FINAL

Report of Working Group 3: Carbon Capture and Geological Storage (CCS)

The Second European Climate Change Programme

As agreed on 1 June 2006

Recommendations

The WG recommends that, during 2007, the Commission produces a Communication outlining the major EU policy choices for CCS, accompanied (where necessary and appropriate) by a proposal for an EU CCS regulatory framework. Those policy and regulatory frameworks should be in place as soon as possible (before 2012) and the Commission should identify which elements of those frameworks should be elaborated at an EU level, in accordance with the principle of subsidiarity.

The Commission is requested to address:

1. Permitting of geological storage sites, including risk management, site selection, operation, monitoring, reporting, verification, closure and post-closure;
2. Liability for leakage from storage sites during operation and post-closure;
3. Clarification of the role of CCS under EU legislation, in particular concerning waste and water, and propose appropriate amendments;
4. The recognition of CCS projects in the EU Emissions Trading Scheme;
5. The need and possible options for incentivising CCS in a transitional period;
6. The status of CCS projects under rules and guidelines for State Aid.

Introduction

The Working Group on Carbon Capture and Geological Storage (CCS) was set up under the Second European Climate Change Programme (ECCP II). The Commission Communication 'Winning the Battle against Global Climate Change' (COM(2005)35), adopted in February 2005, announced ECCP II and pointed out that it would address carbon capture and storage.

Three general objectives of the CCS Working Group were outlined in its mandate (see Annex I). These include:

1. Reviewing the potential, economics and risks of CCS;
2. Identifying regulatory needs and barriers and exploring the elements of an enabling regulatory framework for the development of environmentally sound CCS; and
3. Identifying other barriers that could impede the development of environmentally sound policies to advance CCS, and policies to enable the development of environmentally sound CCS.

The Working Group comprised Member State experts, representatives of relevant business sectors, environmental NGO representatives, independent experts and Commission officials

(see Annex II for the lists of participants). The group met four times between February and June 2006 to deal with the different aspects of CCS. During the opening session on 27 February 2006 the participants explored the state of play of the CCS technology, including updates on the implementation of specific projects. The second session on 20 March 2006 dealt with the risks and economic potential of CCS. On 24 April 2006 the participants discussed the regulatory framework needed for CCS. A final meeting was held on 1 June 2006, at which this final report was reviewed and adopted by consensus. The presentations made at the meetings and minutes of the meetings of the group are available through: http://forum.europa.eu.int/Public/irc/env/eccp_2/home

In its activities the Working Group has focussed on policy development at EU level. National and international developments (such as CCS under London and OSPAR Convention) were discussed but were not the prime focus of the activities of the Working Group. For the purpose of this report, CCS refers to capture, transport and geological storage of carbon dioxide (CO_2) in structures beneath land or sea. In line with its mandate, the WG did not consider ocean storage on the seabed or in the water column.

1. Carbon Capture and Geological Storage: State of Play

1. The Working Group (WG) considers that in the current state of play of CCS technology, the regulatory framework and public acceptance are, next to economic feasibility, two of the most important challenges for the deployment of CCS technology. It notes that the regulatory framework and public acceptance are closely related as the latter is partially dependent on authorities being able to ensure the environmental integrity of the technology, both in the short and long term, through a transparent regulatory framework.

2. In view of meeting the EU's agreed objective that global average temperature increase should not exceed 2°C above pre-industrial level, the WG considers CCS an important option for the mitigation of CO_2 emissions as part of a broad portfolio of measures and technologies, both within the EU and at a global scale. Including CCS as an option alongside other options such as improved energy efficiency and energy demand management in all sectors, renewable energy, and the switch to energy sources with lower CO_2 emissions, could significantly reduce the economic costs of reducing greenhouse gas emissions, or allow deeper reductions with the same cost and time frame, and increase security of energy supply. The WG notes that CCS is a technology that is potentially applicable to a wide range of sectors (based on oil, gas, coal and biomass), such as primary energy production, power generation, and CO_2 intensive industries.

