The White Rose CCS Project: A Pathway to Regional Decarbonisation

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11th EC-EURACOAL COAL DIALOGUE on the future role of coal in Europe and current challenges
Brussels, 08th July, 2015
Topics

- Project Overview & Update
- UK CCS - Pathway to Regional Decarbonisation
‘Carbon Capture and Storage (CCS) has the potential to be one of the most cost effective technologies for decarbonisation of the UK’s power and industrial sectors, as well as those of economies worldwide’

CCS Roadmap
Department of Energy and Climate Change

Vision: White Rose CCS
The Future of Clean Power

Artist impression – courtesy of Arup Associates
Carbon Capture Storage (CCS) Snapshot

- CCS = collection of CO$_2$ emissions from plants, transportation via pipeline and permanent storage underground
- Capture of emissions from power and industrial facilities
- Main technologies for power CCS: pre-combustion, post combustion and oxy-fuel
- Storage techniques used for several decades for enhanced oil recovery (EOR)
- 27 million t/d of CO$_2$ are currently being captured and stored around the world
State of the Nation – CCS Deployment

- 22 large-scale CCS projects in operation or construction globally.
  - Capacity to capture up to 40 mill. tpa of CO₂ eq. 8 million cars off the road.
- 14 large-scale CCS projects in advanced planning stages
  - 9 in the power sector, many of which are anticipated to take a FID in 2014/15.
- 1st large-scale CCS project in the power sector went live at Boundary Dam in Canada on 2nd October, 2014
- Abu Dhabi CCS Project in the UAE (expected to come online in 2016) will be the world’s first large-scale CCS project in the iron and steel sector
- The next two large-scale CCS projects in the power sector are planned to come online in the US:
  - Southern Company’s Kemper County Energy Facility in Mississippi (2016), and the Petra Nova Carbon Capture Project in Texas (2016)
- The US, Canada and China leading the world in the development and deployment of CCS projects
  - Recent US-China emissions agreement likely a catalyst for accelerated CCS deployment.
- The UK is at the vanguard of CCS commercialisation in Europe

(source: GCCSI)
CCS Drivers

Intergovernmental Panel on Climate Change 5th Assessment Report (2013):

“It is extremely likely [>95% certainty] that human influence has been the dominant cause of the observed [climate] warming since the mid-20th century”

• IPCC recommends reduction of global CO₂ emissions by 50 – 85% by 2050
• IEA recommends CCS contributes to 14% of cumulative CO₂ emissions reduction to 2050
• UK 2008 Climate Change Act – legally binding CO₂ targets (80% cut in CO₂ emission level by 2050)
• ETI indicate cost of reducing CO₂ emission level without CCS in UK would equate to 1% GDP (£30 - £40Bn/yr)

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1 IPCC 5th Assessment Report: Summary for Policymakers
2 IEA Technology Roadmap CCS 2013
White Rose CCS - Project Snapshot

- A full-chain integrated CCS project incorporating a new ultrasupercritical Oxy Power Plant, up to 448 MWe (gross)
- Located Drax, North Yorkshire providing >300 MWe clean power, equivalent to the needs of 630,000 homes
- 100% of flue-gas treated, 90% CO₂ capture rate → 2 MTPA
- Biomass co-firing leading to net zero - CO₂ emissions

- CO₂ transported c.a. 100 miles by pipeline to off-shore storage
- CO₂ to be permanently stored in a deep saline formation
Delivery Plan

OXY-POWER PLANT (OPP)
- Full-Chain Integration

- Delivery of OPP
- Integration of OPP

- O&M of OPP
- Trading Services
- Site and Site Services
- Fuel Supply
- Electrical Connection

CO₂ TRANSPORT & STORAGE

- Delivery of ASU
- O&M of ASU

- Delivery of Transport & Storage network
- O&M of Transport & Storage network

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UK CCS Build Out Potential

- UK has tremendous storage potential in the Northern, Central and Southern North Sea as well as the East Irish Sea
- According to ETI, the country has potential storage of 78 G tonnes, well in excess of required storage of 3 G tonnes for the UK industry by 2050
- Transport networks to be planned for current and future CCS

Maps source: 1 Energy Technologies Institute Insights Report, carbon capture and storage potential for CCS in the UK 2 SCCS Unlocking North Sea CO₂ Storage for Europe, Practical actions for the next five years SCCS Recommendations and Conference Report 2013
Project Status

• Preferred Bidder in the UK’s £1Billion CCS Commercialisation Programme

• FEED Contract awarded - signed by the UK Government on 20th December, 2013

• FEED underway: detailed engineering, risk reduction and planning programme leading to financial close, FID and construction commencement.

• Planning Process on track:
  – Power Plant Development Consent Order (DCO) planning application accepted by UK Planning Inspectorate in December, 2014;
  – DCO application for CCS pipeline by National Grid accepted July, 2014

• Continuing work with the UK Government (DECC) towards Project Contract and Contract for Difference (CfD)

FEED Phase ~ 2 years

Construction Phase ~ 4 years

Operating Phase 15 – 20 years
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CCS: Strategic importance

**Security of supply**
The UK needs a diverse energy mix (incl. coal) and flexible generation to support intermittent RE and baseload nuclear.

**Climate change**
Fossil fuels still power over 80% world energy & expected to continue so CCS has a key role to play. Path to COP21 / 2015 agreement.

**Jobs and growth**
Appx 3,300 jobs at WR at peak construction averaging 1,000 jobs pa. Key role in decarbonising Energy Intensive Industries.

**Affordability**
Expected to be cost competitive in 2020s. Without CCS climate targets £30-40bn more expensive per year.

Source slide: DECC
CCS: Strategic importance

TECHNOLOGIES AND ACTIONS

As part of a portfolio of actions, CCS accounts for 14% of total energy-related CO₂ reductions needed by 2050. (Source: IEA, 2012)

Source slide: IEA
Path to Full Commercialisation

By 2030
- Up to 13 GW of CCS power
- Levelised cost of electricity <£100/MWh

A cost-competitive CCS industry

Full Commercialisation (Phase 3)

Transition Phase (Phase 2)

£1bn Commercialisation Programme (Phase 1)

By 2050
- CCS could provide up to 20% of the UK’s energy
- Saving £30 bn

Source slide: DECC
Pathway to Regional Decarbonisation

Next Steps in CSS: Policy Scoping Document

- BECCS (Bio-energy with CCS)
- Financial Incentives & Electricity Market Reform
- Raising Finance
- CCU (Carbon Capture & Utilisation)
- Part Chain Capture
- Clustering
- Part Chain Storage
- EOR (Enhanced Oil Recovery)

Source slide: DECC
CCS: Strategic importance

Source slide: DECC
Costs of Delivering CCS

CCS “has the potential to be cost competitive with other forms of low carbon power generation by 2020s” *CCS Cost Reduction Task Force*

1. UK CCS Cost Reduction Taskforce - Final Report-May 2013
White Rose will show that abated fossil-fuel power stations will be able to generate flexible, reliable and affordable power as mid-merit plants, providing security of supply and grid stability complementing base load nuclear generation and intermittent renewables.
THANK YOU