IEAGHG Information Paper; 2013-IP13: EASAC CCS Report

The European Academies Science Advisory Council (EASAC) was established in 2001 by the national science academies of European countries to provide scientific advice to European Union (EU) policy makers. It set up a working group in October 2011 to examine the challenges that must be addressed to secure carbon capture and storage (CCS) as a viable component of strategies to mitigate climate change, and consequently to consider what contribution it may make in Europe up to 2050. The report of the study is available to download from: http://www.easac.eu/home/reports-and-statements/detail-view/article/easac-report.html

On the **prospects for CCS in Europe to 2050**, an outcome at the lower end of the ranges considered by the Commission in establishing the CCS Directive, and more recently in the Roadmap 2050 exercise (which included scenarios in which fossil fired power stations with CCS contribute 7 to 32% of the EU's electricity in 2050), may be a more realistic central case. The core of this contribution would lie in CCS applications with favourable juxtapositions of sources, sinks and public acceptance. From an electricity systems point of view, it would focus on situations where CCS enables fossil-fired power stations to play a key role in balancing supply and demand in a close-to-zero greenhouse gas emissions electricity system relying primarily on renewable energy sources, and possibly nuclear power. Positioning CCS in this way may help to overcome opposition founded on a belief that pursuit of CCS will be at the expense of developing renewable sources.

At present, the financial and policy conditions are not in place in Europe to attract private investment in CCS. Initial enthusiasm for CCS appears to be waning under the harsh spotlight of funding demonstration plants and the first generation commercial facilities that should follow. Unless decisive policy actions are taken to address this issue, and to provide investors with sufficient confidence in returns over the lifetime of projects, this situation looks set to continue. If CCS is to make a significant contribution in Europe to climate change mitigation, technologies, capacity and infrastructure need to be developed steadily and with greater urgency than currently prevails. CCS is not a tap that can simply be turned on, if and when suitable financial conditions emerge or future policy makers decide that CCS is a crucial component of Europe's energy strategy.

With regard to the **financial viability** of CCS, consideration should be given to additional funding mechanisms to augment EU allowances from the EU Emissions Trading Scheme, such as feed-in tariffs or 'contracts for difference', to tip the economics in favour of CCS deployment, and to the appropriate division of risks between governments and commercial developers. The Emissions Trading Scheme should be extended to include alternative technologies such as the use of biomass with CCS, carbonation, and CO_2 utilisation under the condition that the mitigation effect from the life-cycle of these options (especially in the case of CO_2 utilisation) is significant, and can be measured and proven.

Achieving adequate funding of the capital and operating costs of EU demonstration plants is an immediate priority: current rules for funding the demonstration projects may need to be revisited. While funding constraints may limit the initial number of demonstration plants to three or four, a second tranche of demonstration plants should be planned for and financed in order to demonstrate an adequate range of technologies and application options.

Care must be taken in pushing forward CCS that carbon intensive industries are not driven to other regions where there are fewer restrictions ('carbon leakage') through well-designed packages of regulatory and financial measures. The EU should continue to influence developments globally to secure the introduction of similar levels of environmental protection elsewhere.

The three main technologies for **CO_2 capture** – post-combustion capture, pre-combustion capture and oxy-fuel combustion - are considered technologically feasible, but demonstration of integrated operation on commercial-scale power stations remains is an urgent priority. They have broadly

similar costs, adding around 50% to the levelised cost of electricity when applied to coal- or gas-fired power stations. Present and anticipated developments should bring this penalty down to 30-45% over the next 20 years, and further incremental improvements may be expected beyond that timescale. More substantial improvements based on radically new technologies and configurations are speculative at the present time.

On **storage issues** the report concludes that the processes of **CO_2 storage** are broadly understood, but significant uncertainties remain which will need to be addressed in order to provide sufficient confidence to regulators and the public that CO_2 storage will be safe over the long-term. It recommends that a strong focus be placed on activities to accelerate confidence building on the permanence and safety of CO_2 storage, including clarifying and elaborating regulatory frameworks, and fast-tracking a number of storage facilities through the complete regulatory process in order to minimise associated uncertainties as the volumes of stored CO_2 accumulate. The demonstration plants are essential to provide data at large scale and should be developed as soon as possible. They should be complemented by more pilot-scale injection test sites, perhaps five or six in total, which may be able to be implemented and deliver useful results on shorter timescales.

An early, and major, strategic investment should be made to locate and characterise Europe's CO_2 storage capacity, so that a significantly more confident picture is developed than is available now, and to enable an integrated approach to the development of Europe's CCS infrastructure.

A strategic and pan-European approach should be taken to developing Europe's **CO_2 transport** infrastructure, both pipelines and ships, which should be on a par with critical developments in Europe's electricity grid and natural gas pipeline networks in respect of policy attention, EU support and enabling mechanisms. Ship transport of CO_2 should be fully incorporated into the provisions of the CCS Directive.

An enhanced emphasis should be placed on **public engagement** and debates about the role of CCS in mitigating climate change at an EU and at national levels in relation to other options, in order to increase awareness and to put decisions to proceed with CCS on a firmer footing. These debates should enable a better understanding to be developed of publics' attitudes to CCS and why they are formed

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June 2013