USG response to the carbon capture and storage consultation paper of the European Commission of 27 March 2013

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General remarks

USG fully supports the responses from Cefic, IFIEC Europe and Fertilizers Europe, to which USG contributed.

Potentially CCS may become an important technology, because it offers the opportunity for a diversified energy portfolio with also coal and lignite in the light that the US shifted to cheap natural gas. An advantage of CCS is that there is no problem of intermittency, it is base load.

But presently CCS suffers from various problems: there is no cost-efficient transport infrastructure, there are legal issues regarding long-term storage liability, there is a lack of public acceptance and last but not least the capture technologies are still rather expensive.

The full costs for decarbonisation of society towards 2050 will be significant. CCS has the potential to become cheaper than RES, especially compared with wind off-shore and solar, when all RES costs including the costs for coping with intermittent RES supply are taken into account.

However, CCS on coal-fired electricity and gas-fired electricity is always significantly more expensive than coal-fired electricity and gas-fired electricity without CCS in absence of a global carbon price signal. The same holds for industrial processes. Therefore a new Global Climate Agreement with equal carbon burdens for industry globally is essential. In absence of such an agreement CCS is too expensive to be applied on a large scale.

In view of the relatively high energy cost in Europe (electricity, natural gas and feedstocks), a careful, step-wise approach is essential to avoid long-term subsidisation of high cost technologies. R&D efforts are needed in order to provide the market with a breakthrough technology which would help reducing the costs of CCS; especially in the capture technology (for end of pipe solutions) and/or the oxygen supply (for oxyfuel solutions) there is significant scope for technology improvement.

Most CO_2 emissions related to the fertilizer industry come from the production of ammonia. In Europe nearly all ammonia plants are based on the use of natural gas, and on average 2 tons of CO_2 is generated per ton of ammonia. In total the European ammonia industry generates approx. 30 million tons of CO_2 per year. The ammonia industry is already carrying out carbon capture; - about 2/3 of the CO_2 is captured and purified in the ammonia process and readily available for CCS. Only the compression, storage and logistics systems remain. Part of this pure CO_2 is today used for urea production and as industry gas and in the food and beverage business. The remaining 1/3 of the CO_2 comes from combustion processes and needs to be cleaned before CCS. The CEFIC Roadmap 2050 on climate and energy (http://www.cefic.org/Documents/PolicyCentre/Energy-Roadmap-The%20Report-European-chemistry-for-growth.pdf) has identified CO_2 from ammonia production as the most cost-efficient for CCS.

USG recommends that **all aspects including all costs of CCS should be more carefully studied and compared with RES and energy efficiency of non-ETS sectors** (buildings, transportation) in order to obtain a more holistic view of the totality of options to reduce emissions. This more holistic approach must ensure that the economic interests are safeguarded and **investments in EU manufacturing are incentivised instead of hampered** by increased cost compared to our major competitors in the global market place.

The USG answers below must not be misunderstood as a plea to start deploying CCS on a wide scale, neither mandatory nor based on an artificially increased carbon price or long-term subsidisation. The core plea is to carefully study the possibilities of CCS versus other alternatives and to enhance R&D to achieve more cost-effective capture technologies.

Introduction and questions of the European Commission: *Given the complexities explained above, and in the light of the work started on the 2030 energy and climate framework and the need for an informed debate, including the issue of the determining factors for successful CCS deployment, the Commission invites contributions on the role of CCS in Europe, particularly:*

1) *Should Member States that currently have a high share of coal and gas in their energy mix as well as in industrial processes, and that have not yet done so, be required to:*
    a. *develop a clear roadmap on how to restructure their electricity generation sector towards non-carbon emitting fuels (nuclear or renewables) by 2050,*
    b. *develop a national strategy to prepare for the deployment of CCS technology.*

Answer:

The MSs together with the European Commission should develop a roadmap with various scenarios, in which the deployment of CCS including the required infrastructure (pipelines, storage sites) and the associated costs are included. It is essential that this Roadmap also includes the development per scenario of stationary RES installations, notably wind on-shore, wind off-shore and solar, including all costs. A third pillar should be the scope for energy efficiency measures and GHG reductions in non-ETS sectors, notably buildings and transport.

