



Department
of Energy &
Climate Change

Supporting CCS through Policy & R&D: The UK Approach & Update

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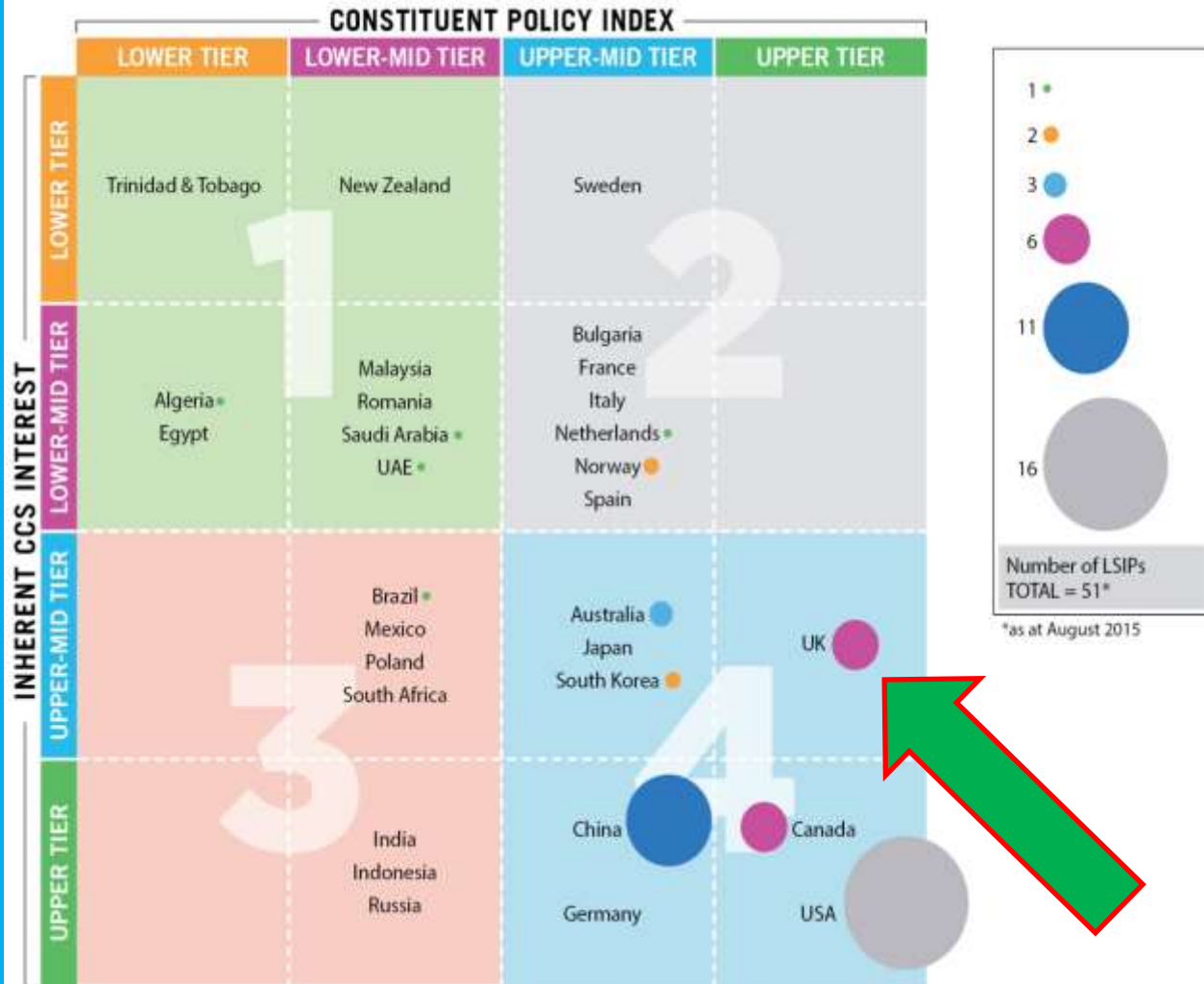
I Will Cover (25 Slides in 15 mins!!!)

