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From Kyoto to The Hague – European perspectives on making the Kyoto Protocol work

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Findings of the second climate policy workshop of
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Preface

I am happy to present to you this report on the second EFIEA Climate Policy workshop, under the auspices of the European Forum on Integrated Environmental Assessment, financed by the Dutch National Research Programme on Climate Change and Global Air Pollution (NRP), and hosted by the National Institute of Public Health and Environmental Protection (RIVM).

The European Forum on Integrated Environmental Assessment (EFIEA) is a concerted action of the Environment and Climate Programme of the European Commission, Research Directorate. It is an initiative to improve the current practice of IEA by means of a network of some 50 European research groups, policy advisers, stakeholders and decision-makers.[1]

The aim of our Forum is to strengthen the science-policy interface. In our workshop we focused on the issues relevant for reaching agreement on the Kyoto Protocol. Our findings are particularly relevant for the meeting of the Conference of the Parties to the UN Framework on Climate Change (COP-6, The Hague, November 2000).

This summary report discusses the most controversial policy questions; it presents consensus views as well as the conflicting issues. It concludes with new perspectives on European Leadership in international climate policies. The report highlights the main arguments and findings from the European research community, it addresses specific proposals from industry, NGOs and governments. It provides an up-to-date overview of the facts, opinions and scientific analysis[2]. It sets the stage for the challenging international negotiations on climate change policies in November 2000 in The Hague. This report can be seen as a guidebook for the Conference and beyond.

Bert Metz and his team at RIVM have done an excellent job in providing the best the European Forum can offer to support the development of international climate change policies.

I want to thank all contributors to the workshop, the NRP and the European Commission, Research Directorate for their support.

Pier Vellinga
Chairman of the European Forum on Integrated Environmental Assessment

[1] Information on the European Forum on Integrated Environmental Assessment (EFIEA) and its goals and objectives can be found on website: http://www.vu.nl/ivm/efiea/efiea.htm

[2] The scientific articles reviewed in the workshop have been published in the Journal 'International Environmental Agreements', Kluwer Academic Publishers, Dordrecht, The Netherlands, Vol. 1, Issue 2, 2000.

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Summary

During the 6th Conference of Parties (CoP-6) to the Climate Convention in The Hague, November 2000, a number of critical outstanding issues related to the Kyoto Protocol will have to be tackled to ensure its early ratification, if not to save it from complete failure. In April 2000, RIVM in co-operation with the Dutch National Research Programme on Climate Change and Global Air Pollution organised the second EFIEA (European Forum of Integrated Environmental Assessment) workshop on climate change where scientists and policy makers discussed a number of these issues and the EU role in a successful implementation of the Kyoto Protocol. In four sessions, presentations were made and discussions were held on the subjects of the Kyoto Mechanisms (KMs), domestic implementation, sinks and EU leadership. This report presents the main findings from the workshop, which can be summarised as follows:

EU Leadership
Although EU leadership is relatively weak in terms of political and economic power (structural leadership) opportunities exist for strengthening instrumental leadership (by building coalitions with developing countries on issues regarding CDM, technology transfer, adaptation and capacity building on scientific infrastructure). EU directional leadership (giving the example through domestic implementation and ideas for solving problems) can be strengthened by taking initiatives in developing effective compliance policies and applying those within the Union first.
EU credibility will be judged inside the EU and by environmental NGOs internationally based on the success of the EU at CoP-6 to defend the environmental effectiveness of the Kyoto Protocol. The problem of USA ratification should not distract from the need for a CoP-6 agreement that is environmentally credible. The EU should invest in building trust with key countries for getting the necessary support for entry into force of the Kyoto Protocol without the USA (the Group of 55 coalition), particularly with Russia and the Ukraine.

Domestic implementation
Credible implementation is a key condition for the EU to exercise directional leadership to help reach agreement at CoP-6 on an environmentally effective Protocol. Strengthening the integration of climate policies with transportation, industry, energy and agricultural policies is important. Awareness raising among the business community and the public may be necessary.
The current liberalisation of European energy markets leads to a decrease in energy prices, potentially resulting in higher greenhouse gas emissions. This might be offset to some extent by a faster switch to gas and a higher sensitivity of energy markets to market-based instruments. Still, there might be a need to 'green' the liberalisation through regulatory interventions.

Ancillary benefits (environmental, economic and technological benefits) are often not included in the analysis of the benefits of climate change policies, resulting in an underestimation of the benefits of climate policies. They can make domestic action cheaper and more attractive than international emission trading.
The local level often tends to be forgotten in implementation strategies. Commitment, public awareness and potential on the local level could be used better.
Due to the economic restructuring process in Eastern Europe, many accession countries will in all likelihood face a narrower Kyoto gap to fill than the current EU-15 or may even have a surplus ("hot air"). It seems unlikely that that the EU could exploit this potential other than by the use of the Kyoto Mechanisms.
The EU commission proposal for internal emission trading raises many questions but deserves due attention. Questions relate to both its internal functioning (e.g. entities involved, compatibility with policies and measures) and relations with the KM regimes. To avoid overselling there is a need for a strong internal compliance system for trading, and it should start with a rigorous set of eligibility criteria, such as used for accession to the Eurozone.

