

Update on CCS Project in the Tees Valley.

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Even with very strong expansion of the use of renewable energy and other low carbon energy sources, fossil fuels could still make up over half of global energy supply in 2050 ... extensive carbon capture and storage will be necessary to allow the continued use of fossil fuels without damage to the atmosphere ... Carbon capture and storage is essential to maintain the role of coal in providing secure and reliable energy for many economies.

Stern Review, October 2006



Extracts from the Budget 2007 report

Chapter 7: Protecting the Environment

Carbon capture and storage (CCS) could reduce the carbon dioxide emissions from fossil fuel power stations by as much as 90%. The Government made clear in the Energy Review that the next logical step for CCS would be building a full-scale demonstration plant, subject to it being cost-effective. Since the 2006 Pre-Budget Report, the DTI has appointed consulting engineers to look robustly at the costs of a CCS plant based in the UK, and help the Government ascertain whether supporting one through a challenge fund or other mechanism would provide value for money.

The Government announces today that it will launch a competition to develop the UK's first full-scale carbon capture and storage demonstration, the result to be announced next year. When operational early in the next decade, this will make the UK a world leader in this globally important new technology.



Energy White Paper May 07

5.4.11 It is in our own vital interest that the technologies necessary to make coal low carbon are developed and deployed as rapidly as possible, since fossil fuel generation will remain a significant part of the global energy mix (on the Governments' present policies meeting almost 70% of global electricity demand by 2030¹⁶⁷). The Government believes that the development and wide-scale deployment of CCS is therefore important for our climate change and security of supply objectives. CCS has the potential to reduce carbon dioxide emissions from fossil fuel power stations by as much as 90%¹⁶⁸. The Stern Review¹⁶⁹ highlighted the strategic role that CCS technology could play globally to lower carbon emissions, with the potential to contribute up to 28%¹⁷⁰ of global carbon dioxide mitigation by 2050, particularly in fast-growing economies with rising fossil fuel consumption such as China and India.

5.4.13 The European Council¹⁷¹ has agreed that Europe should aim for all new fossil fuel power generation built beyond 2020 to be equipped with CCS, subject to the technology being technically and economically feasible. It also recommended that the Commission work towards a series of up to 12 CCS demonstrations by 2015. We welcome the Commission's ambition in this area and we support their suggestion that they make further recommendations within the next couple of years, including further work on technical and economic viability.

5.4.18 In the 2007 Budget the Government announced that it will launch a competition to develop the UK's first commercial-scale demonstration of CC When operational early in the next decade, this will make the UK a world leader in this globally important new technology.



Investment in electricity generation

UKERC May 2007

Policymakers cannot dictate which technologies the electricity industry should build. Governments can set a framework and provide incentives, but private companies, not governments, make investment decisions. Hence, the effectiveness of incentives in shaping investment determines whether energy policy goals will be met. Examples of policies that seek to shape investment include the Renewables Obligation and European Emissions Trading Scheme. The UK government is also consulting on proposals related to new investment in nuclear power and coal or gas with carbon capture. The effectiveness of such policies will depend in large part on the conditions that they create for investment.



Proposed UK CCS projects

Ten CCS projects are currently planned for the UK, with a total generating capacity of nearly 7 GWe. Together, the projects would reduce carbon dioxide emissions by about 30 million tonnes per year.

Pre-combustion capture: solid fuel

- 800 MWe IGCC project at Teesside by Coastal Energy
- 450 MWe project at Killinghlome by E.ON UK
- 900 MWe project at Hatfield Colliery by PowerFuel
- Gasifier at Immingham to power 1200 MWe CHP scheme and process hydrogen, by ConocoPhillips

Post-combustion capture or oxy-fuel

- 500 MWe supercritical, capture-ready retrofit at Ferrybridge by Scottish & Southern Energy
 - 1600 MWe supercritical/oxyfuel Project at Tilbury by RWE npower
 - 1600 MWe supercritical plant with biomass firing at Kingsnorth by E.ON UK
 - 2400MW Supercritical Capture Ready at Blyth
 - By RWE NPOWER
 - Supercritical Capture Ready at Longannet and Cockenzie
- By ScottishPower



Tees Valley IGCC

Clean coal project developer Progressive Energy has concluded an agreement with Centrica to invest in the potential development of an advanced clean coal project to be located in the Tees Valley. If both parties agree to pursue this option further to additional technical work, the project will utilise an integrated gasification combined cycle power station of around 800 MWe, incorporating carbon capture and storage. It is intended to pipe the power station's carbon dioxide emissions to oil fields in the North Sea, where it will be used to enhance oil recovery from mature fields, and permanently stored. The power station would be owned by a new company, Coastal Energy, and the carbon dioxide pipeline assets by a second new company, COOTS Ltd. Centrica will fund the ongoing development costs of Coastal Energy and COOTS, and will have the option to buy Progressive Energy shares in Coastal. Progressive Energy will retain a shareholding in COOTS.

