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Supporting Early Demonstration of Sustainable Power Generation from Fossil Fuels

SUMMARY OF THE IMPACT ASSESSMENT

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SUMMARY OF THE IMPACT ASSESSMENT

The Impact Assessment for which this Executive Summary is presented relates to item 2007/TREN//024 of the Commission Work Programme on a Commission Communication on supporting early demonstration of sustainable power generation from fossil fuels.

The Impact Assessment builds on earlier work, in particular the impact assessment prepared for the January 2007 Commission Communication on 'Sustainable Power Generation from Fossil Fuels'[1] and the Communication itself which cleared a number of key issues regarding:

– the substantial future role of coal in the energy supply, conditioned however on the compatibility of future coal use with the environmental objectives; the technologies of Carbon Capture and Storage (CCS) have been confirmed in this regard as one the suitable solutions (in addition to efficiency improvements);

– the need for a legal and regulatory framework enabling CCS in the EU and internationally as a precondition of further CCS development;

– the need for early demonstration of CCS in large-scale power plants;

– the possibility for CCS in coal-fired generation to become economic around 2020 through the converging effects of lower CCS additional costs (achieved with R&D and demonstration) and of a robust ETS system with predictable prices;

– the opportunities for the EU to export sustainable fossil fuels technologies once they are demonstrated at home.

Accordingly, and also in line with the overall conclusions of the January 2007 energy package and as confirmed in the Spring 2007 Council Conclusions, **the Impact Assessment takes the need for widespread CCS deployment in the EU from 2020 as established.**

Furthermore, the analyses prepared for the Commission Proposal for a Directive on the geological storage of carbon dioxide[2] in particular confirmed:

– the possibility of providing early a legislative framework for CCS, permitting geological storage and clarifying the issues of sites selection and liability for leakage; and

– the acceptance of CCS in the current EU Emissions Trading Scheme.

Finally, impact assessment analyses and other preparatory work for the proposals on ETS post-2012 and the SET-Plan outlined:

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1 COM(2006) 843.

2 Reference for the Draft Directive and its Impact Assessment.

– the role of CCS as one of strategic energy technologies, requiring further R&D and demo in view of speedy arrival to market and, in that view, justifying further public funds for R&D and demonstration; NB: priorities for European R&D in relation to CCS have been clearly identified[3] on the basis of the results of EU-supported R&D and knowledge and experience accumulated in the ETP-ZEP[4];

– the role of ETS as the key market-based mechanism after 2012 to provide incentives not to emit and the confirmation of CCS in ETS as one of legitimate mitigation options.

The Impact Assessment thus focuses on the remaining issue: the options for achieving coordinated and timely demonstration of CCS technologies in Europe which will in particular require:

– the construction by 2015 of a first series of demonstration power plants implementing key CCS technologies and their subsequent operation allowing to draw practical conclusions on the feasibility and economics of CCS in power generation by 2020;

– stimulating sustained involvement of European industry and complementing their material commitments by public financial support as the CCS demonstration plants will bear additional investment and operational costs in comparison with non-CCS generation;

– and starting early preparations for a wider deployment of CCS after 2020 in parallel with the demonstration efforts; this specifically concerns the issues of continued R&D and consideration of CO_2 infrastructure.

The Commission work undertaken in preparation of the Impact Assessment was supported by an external study prepared by PwC which dealt specifically with the evaluation of measures and options for supporting the design, construction and operation by 2015 of up to 12 large-scale demonstrations in commercial power generation. This evaluation is based on partially confidential data on several announced demonstration projects which could fulfil the specifications of large-scale CCS demonstration plants. The main conclusions of the study are supporting the option of combining EU coordination and stimulation of strong MS and other stakeholder commitments as the preferred option, with the strong suggestion to also issue EU Guidelines for harmonising the national funding schemes.

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[3] Focal points are: the improvement of power plant efficiency; the reduction of the efficiency penalty associated with CO_2 capture and the reduction of capital costs (so that the capture cost can be further decreased per tonne of CO_2 avoided); the development of innovative capture processes; the development of new materials, including membranes; the better integration of plant components with a concurrent increase in plant availability; the assessment of European CO_2 storage capacity; the safety of storage and monitoring of storage sites for leakage; and the long term assurance of the permanence of storage.

[4] R&D work undertaken in EU-supported projects (through FP5, FP6, Carnot, ECSC Research Fund) and through national and industrial initiatives brought CCS technologies to a point where they are currently applied in a number of industrial processes. They will however need to be adapted for the use in large-scale power generation. The European Technology Platform for Zero Emission Fossil Fuel Power Plant (ETP-ZEP) in its Strategic Research Agenda estimates that this will require €1bn R&D money between now and 2020.