Kyoto Mechanisms
The challenge of the design and implementation of the Kyoto Mechanisms is how to reduce costs, while still securing sufficient domestic action for international credibility in order to trigger both ratification and increased participation. The CDM has potential for helping developing countries to "green" their economic development and it can help to broaden participation in the international regime over time.
"Hot air" was not regarded to be a very important issue, if looked at from a longer-term perspective. Too much EU emphasis on "Hot air" may hinder alliances with Russia for an early entry into force of the Kyoto Protocol, while there are other ways to limit "Hot air" trading. Involving business parties in a Kyoto Mechanisms system has the potential of making the Emission Trading regime more cost-effective. A strong and effective compliance regime is crucial for the development and credible implementation of the Kyoto Mechanisms.

Sinks
Sinks in principle could offset large amounts of carbon emissions, depending on outstanding issues regarding definitions, additional activities and eligibility of sinks in the CDM. A rough estimate of the sink potential in the short and medium term is about 15% of fossil fuel emissions.
However, including a broad range of sink options already in the first budget period could discourage mitigating fossil fuel emissions and will increase uncertainties. Uncertainties in measuring carbon stocks are large, but may be managed by only crediting the lower level of the uncertainty range, creating incentives for reducing uncertainties through more expensive monitoring or future research. With respect to sinks in the CDM, growing biomass for fossil fuel substitution offers relatively large alternative opportunities and might be less controversial than carbon sequestration and conservation. Avoided deforestation and soil carbon release have important benefits to the capacity to adapt to climate change and could possibly be handled in such a context in view of the political sensitivity of the issue.

Samenvatting

Tijdens de zesde Klimaatconferentie (CoP-6) in november 2000 in Den Haag zal over een aantal belangrijke openstaande punten uit het Kyoto Protocol overeenstemming moeten worden bereikt, teneinde ratificatie of zelfs het behoud van het Protocol te verzekeren. In april 2000 organiseerde het RIVM in samenwerking met het NOP in Amsterdam de tweede EFIEA (European Forum on Integrated Environmental Assessment) workshop klimaatbeleid, om met wetenschappers, beleidsmakers en stakeholders te discussiëren over een aantal van deze belangrijke punten, alsmede over de rol die de EU zou kunnen spelen voor een succesvolle implementatie van het Kyoto Protocol. In vier sessies werden de volgende zaken besproken: Kyoto Mechanismen, binnenlandse uitvoering van klimaatbeleid, putten ("sinks") en EU leiderschap. Dit rapport omvat de belangrijkste resultaten van de workshop, die als volgt kunnen worden samengevat:

EU leiderschap
Hoewel de leidende rol van de EU relatief zwak is voor wat betreft haar politieke en economische kracht (structureel leiderschap), zijn er zeker wel mogelijkheden tot versterking van haar instrumentele leiderschap. Voorbeelden zijn coalities met ontwikkelingslanden m.b.t. CDM, technologie-overdracht, adaptatie aan klimaatverandering, en versterking van de wetenschappelijke infrastructuur. Richtinggevend leiderschap door de EU, op basis van het "geven van het goede voorbeeld", kan verder versterkt worden door initiatieven te nemen in het opzetten en intern toepassen van een effectief regime van handhaving. De EU zal zowel intern als extern (door m.n. milieu-NGO's) beoordeeld worden op haar geloofwaardigheid, op basis van de mate waarin de EU de milieu-effectiviteit van het Kyoto Protocol zal blijven verdedigen. De EU zou moeten investeren in het vertrouwen van belangrijke andere landen, zodat noodzakelijke steun voor de ratificatie van het Kyoto Protocol wordt gecreëerd en het Protocol ook in werking kan treden zonder de VS (met de zgn. Coalitie van 55). Met name Rusland en de Oekraïne zijn belangrijk in dit verband.

Binnenlandse toepassing van klimaatbeleid
Van een richtinggevende leiderschapsrol van de EU, is een geloofwaardige binnenlandse implementatie van klimaat-maatregelen een essentiële voorwaarde. Belangrijk daarbij is het versterken van de integratie van klimaatbeleid met andere beleidsvelden als verkeer, energie en landbouw. Noodzakelijk is ook het versterken van bewustzijn binnen zowel het bedrijfsleven als het publiek. De huidige liberalisatie van de energiemarkt in Europa doet energieprijzen dalen, wat een hogere emissie van broeikasgassen tot gevolg kan hebben. Een snellere omschakeling naar gas of andere emissiearme brandstoffen, en een grotere gevoeligheid van markt-conforme instrumenten kunnen dit wellicht compenseren. Tevens kunnen ter regulatie marktmechanismen worden toegepast. Een "vergroening" van de energiesector kan niettemin noodzakelijk zijn.