As well as providing approximately 6 TWh of low carbon electricity per year, the project has the potential to provide the basis for a wider infrastructure – enabling the disposal of carbon dioxide from other projects that can capture the greenhouse gas. It also opens the door to securing otherwise unrecoverable oil from mature fields in the North Sea, says Progressive.



newenergy + recycling = newopportunities

'Capture ready' plant planned for Blyth

RWE NPOWER is to investigate the feasibility of a new, state-of-the-art 2400 MW, cleaner coal power station on the site of the former Blyth Power Station on the north-east coast. In an environmental 'scoping document' submitted to the DTI, the company outlines proposals for a new power station consisting of three 800 MW, high-efficiency supercritical coal-fired units. The proposed station would be extremely efficient, reducing carbon dioxide emissions by over 22% per unit of electricity generated compared to an equivalent-sized existing UK coal-fired power station, says RWE.

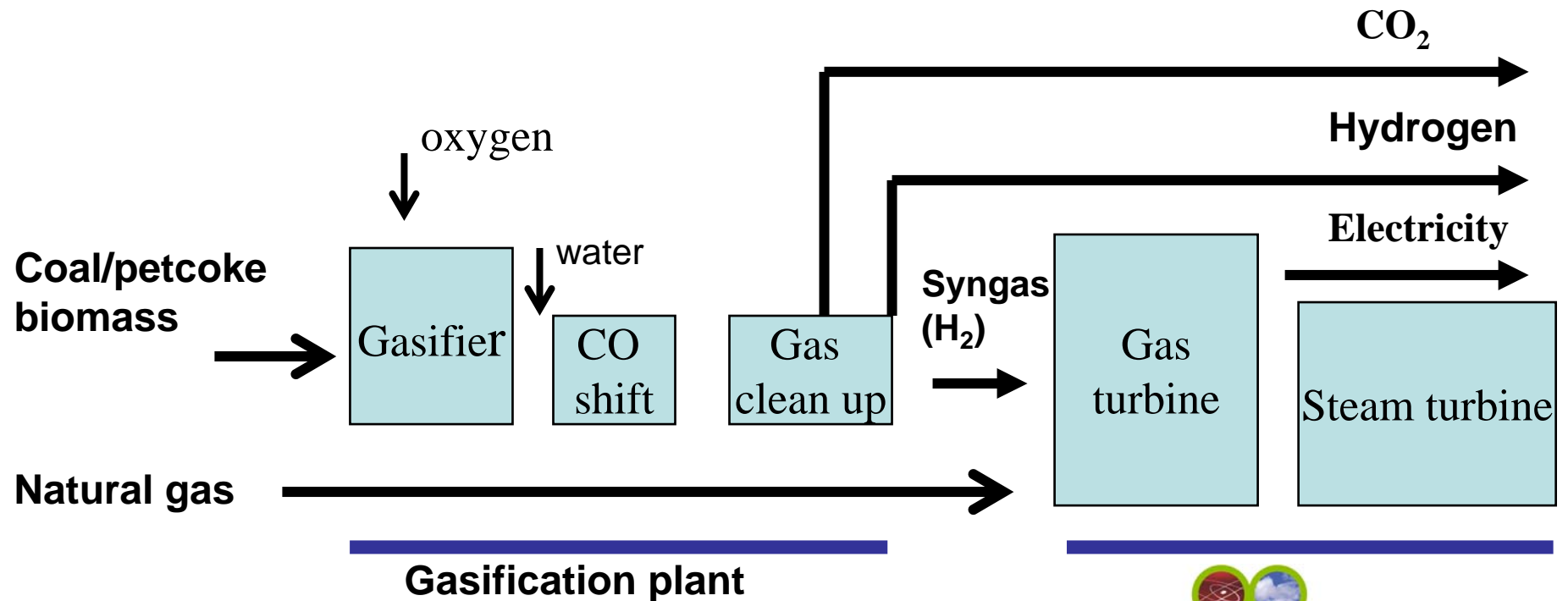
It would also be designed to be 'carbon capture ready' so that, once CCS technology is proven, the carbon dioxide produced would be transported to the North Sea and stored in geological formations. The new station would also be developed to include facilities for burning up to 10% biomass to further reduce emissions.