- 1. UK Position & Approach**
- 2. Our Commercialisation Programme**
- 3. Dissemination of FEED Outputs**
- 4. Next Steps**
- 5. Research & Development**
- 6. Beyond Power**



UK Position

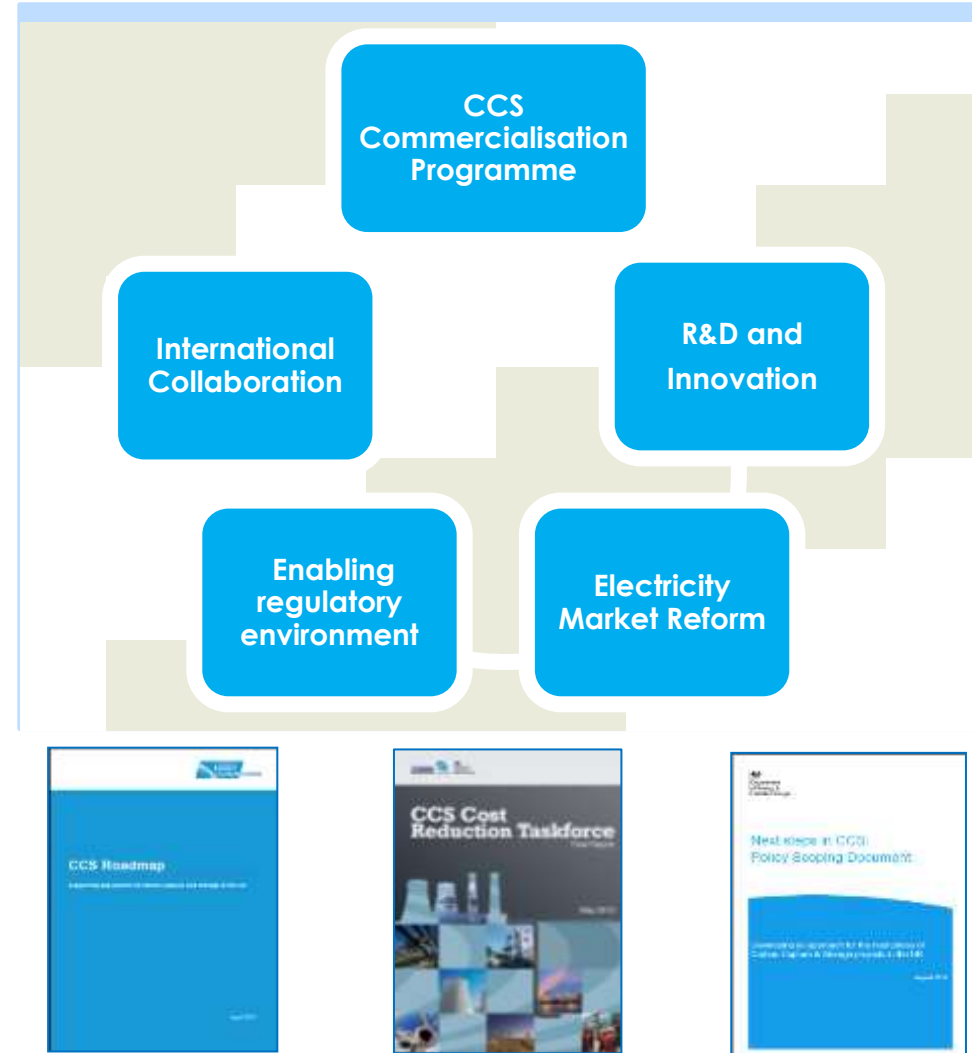
- Most active country in Europe on CCS & the only country in Europe to have successful CCS project awarded funding under NER300
- One of the most favourable policy & regulatory environments (Global CCS Institute)
- Different approach - primary driver is the reduction in CO₂ emissions not enhanced oil recovery
- One of the top countries for CCS research ranking a close third to the USA and China in articles published on the subject (UKCCSRC)
- Active in international fora and bilaterally with priority countries



Source: GCCSI (Aug 2015)

Five Key Strands

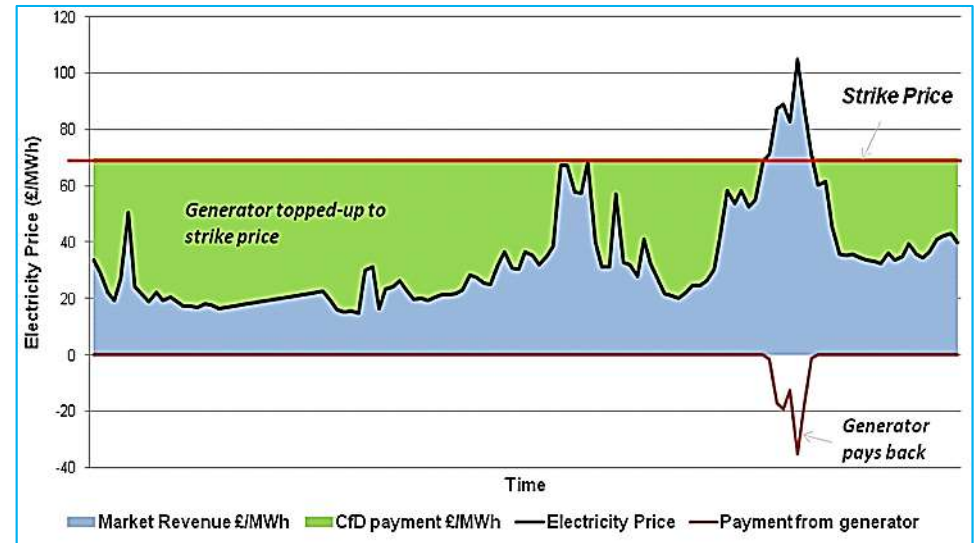
- £1bn CCS Commercialisation Programme
- Implementing an enabling policy and regulatory environment
- Electricity Market Reform: creating a market for low carbon energy
- R&D and Innovation – over £130 million since 2011 (£25m DECC)
- International engagement / EU 2030 framework