Bijkomstige voordelen van klimaatbeleid (op het gebeid van bijv. milieu, economie of technologie) worden maar zelden meegenomen in de analyses van het klimaatbeleid, waardoor de totale voordelen vaak ondergewaardeerd worden. De bijkomende voordelen kunnen, als ze wel meegerekend worden, nationale maatregelen goedkoper en aantrekkelijker maken, in verhouding tot het toepassen van emissiehandel.
Het lokale en regionale niveau verdient meer aandacht in de implementatie-strategieën. Hier kan meer gebruik worden gemaakt van het publieke bewustzijn en engagement.
Door de economische herstructureringen in Oost Europa kunnen veel van de bij de EG toe te treden landen relatief eenvoudig hun Kyoto doelstellingen halen, omdat veel oude vervuilende industrieën worden vervangen. Een aantal landen zit zelfs met een overschot aan emissie-kredieten ("hot air"). Het is echter niet waarschijnlijk dat de EU dit potentieel kan benutten anders dan door middel van de Kyoto Mechanismen.
Het voorstel van de Europese Commissie voor een systeem van interne emissiehandel roept nog veel vragen op, maar verdient zeker aandacht. De vragen hebben zowel betrekking op het interne functioneren (wie er mee doen, relatie met andere beleidsinstrumenten en maatregelen), als de relatie met de andere Kyoto Mechanismen. Om te voorkomen dat er meer wordt gehandeld dan er aan kredieten is toegekend zal er een goed functionerend intern handhavingregime opgezet moeten worden. Het zou moeten beginnen met een aantal duidelijke en toepasbare criteria, zoals die bijv. ook gelden voor de landen die toegang zoeken tot de Eurozone.

Kyoto Mechanismen
De uitdaging van de opzet en uitvoering van een systeem van Kyoto Mechanismen is gelegen in hoe de kosten te beperken en tegelijkertijd te zorgen dat er voldoende wordt gedaan aan binnenlandse reductie activiteiten. Ten behoeve van de internationale geloofwaardigheid, biedt het CDM het potentieel om ontwikkelingslanden te helpen in de "vergroening" van de economie en voor het bevorderen van een geleidelijke uitbreiding van deelname aan het klimaatregime.
De zogenaamde "hot air" werd tijdens de workshop niet beschouwd als een belangrijk item voor de langere termijn. Te veel nadruk hierop zou een alliantie met Rusland voor een snelle ratificatie juist wel eens kunnen hinderen, terwijl er andere mogelijkheden zijn om het gebruik ervan te beperken. Voor een maximaal effectief systeem van emissiehandel is de betrokkenheid van private ondernemingen onontbeerlijk. Een sterk en effectief handhavingregime is cruciaal voor de ontwikkeling van de Kyoto Mechanismen.

Putten
Putten of *sinks* kunnen grote hoeveelheden koolstof opnemen, waardoor ze compenseren voor de emissie van CO_2. Een ruwe schatting leert dat het compenserende potentieel van putten op de korte en middellange termijn circa 15% van de emissies bedraagt. Het potentieel hangt m.n. af van de gehanteerde definities, toegestane categorieën van putten en het opnemen van putten in het kader van CDM. Een brede toepassing van *sinks* maatregelen al in de eerste budget periode kan het nemen van andere (daadwerkelijke) reductie-maatregelen ontmoedigen. De onzekerheden rond het meten van putten zijn nog groot; daar kan mee

rekening worden gehouden door bij benadering de ondergrens van de onzekerheidsmarge te nemen, mede als stimulans voor betere registratie en meting. Met betrekking tot putten in CDM kan er biomassa worden aangeplant, om niet alleen koolstof op te nemen maar ook als alternatieve energiebron. Dit is minder controversieel dan beleidsinstrumenten als natuurbehoud en aanplant vanuit andere overwegingen. Het tegengaan van ontbossing en van het vrijkomen van koolstof uit bodems kan belangrijke voordelen hebben in de mogelijkheid van aanpassing aan klimaatverandering. Deze context zou de politieke gevoeligheid enigszins kunnen verminderen.

1 Introduction

After the Kyoto Protocol was signed in 1997, two more Conferences of the Parties were held in Buenos Aires and Bonn to discuss and solve open ends in this treaty. Many controversies on the Protocol still remain, however. These will be negotiated at the sixth Conference of the Parties in The Hague in the Netherlands (CoP-6), in November 2000. At CoP-6 the EU is expected by many to come up with a strong negotiation position in defence of the environmental effectiveness of the Kyoto Protocol. At the same time, however, the EU may have to give up some long defended positions, such as its demands of ceilings on the use of so-called Kyoto Mechanisms[3] (see following chapters), in order to reach agreement at CoP-6, which is a pre-requisite for rallying sufficient support to have the Kyoto Protocol enter into force at the first place.