3. Estimates show that the potential for CO_2 storage is large. The technical global storage capacity comprises deep saline formations, depleted (on- and off-shore) gas and oil fields (some of which can also be used in combination with enhanced oil and gas recovery -EOR and EGR), and unmineable coal seams (possibly with enhanced coal bed methane). Although estimates vary widely and are subject to considerable uncertainty, this storage capacity covers at least several decades of current global CO_2 emissions (approx. 30 Gt CO_2/year). The 2005 Special Report on Carbon Dioxide Capture and Storage from the Intergovernmental Panel on Climate Change (IPCC) gives an estimated range of the economic potential for CCS in this century between 220-2200 Gt CO_2, which would mean that 15-55% of the world-wide mitigation effort

by 2100 could be achieved through the use of CCS. Nevertheless, the actual application of CCS will depend on a wide range of factors, including the costs, environmental impacts, public acceptance, technology transfer and diffusion, and the policy framework.

4. The EU has many major CO_2 emissions point sources with access to potential storage locations. The WG recommends further research into more accurate quantification and characterisation of storage locations in the EU.

5. The elements of the CCS chain are to a large extent proven technology and in many cases already commercially used in some form. This applies to capture technologies (used commercially, although more innovative and efficient technologies are being developed), transport (CO_2 handling and pipelines is common industrial practice) and CO_2 storage (EOR is used in a number of countries, CO_2 injection in Sleipner since 1996, temporary natural gas storage). The state of the art on all these elements of the CCS chain could enable CCS technology to become widely available by 2020. The innovation of CCS as a carbon abatement option is three-fold:
   a. The combination of a series of technologies at large scale into a functioning CCS chain;
   b. Significantly reducing the costs of capturing CO_2;
   c. The need to ensure long-term storage of CO_2.

6. All elements of the CCS chain could be deployed today at industrial scale at many locations around Europe. EU co-funded research is developing technologies that aim to reduce the costs of CCS deployment and provide assurance of long-term storage integrity. A supportive policy framework for CCS would spur commercial deployment, incentivising industry to compete to develop new technologies to reduce costs. The combination of technology cost reduction with policy and regulatory frameworks would enable the widespread commercial deployment of CCS projects.

7. The WG has considered and welcomes the increased activity and interest in the EU on CCS, at the international, EU and national levels and within the private sector, including:
   - On-going R&D work under the 6th Framework Programme. It welcomes the increased attention on CCS in the 7th Framework Programme and in this context recommends sufficient support without negatively affecting support for other abatement options;
   - The work of the Zero Emission Fossil Fuel Power Plant Technology Platform, to build critical mass on this technology in the EU and development of a Strategic Research Agenda, and a Deployment Strategy;
   - The announcement of several private sector-lead pilot and large scale demonstration projects in Europe, which would represent an investment of several billion €;
   - The IPCC Special Report on CCS and the 2006 IPCC guidelines on national inventories;
   - The on-going work on monitoring and reporting for CCS activities in emission trading schemes;
   - The ongoing work on CCS by the International Energy Agency (IEA) and in the Carbon Sequestration Leadership Forum (CSLF);
   - The ongoing work on CCS in the context of the London and OSPAR Conventions.

2. Environmental risks and impacts of CCS

8. A range of environmental risks and associated potential environmental impacts are associated with the CCS chain, covering CO_2 capture, transport and storage. The main new risk relates to the release of CO_2 from the pipeline or storage site. The WG recommends that health, safety and environmental risks are considered at every stage of the CCS chain.

2.1 CO_2 capture

9. The energy required to operate CO_2 capture systems significantly reduces the overall thermal efficiency of power generation. A power plant equipped with a CCS system would need roughly 10-40% more energy than a plant of equivalent output without CCS, of which most is for capture and compression.[1] This not only implies an extra energy cost, but also additional associated environmental impacts, both upstream (e.g. mining activities, transport of fuels) and downstream (e.g. more solid wastes) of the power plant.

10. The environmental impacts associated with these additional up- and downstream activities are known and are controlled by various pieces of existing legislation. The use of solvent-based capture technologies may also lead to a new waste stream of non-recyclable degraded solvents which would need to be incinerated or disposed of by other means.

11. The reduction of efficiency losses due to capture is therefore important from an environmental and economic point of view. The WG recommends that more efficient capture processes should remain a key focus of research and development activities in the EU.

12. The application of capture technologies can affect the emission of conventional air pollutants (SO_x, NO_x, PM) and in the longer term, might affect (positively or negatively) the compliance of Member States with the National Emissions Ceilings (NEC) Directive.

