 2004 to 2011, due to the excellent quality of the reservoir. Shell has previously said that if the CCS project did not go ahead, the Goldeneye Operator and owners would expect to decommission all of the Goldeneye facilities. If the assets are retained, and in addition to maintaining the Goldeneye assets for future CCS projects, the possibility of low rate CO<sub>2</sub> injection (pilot testing) could be investigated using existing CO<sub>2</sub> streams in the St. Fergus area.

- **Feeder 10 pipeline.** A study conducted by Element Energy in 2014 for Scottish Enterprise concluded that "Feeder 10 has been fully validated through extensive FEED study, for capacity up to 2.5 Mt/yr transport of CO<sub>2</sub> from Avonbridge to St. Fergus, with a predicted capital cost of £77m to make the pipeline fit for transporting gas phase CO<sub>2</sub>. The existing pipeline should be capable of supporting throughput up to 7 MtCO<sub>2</sub>/yr with modest intermediate boosting, and up to 10 MtCO<sub>2</sub>/yr if significant boosting capacity is added." The Caledonia Clean Energy Project currently being supported by the UK and Scottish Governments proposes to use the Feeder 10 pipeline, which over 70% of Scotland's CO<sub>2</sub> emitters are within 20km of.
- **Endurance (5/42) offshore store.** The Endurance store in the Southern North Sea has been characterised and appraised as part of the Don Valley Power Project under the European Energy Programme for Recovery (EPR) European funding programme. The CO<sub>2</sub>Stored programme has estimated that Endurance has a P50 capacity of at least 450 MtCO<sub>2</sub>. In total three wells have been drilled in the aquifer with the last well drilled in 2013 to gather samples and data for CO<sub>2</sub> storage appraisal. Seismic and well data from the surrounding area have also been accessed to support the selection of Endurance and CO<sub>2</sub> storage appraisal. New facilities would need to be developed as part of any future project.

#### Considerations relevant to the retention of CCS infrastructure assets

Retention of existing infrastructure to provide a CCS option will not happen without (a) Government intervention, and (b) the current owners of infrastructure assets being appropriately compensated for any changes in costs, liabilities, tax allowance etc. that they may incur if asked to prolong the life of the infrastructure beyond its optimum decommissioning time.

In the absence of an economic business case for CO<sub>2</sub> storage and a clear Government signal or policy on the future market for CCS in the UK, it is unlikely that any private sector developer would be willing to make the necessary anticipatory investments in CCS infrastructure. Whilst information such as seismic surveys, core samples and previous production history could retain its value into the future, existing physical infrastructure at depleted oil and gas fields, e.g. at Goldeneye, is likely to be decommissioned in order to minimise any ongoing risks and costs associated with ownership and maintenance.

In the case of other assets, including Feeder 10 and the Endurance store, there appears to be no immediate risk of decommissioning or abandonment that could significantly constrain a future CCS option. Despite this, there are clear interventions that Government could make now, at minimal cost, to help maximise opportunities for future CCS projects. Other relevant

assets worthy of further consideration could include the BG Atlantic Cromarty pipeline and the BP Miller field.

### *Goldeneye facilities*

Whilst there is no approved decommissioning programme for the Goldeneye field it is widely recognised that the facilities could be decommissioned, and the wells abandoned as a result of UK oil and gas regulation, within the next 12 to 24 months. Given the impending decision on the future of Goldeneye, there is a need to examine the costs and benefits of retaining its facilities for future CCS projects and what course of action is best for UK tax payers. If a clear case exists for retaining and/or developing the Goldeneye infrastructure in the short term, a number of key issues will need to be addressed, including:

- The need to reach a commercially agreeable solution with all Goldeneye JV partners, preferably that is at least as attractive as the near term abandonment route.
- Anticipated lifespan of the platform / wells / pipeline.
- Cover for the ongoing facilities maintenance costs, estimated to be in the region of £5 million p.a.
- Ongoing risks and liabilities associated with ownership of the asset, e.g. each manned visit to a platform represents one of the most significant risks associated with any offshore activity.
- Any differential between the costs of decommissioning today versus costs of decommissioning in the future, for example, any increase in rig rates between current and future decommissioning should the asset not be used for CCS.
- Any tax implications arising from any different ownership models.
- Consideration of the costs and benefits of accessing the reservoir without using the existing facilities.