The roadmap should include various scenarios (for example 4 scenarios):

- BAU (business as usual) without decarbonisation;
- The share of CCS and RES;
- The costs of additional grid infrastructure and of other measures to cope with intermittency of RES supply;
- The role of energy efficiency;
- ➢ Outcome: the performance and the full costs of each scenario.

The Commission should provide guidance to the types and number of scenarios to be explored. For CCS the roadmaps should include CCS in industry, at coal-fired power plants and at gas-fired power plants.

The RES costs should be the full costs, which includes:

- For solar, the real costs, so excluding tax exemptions for notably citizens. Because these costs are a somewhat hidden subsidy. Then it appears that solar PV is far from "grid parity".
- For solar and especially wind energy, the costs for coping with intermittent supply shall be included as well. A base case for lack of supply could be to do this with flexible CCGT back-up capacity. The CCGT supply costs (including fixed costs) can be expected to be

around € 120-150/MWh delivered, so roughly € 70-100/MWh above the wholesale price, for a period of about 2000-1500 hours per year. But divided over the total supply the fixed cost annualised are about € 12/MWh for all the needed reserve.

  - Example: assume a MS with 50% fossil and 50% intermittent RES; so this RES delivers 50% of the produced electricity. Then (at maximum) 50% of CCGT back-up would be needed, the total fixed cost would then be 50% x € 12/MWh = € 6/MWh. In addition there is additional fuel cost (CCGT is now more expensive, because gas is relatively expensive versus coal). But the peak RES capacity is for example 150% of the average supply (!). Next to short-term flexibility in the 50% fossil-fired capacity, also storage (like OPAC or hydro reservoirs) would be needed in order to eat up peak generation. This adds to the total cost, but the need for back-up reserve capacity will be less.

- The example above shows that a standardised approach is needed, with guidance from the Commission, so that the MSs and the public better understand the issues and the associated full annual costs.

CCS is an important long-term mitigation option because it is a major opportunity to maintain a diversified energy supply portfolio. While the US shifted to cheap natural gas, cheap coal and lignite should probably be part of the future portfolio for Europe. An advantage of CCS is that there is no problem of intermittency, it is base load.

We do not agree with the statement of the Commission in this Communication that *"the lifetime of power plants that were expected to close is now being extended and as such the risk related to carbon lock in for new fossil fuel developments increases."* Firstly, extensions are not for decades and secondly there are CCS-ready requirements for new power plants.

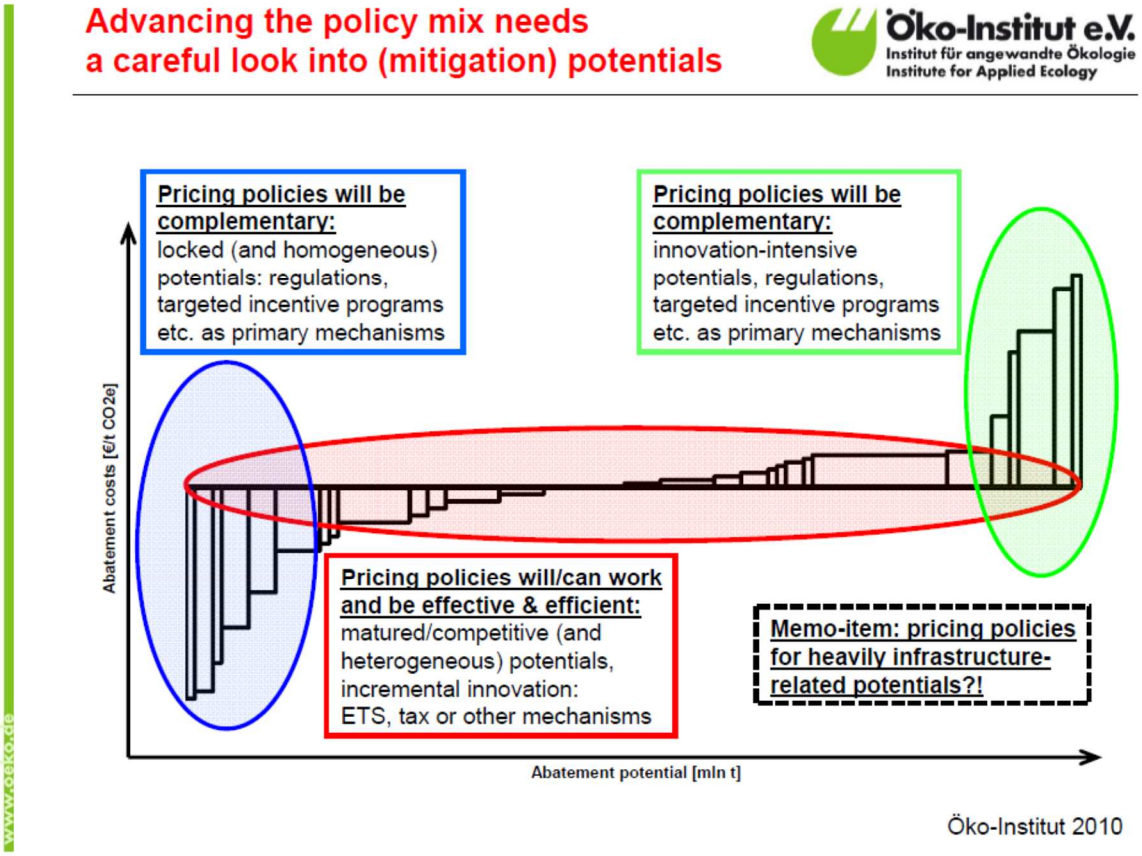
The general expectation is that the full costs for decarbonisation of society are significant, and that CCS is (most) often cheaper than RES solar and wind (off-shore so far more expensive than on-shore). Nevertheless CCS is still expensive, the full costs for capture, transport and storage including the extra electricity costs are possibly in the range of € 120-150/ton CO_2. **Therefore, based on the roadmaps, the MSs should engage to treat CCS in a similar manner as RES.**