Integrated Gasification Combined Cycle: decarbonised electricity, and hydrogen

The Teesside IGCC manufactures a decarbonised synthetic gas from coal which is then used in a standard CCGT to produce electricity.

Decarbonised hydrogen may be supplied for other, offsite, uses.



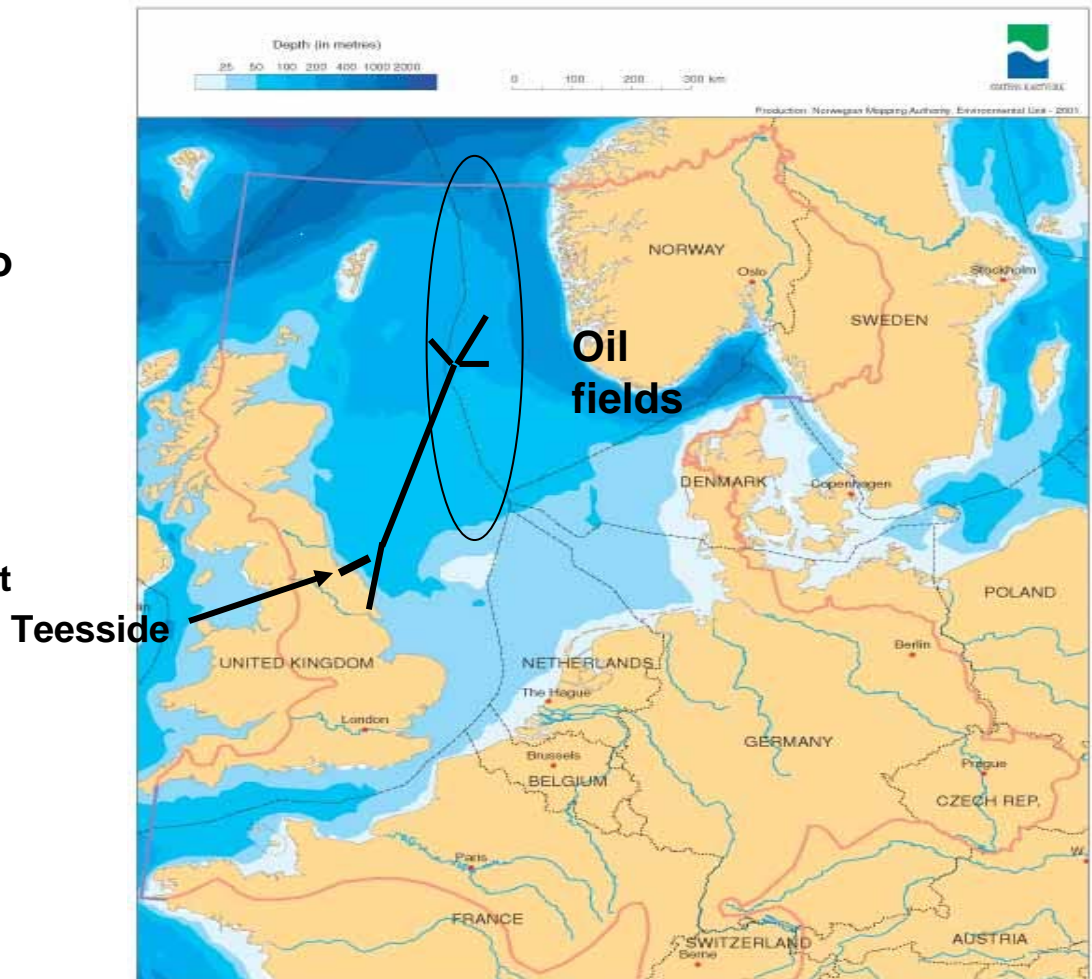
Key parameters

- Produce ~40 te /hr of decarbonised hydrogen some of which can be diverted for 3rd party use.
 - 800MWe producing ~6TWh of electricity per year – 1.5% of UK generation
 - Electricity produced with 85% of CO₂ removed, - 5Mte pa. Capability for biomass use allows prospect of zero CO₂ emissions
 - Decarbonised electricity output equivalent to production from >2000MWe of wind turbines
 - CO₂ piped offshore to produce additional, otherwise unrecoverable oil - potentially ~300M barrels over station lifetime
 - cf 500Mbarrels in 2006 from UKCS.... and falling year on year
 - Seeking to justify 15Mte pa pipeline
 - To allow further major capture projects in North East
 - Potential to extend life of UK oil province by 20+ years
 - Potential local heat supply to adjoining Ecopark and to proposed Council development
- a £1B investment