### *Endurance store and Yorkshire & Humber CO<sub>2</sub> pipeline route*

Through the development work conducted as part of the Don Valley and White Rose projects a collection of data, information and understanding has been created that will be relevant to future CCS projects should they emerge. This includes, for example, data interpretation relating to the production history from neighbouring oil and gas facilities, from the 3 wells and the comprehensive regional information (including seismic data) that is available.

It would be beneficial to the future development of the Endurance store for OGA to review and give an opinion on the storage permit application provided during the White Rose project, this would mitigate some or all of the cost associated with any future permit submission and the significant time involved.

There is currently no physical infrastructure in place at the Endurance store or along the proposed pipeline route that requires immediate investment but there are, however, risks relating to the investment made in developing the proposed onshore CO<sub>2</sub> pipeline route.

In October 2015 the DECC Secretary of State took the decision to delay the award of the Development Consent Order (DCO) for the onshore pipeline associated with the White Rose project. It is thought that an investment of more than £10 million has been made in preparing and applying for the relevant consents for the onshore pipeline over a period of nearly 4 years. This entailed an extended period of engagement with local communities, negotiations with land owners and established a significant amount of public acceptance and goodwill towards the project. If the DCO is not granted by the Secretary of State for DECC later this year not only will more than £10 million of investment be lost – which would need to be replicated by any future project – there is the real threat that the current EU EPR grant funding for the Don Valley project will be withdrawn without a positive outlook on CFD

availability. There is also an additional risk that the goodwill of landowners and local communities will be lost that future projects may not be able to rebuild. The CCSA recommends in this context that the DCO for the National Grid CO<sub>2</sub> pipeline is granted, enabling the purchase of land and the pipeline easements required if the Don Valley project reaches FID<sup>1</sup> or another project materialises in the region in future, but not obliging the developer to purchase land and easements in the short term as would normally be expected.

An additional issue relevant to the White Rose pipeline route, but also applicable to wider future CCS deployment, is access to ‘gateways’ for CO<sub>2</sub> pipelines from onshore to offshore and congestion around sufficient land development corridors. In order to create certainty around the location of future pipeline ‘gateways’, and to ensure that near term developments do not create additional challenges for future CCS projects whilst maximising the potential of the land area, the Crown Estate should be further encouraged to work with the CCS industry and Government to identify areas where CO<sub>2</sub> pipelines can be developed and transition offshore, and to develop standard terms that support early deployment.

### *Feeder 10 pipeline*

Feeder 10 is considered to have sufficient remaining asset life to support the development of a number of CCS projects in Scotland. The pipeline is currently being used for the transport of natural gas from St Fergus.

**Table 1. Assessing the window of opportunity for relevant assets**

<b>Name</b>	<b>Assets</b>	<b>Window of opportunity</b>
Goldeneye facilities	<ul style="list-style-type: none"> <li>• Platform</li> <li>• Wells</li> <li>• Offshore Pipeline</li> <li>• Data (e.g. production history, core samples, etc.)</li> </ul>	Expected to be decommissioned within 12-24 months if no CCS option progressed
Feeder 10 pipeline	<ul style="list-style-type: none"> <li>• Onshore Pipeline</li> <li>• FEED</li> </ul>	Currently used as a natural gas pipeline. No prospect of immediate decommissioning
Endurance store	<ul style="list-style-type: none"> <li>• Data</li> <li>• FEED</li> </ul>	Carbon Sentinel Ltd. (subsidiary of National Grid Carbon) has the Agreement for Lease and Licence
White Rose pipeline investments	<ul style="list-style-type: none"> <li>• FEED</li> <li>• Consents</li> <li>• Public goodwill</li> </ul>	Decision due on Development Consent Order (DCO) by 19 <sup>th</sup> May 2016.

### Short-term ownership of assets

With commercial pressures driving the decommissioning of existing assets, and with significant uncertainty surrounding the future of CCS policy in the UK, the CCSA believes that consideration needs to be given in the short term to retaining the option of progressing projects that utilise existing infrastructure proposals and/or to maximise cost efficiencies from previous investments made under UK CCS competitions.

