

CCSA Briefing Paper: Process Industry CCS in the UK

The Climate Change Act 2008 commits the UK to a legally binding 80% reduction of carbon dioxide (CO₂) emissions by 2050. This requires emission reductions in all sectors. To date, government policy has focused primarily on decarbonising the power sector. Decarbonisation of the Process Industries (PIs) - including **steel, cement, lime, oil refining, aluminium, chemicals, natural gas processing and paper** sectors - has not received the same attention.

The cost of emissions to PIs is set step up from 2013, creating an imperative for cost-efficient CO₂ reduction as soon as possible. Whilst significant strides in reducing emissions, through actions such as fuel-switching and efficiency improvements, have already been made by various PIs further options must be pursued. Carbon Capture & Storage (CCS) has emerged as an attractive solution for abating emissions in many PIs, and is sometimes vital due to the CO₂ unavoidably produced as part of manufacturing processes.

Energy Intensive Industries (EIIs), which are only a subset of the process industries which operate out of the UK, employed 123,000 people during 2009, providing £5 billion of gross value added to the UK economy¹. The near term deployment of CCS is key to maintaining regional jobs and communities, enabling the decarbonisation of PIs and averting the threat of 'carbon leakage' (where companies relocate to economies with less stringent carbon abatement policies), maintaining the competitiveness of UK industry and promoting economic growth whilst allowing climate change goals to be met.

PI capture technologies can differ markedly from the power sector

The technologies for capturing CO₂ from the individual PI sectors vary significantly in both the level of maturity and cost of application. Some PIs are ready to begin capturing as soon as cost-effective transport and storage infrastructure becomes available, whilst others will require a process of piloting and/or demonstration to reach deployment. CCS PI policy must take these differences into account.

Capture technologies proven for the power sector are often not directly applicable to PIs, due to the different gas characteristics, energy flows (and vectors), in operation within such industries and the need to integrate these flows in the most efficient manner. A number of industrial sectors will therefore require the development of new capture technologies and can thereby present an export opportunity that can build on the strong Research & Development (R&D) base in the UK.

However, a number of PIs, such as ammonia and hydrogen production, already produce high-purity CO₂ streams. High purity streams have a relatively low marginal cost for capturing CO₂ and provide early opportunities to implement PI CCS. In comparison to other policy measures for low carbon technologies, including the power sector, the cost per tonne of CO₂ abated through industrial CCS can be extremely competitive and good value for money.

The UK needs PI pilot and demonstration projects urgently

The UK urgently needs a programme of commercially applicable CCS pilots and demonstrations for a variety of process industries. Current UK CCS policy commits to supporting projects in the power sector, but not in PIs. The Government needs to identify financing options to create sufficient support for early PI CCS projects in the UK.

There are currently no pilot, R&D scale PI CCS projects in the UK. The piloting of CCS technologies for a number of different industries, perhaps funded by the Technology Strategy Board and/or Energy Technologies Institute, should be initiated as soon as possible.

¹ Centre for Low Carbon Futures, *Technology Innovation for Energy Intensive Industry in the United Kingdom*, June 2011

PI CCS policy is less developed than CCS power sector policy

Urgent consideration needs to be given to developing and implementing policies that can support CCS in process industries. To enable the UK and other countries to put in place policies that support CCS in PIs, without the risk of capital flight and the attendant carbon leakage, an international agreement on CCS technology within sectors (within or outside the UNFCCC processes) would be valuable. This matter is being considered by the Clean Energy Ministerial process.

As PIs have no or limited options for passing additional costs through to consumers, any developments in emissions policy (in the UK and EU) which result in tightening of targets and increased emissions reductions will represent additional cost burden to these industries. Whilst certain PIs currently receive free EU ETS allowances, the ETS is moving towards 100% auctioning of allowances for the power sector by 2020 (end of Phase 3) and all sectors by 2027. PIs would have to consider the benefits of buying allowances vs. investment to reduce emissions vs. relocation, strengthening the need for early demonstration of CCS in PIs. There are a number of other issues already affecting the base cost of manufacturing in the UK which will influence the take-up of CCS in PIs:

- The current high cost electricity, through the indirect cost of EU ETS allowances in the power sector, the Renewables Obligation and Climate Change Levy in the power sector
- Several PIs have dedicated power plants on site, plants which fall under the EU ETS. Near-elimination of free allocation of allowances to such plants in Phase 3 of the EU ETS will also increase the cost of electricity to these industries
- For a number of PIs that require further CCS technology development, it is expected that potential surplus of free allowances from the EU ETS would be minimal, with the majority used for compliance. For PIs that are able to implement CCS early, there may be a window of opportunity in which CCS investments may be financed from sale of a temporary surplus of allowances
- The Carbon Price Floor (CPF) introduced as part of Electricity Market Reform (EMR) will also come into effect in 2013. It is expected to increase the cost base for electricity from the grid and on-site plants.

PI CCS projects require CCS infrastructure

The early provision of CCS right-sized infrastructure in the UK will be fundamental to the deployment of PI CCS in order to minimise the costs of transporting and storing CO₂. Developing right-sized infrastructure alongside the first CCS power projects will enable the development of low-cost, early opportunity PI CCS projects as well as pilot scale and demonstration projects. Failure to install right-sized infrastructure will become a barrier to PI CCS projects proceeding in the UK.

The UK has the geographic advantage of existing manufacturing bases with large numbers of CO₂ point sources (power and PI) being located in major estuaries. This provides the opportunity to develop CCS on a 'cluster' basis, with pipelines connecting multiple capture sites to multiple storage sites. According to some estimates the 5 main UK clusters – the Humber, Thames, Scotland, Teesside, and Liverpool Bay - account for 127MtCO₂/year, representing 22% of 2009 UK emissions². Many of these industrial clusters are advanced in their thinking on CCS, and some locations have formed CCS groups including a number of PI companies.

PIs have limited funds available to invest in CCS infrastructure and a very limited opportunity to pass additional infrastructure costs through to consumers. Many PIs produce small volumes of CO₂ (compared to power plants) which increases the relative proportion of the costs of transport and storage costs to overall project costs. The provision of right-sized infrastructure would allow PIs access at marginal cost and incentivise investment in CCS.

The successful development of a long-term CCS industry in the UK should consider the strategic early development of right-sized CO₂ transport and storage infrastructure to 'seed' CCS clusters. This can be addressed through the development of a CCS Infrastructure Plan and consideration as part of the UK CCS Demonstration Programme.

² Comparing to 2009 GHG figures (566.3MtCO₂e)