UK Carbon Capture and Storage developments

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Research Coordination Network (RCN) on Carbon Capture Utilization and Storage (CCUS) Annual Meeting
Columbia University, April 15th, 2014

The UKCCSRC is supported by the Engineering and Physical Sciences Research Council as part of the Research Councils UK Energy Programme

About the UKCCSRC

The UK Carbon Capture and Storage Research Centre (UKCCSRC) **leads and coordinates a programme of underpinning research on all aspects of carbon capture and storage** (CCS) in support of basic science and UK government efforts on energy and climate change.

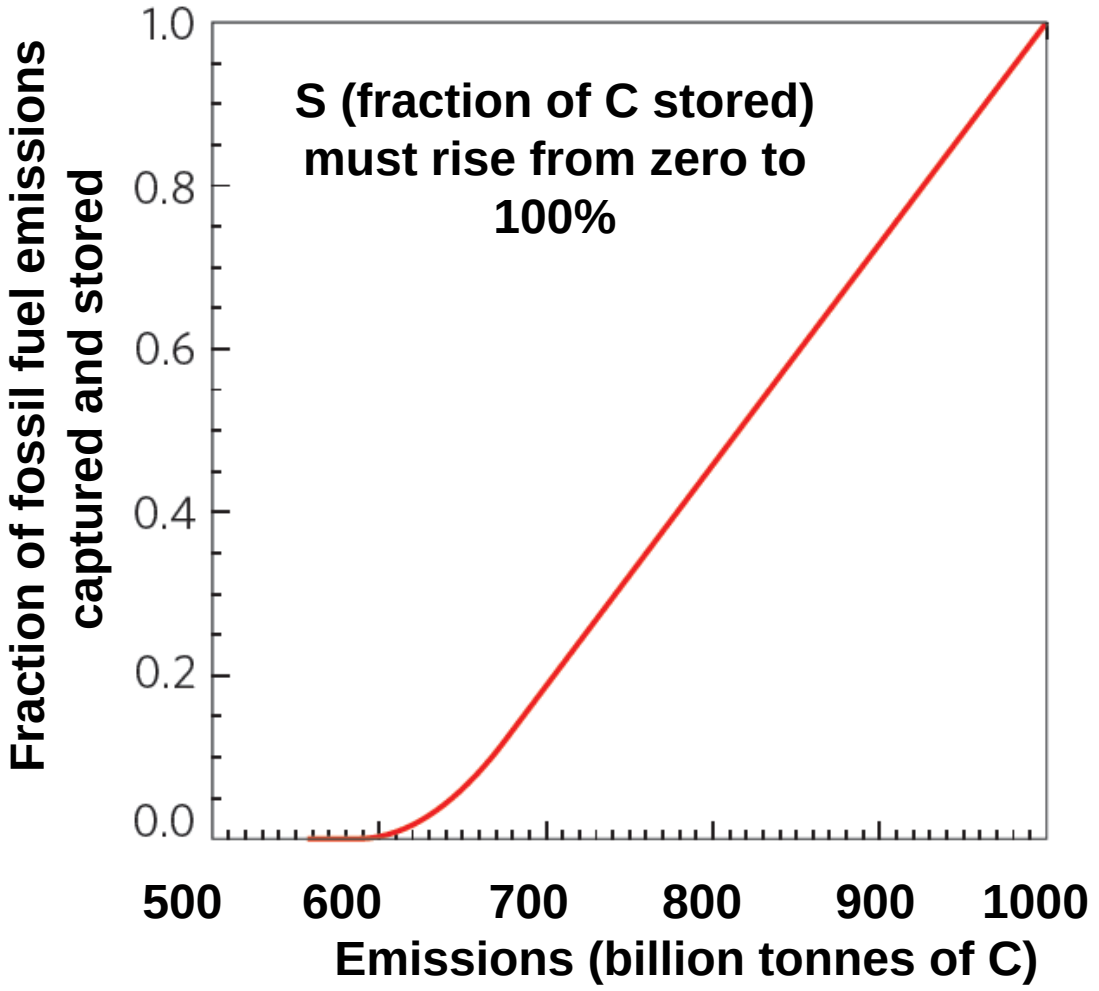
The Centre brings together nearly 200 of the UK's world-class CCS academics and provides a **national focal point for CCS research and development**.

Initial core funding for the UKCCSRC is provided by £10M from the Engineering and Physical Sciences Research Council (EPSRC) as part of the RCUK Energy Programme. This is complemented by £3M in additional funding from the Department of Energy and Climate Change (DECC) to help establish new open-access national pilot-scale facilities (www.pact.ac.uk). Partner institutions have contributed £2.5M.

www.ukccsrc.ac.uk

The prime climate objective is not to end the use of fossil fuels.

