Energy Research Partnership

Submission to consultation 'Towards Carbon Capture and Storage'

The Energy Research Partnership (ERP) is high-level forum bringing together key funders of energy research, development, demonstration and deployment (RDD&D) in Government, industry and academia, plus other interested bodies, to identify and work together towards shared goals. The Partnership has been designed to give strategic direction to UK energy RDD&D in the context of the Government's Energy Policy.

Our response to this consultation represents the views of the non-Government members, and addresses only the first question, on which ERP is particularly well-placed to comment.

> ***Question 1****: We would welcome views on what more the Government might do to promote the development and deployment of CCS technologies in the UK, EU and globally.*

The ERP has previously emphasised the importance of support for demonstration projects and deployment for carbon abatement technologies.[1] Government intervention is necessary because the market incentive (carbon price) is at present too weak to justify risks of investment on the scale and timescale needed. A major gap in the support for demonstration projects and deployment (the current CCS demonstration competition notwithstanding) should be filled via the Environmental Transformation Fund (ETF) and new Treasury incentives.

The current size of the ETF, however, at £400m over three years is unlikely to be sufficient to cover the cost of demonstration projects at the necessary scale. Other sources of funds and coordination with European partners will be required to meet the ambitious goals the Government has for CCS. Investment in CCS technologies by companies will come from long term CO2 reduction targets which give credibility to CO2 prices rising to a level that justifies the investment.

For CCS, parallel demonstrations of capture technologies and storage options are required. While for the 'capture part' of the CCS technology chain the objective of demonstrations is cost reduction via learning-by-doing, for 'storage' the cost reduction potential for is limited. The objective of storage demonstration projects is rather to demonstrate 'containment' with a view to gain public acceptance, support inclusion of CCS into emission trading schemes, and manage local environmental risk.

There is an urgent requirement to accelerate progress of CCS technologies to achieve commercial deployment by 2020. An integrated programme of research, development and demonstration should be implemented over the period from now to 2020:

[1] 'UK Energy Innovation' (May 2007), available from http://www.energyresearchpartnership.org.uk/erp.php?sid=12.

Research: to underpin the development, pilots and demonstration projects and to look for better second generation technologies;
Development: to improve and scale-up the capture technologies;
Demonstration: to validate a number of capture technologies, for coal and gas and a number of storage options.

European and global collaboration will be a critical element of such a programme. International cooperation is also needed to develop accepted standards for performance assessment ('risk assessment') of CCS. Without these standards it is difficult to see how CCS can be incorporated into global trading schemes, via the CDM or its successors. The UK government is well-positioned to play a strong role in facilitating this development.

New technologies on the innovation path

In work to be published shortly, ERP has undertaken an assessment of a large number of energy technologies against criteria relating to how each meets the aims of UK energy policy, and what barriers and enablers the technologies face to eventual commercial deployment. This work followed a rigorous process, drawing on academic and industrial expertise, and undergoing peer review.

The information contained in the resulting technologies matrix is complex and deserves detailed analysis. Those elements which are relevant to this consultation are given at Annex. The granularity of the technologies in this exercise was chosen such that it could help decision makers (in the public and private sector) across the full energy technology spectrum, and there are some general comments we can make in this context:

- CCS technologies can play a key role in meeting the aims of the UK energy policy – the 'essential' criteria in the matrix.
- The technical risks are not significant, and almost all the new technologies considered could be at the commercial deployment stage within ten years.
- The barriers facing capture technologies in the development/demonstration phases are environmental, regulatory and cost. However, these same technologies do have good export potential for the UK.
- Transport and storage technologies face significantly negative societal impacts (from planning/policy/public acceptability) with additional regulatory or fiscal barriers.

Below are specific RDD&D priorities which will be required for reducing the costs and timescales of 'capture at generation' and 'CO2 storage' technologies:

Capture at generation[2]

Post combustion capture

- Process optimisation/ heat integration (including utilisation of waste heat)
- New and less energy intensive solvents (e.g. amines, carbonates, ammonia)
- Avoidance of solvent degradation and for the longer term
- Improved capture technologies

Pre- combustion capture

- Gasification: process integration/optimisation, improved availability, biomass cogasification
- Gas cleaning: improved reliability
- Gas conditioning :
  - CO2 capture : integration and optimisation of shift conversion and CO2 capture processes
  - conditioning of H2 fuel gas stream for GT
- Gas turbine: Premix burners for hydrogen requiring
- Air separation unit: Process optimisation, improved absorbents for contaminant removal, high efficiency packing for distilling fluids close to supercritical conditions

Oxyfuel combustion

- Process optimisation, including start-up/shut-down/flexibility
- Combustion chemistry and kinetics, Heat transfer prediction
- Materials for oxyfuel environment, corrosion issues, ash properties
- FGD performance, Flue gas cleaning to meet CO2 specifications
- ASUs (including membranes)
- 40MW demonstration of new burners, more coal types
- 100 -200 MWe demonstration of Oxyfuel power plant on hard coals

CO2 storage

Specifically, within the UK and Europe there is further RD&D type work required on:

- Site closure in a cost-efficient way so that the CO2 remains subsurface for 1000s of years.
- Post-injection monitoring: what is done, how often, and how the resolution can be improved.
- Long-term integrated (i.e. hydrodynamic, chemical, geomechanical) forward modelling of CO2 migration and trapping - essential for understanding long-term liability for stored CO2.
- Understanding the impacts of small scale leakage of CO2 into the sea.