13. The actual change in emissions of traditional air pollutants associated with the application of CCS compared to conventional technologies without capture and with the same electricity output results from two opposing factors, i.e. the fuel penalty vs. the direct impact of the capture process.[2] This can lead to either a positive or negative impact on air pollution. The WG notes the need to take account of the relationship between CCS technologies and relevant EU Directives and longer term impacts on air quality as part of policy development.

14. The captured CO_2 is not a pure CO_2 stream, but contains trace contaminants. The type and concentration of trace contaminants depends on the type of fuel, the capture

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1 Source : IPCC Special report

2 **For post-combustion processes**: On the one hand the loss of efficiency will lead to increased volumes of flue gasses (and associated air pollutants). On the other hand, some of the produced NO_x and SO_x will be captured by the solvents. In addition, the flue gases may need to get better NO_x/SO_x removal technologies upstream of the capture process to avoid excessive solvent loss, leading to lower emissions. JRC estimates that increased air pollution of SO_x, NO_x to be probably below 5%. **Pre-combustion IGCC plants and oxy-fuel** could lead to lower levels of SO_x/NO_x than conventional pulverised coal.

process and detailed plant design and may include substances such as heavy metals, SO_x, NO_x, H_2S, solvent traces and ammonia. These contaminants potentially have an impact on safety, as well as on environmental and health risks related to CO_2 transport and storage. The WG recommends further work to explore the extent to which trace contaminants in the CO_2 stream will need to be addressed throughout the CCS chain and options for doing so.

2.2 CO_2 transport[3]

15. Apart from CO_2 leakage, health, safety and environmental risks related to CO_2 pipelines are comparable to other pipeline infrastructures and can be dealt with through established industrial practices and existing regulation.

16. Risks for CO_2 leakage relate to potential failure of the pipeline (possibly by outside force), sudden break-out of CO_2, gradual release and potential accumulation. These risks can be dealt with through design of pipelines, wide availability of information of pipeline location, block valves, visual monitoring (e.g. pipeline inspection devices) and the careful selection of the pipeline route.

2.3 CO_2 storage

17. Risks associated with CO_2 storage are both local and global in nature.

18. The local risks are related to the release of CO_2 in the biosphere which could affect groundwater and surface water (including localised acidification of ocean water, with its related impacts on ocean bio-diversity), human and animal health and safety and ecosystem diversity. Local health, safety and environmental hazards arise from three different causes: (1) effects from elevated CO_2 concentrations in the shallow sub-surface and near surface environment; (2) effects of dissolved CO_2 on groundwater chemistry; and (3) effects that arise from the displacement of fluids by the injected CO_2.

19. Global risks are related to the release of CO_2 to the atmosphere through possible leakage.

20. The IPCC has estimated that the fraction retained in appropriately selected and managed geological reservoirs is very likely[4] to exceed 99% over 100 years and is likely[5] to exceed 99% over 1000 years.

21. CO_2 leakage is possible during the injection phase (e.g. mechanical failure, corrosion). Such leakage can be addressed with well designed injection points and with appropriate industrial practices

22. The possible leakage paths for stored CO_2 are through the well bore, faults and the migration through cap-rock. Potential mechanisms leading to leakage are degradation of the sealing of the well, leakage via unknown wells (including additional drilling), fault in the cap-rock, buoyancy, chemical interaction, transport of dissolved CO_2, and natural or induced (due to overpressure) seismicity.

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3 This section focuses on transport by pipelines only.

4 Very likely is a probability of 90 to 99 %

5 Likely is a probability between 66 and 90%

23. Most of the potential mechanisms leading to CO_2 leakage can be managed through the selection, proper characterisation, appropriate design and operation of the well bore and the injection point. These parts of the regulatory framework are therefore of utmost importance. Considerable industrial experience has been gained with storage of natural gas and this experience can be usefully used for CO_2 as well, although the chemical characteristics and long term nature of CO_2 storage are important differences that need to be taken into account.

24. Any regulatory framework for CO_2 storage must be based on an integrated risk assessment for CO_2 leakage, including better assessment tools, consistent and adequate monitoring regimes for CO_2 leakage, and adequate remediation plans in case of leakage. The WG recommends further work on these issues with relevant regulatory agencies to support industrial scale demonstration projects to improve knowledge and expertise, and their inclusion within relevant regulatory frameworks.

