

Position of the VGB/Eurelectric ad hoc Group 'New Technologies – Carbon Capture and Storage'

Essen, 12th August 2007

Preamble

Eurelectric and VGB have set up a common group to work out a **basic position paper** on the issue of "new technologies and **carbon capture and storage, CCS**" initiated by the Technical Advisory Board of VGB. Main concern of this basic position paper is the timely implementation of low carbon technologies within a market-driven framework.

Carbon capture and storage is in the central focus of the European policy in general and of energy in particular. The generators are consequently aware about the high relevance of the complex "climate change".

Therefore the purpose is to have available a *common* position on the topic "Carbon Capture and Storage". This position will be used by the members as part of their argument's portfolio on the different communication platforms. These platforms are - among others - the European technology platform ZEP, the Fossil Fuel Forum and the working group of EPCC.

This basic position paper was also used as technical input to the work of the task force on the CCS topic within Eurelectric.

The VGB/Eurelectric Ad hoc Group supports in principle the ETP-ZEP views and attitude concerning climate change and carbon capture and storage technologies, in particular. The group is especially stressing the efficiency issue and the explicit inclusion of all further low carbon technologies like nuclear energy, renewable energy but also fossil fuels with CCS. Therefore the main messages of ETP-ZEP are quoted here:

The European Technology Platform ZEP

The European Technology Platform „Zero Emission Fossil Fuel Power Plants“ (ETP-ZEP) is an industry initiative (generators, gas -and oil industry, equipment suppliers) with participation of important research institutes and environmental organisations, which is developing long term ideas about future CO₂-free fossil fuelled power plants.

The European utilities are represented within ETP-ZEP by some direct members and by a delegate of VGB PowerTech and Eurelectric, who is integrated in the ZEP coordination group.

The main messages of ETP-ZEP are as follows:

- 1. Coal and fossil fuels are inevitable for the energy supply of Europe and worldwide, at least over the next decades. The demand is growing both absolute quantity and relative share.*
- 2. The actual assessment of the UN International Panel on Climate Change (IPCC) clearly confirms that climate change is forced by anthropogenic effects and mainly by CO₂.*
- 3. Climate change is an international worldwide challenge. Climate change has to be stopped urgently. The CO₂ emissions need to be reduced as soon as possible. The restriction of the increase of the average global temperature to 2°C till 2100 is also required by the European Council.*
- 4. International endeavours to reduce the greenhouse gases are necessary for all sectors including energy supply, transport, buildings, industry, agriculture, forestry and waste.*

Additionally all options for energy savings in production and consumption must be utilised.

- 5. As coal will remain a major share of the primary energy mix worldwide advanced coal technologies should be disseminated when technically and economically mature. Worldwide efficiency increase, in the **first step** by application of the state of the art and in the **second step** by advanced innovative clean coal technologies like the 700°C power plant are necessary for climate protection and saving of resources as well.*
- 6. All further options for CO₂-free respectively low-CO₂ energy supply will be necessary. This includes nuclear power and this includes Carbon Capture and Storage (CCS) as well as all kind of renewable energies.*
- 7. CCS results in much higher investment cost and an significantly increasing input of fuel and both together in much higher cost of electricity.*
- 8. Precondition of the deployment of CCS technologies - the **third step** of CO₂ reduction of power plants - is a clear legal framework for CO₂ transport and storage and the securing of stable long-term political frame conditions to avoid economical disadvantages after CCS investments. Early investments in R&D and demonstration projects need suitable financial support.*
- 9. The CCS technology is still at an early stage and needs validation at industrial scale.*
- 10. The vision of ETP-ZEP: 'To enable European fossil fuel power plants to have zero CO₂ emissions by 2020.' A CO₂ capture rate of about 90% is expected, i.e. a near zero technology is realistic.*

Strategic recommendations of ETP-ZEP

ETP-ZEP has worked out the following strategic recommendations. The Strategic Research Agenda (SRA) describes a collaborative programme of technology development for reducing the costs and risks of deployment. Main recommendation is the urgently implementing of 10 - 12 integrated, large scale CCS demonstration projects Europe-wide based on already identified but not validated new concepts till 2015 and aiming at commercial implementation beyond 2020. Additionally long-term exploratory research on advanced, innovative concepts for implementation of next generation technology will be supported. A maximum cooperation on national, European and international level is intended. The Strategic Deployment Document (SDD) outlines how to accelerate the market for efficient zero emission power production. This includes the kick-starting of the CO₂ value chain with commercial incentives, a regulatory framework for CO₂ transport and storage, comprehensive public information to improve CCS acceptance and R&D funding under FP7 and national programmes.