The Contract for Difference - CfD

- Provides long-term revenue stability for all forms of low carbon electricity
- Generators sell their electricity at a fixed price - the 'strike price'
- A single government owned counterparty body (the Low Carbon Contracts Company) will administer the CfD

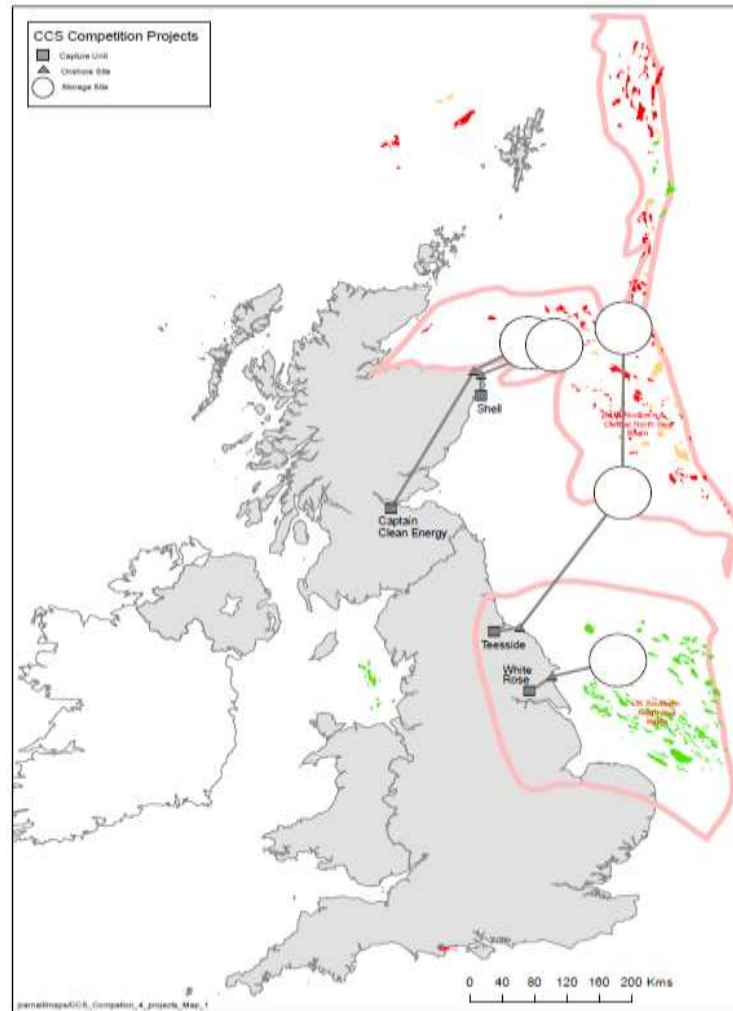


- When market price $<$ 'strike price'
 - The generator receives a top-up
- When market price $>$ 'strike price'
 - The generator pays back the difference



Commercialisation Programme

- £1bn capital funding
- Operational support through CfD
- Government / industry risk-sharing of CCS specific risks





White Rose

- Ultra-supercritical 448MWe (gross) Oxy-Power coal plant at Drax Site, Yorkshire
- Enough low carbon electricity to power the equivalent of 630,000 homes
- 100% of flue-gas treated with 90% CO₂ capture rate. Estimated 2 million tonnes CO₂/year captured
- Potential biomass co-firing leading to zero (or negative) CO₂ emissions
- Anchor project for National Grid's regional CO₂ transport & offshore storage network
- CO₂ storage in a deep saline formation off-shore beneath the North Sea





White Rose Activities Achieved - Consents

- **Key milestone:** Development Consent Order (DCO) application submitted
- **Including:**
 - Rights of Way
 - Environmental Statements
 - Public Consultation
 - Works Plans