25. The WG recommends that a key focus for R&D activities in the EU is to provide assurance of long term integrity of storage, and limiting risks to health, safety and environment.

3. Economics of Carbon Capture and Geological Storage

26. The IPCC Special report indicates a wide range of cost estimates, ranging from US$ 15-75 per tonne of CO_2 for capture from power generation, US$ 5-55 per tonne of CO_2 from gas processing and ammonia production, US$ 25-115 per tonne of CO_2 from other industrial processes, US$1-8 per tonne of CO_2 for transportation (250 km), and US$ 0.5-8 per tonne of CO_2 for injection. Overall, the IPCC considers substantial application of CCS possible above a CO_2 price of US$ 25-30 per tonne of CO_2.

27. Cost estimates vary according to the fuel and specific conversion and capture technologies being used. Also the set of assumptions, relating for instance to the scale of the projects, to fuel and electricity prices, to operating costs, volume of CO_2 stored versus CO_2 avoided, lifetime of the plant, financing interest rates, annual operation hours, inclusion of monitoring costs and expected return on investments, varies significantly between studies and can explain partly differences between cost estimates and makes comparisons challenging. The WG recommends more work to be done on comparing economic assessments of CCS and to develop future economic assessments to be based on more transparent and consistent assumptions relating to key parameters.

28. Further cost reduction can be achieved for instance through more advanced capture technologies as well as demonstration and upscaling ("advancing on the technology learning curve"). More efficient capture technologies also have positive environmental impacts (see paragraph 2.1). The WG recommends that cost reductions are promoted through R&D and demonstration plants.

29. Certain applications, such as in gas supply where CO_2 is already removed from the gas stream, are from an economic point of view particularly interesting and would facilitate early application of CCS technology and increase experience with CO_2 storage. Additional benefits and revenue streams from enhanced oil recovery can also facilitate earlier market deployment.

30. There are also potential economic aspects of CCS activities associated with the potential stranding of economic assets (e.g. oil and gas reservoirs, potable groundwater) by stored CO_2. This should be considered during project planning.

31. Considering that the implementation of the CCS chain comes with additional costs, deployment is dependent on regulatory requirements and incentives in proportion to its CO_2 benefits.

4. An enabling policy and legal framework for CCS

4.1 The need for an EU policy and regulatory framework

32. The WG underlines the urgent need for the development of a policy and regulatory framework for CCS, in particular in view of the important role that this technology can play in reducing the EU's greenhouse gas emissions and the announcement of several potential major industrial-scale projects.

31. The WG requests the Commission to explore during 2006 and 2007, as part of the impact assessment for its Communication, which elements of the legislative framework should be elaborated at EU level and in what level of detail, in accordance with the principle of subsidiarity.

33. A policy and regulatory framework for CCS in the EU should:
    - Ensure the appropriate management of the environmental risks associated with CCS and reduce environmental impacts associated with the CCS chain to an acceptable level, both over the short and long term;
    - Provide clarity, coherence and stability, enabling market operators to invest in CCS facilities across the EU under comparable regulatory conditions;
    - Provide appropriate incentives for the use of this technology, that are in relation to its actual GHG reduction benefits and do not unduly disadvantage the development and deployment other options, in particular in relation to energy efficiency and renewable energy.
    - Address liability issues, in particular responsibility for remediation in relation to leakage from the storage site in the short and long term.

32. The WG urges the Commission to come forward with a Communication outlining the major policy choices in 2007 accompanied (where necessary and appropriate) with a legislative proposal. The WG is of the view that a policy and legislative framework for CCS needs to be in place as soon as possible (before 2012). The WG also urges the Commission to provide, where possible, interim guidance on the role of CCS under existing EU legislation, including the EU emissions trading scheme.

33. The WG recommends the Commission to further explore during 2006 and 2007 the applicability of existing EU legislation to CCS and identify any unwarranted obstacles to the implementation of this technology. In this context, the WG in particular recommends the Commission to explore and clarify the role of CCS under the EU legislation concerning waste and water, and propose amendments in case certain provisions would cause unwarranted obstacles.

5.2 Elements of an enabling EU policy and regulatory framework

34. A regulatory framework for CO_2 storage should require an integrated risk management throughout the life cycle of a CCS project, i.e. from initial site selection in the preparation phase, design and construction, operation including monitoring, reporting and verification, up to closure and post-closure requirements.