A key issue for the retention of existing infrastructure is the ongoing costs and risks associated with ownership of those assets. For this reason, an initial four ownership models

<sup>1</sup> Sargas Power is developing the Don Valley project which is in advanced stage of development. Sargas Power’s cooperation with National Grid will ensure that the DCO infrastructure will not become a stranded asset and will deliver value for money by effectively managing and sequestering future sources of captured CO<sub>2</sub> in the Humber region.

were considered for managing these costs, ownership and risks whilst new CCS policy is developed in the UK:

1. Public ownership with a contracted private sector service provider
2. Continuation of current private ownership with public funding
3. Third party purchase by an entity with a strategic interest in retention of the infrastructure
4. Development of a Public Private Partnership, e.g. Public ownership but with private sector investment

<b>Option 1</b>	<i>Public Ownership, Private Service Provider</i>	
<b>Description</b>	<i>Government purchases assets and contracts a service provider to conduct any necessary works. In the short term this is likely to be maintenance and minor modifications but in the longer term this could extend to injection and operation of the store.</i>	
	<b>Advantages</b>	<b>Disadvantages</b>
	<ul style="list-style-type: none"> <li>• Infrastructure could be transferred into public ownership subject to the necessary commercial negotiations</li> <li>• Projects have confidence in the medium-term availability of assets due to public ownership</li> <li>• Maintenance is assured through competitive procurement for service contracts</li> <li>• Relatively simple public procurement exercise</li> </ul>	<ul style="list-style-type: none"> <li>• Requires public funding to cover maintenance</li> <li>• Require Government taking on residual and ongoing risks associated with existing facilities</li> <li>• Government purchase of offshore assets could constitute State aid and there is therefore a need to explore the full implications of this model.</li> </ul>

<b>Option 2</b>	<i>Continuation of Current Private Ownership with Public Funding</i>	
<b>Description</b>	<i>Current owners of the infrastructure delay decommissioning of the wells and facilities and are compensated by Government for all maintenance and modification costs. Any cost increases between now and future decommissioning would necessarily be covered by Government.</i>	
	<b>Advantages</b>	<b>Disadvantages</b>
	<ul style="list-style-type: none"> <li>• Helps to build/retain private sector interest in CO<sub>2</sub> storage as a potential commercial proposition</li> <li>• Current Owner/Operator is compensated appropriately and not commercially disadvantaged at all</li> </ul>	<ul style="list-style-type: none"> <li>• As Option 1, requires public funding to cover maintenance and acceptance on the part of Government to take on-board a limited amount of risk.</li> <li>• Government investment in offshore assets could constitute State aid and, as above, there is therefore a need to whether this presents a barrier to this model.</li> <li>• Would require a deeper analysis of any procurement/state aid issues</li> </ul>

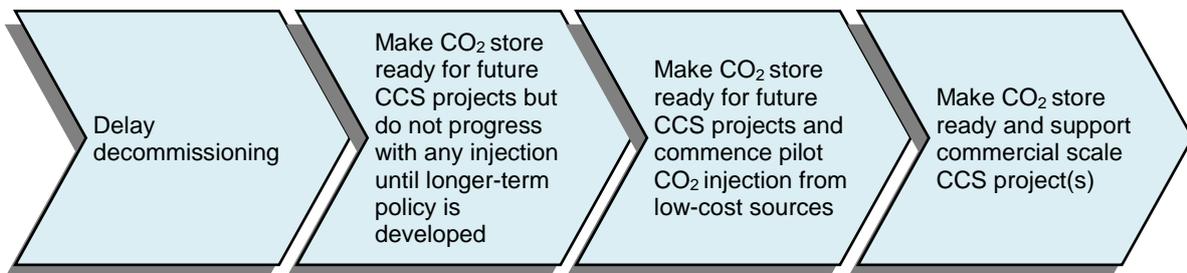
<b>Option 3</b>	<i>Third party purchase</i>	
<b>Description</b>	<i>A third party with strategic interest in CCS but not a commercial entity, e.g. the Green Investment Bank, purchases the assets and takes on all ongoing costs and liabilities with a view to the future CCS commercial opportunity.</i>	
	<b>Advantages</b>	<b>Disadvantages</b>
	<ul style="list-style-type: none"> <li>• Would require no public funding</li> </ul>	<ul style="list-style-type: none"> <li>• Would require longer-term</li> </ul>