The European Forum on Integrated Environmental Assessment (EFIEA) organised its second climate policy workshop in Amsterdam, The Netherlands, in April 2000, as part of the European preparations for CoP-6. The objective of the workshop was to discuss some of the major policy issues for the implementation of the Kyoto Protocol, relevant to CoP-6. Discussions were based on assessments of what scientific research has been able to say about these policy issues, presented by leading European scientists. Comments from stakeholders in the policy process (government officials, environmental NGOs and business representatives) and exchanges of views among participants, contributed to a better mutual understanding and an improvement in the science-policy interface.

The background of the workshop organisers and participants implies discussion from a European perspective. This explains the special attention paid to European leadership and the question whether the EU should take the lead in the ratification and implementation of the Kyoto Protocol. Therefore, in the next chapter an introduction will be made on the background of the European leadership in this issue. Timely ratification of the Kyoto Protocol is crucial for its implementation. Even if CoP-6 resolves the outstanding questions that countries consider crucial for ratification, it is doubtful whether major players such as the USA and Canada are ready to ratify soon. Some of these outstanding issues (domestic action, Kyoto mechanisms (and their supplementarity to domestic actions) and sinks, which together determine the costs of compliance) will be analysed from a European perspective in the subsequent sections of this report. At the end of the report, we will come back to the question if and how the EU could act as a leader in mobilising sufficient support to enable the Kyoto Protocol to enter into force without major countries joining in the initial stage.

[3] Kyoto Mechanisms: Joint Implementation (JI), Emissions Trading (ET), Clean Development Mechanism (CDM)

This report aims to provide a summary of the main conclusions of the EFIEA climate workshop, that can be drawn on basis of the basis of the assessment of the literature and discussions of these research findings with scientists and stakeholders.

2 EU leadership in climate policy: showing the direction[4]

At the workshop, one session dealt with the issue of the EU's credibility to exercise credible leadership on the way to full ratification of the Kyoto Protocol. The assessment paper presented (Gupta and Ringius, 2000) made a useful distinction between structural leadership (based on political and economic power), instrumental leadership (based on diplomatic skills to create winning coalitions) and directional leadership (based on ideas and domestic implementation). There was overwhelming support in the workshop discussions for the notion that the Kyoto Protocol is the only realistic option for short term international action to address climate change and that it therefore needs to enter into force as soon as possible, provided its environmental effectiveness can be maintained. The mostly European scientists and policy stakeholders did not see much merit in considering other approaches to replace the Kyoto Protocol.

In showing leadership, the EU is faced here with a credibility problem, since the only acceptable output of its leadership will be full implementation of the Protocol, which is threatened by the USA reluctance of ratifying and the consequential lack of willingness for other Parties to face up their (future) shares of action. Strengthening the EU credibility often leads to a focus on domestic implementation actions of climate change policies, showing internal action first (see also the chapter 3 in this report). Several other Parties tend to have more sympathy for a system of Kyoto Mechanisms including Emission Trading as a means of implementation of the Kyoto Protocol.

In the workshop presentation of the scientific assessment on the issue, a distinction was made between three types of leadership: structural leadership, directional leadership and instrumental leadership (Gupta and Ringius, 2000). Structural leadership is based on political and economic power, whereas instrumental leadership is based on diplomatic skills and the ability to create winning coalitions. Directional leadership is a means of showing the way, based on ideas and convictions, in climate change policy often associated with the ability to implement domestic mitigation activities.

[4] A session at the workshop on the topic of EU leadership was chaired by Pier Vellinga (Institute of Environmental Studies, Amsterdam Free University, The Netherlands). Joyeeta Gupta (IVM, Amsterdam Free University, The Netherlands) presented an assessment paper, also on behalf of co-author Lasse Ringius (UNEP Centre for Energy an Environment, Denmark). The panel consisted of Igor Bashmakov (Centre for Energy Efficiency, Russia), David Moorcroft (World Business Council for Sustainable Development, Switzerland), Jos Delbeke (Climate Change Unit, EU-DG on the Environment) and Karla Schoeters (Climate Action Network Europe, Brussels, Belgium). See also the last paragraph for additional discussions and its conclusions reached in this same session.

The workshop discussion showed general support for the view that *structural leadership* is currently in any way beyond the EU's reach, since this is by far more the working level of the USA. It was noted that in most international agreements the USA did not only have a structural leadership role, but indeed also showed leadership on the instrumental and directional levels. However, the EU does has several strengths to make use of in its ambitions: its historical ties with developing countries, its substantial geographical and demographical size, (especially if it aligns with proposed future EU member countries), and its balanced policy process due to its internal diversity. Some opportunities and risks for increasing EU leadership were discussed at the workshop.

The EU could strengthen its *instrumental leadership* by helping developing countries in implementing adaptations to climate change threats. This implies the creation of a credible Clean Development Mechanism[5], an instrument for developing climate change-avoiding activities and technologies in developing countries. A smoother way of actions will then be required. Presently, the faster and more flexible internal decision making process within the USA for some part explains the American diplomatic effectiveness compared to the European lack of swift actions. The EU could also strengthen its position in science and technology to increase instrumental leadership. The USA presently dominates climate science, while the EU generally is also behind in technology transfer initiatives. At the workshop it was noted that there are good opportunities for the EU, because the EU is leading in many environmental technologies. The present weaknesses in instrumental leadership may need to have the EU preparing for a package deal with the USA and others at CoP-6, by taking the demands on the Kyoto Mechanisms more serious.

