

# Energy and infrastructure

outlook 2014-15

CCS and natural gas



# Introduction

**Fossil fuels such as coal and gas are expected to play a key role in the UK's energy mix for decades yet. But in order to meet our climate change targets and provide energy security, we will have to develop innovative technologies to reduce their greenhouse gas emissions.**

To do this, we are working with businesses and our partners to de-risk and to promote the development of carbon capture and storage (CCS).

CCS involves removing CO<sub>2</sub> from the exhaust of power plants and industrial processes, transporting it via pipelines or ships, and then pumping it more than a kilometre underground into stable geological formations where it is stored permanently like the oil and natural gas accumulations of the North Sea. The formations used include rocks filled with saline water and former reservoirs of depleted oil and gas fields.

At The Crown Estate, we focus on the second and third stages of the process, providing leases for the transportation and storage of CO<sub>2</sub> in areas of the 12-mile nautical seabed and continental shelf that we manage.

We also work with businesses wishing to invest in facilities for the storage of natural gas to increase the nation's capacity and reduced the chance of supply interruptions or high prices.

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The deployment of Carbon Capture and Storage (CCS) is critical to global efforts to mitigate climate change and keep global warming below 2°C above pre-industrial levels.

**INTERNATIONAL ENERGY  
ASSOCIATION 2011**

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CCS is an industry that can compete with other low-carbon sources to ensure security and diversity of our electricity supply, an industry that can make our energy intensive industries cleaner and an industry that can bring jobs and wealth to our shores.

**THE RT HON EDWARD DAVEY MP  
Secretary of State for Energy and  
Climate Change**

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The Crown Estate's energy and infrastructure portfolio is part of a diverse £8 billion UK property portfolio



COURTESY OF WORLEY PARSONS

The portfolio includes the rights for renewable energy generation on the UK Continental Shelf



COURTESY OF CENTRICA STORAGE

Over the last ten years The Crown Estate has contributed over £2 billion to the Treasury



COURTESY OF STATOIL

## Progress in the UK to date

**Two large-scale projects remain in the government's £1bn CCS Commercialisation Competition – Shell and SSE's Peterhead project, and the White Rose project at the Drax Power site in Yorkshire, which also involves Alstom, BOC and National Grid.**

We have signed Agreements for Lease with both of these projects, which provide exclusive time-limited options over offshore storage sites in the North Sea. Developers will now be working to progress their plans through to Final Investment Decision over the next couple of years.

The Peterhead project plans to store CO<sub>2</sub> at the depleted Goldeneye gas field, located beneath the North Sea, 100km from St Fergus, while the White

Rose scheme expects to store CO<sub>2</sub> in an offshore saline aquifer, 110km from the east Yorkshire coast.

However, much work is still needed to progress CCS beyond these two projects if we are to deliver a cost effective solution for the disposal of CO<sub>2</sub> from industrial processes and the power sector. We are working with a large number of stakeholders to identify ways of overcoming technical, financial and market barriers that could prevent CCS from achieving its full environmental and economic benefits.

In the year ahead we intend to continue working with industry and government to determine the best ways of delivering a no regrets least cost pathway for transport and storage infrastructure in the period to 2030.

## Beyond the energy market

**The first two CCS projects will be financially supported by a combination of capital grants and a 'Contract for Difference' Feed in Tariff which is being delivered as part of the government's Electricity Market Reform package. This approach helps to alleviate risks for power generators, although additional measures may be required in order to tackle issues facing the transport and storage parts of the value chain.**

We have been working with industry through the Cost Reduction Task Force, to identify effort to cut costs of CCS infrastructure. A report the group produced last year highlighted the importance of storage to cutting costs.

Building on the findings of the Task Force, the Crown Estate is chairing a new CO<sub>2</sub> Transport and Storage development group, which will recommend ways of unlocking cost reductions, maximising the benefits of scale and reducing financial and technical barriers in storage.

# £185m

In addition to reserving £1 billion of capital grants for the first full chain CCS projects the UK Government is spending £185 million on a range of important R&D projects

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Successful deployment of CCS would be a major prize for the UK economy, cutting the annual costs of meeting carbon targets by up to 1% of GDP (or around £42 billion per year) by 2050.