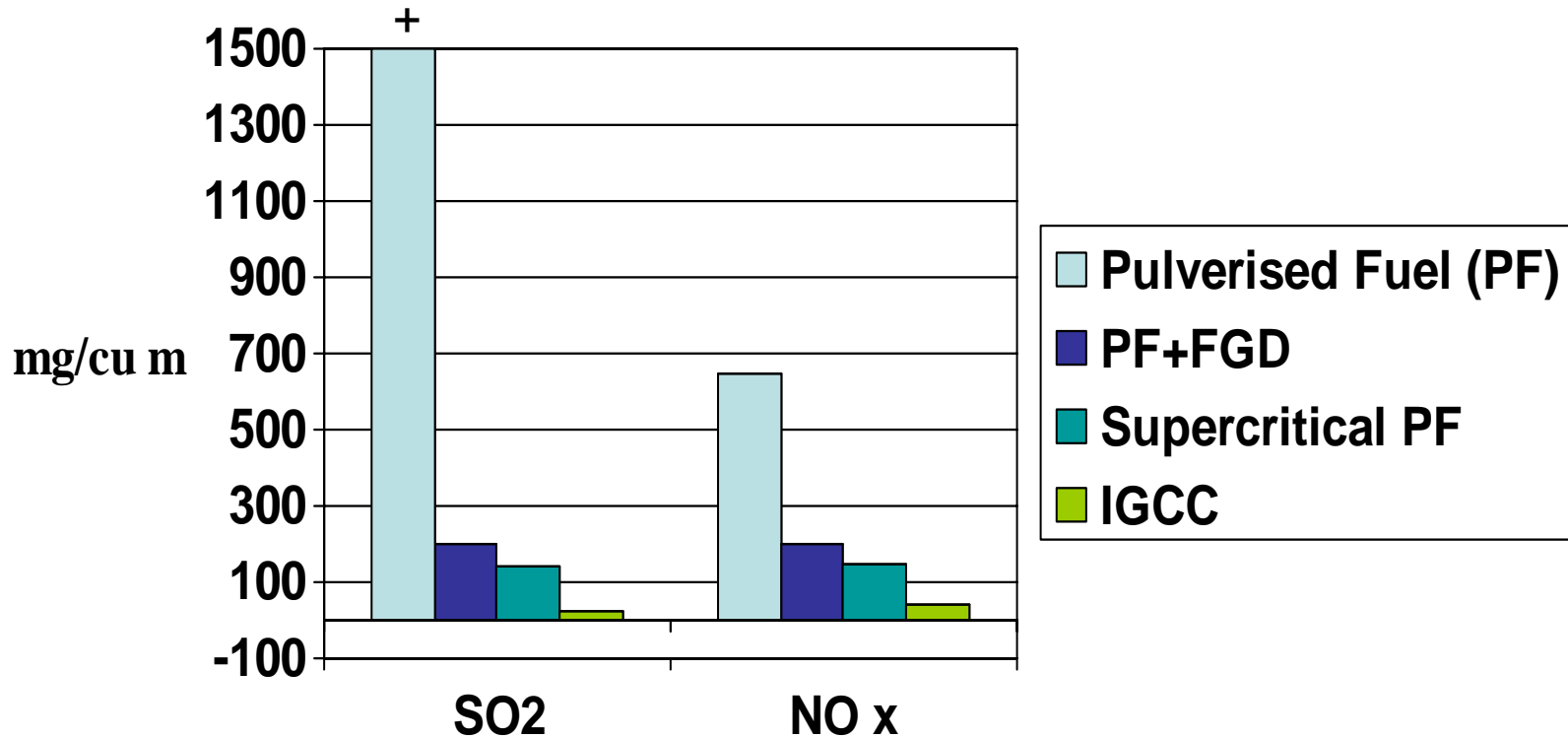


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- **New pipeline infrastructure to Central North Sea**
- **CO₂ injection into mature oil fields for sequestration and/or to enhance oil field recovery**
- **Pipeline sized to accept captured CO₂:**
 - from Teesside IGCC
 - Other (non- generation) plant at Teesside
 - Other capture plant elsewhere in the North East
- **Oil field injection avoids potential legal and regulatory barriers associated with CO₂ sequestration**



The Technology: the Environmental performance of IGCC far exceeds that of competing coal technologies

