



THE CLEAN ENERGY
PROJECT

A decorative graphic consisting of four thick, curved lines in yellow, orange, pink, and light green, arranged in a series of nested curves that sweep from the left towards the right.

CCEP Overview

January 2013

Unlocking CCS in the UK



Sections:



Introduction

Project Detail

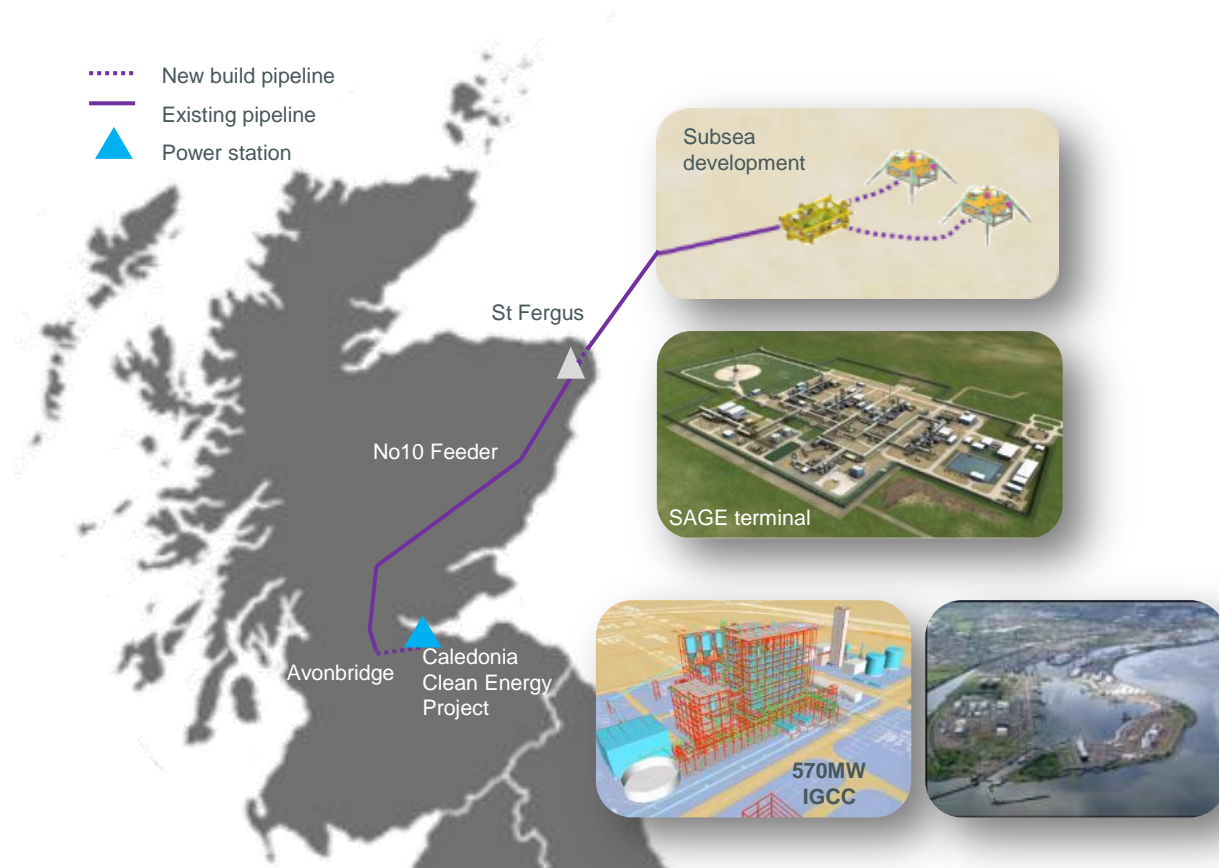
Project Summary

The Captain Clean Energy Project (“CCEP”) is a clean coal carbon capture & sequestration project being developed by the **Summit Power Group**, LLC and **Petrofac**, LTD which will capture and store over 90% of CO₂ produced by the project – over 3.8M tonnes per year.

The project will consist of two primary parts:

- i. an 570 MW integrated gasification combined cycle (“IGCC”) facility located in Grangemouth, Scotland;
- ii. offshore CO₂ Storage site in the North Sea

CO₂ will be transported from the IGCC to the offshore storage facility via National Grid’s Feeder 10 pipeline.



