Retrofitting commercial scale carbon capture at Longannet Power Station

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ScottishPower

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Iberdrola Group and ScottishPower

ScottishPower is part of Iberdrola, a world leader in energy

- Combined April 2007 to form one of the largest global energy companies
- Operates in over 40 countries
- Serves 30 million customers
- 43GW of installed capacity and a world leading 10 GW of renewables
- Over 5 million customers and 6GW of generation capacity across the UK

...with a clear focus on clean, sustainable energy provision
ScottishPower Overview

ScottishPower is one of the “Big 6” energy suppliers in the UK

- We supply 5.2 million customers
- Over 8,000 employees
- 6GW of coal, gas & hydro generation across the UK
- Distribution area of over 35,000 square kilometres
- SP Renewables largest onshore wind operator in UK (800 MW)

Vertically integrated and geographically diverse energy business
Investing in an emerging industry

**Collaborative Research**
- CASSEM Aquifer Storage
- CO₂ Storage Study for Scotland
- World’s first CCS Professorship

**EU CCS Demonstration**
- Unsuccessful in application for €180m grant funding in EEPR
- Potential follow-on funding from EU ETS New Entrant Reserve

**Mobile Test Unit**
- ScottishPower and Aker Clean Carbon are deploying the Mobile Test Unit at Longannet
- An ongoing test programme focussed on capture chemistry

**UK CCS Competition**
- Competition to develop the UK’s first commercial scale full chain CCS demo
- ScottishPower CCS Consortium is one of the final two bidders engaged in the competition process

Focus is on reducing the cost of capture and developing storage options
The ScottishPower CCS Consortium Demonstration Project

A viable scheme capable of delivery by 2014
## The ScottishPower CCS Consortium

### A consortium of world leaders

<table>
<thead>
<tr>
<th>Consortium Partners</th>
<th>Working with</th>
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<tbody>
<tr>
<td><strong>ScottishPower</strong></td>
<td><strong>Accenture</strong></td>
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<tr>
<td>- Part of the World’s 4th largest energy group</td>
<td>- Global knowledge business with operations in more than 50 countries</td>
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<td>- Strategic focus on sustainable energy provision</td>
<td>- Committed to delivering innovation</td>
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<td>- Committed to making the UK a Global Centre of Excellence for CCS</td>
<td>- Knowledge management and transfer at its core</td>
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<td><strong>National Grid</strong></td>
<td><strong>Aker CleanCarbon</strong></td>
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<td>- Owns Britain’s high pressure natural gas transmission system</td>
<td>- Part of the Aker group with a presence in over 30 countries</td>
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<td>- Designs, builds and operates gas pipelines</td>
<td>- Over 16 years experience in CO₂ capture</td>
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<tr>
<td><strong>Shell</strong></td>
<td><strong>Aker CleanCarbon</strong></td>
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<tr>
<td>- Global group of energy and petrochemical companies</td>
<td>- Contractor for design and construction of Sleipner</td>
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<tr>
<td>- Handling of gas and liquids above and below the surface</td>
<td>- Well placed to help deliver CCS</td>
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<td>- Well placed to help deliver CCS</td>
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Committed to understanding requirements for commercial scale CCS
Longannet Power Station - Overview

Second largest coal fired power station in UK – third largest in Europe

- Located in the Firth of Forth - operational in 1970
- 2,400MW capacity – capable of powering over 2 million homes
- Supplied from local and international coal resources
- Opted into the LCPD in 2006
- Progressing life extension options

Ideally situated for CCS CO$_2$ storage – close proximity to North Sea
Energy security relies on a balanced portfolio of generating types

Focussed on providing secure and sustainable energy

- Clear focus on sustainable energy provision
- World leader in Renewables

- Investing to meet emerging generation gap
- Balanced portfolio approach

- Strategy based on security, sustainability and affordability

Increasing efficiency and environmental performance

- 4 x 576MW coal units
- Ongoing efficiency improvements

- Reducing SO₂ emissions
- Flue gas desulphurisation

- Reducing NOₓ emissions
- Life extension

- Reducing CO₂ emissions
- Carbon Capture and Storage

Longannet Pathway to Clean Coal
Challenges of CCS implementation

Significant challenges for what could a world first

- Flexible capture plant required to connect to a commercial station
- Reducing the energy requirement and driving down costs
- Mobile Test Unit at Longannet to prove the capture process
- Integrating the capture plant with the rest of the CCS chain
- Must tie-in with developing commercial & regulatory landscape

ScottishPower is taking the necessary steps to understand these
Progress

On track to be operational in 2014

Taking the lead to make real progress towards delivery

- **2007**: Scheme concept developed
- **Spring 2009**: ScottishPower joins SOLVit programme
- **Spring 2009**: MTU arrival at Longannet
- **Summer 2009**: Consortium formed with Shell & National Grid
- **Summer 2009**: Stuart Haszeldine confirmed as ScottishPower CCS Professor
- **Spring 2010**: UK Government awards SP CCS Consortium FEED contract
- **Autumn 2010**: ScottishPower Academic Alliance commences
The Mobile Test Unit

Bringing CCS out of the lab and into reality

- Part of the SOLVit programme, to improve capture solvent performance
- A cutting edge carbon capture research facility testing the CO₂ capture process
- Small-scale replica of a commercial capture plant; first time fit to coal power station
- Tests the complex chemistry in capturing CO₂ from coal fired power stations
- Ongoing programme with over 4000 hours of CO₂ capture to date
- Essential step to achieving capture plant operating cost certainty

An essential step towards commercialisation of CCS
Summary

✓ Technical challenges of applying CCS at Longannet are becoming clearer
✓ Ongoing collaboration across CCS chain
✓ Actively engaging in UK CCS Demo competition
✓ We believe retrofitting CCS at Longannet is both feasible and desirable
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