[2] From presentation of Dr Mike Farley (Director of Technology Policy Liaison, Doosan Babcock, and member of ERP) to ACCAT.

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Globally there is a need for:

- Regional assessments of storage potential. For major parts of Asia and Africa there is only high-level estimates of subsurface storage potential, a situation that is not very satisfying and inhibits the diffusion of CCS;
- Capacity building on CCS. This is a 'technology transfer' theme and involves building up the technical (geological, geophysical, regulatory) expertise outside the developed world for doing CCS.

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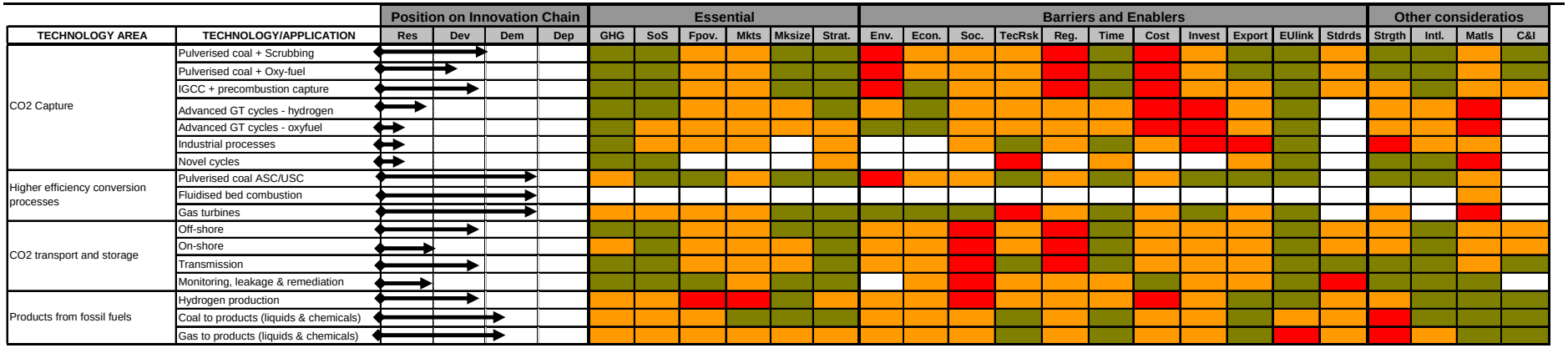
Annex – Extract from ERP Energy Technologies Matrix



Key

Criteria	Abbrev.	Green (3)	Amber (2)	Red (1)
Impact - GHG reduction (UK)	GHG	Significant positive	Limited impact	Significant negative
Impact - Security of Supply (UK)	SoS	Significant positive	Limited impact	Significant negative
Impact - Fuel Poverty (UK)	Fpov.	Significant positive	Limited impact	Significant negative
Impact - Competitive Markets (UK)	Mkts	Significant positive	Limited impact	Significant negative
Size of a mature UK & global market	Mksize	Large (GW.eqv scale)	Medium	Small (~ few MW.eqv)
Fit with government technology strategy	Strat	Strategy recommends	Strategy neutral	Strategy discourages
Environmental impact (other than GHG)	Env.	Significant positive	Limited impact	Significant negative
Wider economic impact (ie broader than GHG)	Econ.	Significant positive	Limited impact	Significant negative
Societal -planning/ policy/ public acceptablility	Soc.	Significant positive	Limited impact	Significant negative
Scientific or technical risk	TecRsk	Low Risk	Medium	High risk
Regulatory or fiscal incentives	Reg.	Clear incentives	None present	Reg/ fis bar'ers in place
Timescale to commercial deployment	Time	0-10y	10-20y	20+y
Costs to commercial deployment (to GW scale)	Cost	Low cost	Medium	High cost
Market willingness to invest	Invest	High	Medium	Low
Ulitimate export potential	Export	Large (GW.eqv scale)	Medium	Small (~ few MW.eqv)
Link with EU energy policy priorities	EUlink	Well aligned	Some correlation	No alignment
Availability of appropriate international standards	Stdrds	Already exist	Some definitions	Not covered
Strength of UK R&D relative to international capabilities	Strgth	Key International contib'n	Recognised capability	No significant capability
Prominence in international energy policies	Intl.	Key in no. of countries	Limited visibility	Does not feature
Availability of appropriate materials technologies	Matls	Already exist	Some development required	Requires significant development
Availability of C&I and monitoring	C&I	Already exist	Some development required	Requires significant development