Post 2020, CCS will be cost-competitive with other low-carbon energy technologies

The companies, scientists, academics and environmental NGOs that together make up the Zero Emissions Platform (ZEP) have undertaken a ground-breaking study into the costs of CO_2 Capture and Storage (CCS) based on new data provided exclusively by ZEP member organisations on existing pilot and planned demonstration projects. The conclusion: following the European Union's CCS demonstration programme, CCS will be cost-competitive with other sources of low-carbon power, including on-/offshore wind, solar power and nuclear.

As publicly available cost data is scarce, ZEP members provided their own in-house data in order to establish a reference point for the costs of CCS based on a "snapshot" in time (all investment costs are referenced to the second quarter of 2009). The aim: to estimate the costs of complete CCS value chains – i.e. the capture, transport and storage of CO_2 – for new-build coal- and gas-fired power plants, located at a generic site in Northern Europe from the early 2020s. This is described in three reports[1] on CO_2 capture, CO_2 transport and CO_2 storage respectively, with resulting integrated CCS value chains presented in a summary report[2].

N.B. As the costs of CCS will be inherently uncertain until further projects come on stream, the ZEP CCS cost study will be updated every two years in line with technological developments and the progress of the EU CCS demonstration programme.

KEY CONCLUSIONS

CCS is on track to become one of the key technologies for combating climate change

In order to keep global warming below 2°C – cost-effectively – CCS must provide 20% of the global cuts required by 2050, according to the International Energy Agency (IEA); the costs of doing so *without* CCS will be over 70% higher. In turn, CCS will enable Europe to enjoy a surge in economic growth – creating new jobs, boosting industry and promoting technology leadership.

ZEP's study indicates that the EU CCS demonstration programme will not only prove the costs of CCS, but provide the basis for future cost reductions, enhanced by the introduction of second- and third-generation technologies. CCS is therefore on track to become one of the key technologies for combating climate change – within a portfolio of technologies, including greater energy efficiency and renewable energy.

Indeed, the future electricity system will look very different from today's, requiring flexible solutions to accommodate increasing quantities of intermittent power sources. Energy storage (e.g. via pumped storage, or new forms such as electric car batteries) is likely to spread and combine with demand-side management, supported by smart grids. Base-load demand will probably fall and the need for balancing power increase in order to complement intermittent power sources. The additional need for energy storage capacity and balancing power, as well as the operation of thermal power plants at lower utilisation, is likely to increase the cost of electricity.

ZEP will therefore undertake a complementary study on the costs of CCS in the context of other low-carbon energy technologies. However, recent reports such as the IEA's "Projected Costs of Generating Electricity - 2010"[3] indicate that the costs of post-demonstration CCS with coal (€70-90/MWh) and gas (€70-120/MWh), as presented in ZEP's study, will be cost-competitive with other low-carbon power options – including on-/offshore wind, solar power and nuclear.

In short, a broad mix of low-carbon energy technologies is necessary, not only to meet CO_2 reduction targets, but ensure a reliable energy supply – cost-effectively.

[1] www.zeroemissionsplatform.eu/library/publication/166-zep-cost-report-capture.html; www.zeroemissionsplatform.eu/library/publication/167-zep-cost-report-transport.html; www.zeroemissionsplatform.eu/library/publication/168-zep-cost-report-storage.html
[2] www.zeroemissionsplatform.eu/library/publication/165-zep-cost-report-summary.html
[3] www.iea.org/publications/free_new_Desc.asp?PUBS_ID=2207

CCS is applicable to both coal- and gas-fired power plants

CCS can technically be applied to both coal- and gas-fired power plants. Their relative economics depend on power plant cost levels, fuel prices and market positioning, whereas applicability is mainly determined by load regime. While co-firing with biomass is not covered in the study, it will be in future updates as it provides significant abatement potential when combining CCS with sustainably-produced biomass feedstock.

All three CO_2 capture technologies could be competitive once successfully demonstrated

The study covers first-generation capture technologies only (post-combustion, pre-combustion and oxy-fuel). Using agreed assumptions and the Levelised Cost of Electricity as the main quantitative value, there is currently no clear difference between any of these and all could be competitive in the future once successfully demonstrated. The main factors influencing total costs are fuel and investment costs.

Early strategic planning of large-scale CO_2 transport infrastructure is vital to reduce costs

Clustering plants to a transport network can achieve significant economies of scale – in both CO_2 transport and CO_2 storage in larger reservoirs, on- and offshore. Large-scale CCS therefore requires the development of a transport infrastructure on a scale matched only by that of the current hydrocarbon infrastructure. As this will lead to greatly reduced long-term costs, early strategic planning is vital – including the development of clusters and over-sized pipelines – with any cross-border restrictions removed.

While the study focuses on power generation, the application of CCS to heavy industry and fuel transformation could abate ~15% of all global man-made CO_2 emissions by 2050 (IEA). Indeed, in steel and cement production, for example, it is the only means of achieving deep emission cuts. If different CO_2 sources – power, industry and fuel transformation – are located in close proximity, they can therefore share CO_2 transport and storage infrastructure, and should be included in all National CCS Master Plans.

A risk-reward mechanism is needed to realise the significant aquifer potential for CO_2 storage

Location and type of storage site, reservoir capacity and quality are the main determinants for the costs of CO_2 storage: onshore is cheaper than offshore; depleted oil and gas fields are cheaper than deep saline aquifers; larger reservoirs are cheaper than smaller ones; high injectivity is cheaper than poor injectivity. Given the large variation in storage costs (up to a factor of 10) and the risk of investing in the exploration of deep saline aquifers that are ultimately found to be unsuitable, a risk-reward mechanism is needed to realise their significant potential and ensure sufficient storage capacity is available – in the time frame needed.

Creating a secure environment for long-term investment in Europe

The current main incentive for the EU-wide deployment of CCS is the price of Emission Unit Allowances (EUAs) under the EU Emissions Trading System (ETS). However, based on current trajectories, this will not be a sufficient driver for investment after the first generation of demonstration projects is built (2015 - 2020). Enabling policies are therefore required in the intermediate period – after the technology is commercially proven, but before the EUA price has increased sufficiently to allow full commercial operation. **The goal: to make new-build power generation *with* CCS more attractive to investors than without it.**

Until a support system for biomass is in place, co-firing with CCS will not be commercially viable. A negative emission factor for such use of biomass under the ETS Directive is therefore necessary in order to create a level playing field between renewable energy and fossil fuel-based CCS. This can be achieved through project-specific applications to the European Commission, which has signalled that it would welcome such requests from Member States.

Incentives for CCS in heavy industry and fuel transformation are also urgently required: to date, only the “NER 300” mechanism provides any significant amount of funding for such applications.

Finally, there is an urgent need to drive down costs via new well-targeted R&D into next-generation technologies, as defined by ZEP in its 2010 report: “Recommendations for Research to Support the Deployment of CCS in Europe beyond 2020.”[4] This identifies key areas for improvement, together with the main strands for R&D to 2030 and beyond.

[4] www.zeroemissionsplatform.eu/library/publication/95-zep-report-on-long-term-ccs-rad.html