As a matter of principle, there should in the long-term be one target: the GHG reduction target. However, before a new Global Climate Agreement with equal carbon burdens for industry globally this may lead to exploding CO_2 prices (i.e. significantly above € 100/ton CO_2, while initially in absence of such high CO_2 prices there would be for quite some years a complete standstill of RES investments).

RES and CCS, are quite expensive. If however, there is a political decision to continue the penetration of RES then there must for the time being a continuation of RES subsidies (of course in a most efficient way, with more cooperation between MSs to achieve the lowest overall costs (overall means: subsidy for RES generation, costs for grid extensions, cost for back-up capacity and for energy storage, etc.) possible (solar where there is much sunshine, wind energy where there is a lot of wind). It is still a **huge and crucial policy challenge** on how to create market-based instruments so that there will be an optimisation between all options to cope with intermittency to achieve the lowest overall costs in Europe (cross border).

Such high CCS costs as indicated above cannot be shouldered by the EU ETS, not before a new Global Climate Agreement is concluded as now planned for in 2015, so that a true global participation with equal carbon burdens for industry globally become effective as from about 2020 onwards. Anyway the EU ETS needs a proper Structural Reform in order to effectively avoid carbon leakage.

The following picture presents an impression of the abatement curve. On the left side are cost effective measures with a negative CO_2 cost, such as insulation of buildings which still need stimulating policies. The EU ETS is in the middle area. On the right side are much more expensive abatement options such as RES (wind, solar) and also CCS.



Stakeholder meeting Structural Reform EU ETS 19 April 2013, presentation by Dr. Felix Matthes of Öko-Institut

For **CCS a limited number of demonstration projects** can be part of the learning exercise. The finance of these CCS demonstration projects should come from various sources, not only from the EU ETS price and from EU ETS auction revenues. In these CCS demonstration projects current road blocks (cost, financing, permitting, liabilities, public acceptance, and infrastructure) for lasting CO_2 reductions via CCS could be identified and solved. The EU ETS is for the time being just a flanking support to cover the costs for CCS and RES. The EU ETS auction revenues should not be regarded as a milk cow for governments, as decreasing competitiveness for industry means increasing the risk of carbon leakage which implies that MSs would start to kill the welfare creator of industrial production, so needed for Growth and Jobs and the Commission target to increase the manufacturing share of 16% now to 20% of GDP by 2020.