CCEP was recently shortlisted (1 of 4) in DECC’s £1 billion CCS Competition

Proven Technologies & Commercial Package at the Heart of CCEP

Proven Technologies

- Siemens gasification technology used in CCEP was proven in Germany before Siemens scaled it up to SFG 500 units. These have had numerous sales in the U.S., and China, and five such gasifiers are already operating in China;
- Linde air separation technology is mature and widely used for commercial production of pure gas from the atmospheric constituents of air;
- Linde Rectisol® gas cleanup process that removes acid gases like sulfur dioxide and captures the carbon dioxide has been deployed and used internationally for decades;
- Siemens power island is a state-of-the-art H-class combustion turbine matched with a steam turbine in combined cycle operation, identical to a natural gas combined cycle power island with certain modifications. Siemens CTs have accumulated more than 750,000 hours of successful operating experience on syngas in IGCC plants
- Onshore & Offshore CO₂ transportation uses existing pipeline infrastructure re-purposed for CO₂ transport. Demo 1 FEED study has proven the feasibility of this repurpose
- CO₂ storage site development incorporates learnings from Demo 1 FEED

Commercial Package

- Contract For Difference (CfD) Mechanism offers a stable, predictable revenue stream with a credit-worthy-counterparty
- EPC package expected to be Lump Sum Turn Key with strong Performance and Delay Liquidated Damages – proven package negotiated by Summit once before and applauded by Independent Engineer
- Long term O&M agreement

Linde Air Separation Unit



Siemens Gasifiers (SFG-500)



Linde RECTISOL® Unit



End Use Facilities - Siemens SGT-8000H turbine



Source: Linde

Source: Siemens

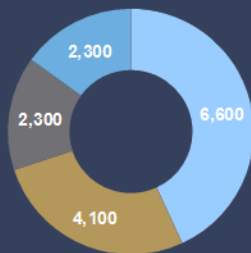
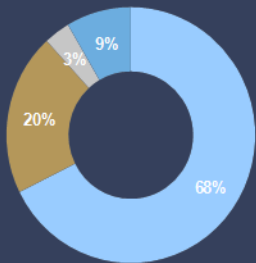
Project Sponsor: Petrofac

- Established player in the oilfield services industry
 - FTSE 100 Company
 - ~£ 5.8 bn / \$ 9.3 bn Market Cap
 - The UK's largest oilfield services business
- Designs, builds, operates and owns energy infrastructure around the world
 - Large gas processing plants > 10bcm/yr
 - Construction of power plants up to 200MW, design up to 800MW
 - Contract size ranges up to \$4bn
 - Extensive offshore oilfield experience including a long history operating in the North Sea
- Strategic investor in CCS and EOR – significant business opportunity for continuing Petrofac's growth
- Key markets: Middle East, Africa, CIS, Europe, UK and Asia Pacific



£3.6Bn Revenue

15,400 People



- Onshore Engineering & Construction
- Offshore Projects & Operations
- Engineering & Consulting Services
- Integrated Energy Services



Project Sponsor: Summit Power Group

- Founded over twenty years ago by former U.S. Secretary of Energy Don Hodel & Earl Gjelde
- Summit's traditional business is power project development
 - Developed over 7,000 MW of large, clean energy projects
 - Over 1,000 MW in development or under construction
- Summit's principal business lines include: Wind, Solar, Natural Gas and Carbon Capture
 - Summit has emerged as a worldwide leader in the development of carbon capture and sequestration projects
- Summit is the developer of the Texas Clean Energy Project ("TCEP")
- TCEP is a "first-of-its-kind" development – CCEP will use TCEP as a template and will use much of the same technology and partners (including Siemens and Linde)
- TCEP was awarded a \$450 million grant from the United States government



Risks Are Being Managed by Relying on Proven Designs

Both the IGCC plant and the CO₂ storage and sequestration will be based on proven concepts that have been significantly de-risked

TCEP will provide a model for the IGCC plant

- TCEP is scheduled to go into commercial operation in 2017 (construction expected to start in 2013)
- Integrated gasification combined cycle (“IGCC”) fertilizer and power plant sited in West Texas’s Permian Basin
- Relies completely on technologies and components already proven in commercial operation
- Execution risk has been minimized through fixed-price turnkey EPC contracts with performance guarantees and liquidated damages
- All the development tasks have been complete and the project is now in the process of closing the financing
- The US Department of Energy granted TCEP a total of US\$450 million as a competitive cash award, the largest clean coal award under this Administration