At the same time, a recent Commission survey based on information collected from European administrations, power companies and energy stakeholders has preliminarily identified 33 large scale demonstration projects (with about 20 planned to be CCS equipped, and the others designed as capture-ready for the moment) which are at various stages of preparation. The list of these projects is annexed to the Impact Assessment Report.

The **main issue** for CCS demonstration is the current cost of CCS technologies which makes their use in power generation uneconomic under current conditions. Plans for power plants equipped with CCS face the prospects of higher investment and operational costs in comparison with non CCS plants of same capacity[5]. The EU ETS is the market based mechanism which in the longer term is expected to provide full compensation of these additional costs. However, with low and highly fluctuating CO_2 prices, as recently experienced, the additional costs of CCS installations are not sufficiently compensated.

Other drivers of the problem are the multiplicity of the configurations of CCS technologies to demonstrate, the lack of coordination of potential CCS demonstration projects and the lack of interaction with similar efforts outside Europe, and limited public support due to low general awareness of the benefits of CCS.

The **main policy objective** is to stimulate the construction of a sufficient number of large-scale CCS demonstration projects by 2015. ETP-ZEP estimates that 10 to 12 demonstration power plants will be needed in order to cover the various combinations of CO_2 capture technologies, storage sites and geographical locations. Constructing a sufficient number of these plants by 2015 and having them operated for a period of five years is a pre-condition for having by 2020 CCS processes fully demonstrated from the technical point of view and with real costs and other economic data.

An **additional objective** is to gear the practical experience form demonstration projects and of the achievements of parallel continued R&D towards decreasing the costs of CCS. Several sources see a future equilibrium between CCS costs and CO_2 price in the range of 25 to 30 € per tonne of CO_2 and indicate this could be reached around 2020.

There is an **urgency** to act now, given the long lead times for preparing, designing, obtaining the authorisations, and constructing large scale CCS demonstration projects.

Policies supporting large scale CCS demonstration projects need to provide three main benefits:

– **coordinate the demonstration projects** to aim at a coherent CCS demonstration program in Europe, testing a variety of combinations of CO_2 capture technologies, storage sites and geographical locations;

– improve **public awareness** of CCS and facilitate Europe's **interaction with CCS-related initiatives abroad**, both in other developed economies aiming at bringing CCS to market soon and in developing economies making use of fossil fuels in power generation;

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[5] A very comprehensive analysis done by the investment firm Climate Change Capital Ldt (CCC) in the summer of 2007 estimated the cost ranges, using several sources. CCC concludes that to cover the CCS-related costs increases, demonstration projects need to receive €1076-1705/kW in upfront capital grants or continued operating support of €25-67/t CO_2 stored. A 400 MW power plant equipped with CCS is assumed to store about 2.5 $MtCO_2$ per year. See the full Impact Assessment for details.

– **bring or facilitate access to public financial support** to complement industry commitments and initiative.

Three policy options are considered in the impact assessment:

– **Policy Option 0** envisages **no policy change**. Demonstration will depend on industry initiative alone although some public financial support for CCS demonstration projects may be available in a few Member States and in Norway.

– **Policy Option 1** envisages the establishment of a mechanism **combining EU coordination and stimulation of strong MS and other stakeholder commitments**. This mechanism will perform the functions of coordinating the projects while Member States relying on coal and other fossil fuels for their electricity production will be expected to provide a vital part of the public financial support. For triggering financial support from Member States, the Commission can announce that it views favourably state aid to CCS demonstration projects (without prejudice to the notification obligation by Member States and later case by case scrutiny).

– **Policy Option 2** envisages the establishment **a Joint Undertaking (JU)** as a Community scheme for both coordinating the projects and providing public financial support. To this end, the Commission could propose to increase very substantially the EU budget available for Clean Coal and CCS under FP7 in order to co-finance large-scale CCS demonstration projects, or to establish a specific budget line. When established, the JU will channel the EU funds to the demonstration projects.

A detailed **analysis of the impacts** of each policy option has been performed (see Impact Assessment Report), systematically checking the effects on each of the following metrics:

– a number of large scale CCS demonstration power plants by 2015;

– improving the economic viability of CCS and technology diversity;

– diversification of energy mix and the cost of electricity;

– global environment and air pollution;

– the economic and social dimension, international cooperation and R&D.

Regarding **the potential for CO_2 capture**, the modelling of the scenario "20% GHG reduction target, 20% renewable energies, full auctioning, and CCS enabled under ETS" undertaken in the preparation of the Directive on geological storage of CO_2 estimated that, with CCS generally commercially viable by 2020, 21 GW of coal-fired installed capacity will be equipped with CCS in 2030; the amount of CO_2 captured in the EU27 can be around 7 Mt in 2020 and around 160 Mt in 2030, representing then 13% of emissions from power and steam generation. This modelling also indicated the potential benefits of reduced air pollution.