2) *How should the ETS be re-structured, so that it could also provide meaningful incentives for CCS deployment? Should this be complemented by using instruments based on auctioning revenues, similar to NER300?*

Answer:

The Structural Reform of the EU ETS is a different subject, **this should not be led by the desire to create more support for CCS and/or RES**, which are both rather expensive

technologies in the foreseeable future. This is especially valid because the total EU ETS cap really starts to bite in the period 2021-2030, which is in our opinion rather underestimated by many analysts and the Commission. The first priority is to drastically reform the EU ETS to make it carbon leakage proof. See further above (answer to question 1).

3) *Should the Commission propose other means of support or consider other policy measures to pave the road towards early deployment, by:*
   a. *support through auctioning recycling or other funding approaches*[1]
   b. *an Emission Performance Standard*
   c. *a CCS certificate system*
   d. *another type of policy measure*

Answer:

Ad a.: From this Commission Communication one question is to generate support like the NER300 also for after 2020 until 2030. Based on the experience of the first NER 300 this is not a good idea, because then allowances are auctioned without an industrial activity with an emission.

Ad b.: An Emission Performance Standard is not effective, as there will be a dash for gas and this would be a huge interference in the market-based EU ETS. The Norwegian system (CO_2 tax of € 25/ton CO_2 on top of the EU ETS inclusion) is also not a good idea because of the interference in the market-based EU ETS.

Ad c.: A CCS certificate system as indicated in this Commission Communication is unclear. Anyhow, any double pricing (CCS and EUA) must be avoided.

Theoretically, a CCS certificate system could be interesting if a limited number of CCS demonstration plants (industrial plants and power plants) would be supported from revenues out of CCS certificates, while there is no double pricing. However, it seems questionable whether this can be integrated in a good functioning EU ETS. To be able to judge this, more details of such a CCS certificate system should be communicated. Anyway, such an ad-on system must never lead to windfall profits for electricity producers, which would increase the electricity prices in an unjustified way (this would worsen instead of improve global industrial competitiveness).

Ad d.: There should not be policy measures to pave the road towards early deployment of CCS. CCS is an expensive abatement technology. As mentioned in the general remarks, a more holistic approach must ensure that the economic interests are safeguarded and **investments in EU manufacturing are incentivised** instead of hampered by increased cost compared to our major competitors in the global market place.

[1] Taking into account complementarity with the European Structural and Investment Funds (ESI), as set out in the Common Strategic Framework annexed to the Commission proposal for a Common provisions regulation of the ESI Funds

4) *Should energy utilities henceforth be required to install CCS-ready equipment for all new investments (coal and potentially also gas) in order to facilitate the necessary CCS retrofit?*

Answer:

CCS-ready requirements should not go beyond the requirements of the CCS Directive. The CCS is still too expensive to demand further costly measures.

According to the CCS Directive, Art. 33, these requirements are:

"1. Member States shall ensure that operators of all combustion plants with a rated electrical output of 300 megawatts or more for which the original construction licence or, in the absence of such a procedure, the original operating licence is granted after the entry into force of Directive 2009/31/EC of the European Parliament and of the Council of 23 April 2009 on the geological storage of carbon dioxide, have assessed whether the following conditions are met:

— suitable storage sites are available,

— transport facilities are technically and economically feasible,

— it is technically and economically feasible to retrofit for CO_2 capture.

2. If the conditions in paragraph 1 are met, the competent authority shall ensure that suitable space on the installation site for the equipment necessary to capture and compress CO_2 is set aside. The competent authority shall determine whether the conditions are met on the basis of the assessment referred to in paragraph 1 and other available information, particularly concerning the protection of the environment and human health."

These requirements are ambiguous, what means: suitable storage sites are available and transport facilities are technically (OK) and economically feasible, retrofit for CO_2 capture is technically (OK) and economically feasible? **All these aspects are at the moment not economically feasible.** Will there be differences of interpretation between MSs?

5) *Should fossil fuel providers contribute to CCS demonstration and deployment through specific measures that ensure additional financing?*

Answer:

No, this would be a backdoor methodology to artificially increase the cost of energy.

6) *What are the main obstacles to ensuring sufficient demonstration of CCS in the EU?*

Answer:

Public acceptance, the still high costs for CCS, a laissez faire attitude of MSs regarding transport infrastructure and the long term legal liability of carbon storage.