Transport & Storage benefits from Demo 1 FEED study

- Petrofac previously participated in the development of offshore solution for the Longannet project in the Demo 1 study during 2010/2011.
- The CO₂ storage site development incorporates learnings from Demo 1 FEED - all offshore development will be subsea, thus reducing capex/opex and minimising offshore HSE issues. Such technology has been proven in both the oil and gas arena and also with offshore CO₂ injection at Statoil’s Snohvit project in Northern Norway
- Demonstration of saline formation storage at a location where static and dynamic reservoir data exists, significantly mitigating the risk of non-performance
- Application of Demo1 FEED study for the onshore FEEDER10 pipeline



Sections:

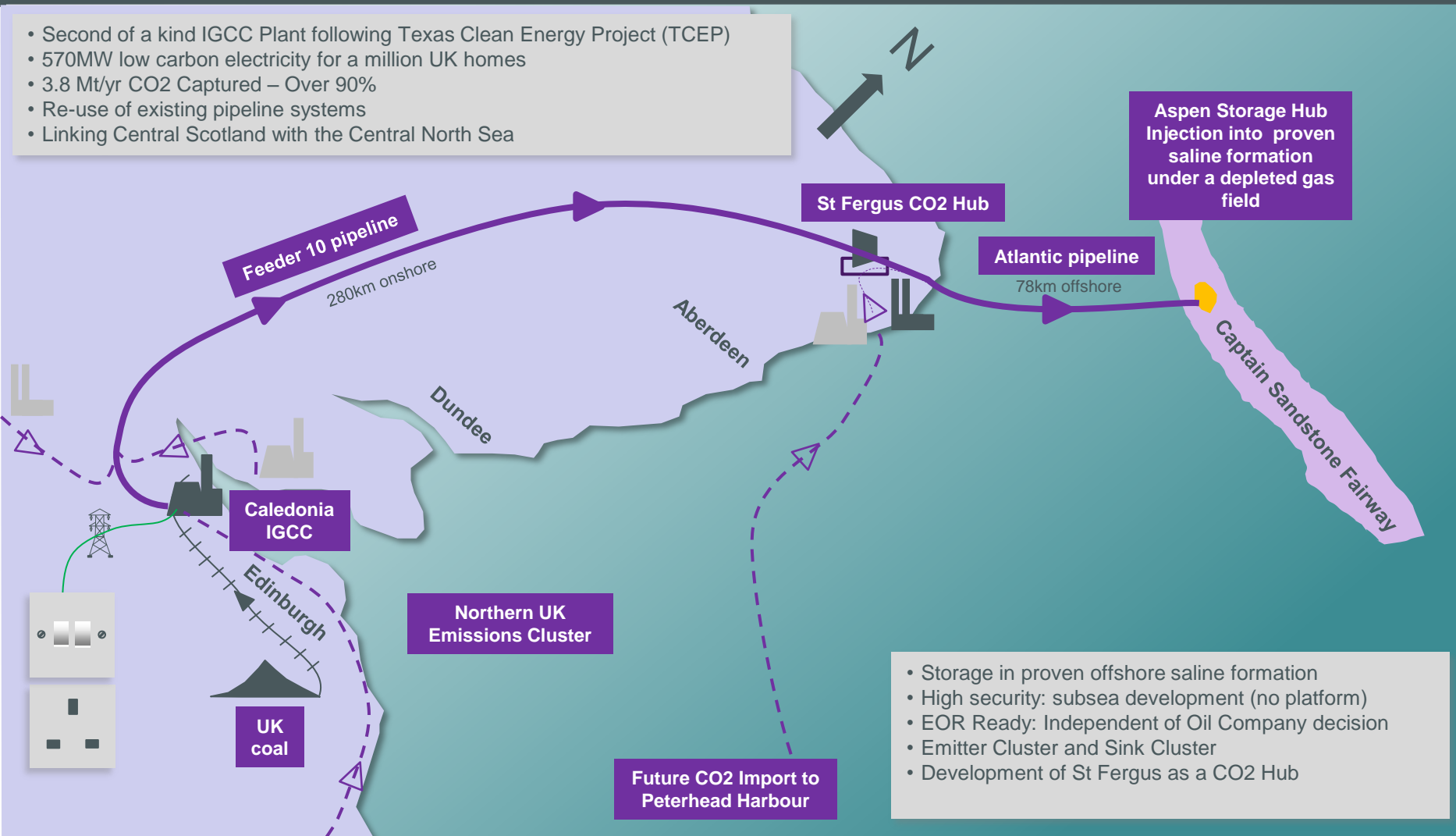
Introduction



Project Detail

CCEP CO2 Chain Overview

- Second of a kind IGCC Plant following Texas Clean Energy Project (TCEP)
- 570MW low carbon electricity for a million UK homes
- 3.8 Mt/yr CO₂ Captured – Over 90%
- Re-use of existing pipeline systems
- Linking Central Scotland with the Central North Sea

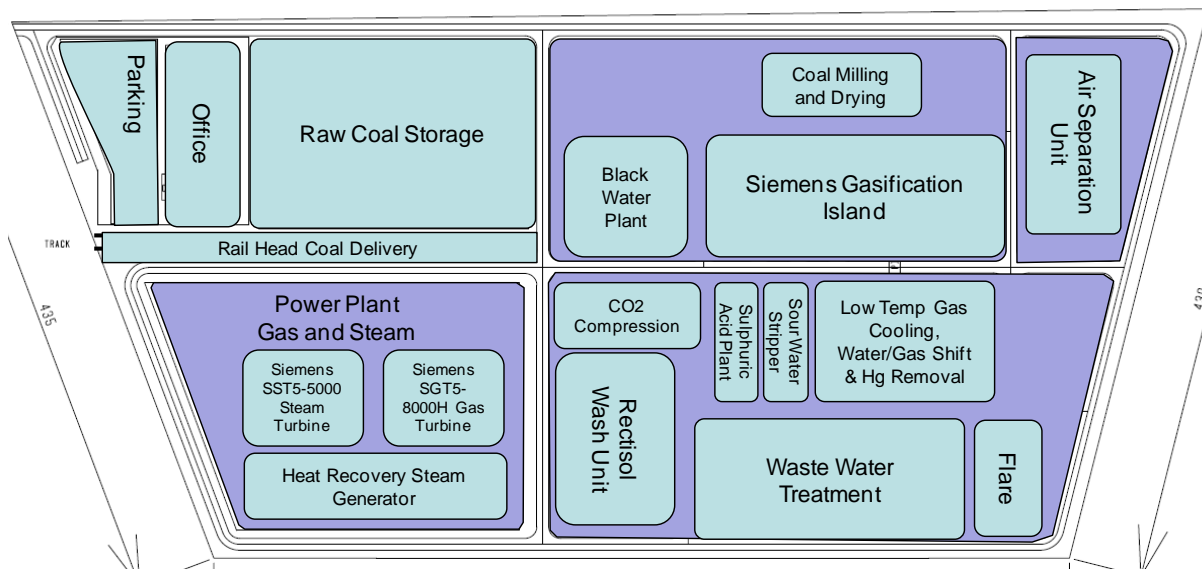


- Storage in proven offshore saline formation
- High security: subsea development (no platform)
- EOR Ready: Independent of Oil Company decision
- Emitter Cluster and Sink Cluster
- Development of St Fergus as a CO₂ Hub