ZEP Task Forces (TF) to implement the recommendations

Four Task Forces within ETP-ZEP are actually working on the implementation of the recommendations. The TF Technology (Research) shall improve the coordination between national programmes and FP7. Die TF Demonstration und Implementation shall develop a Flagship Programme with 10 - 12 demonstration projects. Subgroups were established concerning project proposals, funding models, market analysing of CO₂ source and storage markets, infrastructure, legal framework, knowledge network and ranking projects as well as recommendations for implementation. The TF Policy and Regulation is the primary interface between EC and ETP-ZEP. The TF Public Communication aims at improving public acceptance. It intends to organise public debates at universities and the development of a professional website.

In addition to these clear messages the VGB/EURELECTRIC ad hoc group strongly recommends the following statements that mostly aim at a timely implementation of low carbon technologies within a market-driven framework.

Basic Key-Notes

- Increase of overall efficiency is a necessary prerequisite for CCS in avoiding the production of CO₂ and saving resources
- CCS is believed to become a technically feasible option. With extensive RD&D efforts the CCS Technologies can presumably be developed to commercial maturity until 2020.
- CCS makes it possible to keep fossil fuels as significant part of the energy mix and at the same time to reach challenging climate protection targets.
- The public acceptance of CCS is essential and can only be reached by a joint initiative of policy and all involved sectors.

Capture Technologies

- All CCS technology pathways have to be developed collateral, because the state of development is actually insufficient to prioritise one technology. Free competition of technologies is valuable.
- The different technologies hold research requirements in detail and in terms of large scale demonstration. In order to mitigate the economic risks a step by step approach is required, i.e. basic research, laboratory scale and pilot facility and as final step demonstration at industrial scale.
- In particular the installation of large scale demo plants holds considerable economic risks for the utilities. But the utilities agree to take a reasonable share of the burden associated with this risk.

Transport

- The CO₂ that will be separated in power plants should most likely be transported via pipelines under liquid conditions, because of the enormous quantity. This method is most practical from economic and technical point of view.
- The risk of the CO₂ transport is low compared to commercial transport systems of many other technical gases.
- The composition of CO₂ is of relevance for choosing proper material
- The public acceptance of commercial scale on shore CO₂ pipeline transport has to be accelerated and ensured by policy cooperation with all other stakeholders.
- The legal and regulatory framework process has to be accelerated and ensured by policy cooperation with all other stakeholders.
- A list of criteria for a future CO₂ infrastructure has to be defined and considerations for the implementation of a CO₂ infrastructure have to be worked out on national and European level, taking interconnection of different national storage capacities into account. In this field the issue of cross-border transport of CO₂ has to be addressed and clarified.
- It is recommended to have a continuous communication with members from Governments, Economy, Science and NGOs to accompany the successive assembling of an European CO₂ infrastructure.

Storage

- CO₂ storage in geological formations is realistic according to expert's opinion.

- One key issue is to accelerate the process to achieve public acceptance and to ensure a credible CCS deployment strategy
- Essential storage options are aquifer formations, as well as depleted oil and gas fields.
- The legal and regulatory framework process has to be accelerated and ensured by policy cooperation with all other stakeholders. Particular attention is given to the EC ensuring fair access for all countries and companies.
- The necessary technologies for operation and monitoring of CO₂ storage for commercial projects can be developed until 2020. The safety of geological storage can presumably also be proven at industrial scale until 2020.
- To reach this a consistent and transparent legal framework for CO₂ storage and transport is required. Within this framework the issue of long-term liability has to be addressed.

Capture Readiness

- The consideration of retrofit possibilities for CCS in the already ongoing process of coal fleet renewal already takes place as far as necessary because of the basic interest of the utilities to limit the investment risk.
- Any regulatory specification of a capture ready standard would not be reasonable. Policy and regulatory authorities should focus on market framework instead of defining technological requirements.
- The technical specifications of power plants will be defined by the utilities under consideration of environmental, economical and legal aspects.

Time Scheme for Demo and Commercial CCS Projects

- Demo projects are defined as the last step before the realisation of commercial projects. The EU Flagship Programme (composed of 10 to 12 large scale demo plants) aims to cover the full chain from efficient power generation, over carbon capture processes to CO₂ transport systems and storage facilities. Projects of large scale demonstration that deal with part of the CCS process chain only and also retrofit projects should be possible within the flagship programme.
- For demo projects exception licenses might be sufficient.
- For the realisation of commercial projects clearly defined and timely licensing procedures are indispensable.
- To make the European flagship programme happen till 2015 the legal and regulatory framework for CO₂ capture, transport and storage for demonstration projects must be finalized on European level till mid 2008 and even more important on national level till end of 2009. Investment of power industry in commercial scale CO₂ capture, transport and storage projects needs a fixed framework on national level till mid 2014 latest to enable start of operation in 2020 in a straightforward time frame.

