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CCSA Briefing Paper - Benefits of Carbon Capture & Storage (CCS)

Introduction – the need for CCS

Carbon Capture & Storage (CCS) is a vital low-carbon electricity generating technology which will enable the decarbonisation of the UK's power and industrial sectors. The successful deployment of CCS represents a major investment in UK infrastructure, whilst creating and retaining a large number of vital UK jobs.

With 35GW of existing electricity generating capacity due to close in the next decade, there is an urgent need to replace the UK's ageing fleet of power stations. CCS is currently the only technology which enables these power stations to be replaced by cleaner and more efficient solutions and is therefore crucial in ensuring the continued use of fossil fuels to meet growing electricity demand, whilst still meeting the UK statutory target to reduce greenhouse gas emissions by 80% by 2050, and largely decarbonising the power sector by 2030.

More than two thirds of the UK's electricity currently comes from fossil fuels– and this trend is expected to continue for the foreseeable future. Fossil fuel power plants fitted with CCS will be needed in a balanced mix of energy sources to complement the intermittency of renewables and the inflexibility of nuclear power. The CCSA estimates that the UK needs 20-30GW of CCS fitted power plant in operation by 2030 to meet its long-term decarbonisation objectives and growing demand for secure, cost effective and low-carbon electricity.

CCS is the only technology to enable the decarbonisation of UK industrial sectors such as steel, cement, refineries, chemicals, etc. CCS will therefore be crucial if these sectors are to be retained in the UK and continue to operate under increasingly stringent climate change policies.

CCS Benefits to the UK

The potential size of CCS industry should not be underestimated – the global market is expected to be worth trillions of dollars by 2050, a value similar to the current global oil industry. The UK has the potential to take a significant share of this global market – with an estimated market value of £6.5 billion to the UK economy by 2030, and creating up to 100,000 jobs.

Building multiple CCS projects today represents a major investment in UK infrastructure – on average, one CCS project would unlock several £billions in infrastructure investment, creating several thousands of jobs during construction and operation.

The UK is well-placed to take a lead in the development and commercialisation of CCS due to its ideal geographical location - in particular, its close proximity to abundant offshore CO_2 storage sites in both depleted oil and gas fields and deep saline formations in the North Sea. The Energy Technologies Institute (ETI) estimates that the sub-seabed of the North Sea can safely store up to 70 billion tonnes of CO_2 – enough to meet the needs of CCS for the next 100 years.

The UK also has the potential to reap significant benefits from the use of CCS with Enhanced Oil Recovery (EOR), where carbon dioxide is injected into near-depleted oil fields to produce significant amounts of otherwise unrecoverable oil. The additional oil revenue generated could enable EOR operators to offer CO_2 storage at very low cost to the power plant operator, whilst delaying the significant cost of decommissioning and generating billions of pounds in tax revenue for the UK Treasury.

The Global CCS Institute (GCCSI) identifies 75 planned CCS projects worldwide, with 8 currently in operation. The UK must not miss out on the opportunity to become one of the early global leaders in CCS alongside countries such as the U.S., China, Canada, and Australia which are already developing the technology. The UK is undoubtedly a strong competitor as it has a world-class well-established oil and gas industry with brilliant engineering skills as well as existing infrastructure which can be effectively utilised for CCS before it is decommissioned.

Cost Issues

CCS represents a very cost-effective way of generating low-carbon electricity that can be cost-competitive with other forms of low-carbon power, such as nuclear and renewables. Although early CCS projects require high upfront investment, costs are expected to decline rapidly as the technology matures and more projects are built. In November 2012 the CCS Cost Reduction Task Force published its interim report, in which it concluded that UK gas and coal power stations equipped with CCS can deliver electricity at a cost approaching £100/MWh by the early 2020s, and this cost will decrease significantly soon thereafter.

Importance of CCS Infrastructure

Crucial to the development of a successful UK CCS industry is the creation of several regional transport and storage hubs, which can transport carbon dioxide from both power and industrial sources to a network of large reliable offshore storage sites. By constructing the first CCS projects with the right-sized pipelines and storage sites from the start, the UK will kick-start the development of a UK national CO_2 transportation and storage network. The cost savings are substantial – by doubling the investment in a pipeline, the pipeline diameter can be increased to carry 10 times the CO_2 capacity. In particular, the existence of CO_2 transport and storage infrastructure will be vital to enable the cost-effective decarbonisation of industrial sectors, as many of these cannot afford the full cost of fitting CCS.

Safety of CCS

The three main parts of CCS – capture, transport and storage – are already well-established technologies in use in a variety of industries around the world. For example, there is over 30 years experience of transporting and injecting CO_2 into oil fields in the US for use in EOR. The Sleipner CCS project in the Norwegian North Sea has successfully stored more than 10 million tonnes of CO_2 since 1996.

The end-point of CCS is permanent storage of CO_2 and the current UK and EU regulations place significant requirements on a storage developer regarding storage site characterisation, selection and monitoring - to ensure only the best sites are chosen. In the UK, CO_2 is stored in geological formations between 1 and 4km below the sea-bed, beneath many different layers of rock. The CO_2 moves through the geological formation until it reaches the 'caprock' – the impermeable layer of rock which overlays the formation and acts as a seal. With time, the CO_2 goes through a number of different storage processes which effectively 'trap' the CO_2 and ensure the CO_2 is locked away permanently.

Urgency

Without CCS, the costs to society will increase significantly. The Energy Technologies Institute estimate that without CCS in the UK, the cost of delivering a low-carbon electricity mix in 2050 would increase by £42 billion per year. Whilst there are significant benefits to the UK from developing CCS – these can only be realised with an ambitious number of projects built today. We urgently need to build multiple CCS projects to initiate the creation of CCS networks, start down the CCS cost-reduction curve and enable the decarbonisation of our vital industrial sectors.