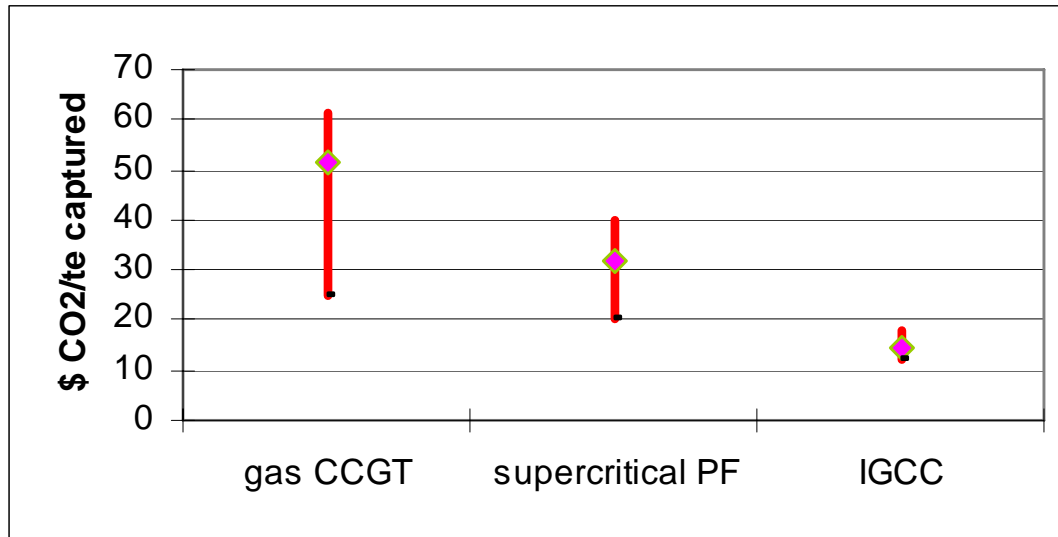


SO_x and NO_x emissions are comparable with gas CCGT.

Hg and particulate emissions are insignificant



Affordable CO₂ capture



- Many general studies on CO₂ capture cost for technology available now and possible over next 10+ years.
- Range of predicted costs dependent on assumptions: Variables include gas/coal/petcoke price; additional capex required; assumptions about timescale when available commercially.

CO₂ Capture technology is available today

Capture cost depends on technology,

IGCC has lowest capture cost now.