We strongly oppose that measures are taken to drive up the carbon price while the many flaws in the present EU ETS remain untouched. The result would be massive carbon leakage. The

avoidance of carbon leakage is much more important than having a limited number of CCS demonstration projects in the medium term. Early deployment of CCS can only be considered after it is ensured that it will not affect global competitiveness of European industry.

To avoid carbon leakage a much higher allocation for direct and also indirect emissions of industry is necessary. With the present Linear Reduction Factor (LRF) of 1.74% points per year the total EU ETS cap starts really to bite in the period 2021-2030. Inevitably a significant carbon price will emerge, sooner or later. In the present rules, the same LRF must be multiplied with the already too ambitious top 10% benchmark for the allocation of allowances to new entrants. This must be increased, otherwise no new investment for growth or replacement of older less efficient plants will take place in Europe.

This would lead to significant investment carbon leakage. Therefore the total EU ETS cap between 2021 and 2030 is much more stringent than perceived by many analysts.

CCS is a proven technology, but still too expensive and there is yet no global level playing field. Storage needs infrastructure investments, here is not much to be gained. Storage and transport require compression costs, which have also not so much scope for technological improvement and cost reduction. Transport will initially be costly, but with an application on larger scale the cost for transport will be reasonable (as low as € 3-5/ton CO_2 for about 3 Mton CO_2/year, see for example Cefic Roadmap 2050 Annex 1). The capture technology is proven but still rather costly, e.g. requiring an investment of € 600 mln for 3 Mton CO_2/year captured (see Cefic Roadmap). The scope for improvement is significant, probably more than 50%. In this field intensive R&D is needed, which should be supported. There are various options next to end of pipe post-combustion capture, such as notably pre-combustion capture and oxyfuel.

Laissez faire refers to a too reluctant attitude of MSs in general, CCS is left to the EU ETS market and to the NER 300 and ESI. MSs should also become the prime institution **to explore in investing, supporting and developing the transport infrastructure**, just as in the past was most often done for the infrastructure for electricity and natural gas.

In view of the above mentioned situation, the **medium-term focus should be on R&D of capture technologies and a limited number of demonstration projects. Not on a soon large scale implementation.** Large scale implementation should be dependent on the forthcoming new Global Climate Agreement and the cost comparison with RES, energy efficiency and so forth as to be analysed in more detail in the next years.

The short and long term legal liability for carbon storage is according to the CCS Directive placed fully on the storage operator. This is probably an underestimated barrier for the deployment of CCS. In a $CATO_2$ workshop on 25 September 2012 it is reported: *"In the Shell Quest project in Canada, Shell have said that they cannot manage the liabilities, and the understanding is that the Alberta authorities have taken the liability exposure."* Another quote: *"Initial indications point towards no economically feasible solution from the private insurance market to insure liabilities related to CO_2 leakage, at least not in the demonstration phase time span."*

In this workshop various alternative to limit the storage operator liability were evaluated; it may be an option that a significant part of the – especially long-term – liability should move from the operator to the Member State. Or that the Member State should back insurance risks, which are much lower risks than e.g. by giving insurances to MSs to maintain the Euro.

7) *How can public acceptance for CCS be increased?*

Answer:

Gaining public acceptance is a crucial and not an easy task. More attention should be devoted to this issue, there should be a close cooperation between the Commission and the MSs. Best practices, such as apparently a case in Spain, should be actively shared and deployed.

Two categories of issues are to be addressed in an active and open two-way communication:

A. The relative risks of CCS for health and safety versus other risks in society;
B. The potential importance of CCS versus other low carbon technologies.

Ad A: A comparison of health and safety risks of CCS (the capture, transport by pipeline or ship and after storage) with many other risks in our society. CCS is not a zero risk operation, but many other activities are not zero risk either. Modern technologies should play an important role for adequate monitoring of undesired leakages and to provide for emergency measures in case of a detected leak.

Ad B: A comparison of the full costs of CCS with the full costs of other climate mitigation measures like especially all forms of RES.

Transparency and a very active communication to the public are of utmost importance. Communication is not a one-way street, active involvement of the public should be encouraged. The space for transportation and storage sites should be selected in a well-balanced way to minimise the perception of “not in my backyard”.