	<ul style="list-style-type: none"> <li>• Minimal Government intervention</li> <li>• Relatively simple commercial transaction</li> </ul>	<p>strategic thinking from the third party and a willingness to accept significant costs/risks without any foresight of future revenues.</p> <ul style="list-style-type: none"> <li>• Likely to be major difficulties in attracting interest from third parties</li> </ul>
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<b>Option 4</b>	<b>Public Private Partnership (Public Ownership, Private Investment)</b>	
<b>Description</b>	<i>Assets are transferred into public ownership and Government takes on all risks associated with that. Any necessary investments in maintenance and minor modifications are paid for by the private sector in return for first refusal on operating the store in the future. Private investment would need to be incentivised, e.g. by making investments in Government-owned stores tax deductible.</i>	
	<b>Advantages</b>	<b>Disadvantages</b>
	<ul style="list-style-type: none"> <li>• Ensures assets are not lost and necessary investments are made in infrastructure preservation/modification.</li> <li>• Current Owner/Operator is compensated appropriately and not commercially disadvantaged at all</li> <li>• Requires very limited public capital investment</li> <li>• Projects have confidence in the medium-term availability of assets due to public ownership</li> <li>• Creates an incentive for private investment in assets.</li> </ul>	<ul style="list-style-type: none"> <li>• Requires all risks associated with ownership and decommissioning to be taken on by the Government.</li> <li>• Presumption that future CO<sub>2</sub> storage liabilities would also be owned/shared by Government.</li> <li>• Could entail complex procurement process.</li> </ul>

Potential policy and funding options

Building on the potential short-term ownership options presented above, four additional policy options have been assessed below that could be considered as part of a longer term approach to the development of CO<sub>2</sub> storage sites in the UK. Whilst the first of these scenarios (“Delay Decommissioning”) is only considered in the context of the Goldeneye facilities, the other three options could be progressed at either Goldeneye or Endurance, or potentially any of the other sites identified as part of the ongoing DECC/ETI Strategic CO<sub>2</sub> Storage Appraisal Study<sup>ii</sup>.



In order to fully understand the value proposition offered by existing infrastructure and investments made to date, Government should rapidly undertake a series of analyses to establish the scale of the opportunity on offer and better understand the cost implications of

each of the scenarios presented in table 2. In particular, the CCSA believes there is a need to undertake:

- An assessment of the readiness of prospective CCS projects to establish how long decommissioning would need to be delayed in order for front-running projects to make use of existing infrastructure.
- A Cost Benefit Analysis (CBA) of the costs involved with delaying decommissioning versus installation of new facilities (e.g. subsea) at the same site, and the likely cost and timing implications this could have for projects currently in development, e.g. at Teesside and for the Caledonia Clean Energy Project. This should also include an analysis of which aspects of existing facilities at a site may need to be retained, e.g. whether it would be the pipeline, platform and wells or a different combination of those.
- A risk assessment to identify the likely change in risk profile associated with the use of existing facilities versus abandonment of existing facilities and installation of new facilities.

In addition to establishing a better understanding of the costs, benefits and timing issues pertaining to the use of existing infrastructure, there is also a need for Government to explore all potential funding options, including those that may come from outside the UK. Depending on the level of investment the Government is willing to make in developing large-scale CO<sub>2</sub> storage in the UK, these options could include:

- ETS revenue “hypothecation”.
- Reinstatement of the CCS Levy.
- Work with the European Commission to try and repurpose unspent NER300 funds.
- Horizon 2020 funding, e.g. an ERA-NET type approach in the 2017/18 work programme.
- Government R&D Funding, e.g. through an entity such as Innovate UK and/or research councils.
- Potential early access to EU Innovation Funding in the event that a “bridge fund” between NER300 and the new Innovation Fund materialises.
- Direct support from the Scottish Government for investment in assets of direct value to Scotland.
- Funding the development of infrastructure through Contracts for Difference and/or industrial capture incentive (subject to policy development).

Table 2 (overleaf) describes the varying degree to which Government could intervene in the development of CO<sub>2</sub> storage in the UK over the course of this Parliament. A high level indication on likely costs is derived on the basis of the Goldeneye facilities, primarily because of the significant investments made to date in scoping future CO<sub>2</sub> potential at the site. Options B) to D) could additionally or alternatively be developed at other potential storage sites, or could be adapted to the Endurance store for example, subject to the necessary interest and agreement of project developers.

A necessary pre-condition to repurposing any existing infrastructure or potential storage sites is that the current owners are appropriately compensated for any changes in costs, liabilities, tax allowance etc. that they may incur if asked to prolong the life of the existing infrastructure beyond its optimum decommissioning time. The options assessed here are all predicated on this principle.