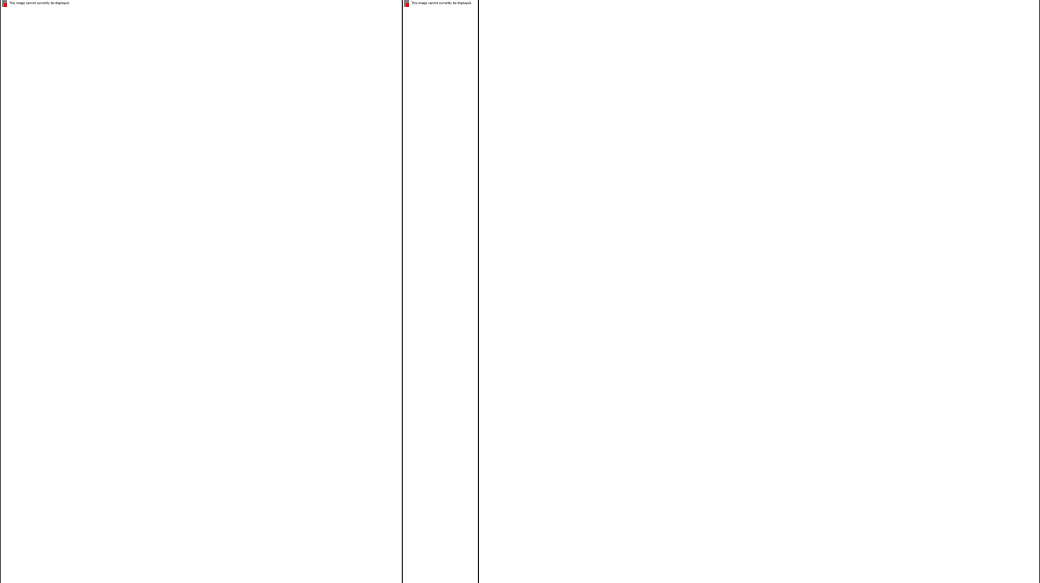
White Rose Forward Look

- **Completing the Onshore Transport FEED**
 - Key Milestone: Onshore Electrical Design
- **Completing the Offshore Transport FEED**
 - Key Milestone: Environmental Permit Application
- **Completing the Storage FEED**
 - Key Milestone: Storage Permit Application
- **Gaining consents**
 - Key Milestone: Grid Expected Planning Consent Approval
 - Key Milestone: Oxy-Power Plant Expected Planning Consent Approval



Peterhead

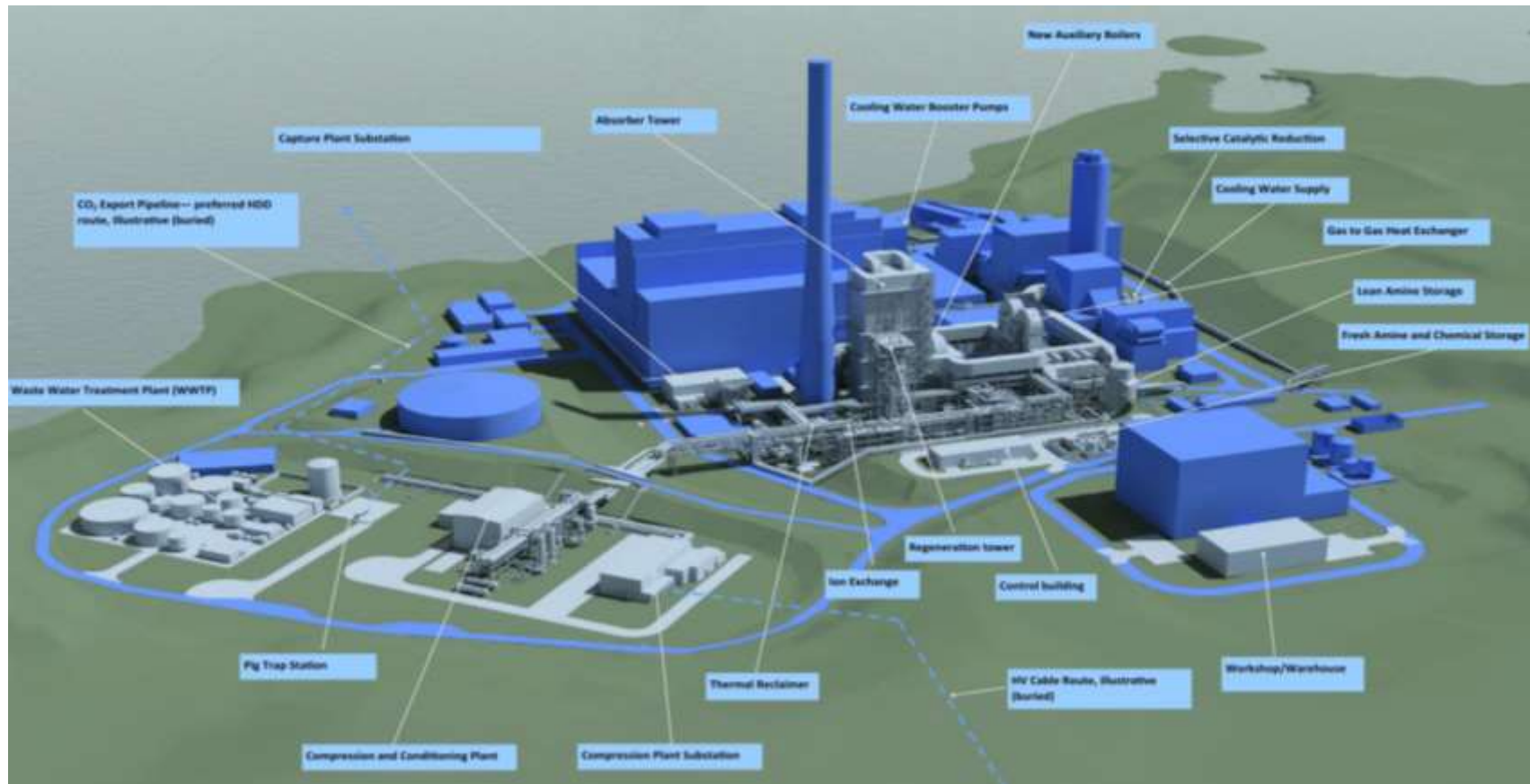
- **World's first full scale gas CCS project**
- **A 340MW post-combustion capture retrofitted to part of an existing CCGT power station at Peterhead, Scotland**
- **Enough low carbon electricity to power the equivalent of 500,000 homes**
- **85% CO₂ capture rate. Estimated 1 million tonnes CO₂/year captured**
- **Reuse of North Sea infrastructure - linking into the existing offshore pipeline from St Fergus to the store**
- **Storage in the depleted Goldeneye reservoir (a producing gas field from 2004 to 2011)**