The prime objective is to develop and deploy 100% CCS in time to cap cumulative emissions of carbon at a safe level.



Myles R. Allen, David J. Frame & Charles F. Mason, The case for mandatory sequestration, Nature Geoscience 2, 813 - 814 (2009), doi:10.1038/ngeo709

CO_2 EOR should be seen as a stage in a path from zero CO_2 capture to 100% CCS.

It is a move in the right direction from where we are now – emitting 100% of fossil carbon to atmosphere.

The technologies that CO_2 EOR helps to develop can readily be adapted to get higher fractions of CO_2 stored (higher S values).

How did we get where we are now?

Demonstrate CCS asap for G8 initiative **Peterhead / DF1 2005**

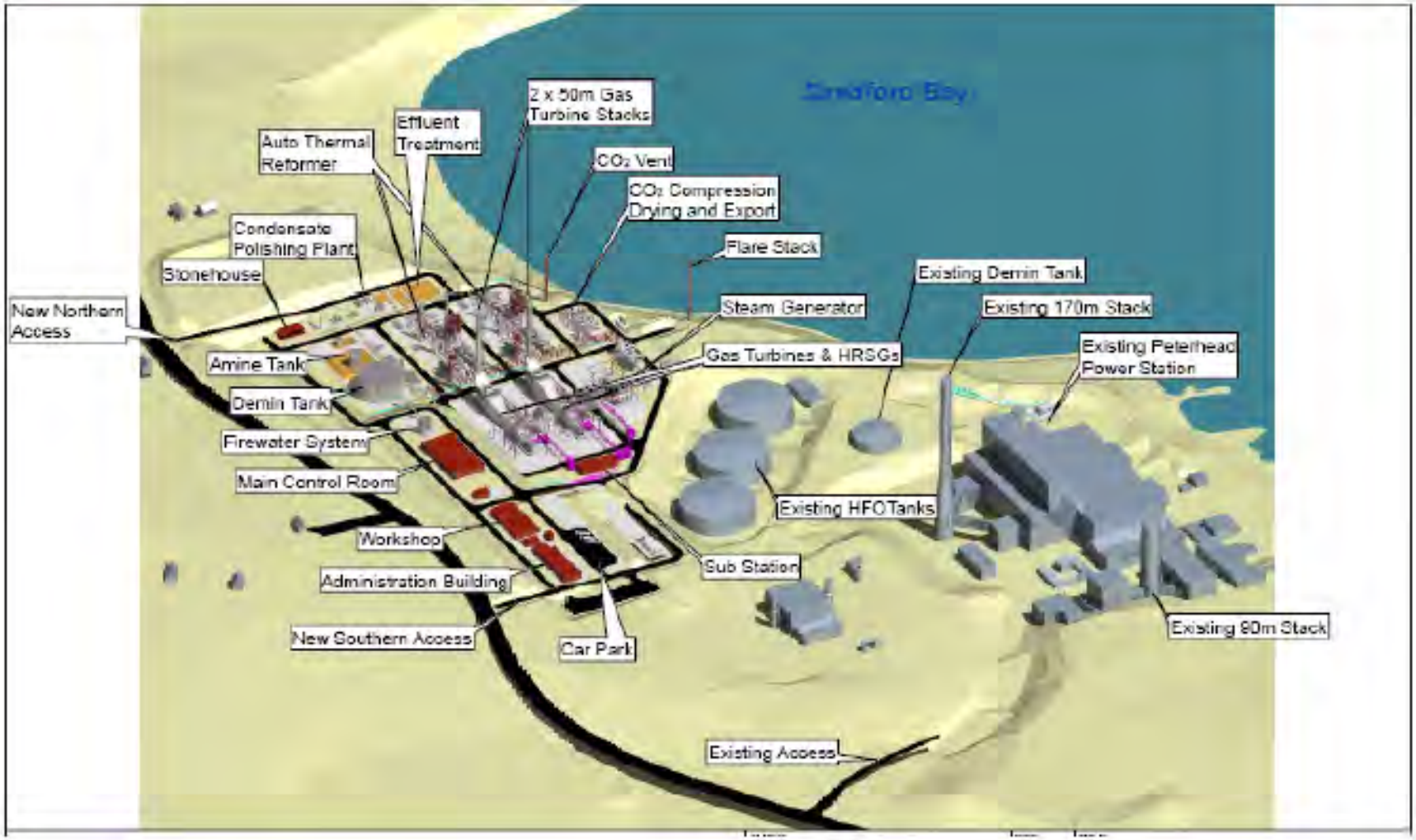
alternativenergy
Powered by BP

http://www.ccsassociation.org.uk/docs/2007/Monday%201415%20-%20Jane%20Paxman.pdf

bp

DF1 – Site Layout

FEED announced 30 June 2005, project cancelled mid 2007



How did we get where we are now?