**Table 2. Options for developing CO<sub>2</sub> infrastructure using existing facilities (using the Goldeneye store as an example)**

Option	A – Delay Decommissioning	B - Make CO <sub>2</sub> store ready for future CCS Projects (Pre-investment)	C – Make CO <sub>2</sub> store ready for future CCS Projects and commence pilot CO <sub>2</sub> injection (Pilot)	D – Make CO <sub>2</sub> Store ready and commence CCS Projects (Progress)
<b>Description</b>	<i>Using one of the above ownership structures, delay decommissioning and maintain the assets for future CCS use but do not invest any further.</i>	<i>Using one of the above ownership structures, recompleting wells, enable FID to be taken on platform modifications needed to make the assets ready for future CCS use. Do not proceed to injection, thereby delaying the need for permitting and temporarily avoiding need for an immediate decision on risk sharing of CO<sub>2</sub> storage liabilities.</i>	<i>Using one of the above ownership structures, recompleting wells, enable FID to be taken on platform modifications needed to make the assets ready for future CCS use and undertake any necessary pipeline preparations. Capture CO<sub>2</sub> from, e.g. industrial facilities in St. Fergus, hook up to Goldeneye line and commence gaseous phase pilot injection.</i>	<i>Using one of the above ownership structures, recompleting wells, enable FID to be taken on platform modifications needed to make the assets ready for future CCS use and necessary pipeline preparations. Proceed with pre-FEED on modular industrial and/or power CCS projects.</i>
<b>Costs</b>	<ul style="list-style-type: none"> <li>• Agreed level of compensation for current owners of assets.</li> <li>• c. £5m per annum in ongoing maintenance costs for the Goldeneye facilities.</li> <li>• Cost differential between decommissioning today versus decommissioning in the future (including recognition of any tax impacts).</li> </ul>	<ul style="list-style-type: none"> <li>• All those identified in the “Delay Decommissioning” scenario.</li> <li>• For Goldeneye, the additional costs of well recompletion and minor modifications have been fully defined as part of the Peterhead project FEED study although there may be additional liabilities that arise through the recompletion work depending on the ownership model. These would need quantification and further consideration.</li> </ul>	<ul style="list-style-type: none"> <li>• All those identified in the “Pre-investment” scenario.</li> <li>• Additional costs arising from pipeline preparations and cost of permitting.</li> <li>• Additional cost implications arising from need to resolve ownership of CO<sub>2</sub> storage liabilities. These would most likely need to be directly or indirectly taken on by Government.</li> <li>• Ongoing operation and maintenance costs during pilot injection</li> </ul>	<ul style="list-style-type: none"> <li>• All those identified in the “Pilot” scenario.</li> <li>• Additional costs arising from the capture and transportation of CO<sub>2</sub> from large-scale emitters, most likely taken on by consumers through policies such as the CfD or an equivalent mechanism developed for industrial emitters (e.g. steel and cement industries).</li> </ul>
<b>Benefits</b>	<ul style="list-style-type: none"> <li>• Retains option on a low-cost, well-understood, well-appraised store (Goldeneye).</li> <li>• Helps retain other regional opportunities, e.g. for wider storage hub and/or CO<sub>2</sub>-EOR.</li> <li>• Costs and risks are well known as Goldeneye assets are already in “maintain” mode.</li> </ul>	<ul style="list-style-type: none"> <li>• Retains option on a low-cost, well-understood, well-appraised store.</li> <li>• With assets ready, creates a more level playing field for future CCS projects with more-developed power technologies (i.e. reduces future Strike Prices).</li> <li>• Increases the likelihood of commercial scale CCS projects</li> </ul>	<ul style="list-style-type: none"> <li>• All the benefits of “Pre-investment” scenario.</li> <li>• High likelihood of EU funding eligibility as capture and pilot injection could be funded within scope of existing funding mechanisms such as H2020 with co-funding from HMG.</li> <li>• Transport of CO<sub>2</sub> could also be covered by above or could form the</li> </ul>	<ul style="list-style-type: none"> <li>• All the benefits of the “Pre-investment” and “Pilot” scenarios.</li> <li>• Quantifiable contribution towards 4<sup>th</sup> and 5<sup>th</sup> Carbon Budget the potential to stimulate development of a UK Hydrogen economy.</li> <li>• Re-establish UK as a global leader and innovator on CCS.</li> </ul>