Peterhead CCS FEED

Basic Design and Engineering Package completed



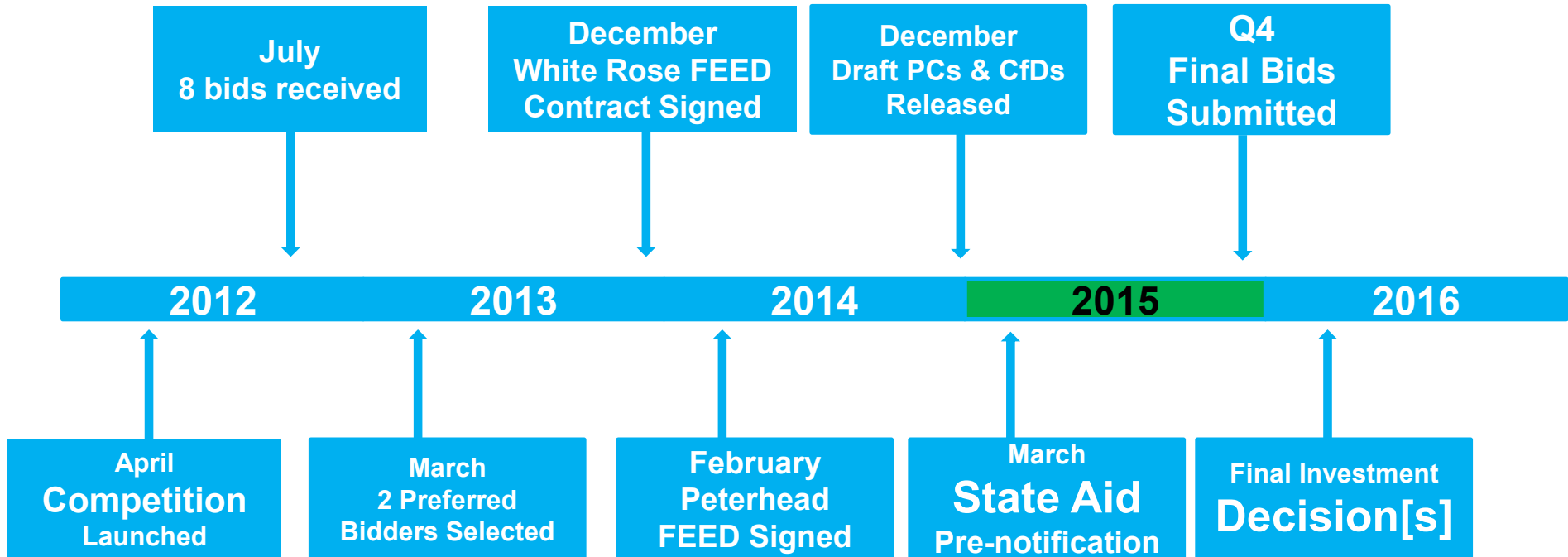
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Peterhead Forward Look