**UK CCS COST REDUCTION  
TASKFORCE**

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The Goldeneye depleted gas field is an example of infrastructure that is planned to be converted to use for CO<sub>2</sub> storage operation



# 78,000 million tonnes

The UK Energy Technologies Institute has estimated that there is a **50%** probability of **78,000 million tonnes** of storage capacity beneath the UK continental shelf. To put this in context **310 million tonnes** of CO<sub>2</sub> will need to be stored per year in Europe by 2030 to achieve the IEA 2°C scenario for emissions abatement

## A coordinated pipeline

**One key question facing the industry is how to progress CCS after the initial projects have been built out to ensure maximum cost efficiencies.**

The task force has found it will be essential to develop a coordinated approach in future, which delivers CCS “clusters” that share existing transport and storage infrastructure. This will contribute to achieving economies of scale, reducing cost and establishing lower cost options for future use of CCS in industrial applications.

## Storage appraisal

**To help maintain the momentum of CCS development over the next decade, oil and gas operators could start to examine whether geological formations in and around their productive fields or those approaching decommissioning could be used for CO<sub>2</sub> storage.**

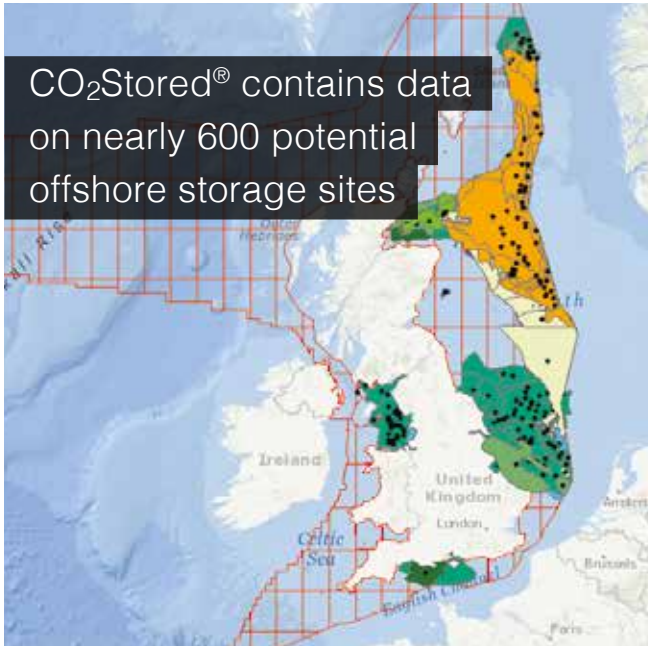
At the moment operators find it difficult to make a business case and invest in these activities. Through the UK CCS Commercial Development Group we are working with industry and government to identify those additional policies and support mechanisms beyond the domestic electricity market reform that may be needed to help incentivise early storage appraisal.

## CO<sub>2</sub> in the subsurface

**Working with Durham and Herriot Watt Universities, we are looking at how CO<sub>2</sub> behaves and flows in geological formations more than a kilometre under the seabed.**

We are striving to understand the uncertainties that have the biggest impact on costs for next phase of storage infrastructure. This scientific work helps us understand more about how much CO<sub>2</sub> and how quickly you can put it into the storage site.

CO<sub>2</sub>Stored® contains data on nearly 600 potential offshore storage sites



The Rough natural gas storage facility holds more than 70% of the UK storage capacity and has been operational since 1983



10%

The largest of nine commercial gas storage facilities in the UK, Rough, is located offshore and can deliver 10 per cent of typical UK winter daily demand

## CO<sub>2</sub>Stored®



In partnership with the British Geological Survey (BGS) last year we launched an online website, database and interactive mapping tool known as CO<sub>2</sub>Stored®, which offers unprecedented access to information for developers on where carbon dioxide (CO<sub>2</sub>) can be stored around the UK continental shelf.

This £1 million project to 2018 aims to help government and industry make informed decisions about how to best develop CCS infrastructure.