~~Demonstrate CCS asap for G8 initiative~~ ~~Peterhead / DF1 2005-2007~~

Response to a dash for coal 2007/2008

CCS Competition 2007
Kingsnorth/Longannet
Energy Act 2010

6 August, 2008

Climate Camp at Kingsnorth Power Station

UKCCS RESEARCH CENTRE

11 October, 2009

Protest at

House of Commons

How did we get where we are now?

~~Demonstrate CCS asap for G8 initiative~~ ~~Peterhead / DF1 2005-2007~~

~~Response to a dash for coal 2007/2008~~ ~~CCS Competition 2007~~

~~Kingsnorth/Longannet~~

~~Energy Act 2010~~

New Kingsnorth power plant plans shelved **7 October 2009**

http://www.theguardian.com/environment/2009/oct/07/eon-cancels-kingsnorth-power-station

- Decision hailed by groups who staged Climate Camp protest
- Lower electricity demands due to recession cited as reason

E.ON withdraws Kingsnorth from Competition **20 October 2010**

Longannet CCS project cancelled **19 October 2011**

National Audit Office report on Competition **16 March 2012**

DECC CCS Commercialisation Programme (+£1bn) **3 April 2012**

Four projects shortlisted **31 October 2012**

Two preferred bidders announced **20 March 2013**

Energy Bill (for EMR & FiT CfD) Royal Assent **18 December 2013**

An indicative illustration of Drax Power Station (left) and the White Rose Carbon Capture and Storage Project (right)

White Rose CCS Project

- New standalone power plant at the existing Drax Power Station site near Selby,
- State-of-the-art coal-fired power plant with the potential to co-fire biomass.
- 426MWe (gross) oxyfuel power and carbon capture and storage
- 90% of all CO_2 emissions captured
- Capturing approximately 2 million tonnes of CO_2 per year
- Anchor project for Yorkshire CO_2 transportation and storage network

http://www.whiteroseccs.co.uk

White Rose CCS Project

Fuel (http://www.whiteroseccs.co.uk/your-questions-answered/fuel)

What mix of fuels will be used at the plant?
The primary fuel will be coal that is already fired at the existing power station. It is anticipated that the plant will be capable of co-firing biomass with the coal to reduce further the CO2 emissions.

How much fuel will the plant need?
The plant is expected to require approximately 1.2 million tonnes of coal and 300,000 tonnes of biomass per annum (assuming the combustion of 15% biomass).

Where will the fuel come from?
It is likely that the coal and biomass required will come from the same sources as the coal and biomass already delivered to the existing power station. These are a mix of imported coal and coal mined in the UK, as well as biomass sourced from abroad and from over 100 local farmers who have contracts to supply Drax with biomass products.

How will the fuel be stored?
The coal and biomass will be stored onsite within the existing coal stock area and transported to the new power station by a conveyor belt system. There will also be some fuel storage available on the project site.

Will biomass energy crops be grown at the expense of food crops?
Energy crops sourced by Drax are grown on land that is unsuitable for food production in order to comply with the company's robust sustainability criteria. Drax only purchases biomass from sources that are considered sustainable.

Peterhead CCS Project

Shell UK Limited and SSE

Post-combustion capture on one of three existing GT units

Approximately 400MW equivalent capacity (Siemens SGT5-4000F) and 1MtCO_2/yr

Gas turbine and heat recovery steam generator (HRSG)