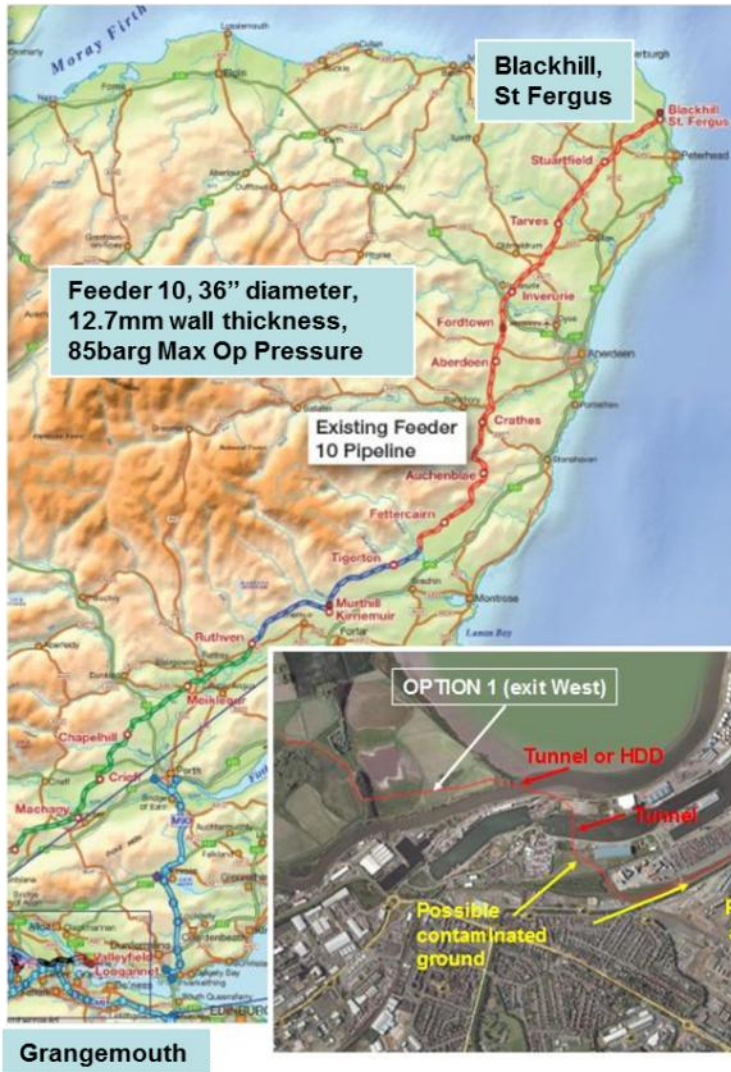
Project Overview – IGCC Caledonia Power Plant – Grangemouth



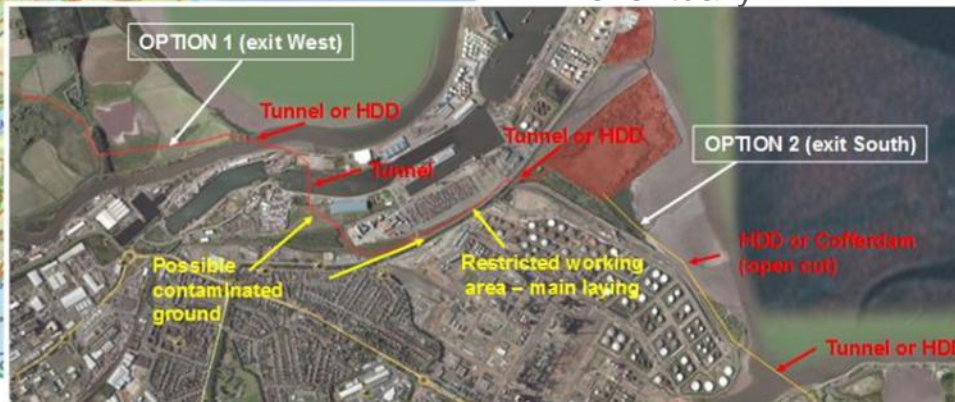
System	Equipment/Process	Manufacturer
Gasifiers	3no Siemens SFG-500 gasifier	Siemens
Combustion Turbine	1no Siemens SGT5-8000H	Siemens
Steam Turbine	1no Siemens SST5-3000RH	Siemens
Air Separation Unit	Air Compressors and Cold Box	Linde
H ₂ S Separation	Rectisol	Linde
CO ₂ Separation	Rectisol	Linde
Heat Recovery Steam Generator	1no Triple Pressure with Duct Firing	Nooter/Eriksen or equivalent
Water-Gas Shift	Two-stage Sour Shift	Haldor Topsoe or equivalent
Sulfur Recovery	Sulfuric Acid Plant	Monsanto or equivalent
Mercury Control	Carbon Bed	Several