The website provides access to data for stakeholders on nearly 600 potential storage units in depleted oil fields, gas fields and saline aquifers around the UK, including in-depth information on their geological formation, porosity, injectivity, fracture pressure, and storage risks.

The site can be accessed at [www.co2stored.co.uk](http://www.co2stored.co.uk)

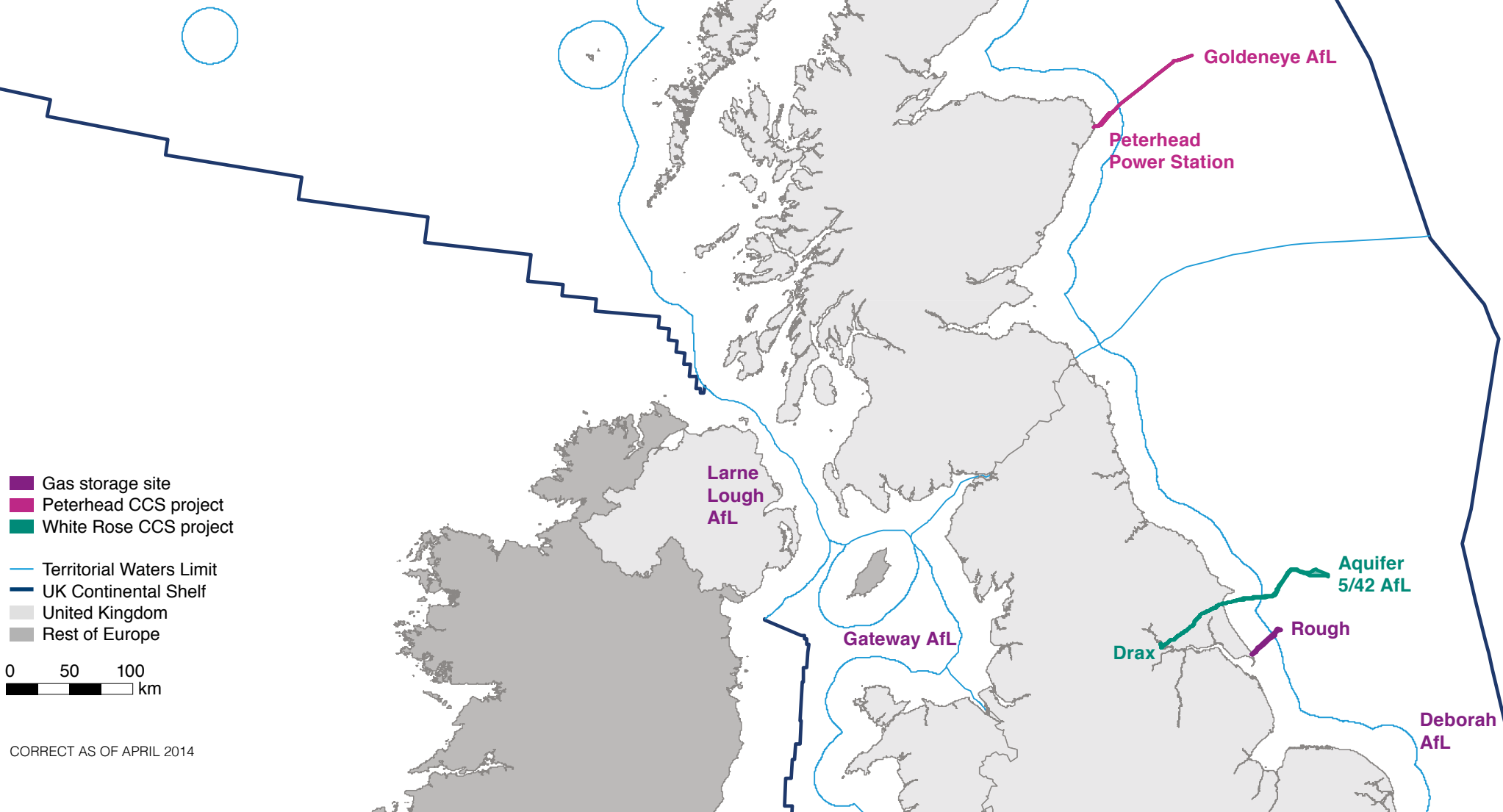
## Natural gas storage

Natural gas storage facilities help to deliver a stable supply and price of energy during the cold winter months. The UK currently has nine commercial gas storage facilities with a total capacity of 4.4 billion cubic meters. Rough, the largest of these sites, is located offshore and can deliver 10 per cent of typical UK winter daily demand. The Rough storage site is leased from us by Centrica Storage Ltd.

