Economics modelling CCS

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17th April 2007
Introduction

- Very different views on the competitiveness of CCS

- Sensitivity to assumptions – technologies, fuel and carbon prices etc

- Need to examine end-to-end economics and optimise system across the chain

- DTI support – report available on:
  
  http://www.dti.gov.uk/energy/sources/sustainable/carbon-abatement-tech/page19502.html
Key Sources of information

- International Energy Agency
- IPPC Report Carbon Dioxide Capture and Storage
- British Geological Survey
Economic assessments – a health warning

- Answers very dependent on view of “do-nothing”
  - Company investment economics likely to be based on current assets
  - Traditional currency of abatement is vs CCGT alternative
- Abatement £/tonne figures for coal plant are very sensitive to choice of counterfactual
Modelling process

Capture
- Technologies
- Performance
- Capital costs
- Operating costs
- Return on capital
- Fuel costs
- Carbon markets
- Learning curves
- Asset lifetimes

Transport
- Onshore
- Existing terminals
- Offshore
- Hub and spoke vs Direct connect
- Pipes
- Compressors

Storage
- Field Type
- EOR revenue
- Sea depth
- Reservoir size depth
- Platform costs
- Drilling costs
Abatement v capture

• More CO₂ is captured than abated
• CO₂ captured is difference between the volume generated and released, ie 2.6 Mt
• CO₂ abated is difference between the volume counterfactual generates and that released, ie 2.1 Mt
Capture economics

- Gas Retrofit
- Coal Retrofit

Graph showing cost of abatement (£/tCO2 abated) against total volume abated (mtCO2 annually).
Transport costs depend on how much steel is required and how many booster are needed.

Both of these depend on diameter and length.
Storage economics

Curve for 2015: Central Favouring Coal

Cost of storage (£/tCO2 stored)

Total volume stored (mtCO2) annually

Aquifers

Oil & Gasfields

EOR
Example transport infrastructure

- Model can optimise transport system to lowest cost fields
- Hub and spoke vs direct connect
- Assume terminal constraint
Basecase total cost curve

Cost £/tonne vs. Annual abatement of CO\(_2\) Mt
Sensitivity to Fuel Prices

![Graph showing the cost of abatement (£/tCO2 abated) vs. total volume abated (MtCO2 annually) for Gas Retrofit and Coal Retrofit.](image)

- **Coal Retrofit**
- **Gas Retrofit**
Sensitivity to Carbon Prices

- Zero price of carbon allowances
- £10/t price of carbon allowances
Counterfactual differences

vs Existing plant

vs CCGT

Cost £/tonne

Annual abatement of CO₂ Mt

CCGT

Actual
Conclusions

- Significant potential for CCS at prices below £25/tonne
- Large sensitivity to inputs especially fuel
- Costs dominated by capture – UK has some very cheap carbon storage sites
Introducing Pöyry Energy Consulting

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- A pan-European energy consultancy formed from the merger of four highly respected consultancies
- 10 offices in Europe:
  - Oxford  – Helsinki  – Hamburg
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  - Paris
- Over 150 energy market experts