Project Overview – Onshore Transport

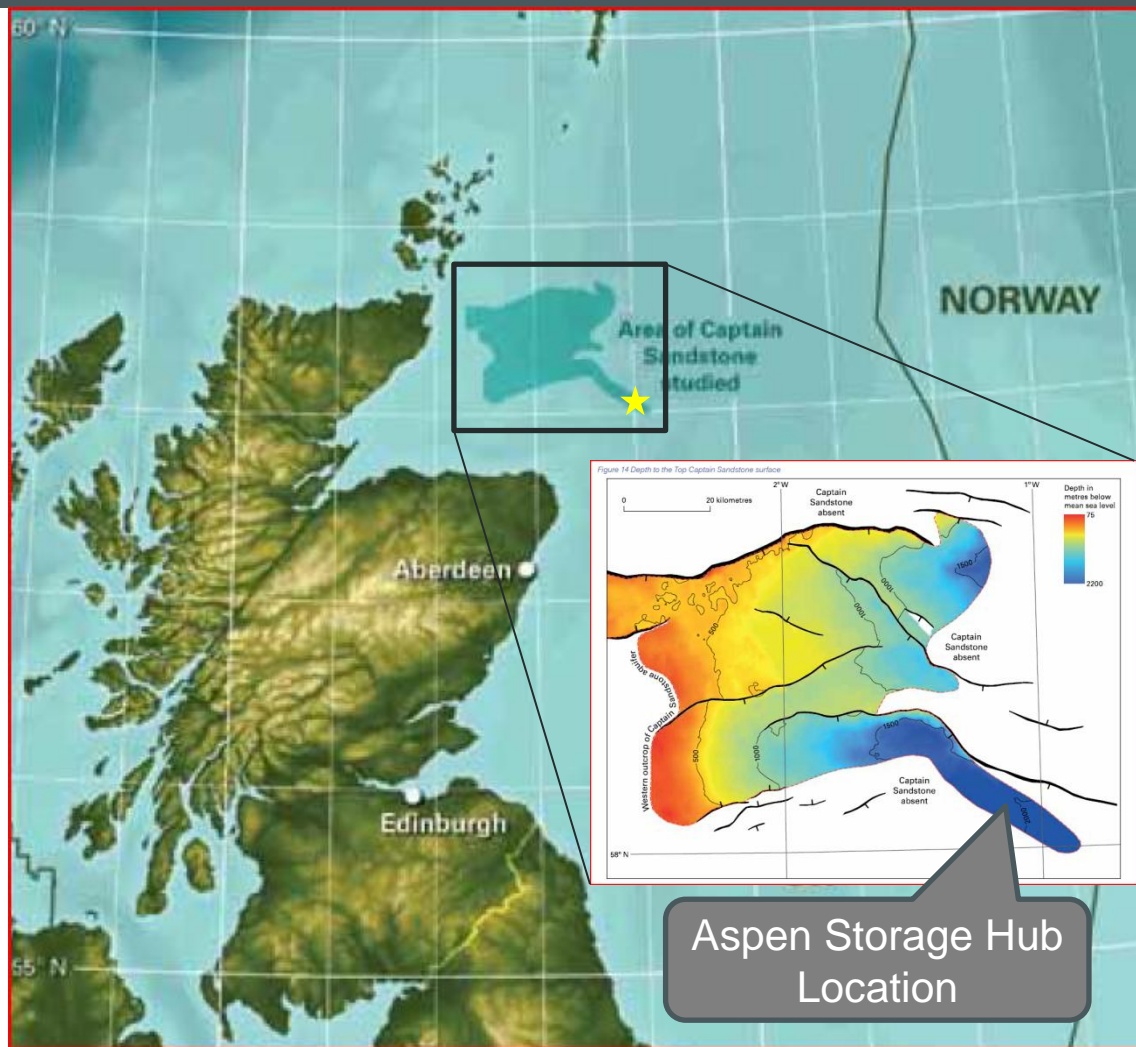


- Onshore transport will be handled by National Grid through their existing Feeder 10 Pipeline
- Existing natural gas pipeline will be repurposed for CO2 transport
- FEED study completed during DEMO 1 process
- Outside the fence arrangement with National Grid owning and operating pipeline
- Contract to include penalties guaranteeing CCEP uptime performance
- CCEP pays no capital cost – only use-of-system tariff and capacity tariff
- Excess capacity may be used to transport other CO2 eventually