Option	A – Delay Decommissioning	B - Make CO <sub>2</sub> store ready for future CCS Projects (Pre-investment)	C – Make CO <sub>2</sub> store ready for future CCS Projects and commence pilot CO <sub>2</sub> injection (Pilot)	D – Make CO <sub>2</sub> Store ready and commence CCS Projects (Progress)
	<ul style="list-style-type: none"> <li>• Doesn't require long-term Government commitment to large capital or operational expenditure on CCS projects.</li> <li>• Demonstrates to industrial emitters that Government still considers a near-term future for CCS.</li> <li>• With addition of public funding/risk taking, provides a solid foundation for future low-cost, low-risk CCS projects and could stimulate the development of low-cost CO<sub>2</sub> capture projects.</li> <li>• Creates optionality for future CCS business models</li> <li>• Retention of skills and jobs.</li> </ul>	<p>being deployed, which helps to minimise longer-term costs of meeting climate change targets to consumers.</p> <ul style="list-style-type: none"> <li>• Costs all well known as Goldeneye FEED is completed and assets are already in "maintain" mode.</li> <li>• Could stimulate the creation of a North Sea CCS industry, retaining and creating jobs and creating new business opportunities for UK to dispose of CO<sub>2</sub> from neighbouring countries.</li> <li>• Retention of skills and jobs.</li> </ul>	<p>basis of a North Sea Project of Common Interest under the Connecting Europe Facility.</p> <ul style="list-style-type: none"> <li>• Huge opportunity for learning from injection, including derisking the store for future projects.</li> <li>• More likely to stimulate the creation of a market than "Pre-investment".</li> <li>• Opportunity for UK to retain a leadership role within the EU on CCS and to demonstrate credibility of longer term energy and climate policies.</li> <li>• CO<sub>2</sub> capture cluster could be developed, creating opportunities for on-site CCU innovation in support of CCS learning.</li> <li>• Retention of existing jobs and new jobs created.</li> <li>• Opportunity to gain operational experience which could be applied to future projects</li> </ul>	<ul style="list-style-type: none"> <li>• Retains small possibility of delivery against Commercialisation Programme/Competition "Outcome".</li> <li>• Potential £1 bn - £2 bn savings to UK consumers throughout 2020s (see Endnote 1).</li> <li>• Helps to reduce the need for more-expensive interventions in costly-to-abate sectors.</li> <li>• Retention of existing jobs and new jobs created.</li> </ul>

## Conclusions and recommendations

There is a time-limited opportunity to derive value from investments made in the CCS Commercialisation Programme. The options presented in this paper are intended to kick-start a discussion on the costs and benefits of realising these opportunities, ensuring that investments made in developing CCS projects (characterising potential stores, conducting FEED studies, keeping existing facilities in place with the potential for repurposing, etc.) are not lost as a result of the Government's Spending Review decision. Whilst Government develops its 'new approach' to CCS<sup>iii</sup>, the CCSA recommends that the following low-cost steps are taken to minimise the risk of losing options.

1. Rapidly undertake a cost-benefit analysis of the potential short-term ownership models presented in this paper. Consider all possible sources of public and non-public finance to cover maintenance costs, and ensure that any additional or residual costs and risks do not disadvantage the current owners of relevant infrastructure. As part of the 'new approach' to CCS expected from DECC in Autumn/Winter 2016, conduct a detailed analysis of CO<sub>2</sub> storage business models to assess the market failures and need for further Government intervention.
2. Undertake a Cost Benefit Analysis (CBA) of the costs involved with delaying decommissioning versus installation of new facilities (e.g. subsea) at the same site, and the likely cost and timing implications this could have for projects currently in development, e.g. at Teesside and for the Caledonia Clean Energy Project. In addition, work with industry to assess the readiness of prospective CCS projects to establish how long decommissioning would need to be delayed in order for front-running projects to make use of existing infrastructure.
3. Grant the DCO for the proposed White Rose onshore pipeline, removing any obligations for the immediate purchase of land and pipeline easements but retaining the ability for the developer to purchase this land and pipeline easements in the event that the Don Valley project reaches FID and/or any other a relevant project materialises in the life of the DCO.
4. Open discussions with the CCS industry, the Crown Estate and the Pipeline Works Authority to begin identifying potential onshore-offshore 'gateways' for future CO<sub>2</sub> pipelines and supportive framework to secure rights.

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<sup>i</sup> [Letter](#) from Dr. David Clarke to Angus MacNeil MP in submission to the Energy and Climate Change Committee Inquiry into the cancellation of the CCS Commercialisation Programme (January 2016).

<sup>ii</sup> For further details see: <http://www.eti.co.uk/project/decc-ccs-storage-appraisal/>

<sup>iii</sup> Referred to in the [Energy Bill Committee Debate, 6<sup>th</sup> Sitting: House of Commons, 4<sup>th</sup> February 2016](#)