Economic Framework

- CCS and other low carbon technologies have to assert themselves under market conditions.
- Well-defined, long-term climate protection targets (CO₂ emission reduction) in the frame of the European ETS as well as an Europe-wide agreed positioning to all low carbon and CO₂-free technologies (and JI/CDM mechanism) are appropriate, to ensure adequate legal framework for the market-entry of CCS technologies. This mechanism must bring CCS into the market.
- Additional regulatory measures are not necessary (as for example obligation to use pre defined technologies, fixed energy mix etc.).

- Especially feed-in tariffs are not acceptable, as they work against market mechanism and in addition to that appoint contra-productive incentives and distort the competition of technologies.
- Probably the ETS offers the only realistic chance for the necessary amount of financial support of industrial scale CCS demonstration plants. The political challenge is to steer a course that avoids an early increase of CO₂ prices before the CCS technology is available because this would impose an excessive burden to the GDP with negative impact for the economy in Europe.

Funding Instruments for CCS Demo Plants

- The determination of the overall value of the ZEP flagship programme of 10 – 12 large demonstration plants has to consider the following cost positions:
 - additional investment for demo plants in the unit size of some hundred MW including innovative technologies and efficiency increasing measures compared to commercial state of the art units
 - additional equipment for CO₂ capture transport and storage
 - additional cost of operation
 - the additional cost caused by lower availability of demo plants during the first years of operation

An estimation of averaged costs results in an overall volume of the European flagship programme in the range of 5 to 10 billion Euro.

- Investors, industry, and the public shall strive to share the burden of the additional CCS costs in particular during the demonstration phase. Based on this prerequisite, different funding instruments, which can partly be combined or used alternatively, are conceivable.
- To support “first of its kind” demo plants a **new system of financial support** for compensation of additional R&D engagement of the utilities, one-time funding should be found. This funding Scheme should be limited to a transition period. It should use a competition and market mechanism to give a price-seeking element, because a reliable financial basis in the electricity and carbon market is necessary. As mentioned above the system should not be pre descriptive on which technology is used, so that competition of technologies is ensured and several CCS technologies and efficiency increasing measures can be developed for the market.
- The prerequisite for funding would be that the funding of CCS technology is incorporated into **EU aid law** with eligibility for up to 50% of total costs.
- All demonstration plants, independent of whether they are complete, newly erected or retrofitted existing ones that are used to test the reduction of carbon emissions into the atmosphere by means of CCS technology, should be included in the **EU Emission Trading Scheme**. The plants should be equipped with free emission allowances so that operators can put the CO₂ emission allowances of every ton of carbon dioxide that has not been emitted into the atmosphere to other economic use.

Since the development of CO₂ prices and, hence, the economic advantages of such a provision cannot be predicted but are influenced by market action, this funding instrument alone could not suffice to hedge the basic investment risk.

- **Direct capital investment grant** would be a very practicable funding instrument in particular for large-scale projects with capacities comparable to present-day commercial power plants without CCS. Investment aids would reduce the investment risk involved especially in building pipelines for the transport of CO₂ and in exploring carbon storage sites. It is by no means certain that carbon storage sites have predictable and sufficient storage capacities for the carbon that is to be captured over

the life of a power plant. Fund rates of up to 50% granted as direct investment aid should thus be adequate for these facilities.

If the storage technology is successfully demonstrated, the investment aids received for carbon disposal infrastructure may be credited to other users on a pro-rata basis - if needed within a regulated framework – when transmission tariffs and grid fees are fixed.

- Further on, the following funding instruments may also be effective:
 - **Reduced-interest loans** granted by the European Investment Bank
 - **Tax benefits** - this issue may be settled individually by member states of the European Union
- A combination of all above-mentioned funding instruments is possible, but allocating funds beyond the additional CCS-related expenses has to be prevented.

Conclusion

Based on the allocation of responsibilities of industry and politics it is evident that a fair burden sharing is necessary to achieve the goal of an introduction of CO₂ capture and storage within the time schedule defined by the European Council in March 2007. The power industry will certainly take their part. The final time schedule however will not only depend on the securing of common funding but also on the timely implementation of the regulatory framework and the success of all technical development efforts. The European flagship programme of 10 to 12 large scale demonstration plants is a promising proposal on the right track that should be fully supported.