Project Overview – Aspen Storage Hub

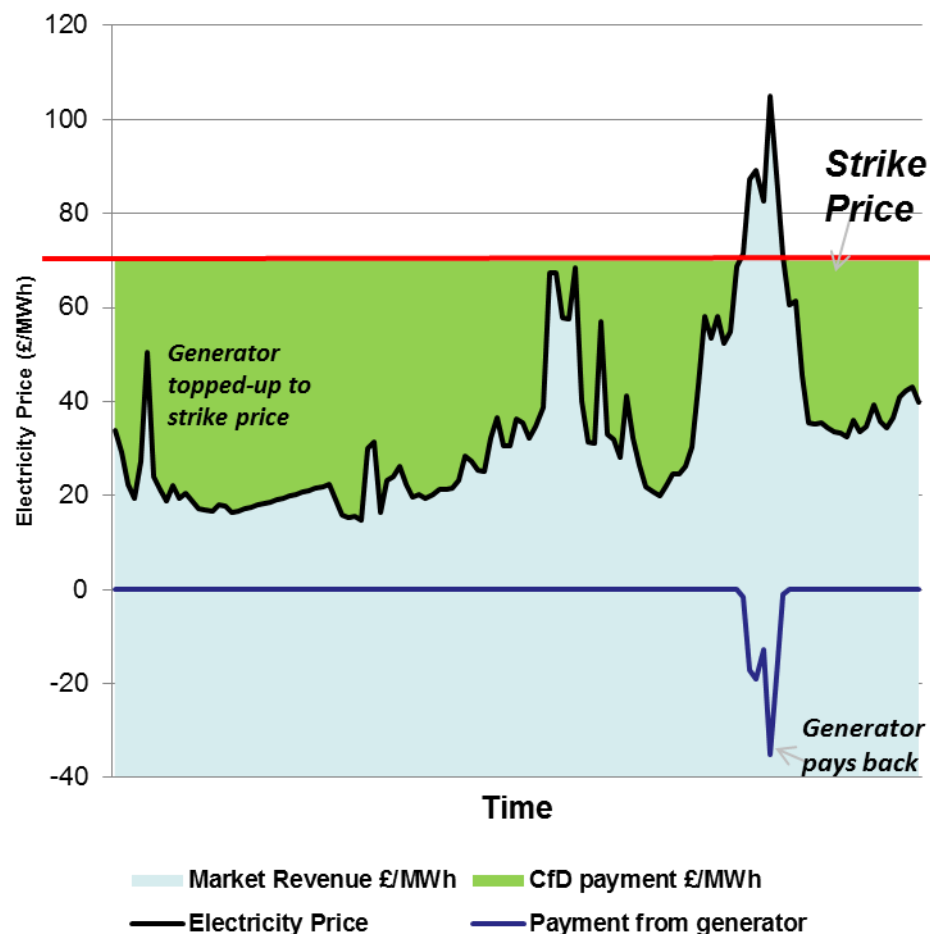
- Offshore transport and sequestration will be owned and operated by CCEP
- Target storage reservoir is the saline aquifer below a depleted Gas Field in the Captain Sandstone fairway in the Outer Moray Firth region of the Central North Sea
- An existing Natural Gas Pipeline will be redesignated for CO₂ transport
- Captain Sandstone – Lr Cretaceous
 - Depth >1500m, >20% porosity, ~2000mD
- Gas field – now being decommissioned
- 3D seismic coverage with 19 wells
- New purpose designed wells are planned
 - Excellent injectivity potential – up to 2 MT/yr per well (100mmscf/d equiv)
- Strong active aquifer with regional connectivity proven during production
- Excellent caprock and secondary seals



From “Progressing Scotland’s CO₂ Storage Opportunities March 2011” - SCCS

Revenue – Contract for Differences (CfD) Mechanism

- **Purpose** - Contractual Mechanism designed by UK Government to achieve policy objective of replacing existing generation capacity with low carbon generation over time.
- **CfD Counterparty** – Government-owned, limited liability company funded by compulsory levy on all licensed electricity suppliers in Great Britain and Northern Ireland
- **Payment** – Intended to eliminate exposure to market price risk. Generator will receive market reference price via a separately contracted PPA plus either a “top up” or a payment so that generator receives a consistent strike price per MWh generated.
- **Inflation Linked** – DECC intends that CfD mechanism will include full or partial linkage to CPI
- **Fuel Indexation** – Expected to index against 100% of price movement of the fuel used with an adjustment to account for any double counting of inflation.
- **Change in law** - CfD will also provide investors with a degree of protection against certain changes in law and regulation
- **Timing** – Still under development. Full details to be promulgated July 2013, well in advance of financial close



* Prices shown are illustrative



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