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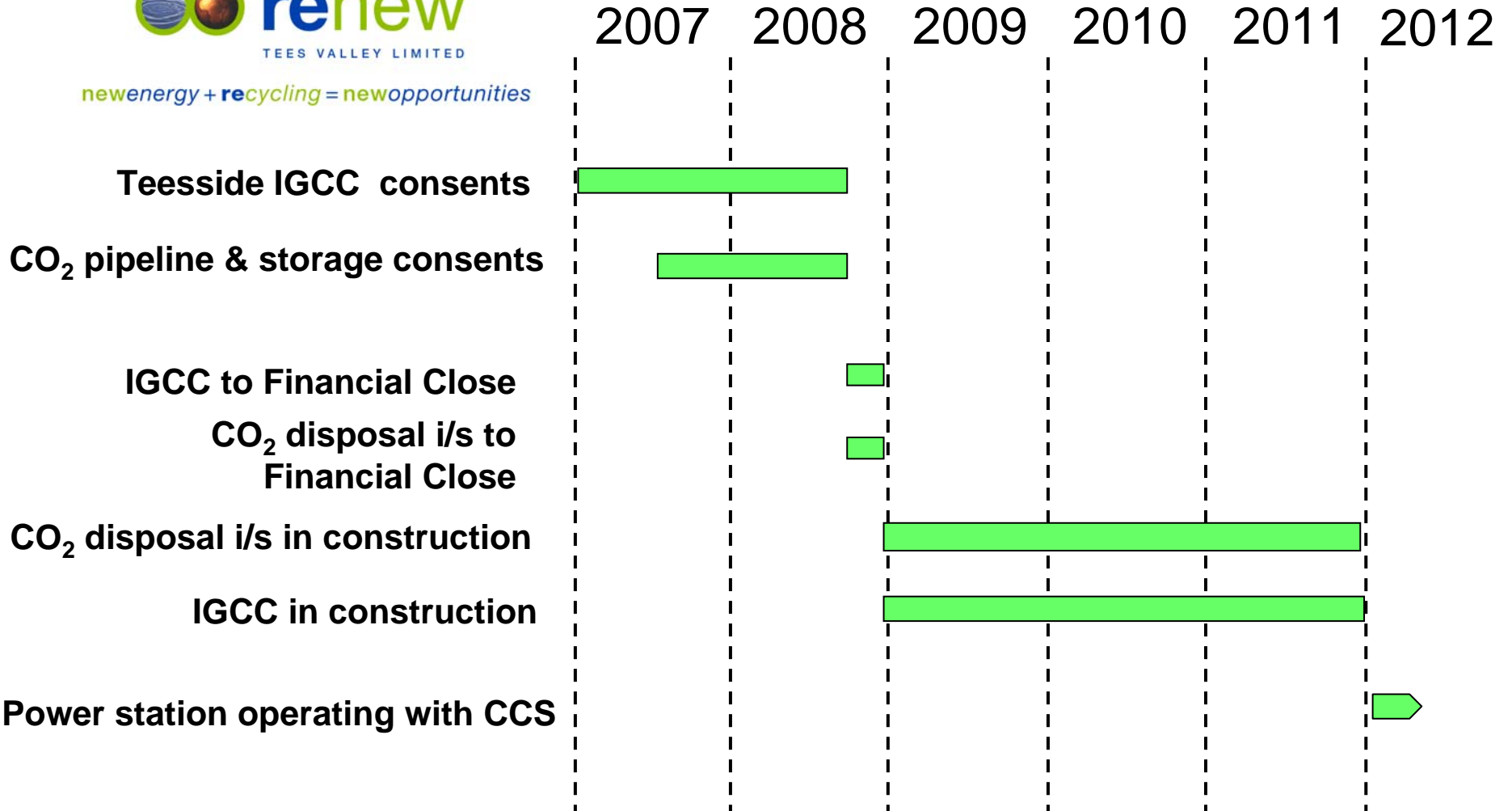
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Sources include: IEA Greenhouse Gas Study Oct 2002; CCP 2003; CENS Project 2004; Progressive Energy internal

Teesside Project Timeline



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Credible project partners

- Centrica :
 - Is a leading supplier of gas and electricity in the UK and had a turnover of £16.5B in 2006. Centrica owns a 3.4GW fleet of power stations but does not currently have coal generation capacity
- Progressive Energy:
 - Is the only specialist IGCC project development company in Europe, and is at forefront of IGCC design incorporating Carbon Capture and Storage,
- Centrica and Progressive jointly own
 - **Coastal Energy**, which holds the Teesside power station assets. Coastal will ultimately be 100% owned by Centrica
 - **COOTs**, which holds the CO₂ transport and disposal infrastructure required by the project.



The UK energy market: Drivers for Carbon Capture and Storage (CCS)

- Growing need for new Power stations in the UK:
 - Demand growth
 - Closure of first generation nuclear fleet
 - Closure of old coal plant
 - **16-20GW by 2015; >35% of UK capacity by 2020**
- All major new build in last 15 years has been gas fired CCGT but there are new drivers that may change this:
 - Gas price volatility
 - Security of supply and fuel diversity
- Requirement for bulk economic power generation which must be environmentally benign – LCPD AND EU emissions trading for CO2.... And eventual restrictions on other pollutants
- Significant overseas interest (China, India, USA, Australia)
- Consider Industries investment strategies (UKERC Study)
- Skills Shortage!?