35. The WG recommends that an regulatory framework in the EU for CCS:
    - Ensures the assessment of environmental risks and impacts;
    - Provides a framework for the permitting of CCS activities, including monitoring, reporting and verification, as well as conditions for site selection, operation and closure;
    - Allows for the inclusion of CCS activities in the EU ETS and clarifies its role under other incentive mechanisms;
    - Sets appropriate liability rules, in particular in relation to leakage from the storage site in the short and long term.

36. The WG underlines the need for the regulatory framework to provide for public participation and transparency in decision making on CCS activities. The WG furthermore underlines the need for the regulatory framework to address transboundary issues and access to infrastructure related to CCS activities.

Health, safety and environmental risks and impacts of CCS activities

37. The WG recommends the definition of a risk management approach early on in the design of a CCS project, which includes an assessment of health, safety and environmental risks. The WG recognises in particular that appropriate site selection criteria are key in minimising any long term risks related to CO_2 leakage. The WG recommends that risk assessment and management are integrated in the environmental impact assessment for the site and the criteria for the operation permit.

38. The WG recommends that the Commission further explores the possible role of existing EU instruments such as the Environmental Impact Assessment Directive, the Strategic Environmental Impact Assessment Directive, the Water Framework Directive, and the Integrated Pollution Prevention and Control (IPPC) permit to help assess and manage environmental risks and impacts.

Permitting of CCS activities

39. The WG underlines the need for effective permitting of CO_2 storage sites. A permitting regime in the EU should:
    - Ensure the application of site selection criteria and/or standards;
    - provide rules for the design of the CO_2 injection and storage site;
    - set rules for trace contaminants in the injected CO_2 stream;
    - provide criteria for the operation of the storage site;
    - provide for common and transparent criteria for the monitoring, reporting, verification and inspection of CCS activities, both during their operation, on cessation of operation and after their closure, taking into account the 2006 IPCC guidelines for national inventories;

- provide for obligatory mitigation/remediation measures, including activities to reduce environmental, health and safety impacts of occurred CO_2 leakage and activities to prevent additional CO_2 leakage;
- Take into account relevant international agreements, including the London Convention and Protocol and the OSPAR Convention.

Incentives for CCS activities

40. The WG recommends that CCS activities are recognised in the EU emissions trading scheme, giving commercial entities an incentive to invest in CCS activities. The WG recommends use of the IPCC 2006 guidelines for national inventories methodology, including a mass balance approach where appropriate to account for all direct and fugitive emissions across the complete CCS chain (conversion plant, pipeline and storage site). Appropriate recognition of CCS activities should be considered in relation to the forthcoming review of the EU ETS.

41. The WG notes that the current situation on the international climate regime and the EU emissions trading scheme might not provide sufficient incentive or certainty for investment in CCS. Considering the potential of this technology as part of a wide range of carbon abatement options and in view of the need for learning, the WG recommends the Commission and the Member States to explore during 2006 and 2007 the need and possible options for incentivising CCS in a transitional period. The WG recommends that the Commission provides guidance on the status of CCS projects under rules and guidelines for State Aid.

Liability for CCS activities

42. The WG underlined the need for the full accounting of the effects of CCS for the atmosphere. It recommended the development of a suitable liability regime that provides for additional greenhouse gas emission reductions to cover leakage of CO_2 from CCS activities to the atmosphere, both in the short and in the long term, and addresses adverse local environmental impacts resulting from the CCS activity.

43. The WG concluded that liability issues that may arise in relation to activities that capture and transport CO_2 are comparable to those that may arise from other industrial activities and the transport of various gases. This is especially so for the transport of CO_2 that is already taking place. The WG therefore recommends that the Commission explores the applicability of this legislation to the capture and transport of CO_2, as well as any need for the further development of this legislation.

44. The WG discussed the option that the responsibility over a storage site is transferred to government at some point after the end of the injection period, and recommends that this option should be explored further. This further work should include the conditions under which such transfer would take place, including the adherence to permitting requirements for the CO_2 storage site by the operator, a long term assessment of the storage situation, continued maintenance of the storage site, as well as long-term monitoring requirements. The principles for hand-over should take into account liability issues, as well as guidance for monitoring stored CO_2 after site closure as laid down in the IPCC 2006 Guidelines for national inventories.