Some forecasters, such as Deloitte, suggest that storage capacity will need to double by 2020 to ensure security of gas supply during peak winter months.

Developers of offshore natural gas storage sites must obtain a storage lease from The Crown Estate, as well as a storage licence from government. We work closely with stakeholders to ensure that the potential of offshore gas storage is fulfilled.

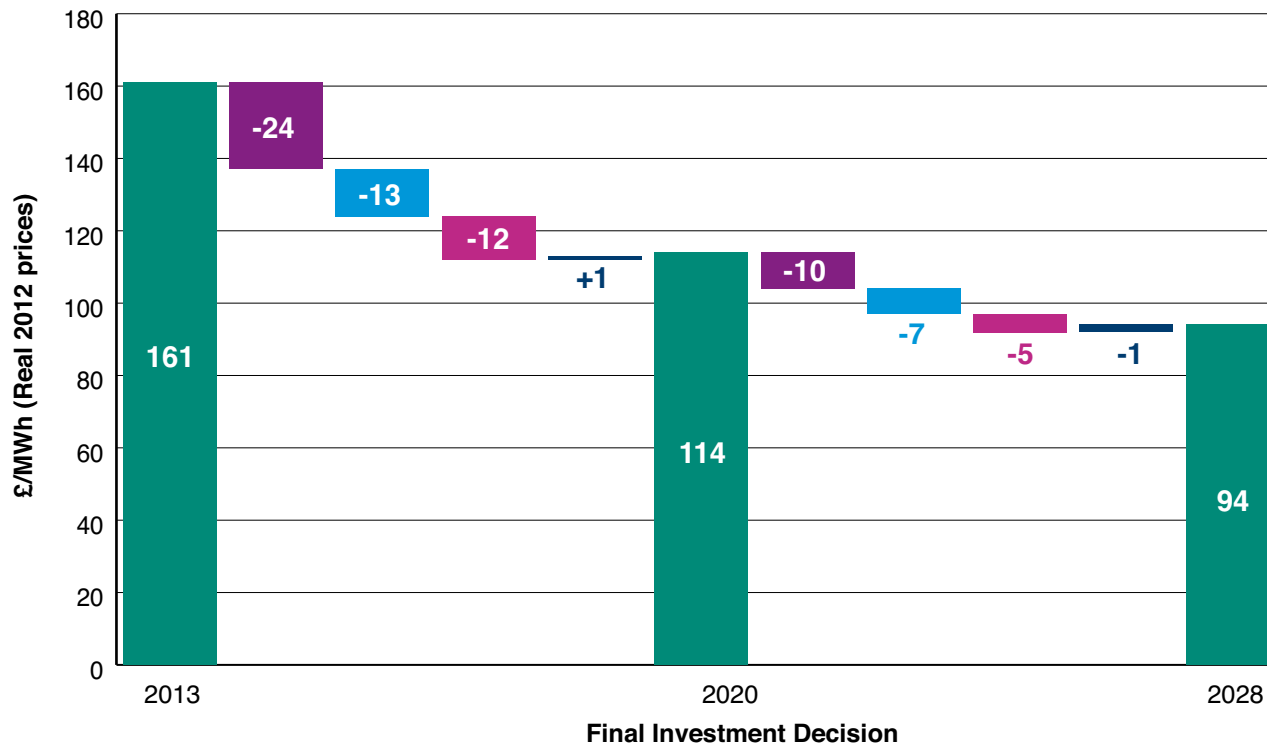
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CORRECT AS OF APRIL 2014