The **results** of the Impact assessment are the following:

Policy Option 0 (no policy change) will result in only a limited number of large scale CCS demonstration projects would be put on stream by 2015, leaving outside of the demonstration activity several CCS technologies and many potentially interested Member States and operators. Selected CCS technologies may become economically viable by 2020 in specific situations, e.g. in favourable locations or countries with special policies to promote them (as is the case in Norway and could be in the UK or Netherlands) but will not be sufficiently demonstrated by 2020 to allow for their wide deployment across Europe.

The potential for CO_2 capture outlined above would remain largely unrealized under policy option 0. Alternatively, if the pressure to fight climate change and conditions in the fuels market dictated both continued reliance on coal and radical reduction of the carbon footprint associated with its use, the EU could find itself in the position of an importer of CCS technologies developed on other continents (in USA, in Japan or even in China). Another alternative would be a radical shift from coal use to other fuels, probably to the detriment of the diversity of EU energy mix and resulting implications for security of supply.

In less extreme conditions, option 0 would simply lead to delays in the introduction of CCS, compromising current ambitious goals for fighting climate change. For example, a delay of 7 years in global introduction of CCS is estimated to mean avoidable CO_2 emissions of approximately 100 Gt being released in the next 50 years, resulting in an increase of 10 parts per million in atmospheric CO_2 concentration. This is significant, given the struggle to limit total increases to less than 100 ppm above today's level[6].

Policy Option 1 (establishing a mechanism combining EU coordination and strong MS and other stakeholder commitments) can result in effective coordination of demonstration projects and can create a favourable context for the supply of public financial support.

The Commission can quickly implement a part of the mechanism using existing EU legal instruments and agreed EU financial envelopes. In particular, the Commission can put in place a supporting network structure for qualifying demonstration projects in the course of 2008[7]. Individual CCS projects (regardless whether participating in the network or staying outside of it) will have to rely for resources primarily on Member States and corporate finance. To the extent that support from Member States may involve the use of public funds, state aid issues will need to be clarified by the Commission at early stages.

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6 Source: 2008 Shell Scenarios to 2050.

7 On the basis of consultations undertaken to date the Commission is of the preliminary opinion that the following criteria should be used in the selection for projects for participation in the Network: (a) capacity of at least 300 MWe, with significant use of fossil fuels (but allowing e.g. also biomass co-firing); in case of multiple-purpose installations the power generation element should represent a fraction of the total capacity corresponding to at least 250 MW; (b) inclusion in the project concept of technical solutions for all parts of the concept of sustainable fossil fuels in power generation, ie. efficient power generation (at BAT level), capture of CO_2, its transportation and injection underground for a safe long-term storage; (c) provisions for the capture and storage rate of at least 85% of the carbon content of the fossil fuels used; (d) commissioning before end of 2015; (e) demonstration of a clear commitment for the project to be undertaken (e.g. presentation of an engineering study for the project); (f) readiness to share information on the project, subject to protection of intellectual Property rights (IPR).

With strong industry and Member State commitments, it is considered that around a dozen large scale CCS demonstration projects can be commissioned by 2015. Assuming these projects cover a wide range of technological, geographical and organizational options, CCS technologies can be demonstrated by 2020 as economically feasible and will be ready for wide deployment in Europe and in third countries.

As result, the benefits associated with deployment of CCS and modelled under the "20% GHG reduction target, 20% renewable energies, full auctioning, and CCS enabled under ETS" (see above) can be realized. Furthermore, Europe will become a provider of such technologies on the world markets, generating commercial opportunities for European businesses.

Policy Option 2 (establishing a Joint Undertaking - JU) can be seen as the one with most evident conflict of benefits and disadvantages. The JU can fulfil most of the functions of coordinating the projects and bringing financial support. It would provide the strongest instrument for effective coordination of projects and for ensuring that a full range of options is tested across Europe.

However, such a mechanism would need substantial EU funding that is simply not available under the current EU financial arrangements. The ETP-ZEP estimates that a "Flagship Programme" of this kind would require the capitalization of €9-16bn. This would correspond to a contribution from EU's public funds in the order of magnitude of €5 bn or more.

Only a limited amount of EU funding could be made readily available for the JU from the FP7 budget currently foreseen for Clean Coal and CCS (in the range of 100-200 millions €) but such amount can not finance a comprehensive demonstration program. Reaching an agreement on providing substantial EU finance for CCS demonstration could prove lengthy, resulting in delays of several years. As result, only a small number of CCS demonstration plants will be constructed by 2015 and CCS technologies will not be fully demonstrated by 2020 in Europe. The negative effects are similar as for Option 0, at least for the short- to medium term. In the longer term, if the Joint Undertaking is established, most of the benefits of Option 1 could materialise.