BMWA Federal Ministry of Economics and Labour

Carbon Capture and Storage Activities in Germany

The German energy market is dominated by the use of fossil fuels. In the field of electricity generation coal accounts for 50 % and natural gas for 10% of primary energy consumption. If the phasing-out of nuclear energy is executed as has been agreed between the government and the industry, fossil fuels will contribute even up to 80 % to electricity generation around 2020.

On the other hand, Germany is very much committed to the reduction of greenhouse gases based on the Kyoto protocol and the European burden sharing. In the energy economy, electricity generation is in particular a key sector for CO_2 reduction. At the same time, a secure and affordable energy supply has to be maintained. The role of energy policy is to set framework conditions to meet both objectives.

One important advantage for energy policy is that its lever arm is very long because old, less efficient power plants will have to be substituted by new plants in the coming decades. In Germany, 40,000 MW of power generation capacity will have to be replaced in the coming 20 years. The use of the latest technologies can lead to a substantial reduction of CO_2 emissions or at least compensate an increased share of fossil fuels. The technologies with the highest CO_2 reduction potential, however, still need R&D to be economically feasible. Therefore, funding of R&D is an important means of energy policy.

The direction of the German government's R&D funding is outlined in the 5th Energy Research Programme "Innovations and New Energy Technologies" which was adopted by the federal cabinet in June 2005. The programme gives a political frame to the COORETEC concept published in 2003. Since then, funding of R&D has been oriented towards the COORETEC concept.

The COORETEC concept is arranged on the basis of two major technology routes. One route is efficiency increase. Efficiency increase may result from improved or innovative power plant processes or from component optimisation. The other technology route is Carbon Capture and Storage (CCS). These two technology routes are interlinked. An increase in process or component efficiency can help reduce the loss of efficiency due to CO_2 capture, compression, transport, injection and monitoring. Altogether, the combination of an advanced, highly efficient power plant and CCS is expected to have a higher efficiency compared to the world wide average of power plants today.

Concerning carbon capture, the federal government supports R&D on different technology lines:

- In the project COORIVA, the conceptual design of a highly efficient IGCC plant with CCS is compiled. In addition to the optimisation of the process, the single components are optimised.
- In the ADECOS project, the combustion with pure oxygen is investigated (oxyfuel). The work plan includes basic investigations of the combustion behaviour as well as numerical simulations of larger plants.
- The project OXYCOAL goes one step further. It deals with an oxyfuel plant equipped with a membrane reactor for air separation. Using this reactor, the energy penalty for carbon capture can be reduced to 2 – 4 percentage points of efficiency.
- In another project, the reaction between the materials used in boilers and an atmosphere with a high CO_2 concentration is investigated. A list of best suited materials shall be worked out.
- A component being important for both technology lines is the compressor. It is needed to provide air to the air separation unit and to compress the captured CO_2. Several projects to develop larger and more efficient compressor units are supported.

In addition to the development of technologies for CO_2 capture and compression projects on CO_2 injection, R&D on storage and monitoring is funded. A decisive insight on the safety of carbon sequestration is expected to result from the CO2SINK project. In the framework of CO2SINK, 60,000 t of CO_2 will be injected into an aquifer under settled area. The main focus will be the behaviour of CO_2 underground. The project is funded by the European Commission, the federal government and the State of Brandenburg.

Furthermore, the programme GEO-TECHNOLOGIES has two foci with respect to CCS. One focus is an estimation of the storage potential of depleted oil and gas fields, coal seams and aquifers. The different storage options are numerically simulated and rated. A project is under discussion to set up a land register on possible CO_2 storage sites.

Another priority is set on the chemical behaviour of CO_2 stored underground. The reactions with the cap rock and with micro-organisms are investigated.

The federal government is aware of the fact that CCS can only be realised as a carbon mitigation option if it is accepted by the public. As a first step to counteract fears and doubts, an independent institute is currently investigating CCS from a holistic point of view. CCS is being compared to other climate change mitigation options. Some studies on the acceptance of CCS by the public will be launched in the near future.

National and international scientists as well as decision makers in the industry and politics are highly interested in the results of these projects. Therefore, the federal government supports the publication of the project results. In 2004, an international congress on power plant technologies was held in Berlin. In 2005, a workshop was held in Leipzig. In 2006, a large international conference is planned to take place in Germany.

The presentations given at the congress and the workshop gave a good insight into the project results. They can be downloaded from the COORETEC website www.cooretec.de. Information on the programme GEO-TECHNOLOGIES is available on the website www.geotechnologien.de.

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