Notwithstanding the credibility gap due to slow implementation of domestic mitigation activities, the EU has growing potential to be a *directional leader* on climate policies. Internal EU policy initiatives (including the voluntary agreement with the European car industry and the recent Green Paper on Emission Trading) and the fact that some workshop participants proposed common policies such as a carbon tax have already been implemented by a number of EU member states, are examples of that. Some participants wondered whether the EU's Green Paper on Emission Trading (European Commission, 2000a) might not shift the focus from domestic action to market mechanisms and hence confuse the negotiations and threaten the EU's credibility. It could generate allegations of using double standards by considering an internal trading system that may differ from the rules for the Kyoto Mechanisms (see the chapter 4). It was noted that the internal EU implementation of domestic actions is not only important for its international credibility, but also for strengthening the position of NGOs, in order to effectively influence the climate policy debates by showing the way.

[5] The CDM implies transfer of carbon mitigation technologies from Annex-I countries to non-Annex-I countries: the Annex-I country pays for the 'new technology', but also received the credits of mitigation. This is more or less opposed to JI, which involves mitigation projects between Annex-I countries, where the credits of mitigation are also shared.

In the discussions, the need for more public awareness in the EU was stressed as well. NGOs have an important task in convincing people, e.g. in the notion that the costs of mitigation are lower than the costs of adapting to the impacts of climate change. A process of awareness in the business community is already developing, mostly in the form of energy efficiency or Emission Trading, but many companies still do not have climate change as such on their radar screen. Climate change policies should be seen as part of industrial transformation processes and strategic visions for the longer-term therefore need to be developed.

3 Domestic implementation issues within the EU[6]

As is shown in the previous chapter, implementing the Kyoto Protocol through the use of domestic measures in the European Union is broadly seen as a way for the EU to show directional leadership in the negotiations, especially in the view of the emphasis the EU itself is putting on the need for domestic action. But there are several reasons why it is argued that domestic implementation issues should receive more attention in European climate policy. First, because it is necessary in the view of the commitments of the EU (-8% compared to 1990) under the Kyoto Protocol. The special arrangement the EU has made to redistribute the efforts for implementing the –8% reduction among member States (EU burden sharing agreement, using the "bubble provision" of article 4 of the Protocol) poses additional challenges on the implementation, but also on the credibility of the ambitions for a leadership role. Large domestic reduction potentials do exist within the EU, but implementation of domestic actions is currently still rather low. In the light of the current international debate on the Kyoto Mechanisms, the EU is starting to debate a possible internal emission-trading scheme. Although implementation of domestic measures and the role of using the Kyoto Mechanisms are mutually dependent (Barker et al., 2000), it is not clear if domestic policies and measures and the Kyoto mechanisms will work in synergetic way.

At the workshop an assessment paper (see Barker et al, 2000) was presented on the topic of domestic greenhouse gas mitigation options, followed by a panel discussion as well as a plenary debate. With respect to the credibility of the EU (directional) leadership position, domestic actions at EU level (co-ordinated common policies and measures) is key, taking also into account the consequences of the EU enlargement for future climate policies. Implementation of an EU internal Emission Trading system will be discussed in the next section on the Kyoto Mechanisms.

On the topic of domestic mitigation actions, the EU has published "*European policies and measures to reduce greenhouse gas emissions: toward a European climate change programme"* (EU, 2000b). It is reasoned that the internal market within the EU will continuously give a strong impetus to develop climate policies and measures on the EU level. Of great relevance for implementing domestic actions in the EU, several points of attentions and opportunities were presented in the sessions' assessment paper and generally supported

[6] The workshop session on this topic was chaired by Nigel Haigh (former director Institute for European Environmental Policy, London). Sebastian Oberthür (Ecologic, Germany) presented the assessment paper, on behalf of the other authors Terry Barker (Cambridge University, UK), Tom Kram and Monique Voogt (Energy Research Foundation, The Netherlands). The panel consisted of representatives from policy and science (Dimitri Lalas, National Observatory Athens), environmental NGOs (Nuno Lacasta, Euronatura, Portugal), policy (Ewaryst Hille from the Polish Foundation for Energy Efficiency) and policy/business (Hans-Eike von Scholz, DG Transport and Energy).

in the workshop discussion. An important gripping point for actions is the current liberalisation of European energy markets, which will lead to a decrease in energy prices, potentially resulting in higher greenhouse gas emissions. This may be (partially) offset by a faster switch to gas and other low-carbon fuels, as well as by a higher sensitivity of energy markets to market-based instruments. Still, there might be a need to "green" the liberalisation process through regulatory interventions (Barker et al, 2000).
Another important notion from the workshop is the fact that ancillary benefits (environmental, economic and technological benefits) are often not included in the analysis of the benefits of climate change policies, resulting in an underestimation of the aggregate benefits. It is important to note that the existence of ancillary benefits can make domestic action cheaper and more attractive than international Emission Trading. Also, integrating climate policies in other policy areas such as industry, transport and agriculture becomes more and more important. The Cardiff-process (European Commission, 1999) within the EU, which strives to achieve such an integration of environmental and climate policies in all relevant sectors, should therefore receive priority. In addition to measures at the EU community level and implementation at the Member State level, it was recognised to also include the local level in such implementation strategies, which often tends to be forgotten. Commitment and public awareness are key words in this respect. Furthermore, the already introduced EU Monitoring Mechanisms could play an important role in ensuring adequate implementation of the Kyoto Protocol commitments.