- **Completing the technical FEED**
 - Key milestone: Confirming the onshore pipeline route and method
- **Gaining consents**
 - Key Milestone: Planning Consent Approval
 - Key Milestone: Carbon Storage Permit Approval
- **Procurement preparation for construction**
 - Key Milestone : Recommend to award EPC contracts

Road to Final Investment Decision



“As a result of the interventions, private sector electricity companies can take investment decisions to build CCS equipped fossil-fuel power stations, in the early 2020s, without Government capital subsidy, at an agreed CfD strike price that is competitive with the strike prices for other low carbon generation technologies.” CCS Roadmap, April 2012

Dissemination Principles for Commercialisation Programme

Key Knowledge Deliverables (KKD)

- All KKD's will be released over a 2yr period on the DECC website
- Free – no £££££ \$\$\$\$\$ €€€€€
- Unrestricted access
- Unlimited access
- Easy to download to laptop or ipad

Audience

- Developers
- Industry
- Power station operators
- Academia



Current FEED KKDs (1)

Technical: Subsurface and Well Engineering

- Abandonment Concept for Injection Wells (PH)
- Conceptual Completions & Well Intervention Design Report (PH)
- Initial In Place (IIP) Volumes Estimate Report (PH)
- Petrophysical Modelling Report (PH)
- Pressure, Volume and Temperature (PVT) Report (PH)
- Seismic Interpretation Report (PH)
- Well Functional Specification (WFS) Document (PH)
- Well Operation Guidelines (PH)
- Well Technical Specification (PH)
- Peterhead: Introduction to the Subsurface and Well Engineering Key Knowledge Deliverables Static Model Reports (PH)

Current FEED KKDs (2)

Technical: Power and Capture

- Oxy Power Plant Plot Plan (WR)

Technical: Full Chain

- Operation and Maintenance Philosophy (PH)
- Peterhead CCS Project - Relief Flare and Vent Study Report
- Peterhead CCS Project - Site Selection Report

Commercial, Project Management and Lessons Learned

- Insurance Plan (PH)
- Peterhead CCS Project - Health, Safety and Environmental Report.

Available at:

<https://www.gov.uk/government/collections/carbon-capture-and-storage-knowledge-sharing>

Previous FEED KKDs

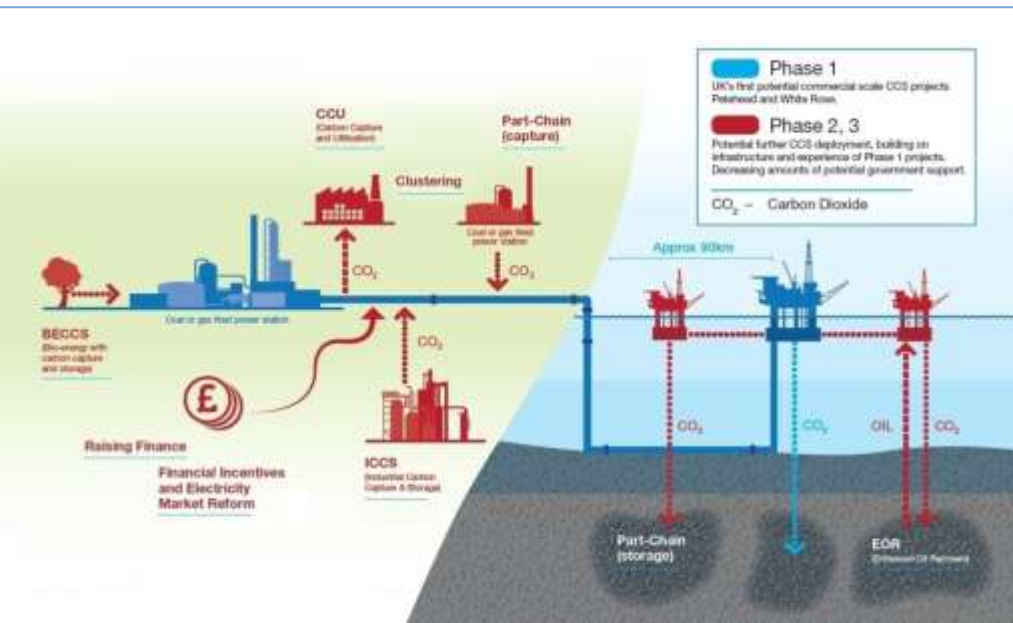
Commissioned reports and related work

- Kingsnorth FEED
- Longannet FEED
- Cost reduction work

Available at:

www.gov.uk/uk-carbon-capture-and-storage-government-funding-and-support

Next steps in CCS: Policy Scoping Document



- Informal Public Consultation published August 2014
- Summarised the policies and actions taken to support CCS deployment
- Reaffirmed commitment to enable deployment of CCS (power and industrial) in the UK
- Sought views and evidence from the CCS sector on future phases of CCS deployment