45. The WG concludes that the use of insurance or related financial mechanisms should be further explored, as one of the options for addressing liability for leakage of CO_2 from a storage site to the atmosphere, in particular in the longer term. This work should include exploring the possibilities for specific funds, financed through contributions from storage site operators, to cover liability during the operation of storage facilities and after the potential transfer of the site to the government. Consistency with the environmental liability Directive should be investigated as part of this work.

Annex I:

ECCP II
WG III: Carbon capture and geological storage

Mandate

1. Background

The European Climate Change Programme (ECCP) was established in June 2000 to help identify the most environmentally and cost-effective EU measures enabling the EU to meet its target under the Kyoto Protocol, namely an 8% reduction in greenhouse gas emissions from 1990 levels by 2008-2012, complementing Member States efforts. In total, 11 different working groups were established and have operated under the co-ordination of an ECCP Steering Committee:

The results from the ECCP formed an important contribution to the October 2001 Communication[6] on the implementation of the first phase of the European Climate Change Programme", converting the ECCP results into a clear political commitment from the Commission. It highlighted a package of twelve priority measures and an action plan for implementation of these measures, to be brought forward by the Commission in 2002 and 2003. A progress report on the implementation of the ECCP was made in May 2003.

The February 2005 Communication 'Winning the battle against global climate change'[7] indicated that the Commission "*will review progress and explore new actions to systematically exploit cost effective emission reduction options in synergy with the Lisbon strategy*" and stated that "*attention will be paid in particular to […] carbon capture and storage*".

2. General Objective

The general objective of the Working Group is to explore geological carbon capture and storage (CCS) as a mitigation option by:

- reviewing the potential, economics and risks of CCS;
- identifying regulatory needs and barriers and exploring the elements of an enabling regulatory framework for the development of environmentally sound CCS;
- identifying other barriers that could impede the development of environmentally sound policies to advance CCS, and policies to enable the development of environmentally sound CCS.

3. Policy Deliverable

The Working Group will deliver a final report by March 2006. Taking into account this report, the Commission intends to present a Communication on Carbon Capture and Geological Storage at the end of 2006 or early 2007.

[6] COM (2001) 580 final
[7] COM(2005) 35

4. Organisation, work programme and time table

The Group is chaired by the Commission service in charge and will be composed of maximum 25 stakeholders plus Commission officials of relevant services. The Working Group will comprise Member State experts, representatives of relevant business sectors, NGO representatives, academic experts and Commission officials. Members of the group and, where appropriate, external experts will be asked to make specific contributions in the form of presentations and issue papers. Members of the group will also be asked to contribute and comment on the final report.

Working Group III will meet four times between February and May 2006. The Chairman will prepare minutes of each meeting, for adoption by the group. The Chairman will also prepare the final report, which will draw conclusions as well as set out key options based on the discussions in the group.

The four meetings of the working group will cover the following issues:

- Opening session (February 2006): **State of play**. At this session participants will explore the state of play of the CCS technology, including updates on the implementation of specific projects, on the basis of expert presentations.
- Second session (March 2006): **Risks and economic potential**. At this session participants will explore the economic potential of CCS technology as well as the risks associated with its use on the basis of expert presentations.
- Third session (April 2006): **The regulatory framework**. At this session participants will explore regulatory barriers to the implementation of the technology and regulatory needs for its safe and environmentally sound deployment on the basis of expert presentations.
- Closing session (May 2006): Summary and conclusions of previous meetings and discussion of the final report.