Apart from integrating climate change in other policy fields, the need to design policies for the long term is strongly felt. This may be achieved by developing financial policies such as taxation, and incentives for investments, as well as designing short-term regulation and planning in such a way that they will pave the way to intensifying reduction policies after 2012 (which notes the Kyoto Protocol horizon).
The EU unanimity rules for decision making are a potential obstacle for implementation of a strong climate change policy at the domestic implementation front. The "closer co-operation provisions" in the Amsterdam Treaty were mentioned as a possible way to overcome this obstacle: a majority decision that would not apply to a minority that decides to stay outside such a policy framework. It remains clear, that more co-operative rules of decision making will strongly influence climate change policies in any way.

Another issue of high relevance on all policy areas, including climate change policy, deals with the consequences of the EU enlargement. Most candidate members of the EU have agreed to similar targets as the present 15 EU countries (EU-15). Nevertheless, due to the economic restructuring process in Eastern Europe many accession countries will in all likelihood face a narrower Kyoto gap to fill than the current EU-15 or may even have a surplus ("hot air") (see Michaelowa and Betz, 2000). On top of that there seems to be a considerable potential for reduced emissions by 2008-2012, due to the outdated energy infrastructure system in most of these countries. It was concluded that it is very unlikely that the EU could exploit this by adding these countries to the "bubble". The Kyoto Protocol would only allow this before ratification and the time schedule for EU extension does not

foresee accession in such a short term. Some of its potential may, however, be exploited by use of the Kyoto Mechanisms of Emission Trading and joint implementation. Regarding the potential of domestic implementation actions, it was suggested in the workshop discussion that accession countries should try to create synergy between climate policies and economic restructuring, i.e. focus on assets with a long lifetime and avoid creating future stranded assets.

Workshop conclusions: implementation issues

- The current liberalisation of European energy markets leads to a decrease in energy prices, potentially resulting in higher greenhouse gas emissions. Although some positive effects can be expected, e.g. in shifts from coal to gas, there might be a need to "green" the liberalisation through regulatory interventions.
- Ancillary benefits are often not included in the analysis of climate change policies, resulting in an underestimation of the benefits and an overestimation of the costs.
- Policies should be designed for the long term, paving the way to intensify reduction policies after 2012.
- Integrating climate policies in other policy areas such as industry, transport and agriculture becomes more and more important.
- The local level often tends to be forgotten in implementation strategies. Commitment, public awareness and potential on the local level could be used better.
- The EU Monitoring Mechanisms could play an important role in ensuring adequate implementation of the Kyoto Protocol commitments.
- EU unanimity rules for decision making are a potential obstacle. The "closer co-operation provisions" as proposed in the Amsterdam Treaty, allowing a majority decision that would not apply to a minority, might be useful to increase dynamics.
- Due to the economic restructuring process in Eastern Europe, many accession countries will in all likelihood face a narrower Kyoto gap to fill than the current EU-15 or may even have a surplus ("hot air"). On top of that there seems to be a considerable potential for reduced emissions by 2008-2012. It was concluded that it is very unlikely that the EU could exploit this by adding these countries to the "bubble", since ratification of the Protocol will most probably be earlier than accession of the countries and additions to the bubble will then not be allowed anymore.

4 Kyoto Mechanisms[7]

Without regarding the issue of supplementarity (see next chapter), a number of market-oriented mechanisms are available to the Parties under the Protocol, in addition to (or possibly replacing the) domestic activities of implementing climate change policies. The so-called Kyoto Mechanisms are Emission Trading (ET), Joint Implementation (JI) and the Clean Development Mechanism (CDM). ET involves the trading of excesses of the assigned amounts of carbon dioxide emissions. Any country that emits less greenhouse gases than the amount it is allowed to emit can in the ET system trade the "leftovers" on the emissions market. JI involves projects to mitigate greenhouse gases such as e.g. replacing an old (and less efficient) coal plant by a modern one, to decrease emissions. Essential to JI projects is that they take place within the Annex-I countries, where one country accounts for the costs of the project applied in another country. The credits of mitigation are shared between the two parties involved. JI usually applies to replacement technologies. CDM involves projects of new technologies in non-Annex-I countries, but afforded for by an Annex-I party. The development of new technologies and technology transfer should be consistent with the rule of "environmental additionality" and the mitigation of greenhouse gases will be credited to the financing Annex-I party.
The issue of supplementarity of the Kyoto Mechanisms will be treated in the next chapter. At the Amsterdam workshop, a number of other issues with respect to Kyoto Mechanisms were discussed during several of the workshop sessions:

- *The opportunities and risks of the CDM:* The sustainable development contribution requirement of CDM projects in the Protocol raises expectations about influencing development paths in a more sustainable direction and, more in particular, to the transfer of technology to developing countries. Many stakeholders in the climate negotiations express concerns about the risks of the CDM, e.g. in terms of inflated baselines, leading to crediting emission reductions that otherwise would also have occurred (violating the "environmental additionality" requirements of the Protocol).
- *The EU internal Emission Trading system:* The European Commission has taken the initiative to publish the *"Green Paper on greenhouse emissions trading within the European Union"* (European Commission, 2000a), introducing opportunities for an Emission Trading system for the EU. As discussed in the previous paragraph,

[7] The workshop session on Kyoto Mechanisms was chaired by Carlo Carraro (Fondazione Eni Enrico Mattei, Italy). Keynote speaker was Farhana Yamin (Foundation for International Environmental Law and Development, UK) who presented the paper on behalf of the other two authors (Jean-Marc Burniaux and Andries Nentjes). The panel included a varied group of people representing policy (Sylviane Gastaldo from the French Ministry of Economics and Finance), industry (Mike Wriglesworth from BP-Amoco), environmental NGOs (Stefan Singer from WWF International) and science (Adam Rose from Pennsylvania State University).

supplementarity to domestic actions remains an issue, although the system itself could provide useful practical experience.

- *Participation of private entities:* the Kyoto Protocol allows involvement of business and other organisations ("private and public entities") in implementing JI and CDM. For Emission Trading no indications are given in the legal text. Since a trading system would be most interesting to the business community, the debate is ongoing whether and how a system for implementing the Kyoto mechanisms could benefit from participation by "private and public entities", and what the consequences are for the organisation of the administrative systems.
- *The design of a compliance regime:* for a credible use of the Kyoto Mechanisms a solid compliance and enforcement system is a necessity. The risk of overselling and project failure is real, especially when a futures market for emission reductions would develop. As part of the debate about the overall compliance system for the Kyoto Protocol many different options for encouraging compliance and applying sanctions are being discussed in preparation for CoP-6.

Opportunities and risks of the Clean Development Mechanism

During the workshop, there was general agreement that the CDM could lead to substantial economic benefits for a number of developing countries. It could further diminish adverse economic effects on developing countries as a result of Annex-I implementation of the Kyoto Protocol commitments because it reduces compliance costs. Much of the debate about CDM focussed on the question on how to make the CDM work, as it is yet the only legal alternative within the Kyoto Protocol in helping developing countries to "green" their economies and trying to commit them to emission limitations or reductions in the future. Keys issue in that respect will be how projects can contribute to a sustainable development. Suggestions were made to opt for an internationally agreed "list approach" within the CDM system. Such a list could contain eligible project types or could exclude "unwanted" projects, such as the often-mentioned nuclear power, sinks and large projects for fossil fuel energy and hydroelectricity. Concerns were expressed regarding the notion, that market-based arguments may have investors leaving out a large group of developing countries from the CDM. In the discussion it was emphasised that the CDM, or equity considerations in a more general way, are absolutely crucial to get developing countries involved and to induce more participation in the Kyoto Protocol and future agreements under the UNFCCC. More participation implies more abatement and lower costs; hence equity means more efficiency.

Internal EU Emission Trading

The EC proposal on Emission Trading within the EU bubble proposes starting with a selected group of emitters, representing 45% of CO_2 emissions within the EU. For the EU (for reasons of internal market and competition) it is important that a common EU Emission Trading (ET) scheme will be developed, that is mandatory for all 15 different nations and results in consistent national trading schemes and a level playing field. For instance, different choices of a permit allocation scheme by Member States (grandfathering versus auctioning of permits) could lead to distortion of the internal market.

Discussion was raised on including both business entities as well as additional greenhouse gases in such a system of ET. On including other greenhouse gases, it was mentioned that only gases that can be well monitored should be included. For small and medium sized enterprises it was discussed how they could be included in a trade system and how a tax and trading regime for these businesses could be combined (see below, at "private entities").
With respect to the question of compliance and enforcement against overselling emission quota, it was suggested to take the "Eurozone eligibility criteria" as an example of dealing with the question which nations can join the EU Emission Trading scheme. Proper monitoring and enforcement systems should be among the major criteria for countries to be able to join.
Also the issue of setting a ceiling on internal EU trading was discussed. On the one hand, if the EU is proposing a cap on the use of Kyoto mechanisms for Annex-I countries under the Protocol, it may look strange if unlimited trade would at the same time be allowed within the EU. On the other hand, free trade in conformity with the EU internal market provisions should be allowed within the EU. One interesting suggestion was for the EU to set a unilateral cap on use of the Kyoto Mechanisms (not obliging others to do the same) in combination with free emissions trading within the EU.
An important question for implementation is how Emission Trading can be combined with policies and measures. As indicated earlier, it may not be easy to combine taxation and other regulatory measures with a trading scheme. Both at national and EU level substantial changes in the relevant legislation may be required. The possible low international price for credits as a consequence of the implementation of the Kyoto Mechanisms will possibly make domestic action economically unattractive. The general feeling, however, is that in the long term all national, European and international policies and measures are needed. This issue remains one of high relevance.