Responses to Policy Scoping Document

Responses received from a range of CCS stakeholders including; the CCS Association, project developers, academia and the public sector

PSD Key Messages Received

- Want long term vision for CCS
- Need certainty from Government on financial support for follow-on projects (clear line of sight)
- Need to consider how to de-risk FEED
- Need robust regulatory framework
- Look at role of GIB and EIB in attracting private funding for CCS projects
- Long term framework for CCS transport and storage infrastructure right





Phase 2

- Creating right policy framework to enable follow-on projects to come forward
- £4.2m for industrial research (pre-FEED) for Caledonia Clean Energy Project
- Projects coming forward with little or no capital funding from Government
- Financial support through CfDs
- Storage appraisal & continued investment in R&D and innovation
- Working to strengthen the business case and achieve cost reductions:
 - Utilising shared infrastructure
 - Learning from global projects
 - Collaborative R&D (EU)
 - Enhanced Oil Recovery



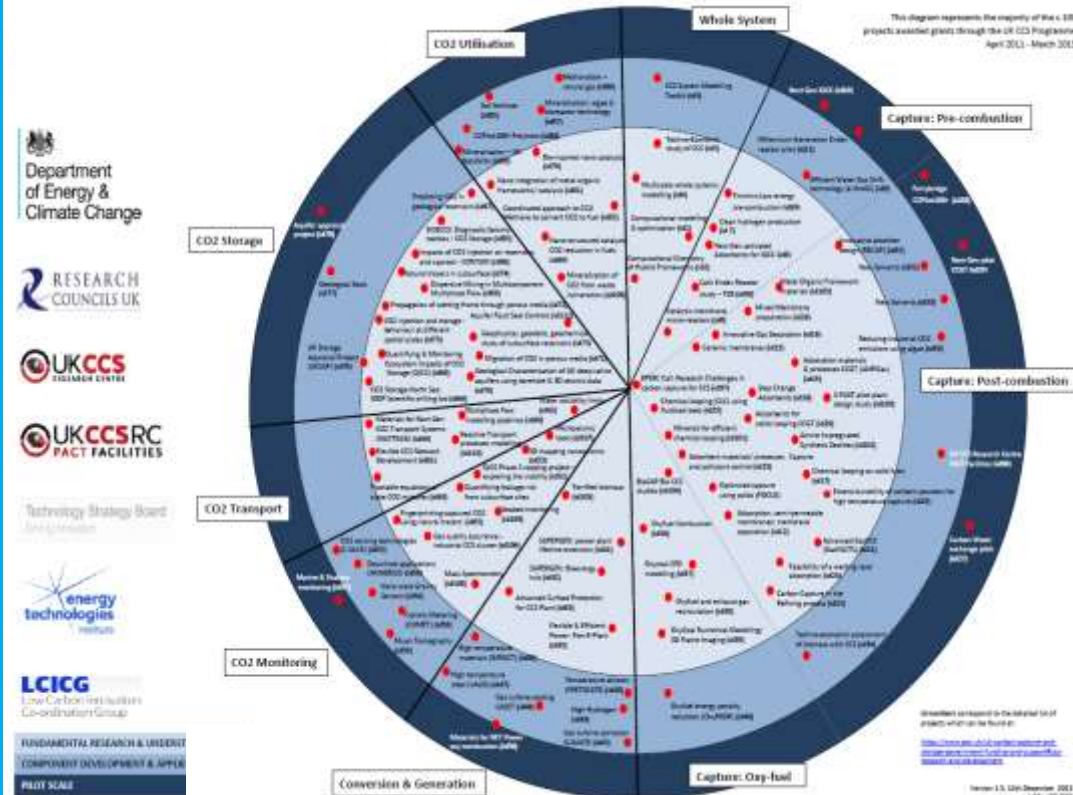
Phase 3

- **CCS projects competing on cost with other low carbon technologies**
- **Enabled by EMR**
- **Benefitting from (for example):**
 - **Learnings from previous projects and increased confidence**
 - **Established supply chain**
 - **Significant cost reductions**
 - **Outputs of earlier R&D investments**