Annex II: List of Participants

Participants list 1st ECCP WG CCS Meeting – 27 February 2006

Name	Member State/Organisation
1. Jesper Gundermann	Denmark
2. François Bersani	France
3. Chris Dekkers	The Netherlands
4. Pawel Krzystolik	Poland
5. Vit Hladik	Czech Republic
6. Roberto Martínez Orío	Spain
7. Sven-Olov Ericson	Sweden
8. Jim Penman	United Kingdom
9. Tonje Hagen Geira	Norway
10. Robert PENTEL	EURACOAL
11. Wolfgang Heidug	OGP
12. Claude Roulet	EUROGIF
13. Rose de Lannoy	EURELECTRIC
14. Yann de Lassat	EUROFER
15. Rob van der Meer	CEMBUREAU
16. Hans-Wilhelm Schiffer	RWE
17. Miroslaw Niewiadomski	BOT Mining and Power
18. Arve Thorvik	Statoil
19. Iain W. Wright	BP
20. Francois Giger	EDF
21. Jason Anderson	IEEP
22. Chris Hendriks	ECOFYS
23. Paul Zakkour	ERM
24. Gabriela Von Goerne	Greenpeace
25. Jürgen Lefevere	DG ENV
26. Stefaan Vergote	DG ENV
27. Pierre Dechamps	DG RTD
28. TobyiasWiesenthal	EEA
29. Evangelos Tzimas	JRC
30. Wolfgang Heidug	OGP/EUROPIA/Shell
31. Lars Stromberg	Vattenfall
32. Pietro Dizanno	Airliquide
33. Leo Meyer	IPCC
34. Stephan Singer	WWF
35. Ton Wildenborg	TNO

Participants list 2nd ECCP WG CCS Meeting – 20 March 2006

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7. Vit Hladik	Czech Republic
8. Roberto Martínez Orío	Spain
9. Sven-Olov Ericson	Sweden
10. Jim Penman	United Kingdom
11. Tonje Hagen Geiran	Norway
12. Robert Pentel	EURACOAL
13. Wolfgang Heidug	OGP/EUROPIA/Shell
14. France Dantin	EUROGIF
15. Rose de Lannoy	EURELECTRIC
16. Rob van der Meer	CEMBUREAU
17. Hans-Wilhelm Schiffer	RWE
18. David Corregidor	ENDESA
19. Miroslaw Niewiadomski	BOT Mining and Power
20. Arve Thorvik	Statoil
21. Iain W. Wright	BP
22. Francois Giger	EDF
23. Jason Anderson	IEEP
24. Chris Hendriks	ECOFYS
25. Paul Zakkour	ERM
26. Manfred Treber	Germanwatch
27. Gabriela Von Goerne	Greenpeace
28. Stephan Singer	WWF
29. Jürgen Lefevere	DG ENV
30. Stefaan Vergote	DG ENV
31. Luca Marmo	DG ENV
32. Thomas Schneider	DG TREN
33. Joachim Ehrenberg	DG ENTR
34. Estathios Peteves	JRC
35. Evangelos Tzimas	JRC
36. Mona Bjorklund	SG
37. Magnus Pettersson	SwedPower
38. Stale Selmer-Olsen	DNV
39. Jean Paul Gourlia	TOTAL
40. Bjorn-Erik Haugan	Gassnova
41. Clas Ekström	Vattenfall
42. Francois Kalaydjian	IFP
43. Alexandre Rojey	IFP

Participants list 3rd ECCP WG CCS Meeting – 24 April 2006

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6. Pawel Krzystolik	Poland
7. Vit Hladik	Czech Republic
8. Sven-Olov Ericson	Sweden
9. Tim Dixon	UK DTI
10. Elizabeth Hattan	UK DEFRA
11. Tonje Hagen Geiran	Norway
12. Robert Pentel	EURACOAL
13. Wolfgang Heidug	OGP/EUROPIA/Shell
14. Claude Roulet	EUROGIF
15. Rose de Lannoy	EURELECTRIC
16. Hans-Wilhelm Schiffer	RWE
17. Eva Muro Redondo	ENDESA
18. Miroslaw Niewiadomski	BOT Mining and Power
19. Arve Thorvik	Statoil
20. Iain W. Wright	BP
21. Francois Giger	EDF
22. Jason Anderson	IEEP
23. Harry Audus	IEA
24. Ton Wildenborg	TNO
25. Chris Hendriks	ECOFYS
26. Paul Zakkour	ERM
27. MJ Mace	FIELD
28. Gabriela Von Goerne	Greenpeace
29. Stephan Singer	WWF
30. Kirsten Macey	CAN Europe
31. Jürgen Lefevere	DG ENV
32. Stefaan Vergote	DG ENV
33. Charles Pirotte	DG ENV
34. Scott Brockett	DG ENV
35. Thomas Schneider	DG TREN
36. Lars Stroemberg	Vattenfall
37. Sophie Mueller	EC SG

Participants list 4th ECCP WG CCS Meeting – 1 June 2006

To be completed