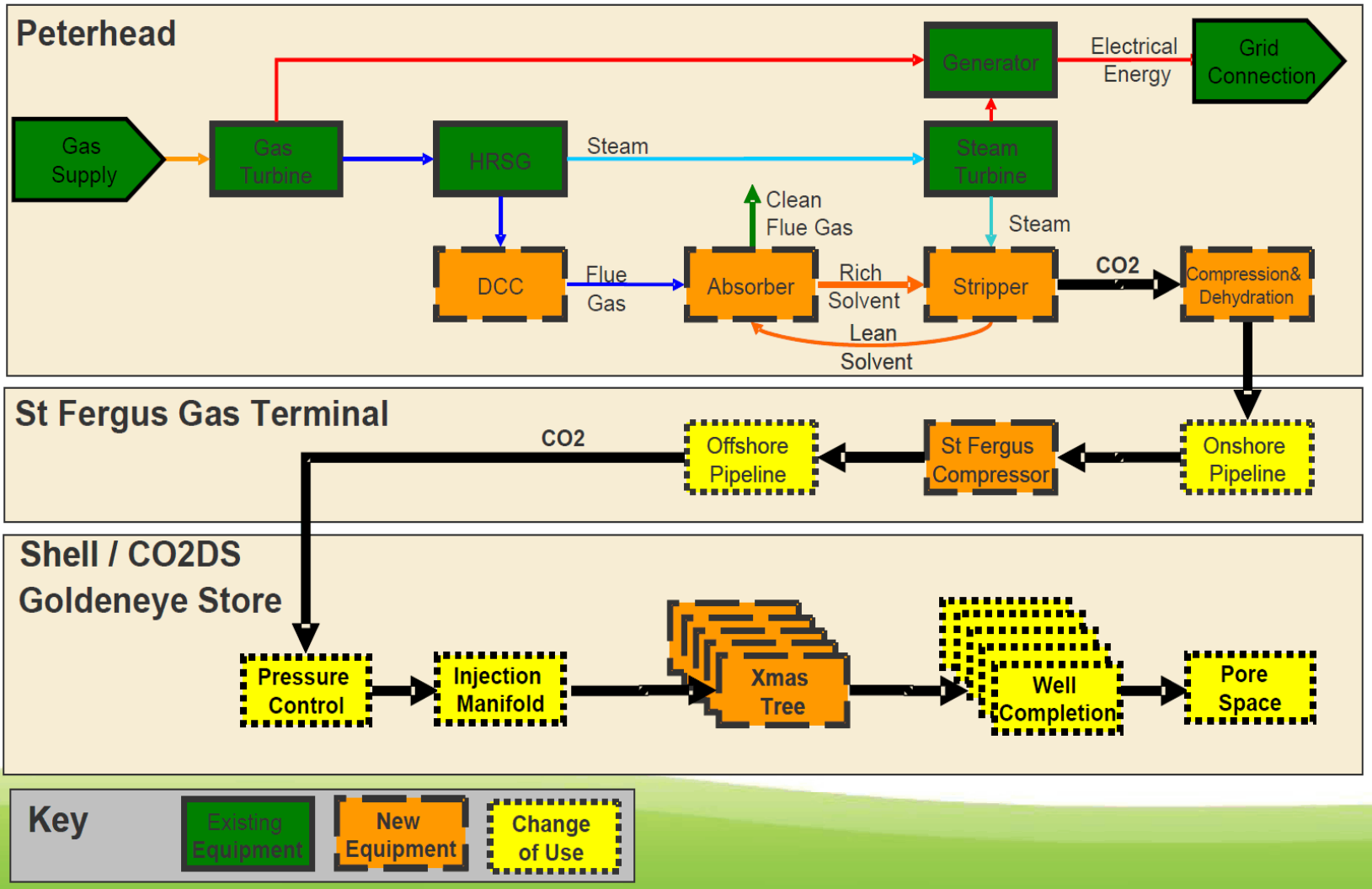
http://www.shell.co.uk/gbr/environment-society/environment-tpkg/peterhead-ccs-project.html

http://www.shell.co.uk/gbr/environment-society/environment-tpkg/peterhead-ccs-project.html

Goldeneye Platform

Up to 10 million tonnes of carbon dioxide (CO_2) emissions could be captured from the Peterhead Power Station in Aberdeenshire, Scotland and then transported by pipeline and stored, approximately 100km offshore in the depleted Goldeneye gas reservoir, more than 2km under the North Sea.

Peterhead CCS Process Overview



Department of Energy & Climate Change

Presentation made at Westminster Energy, Environment & Transport Forum Keynote Seminar: Next steps for Carbon Capture and Storage in the UK 27th February 2014

Maintaining UK energy security cleanly – an update on the role of CCS within the UK's energy mix

Matthew Billson
Office of Carbon Capture and Storage

Department of Energy & Climate Change

Presentation made at Westminster Energy, Environment & Transport Forum Keynote Seminar: Next steps for Carbon Capture and Storage in the UK 27th February 2014

CCS by numbers

3 Possible phases of CCS development in the UK

13GW Of CCS deployed by 2030

1% Of GDP saved per year by having CCS in the mix

"Achieving an affordable, secure, low carbon energy mix with renewable and nuclear energy alone will be much more difficult and much more expensive." Ed Davey, 24 Feb 2014

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Phase 1

- FEED+ £100m investment
- CCS Commercialisation Programme

Underpinning phase 1 onwards:

- **UK CCS Roadmap 2012**
- £125m R&D Programme

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White Rose

- FEED contract signed 20 December 2013
- World's largest Oxyfuel power plant
- Yorkshire / Humber CCS Trunkline

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Peterhead

- FEED contract signed 24 February 2014
- World's first commercial scale gas CCS project
- Reuse of existing North Sea infrastructure
- Wider opportunities beyond project itself

Department of Energy & Climate Change

DECC Response to Task Force, Oct 2013

Phase 2

- Projects without capital funding from Government; support through CfDs
- **Development Forum** March 2014
- Working to strengthen the business case
  - FIDe process
  - Learning from global projects
  - EOR / Wood Review
  - Industrial CCS (Tees Valley £1m)
  - Shared infrastructure

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Phase 3

- CCS projects competing on cost with other low carbon technologies

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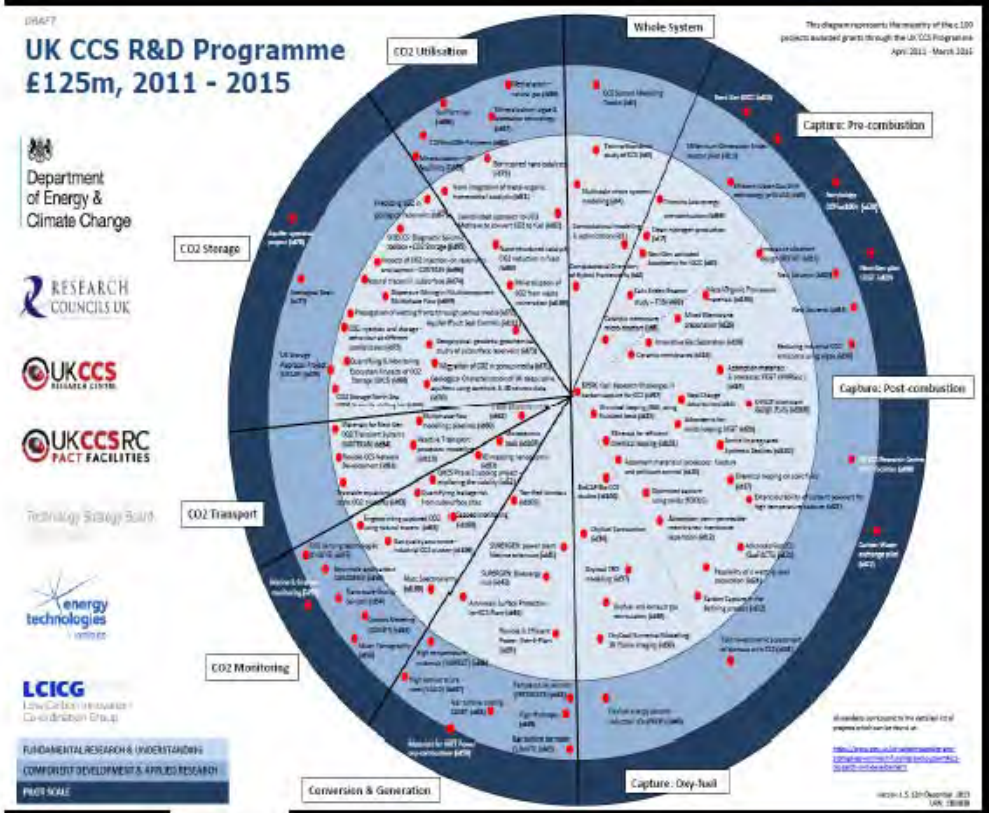
R&D Programme



- World class CCS research
- Comprehensive approach

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Europe & 2030

- Ambitious GHG reduction target
- Technology neutral approach
- Reform of EU ETS
- Review of CCS Directive
- Support to first mover projects
- North Sea as a storage hub

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Thank you

twitter.com/DECCgovuk
gov.uk/decc

http://blog.decc.gov.uk/2014/02/24/ccs-a-great-opportunity-for-the-uk/

Some key features of current UK CCS scene

- Third Time Lucky! Plus different and relevant projects.
- Power plant CCS mainstream policy for 8 years, + industry now.
- CCS is the priority, not the fuel (gas and biomass, as well as coal).
- Support mechanism in place on same basis as renewables and for electricity supplied, not CO_2 captured.
- Plant level emission performance standard at NGCC level is a backstop, not the main CCS (non-)delivery driver.
- Offshore storage – multiple storage clusters, EOR prospects once CO_2 supplies established.
- Industry CCS also recognised – Teeside project funding.
- Excellent academic support activities for UK CCS delivery
- Strong overseas links –North America & China key partners