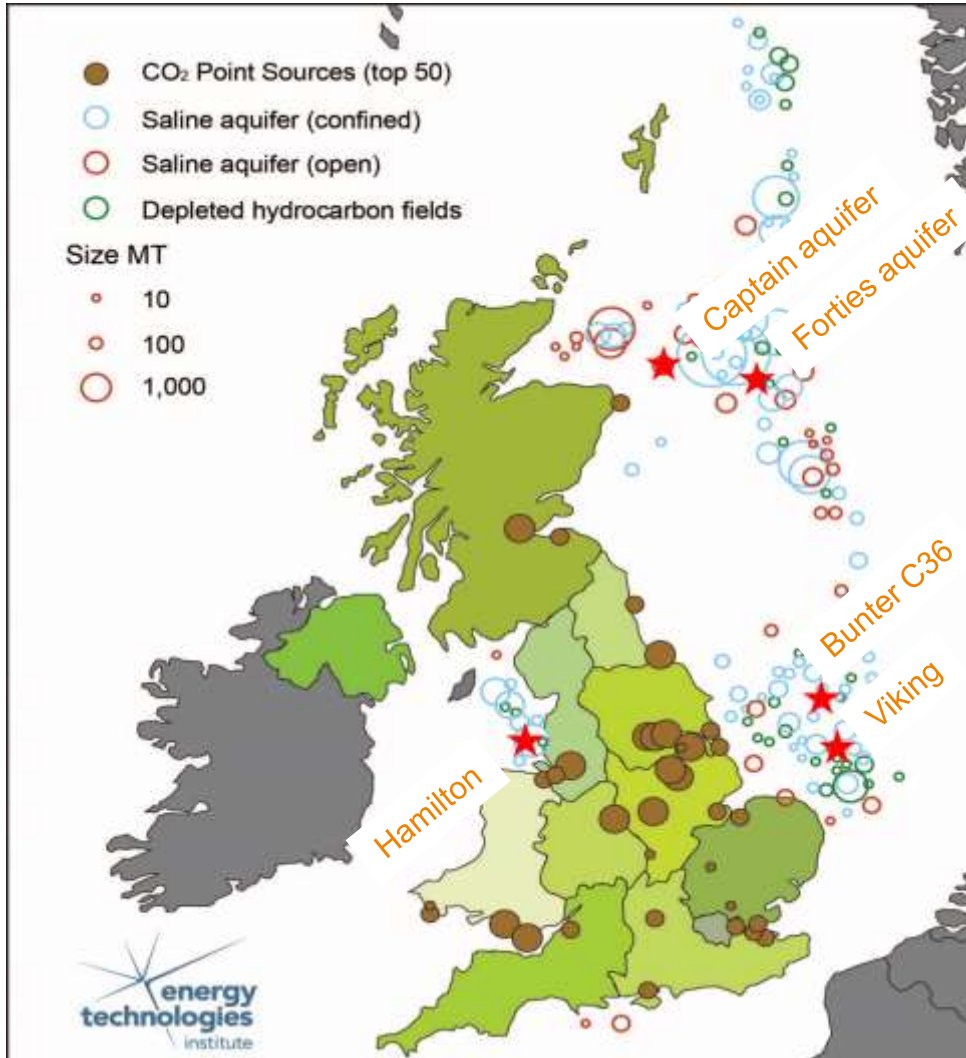
R&D Comprehensive Approach

- Fundamental research and understanding
- CCS ERA-NET (ACT) total ~ €42
- Strategic UK CCS Storage Appraisal Project (£2.5)
- Energy Entrepreneurs Fund (£2.5)
- Caledonia Clean Energy project (£1.75m)



Strategic UK CCS Storage Appraisal Project

Selected Portfolio of 5 sites



Pale Blue Dot.



Selected portfolio

- Regionally distributed
- Significant capacity (1606 Mt)
- Diverse types
- Strong build out from Phase 1 projects
- Good fit with ETI Scenarios
- Enables further build out

There are many other candidate storage sites around the UK with significant storage potential

“The UK has lots of storage”

CCS Decarbonising Energy Intensive Industries

Beyond Power

- Expect CCS to be key for decarbonising many industrial emitters
- Particularly looking at iron, steel, oil refining, cement and chemicals industries
- Industrial Decarbonisation and Energy Efficiency Roadmaps to 2050
<https://www.gov.uk/government/publications/industrial-decarbonisation-and-energy-efficiency-roadmaps-to-2050>
- Funding pre-FEED industrial CCS study in the Tees Valley
<http://www.teessidecollective.co.uk/>

- CCS vital to successfully decarbonising energy intensive industries (iron and steel, cement, chemical and oil refining)
- Could deliver 20mtCO₂/yr abatement by 2050
- Cross benefits – economies of scale, de-risking CCS infrastructure investment, supply chain development
- £1m funding for Teesside industrial CCS study



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