# CSS cost reduction trajectory



- Transport and storage scale and utilisation
- Improved financeability for CCS chain
- Improved engineering designs and performance
- Other cost changes\*

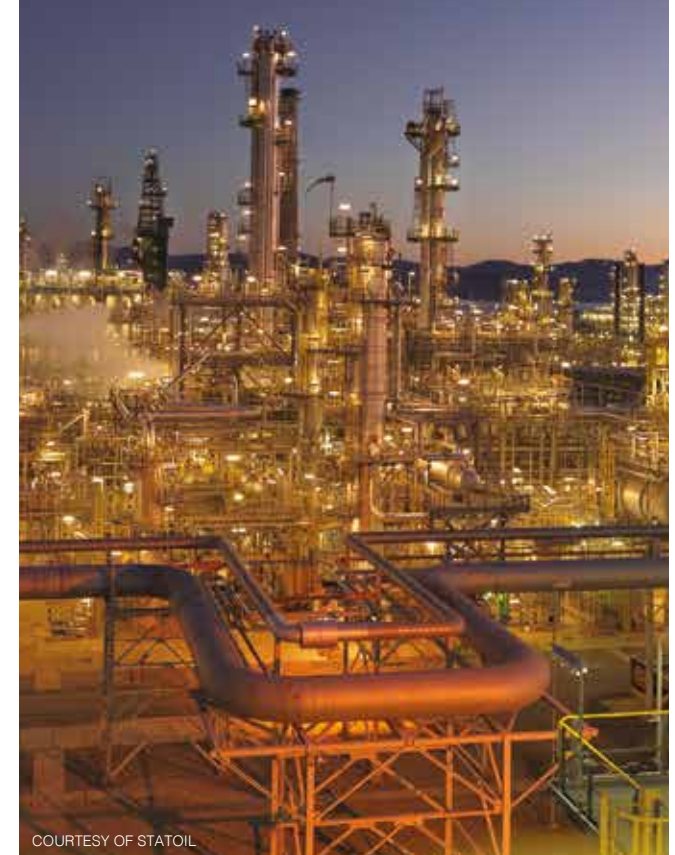
Potential additional EOR benefit in the range £5-12/MWh for gas CCS and £10-£26/MWh for coal CCS. Could make starting point of 'FID 2013' plant less than £140/MWh, with similar impacts on plant with FID dates in the 2020s.

NOTE: Shows average costs across technologies.

\*E.C. Increasing CO<sub>2</sub> price, falling storage abandonment costs

SOURCE: CCS Cost Reduction Taskforce Final Report, May 2013, London UK

CCS is the only known suite of technologies that can abate emissions from industrial processes such as refining, fertiliser, cement and steel production



COURTESY OF STATOIL

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**London**

The Crown Estate  
16 New Burlington Place  
London  
W1S 2HX  
T 020 7851 5000

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**Edinburgh**

The Crown Estate  
6 Bell's Brae  
Edinburgh  
EH4 3BJ  
T 0131 260 6070

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**[www.thecrownestate.co.uk/  
energy-infrastructure](http://www.thecrownestate.co.uk/energy-infrastructure)**

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Correct as of May 2014

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**At The Crown Estate, we are landlords of the UK's seabed, managing it effectively and sustainably, balancing different interests and delivering the best value over the long-term.**

This gives us a unique role to play in developing and helping sustain the UK's energy supply and infrastructure, by working in partnership with a wide range of organisations that have interests in the seabed.

These include wind, wave and tidal power, carbon capture and storage, gas storage, marine aggregates and minerals, cables and pipelines.

We are active asset managers, applying our experience, skills and understanding to deliver optimum returns, create opportunities for ourselves and our partners, and provide a quality service to our customers.

Aware of our monopoly position and the impact of our activities, we are careful to comply with competition laws, co-exist with the wider marine community, and be open and transparent in our dealings.

Because of who we are, we are able to see the bigger picture, making best use of the seabed, and supporting and investing in sustainable development for the long-term benefit of the whole of the UK, now and in the future.