Participation of private entities
The question of which legal entities should be eligible to trade under an Emission Trading regime is one of the outstanding issues in the negotiations. Should it only be governments, representing the parties of the Protocol, or private entities as well? Both from the literature as well as from interventions of business representatives at the workshop, the conclusion can be drawn that the involvement of business as entities has the potential to make the Emission Trading regime more cost-effective and put it into line with current business initiatives.
With respect to the proposed Emission Trading system for the EU, as mentioned above, it was discussed to what extent also small and medium sized enterprises (SMEs) should be included in the system. There are no fundamental reasons for excluding them from such a system, but combining policies and measures could be complicated, such as an energy/carbon taxation combined with a trading system. One useful distinction made at the workshop could be to exclude energy-extensive SMEs initially, since they are more likely be included in an environmental taxation scheme. Barker et al. (2000) suggested that if certain minimum requirements concerning monitoring and verification would be met, actors could voluntary opt-in for the trading system.

Compliance

The design of a credible and effective compliance and enforcement system for the Kyoto Protocol in general and the Kyoto mechanisms in particular is seen by many as crucial for the environmental effectiveness of the Kyoto Protocol. There is a growing literature on options for such a system (Yamin et al, 2000, UNFCCC, 2000).

One particular problem with a system of Emission Trading is the possibility of "overselling": transferring so much of the assigned amount that the seller is no longer in compliance. This poses the question of who should be responsible when an entity has oversold its permits, the buyer or the seller? *Buyer liability* is generally seen as "risk averse", but with potentially serious discouragement of using Emission Trading because of the higher possible transaction costs and the need to wait until more clarity about trustworthy sellers would be available. *Seller liability* would help establish a trading system early, because buyers would not have to worry about future risks, but it depends very much on a strong international compliance regime. The "traffic light"-approach is emerging as a compromise proposal: trading is initially allowed to proceed on a seller liability basis, and buyer liability is only triggered where compliance problems are identified. During the workshop debates, participants showed serious doubts about the effectiveness of the "traffic light approach". The weakest spot in such a system would be the long lead times before corrective actions against violators can be taken. Establishing a record of non-compliance and then getting agreement between the Parties to the Kyoto Protocol to take action would require so much time, that effective protection against overselling would be difficult.

More general doubts on compliance were expressed on whether an effective international sanction regime could be established, given the general experience in enforcing international law. Would the Meeting of the Parties be able to create an independent body that could implement such sanctions? Maybe more emphasis should be put on the so called preventive approaches that have been suggested in the literature such as strict eligibility requirements for participants in a trading system, reflecting the capability to measure emissions and to make reliable projections of the effect of measures. Other provisions suggested are limiting trading of future assigned amounts of emissions, or reliance on trading of realised reductions only.

Workshop conclusions: Kyoto mechanisms

The design and implementation of the Kyoto Mechanisms is a litmus test for the acceptability of the Kyoto Protocol. The challenge is how to reduce costs and demonstrate international credibility at the same time in order to trigger both ratification and increased participation. Some conclusions from the discussions are:

- A strong internal compliance system for trading should start with a rigorous set of eligibility criteria, such as used for accession to the Eurozone.
- The CDM has potential for helping developing countries to "green" their economic development and it can help to broaden participation in the international regime over time.
- An EU internal Emission Trading regime will reduce calls for renegotiating the EU burden sharing agreement; it needs to be harmonised across Member States to avoid distortion of competition.
- Involving business parties in a Kyoto Mechanisms system has the potential of making the Emission Trading regime more cost-effective.
- A strong and effective compliance regime is crucial for the development and credible implementation of the Kyoto Mechanisms. The liability regime is a critical factor. There are serious doubts about the effectiveness of a "traffic light approach", especially since a credible international sanction regime might be difficult to implement. A strong internal compliance system for trading might start with a rigorous set of eligibility criteria, such as used for accession to the Eurozone

5 Combining domestic action and Kyoto mechanisms: the question of supplementarity

A major question which links domestic implementation actions with the Kyoto Mechanisms, is the issue of supplementarity: should the Kyoto Mechanisms be used in addition to domestic actions, or are they allowed to be used for complying with the total agreed reduction percentage? The EU and the USA especially, are taking opposed positions on this issue: the EU takes the notion, that Kyoto Mechanisms are only allowed as some kind of additional resort, whereas the USA supports the idea of increasing the availability of Kyoto Mechanisms. The Kyoto Protocol clearly specifies that the use of the Kyoto Mechanisms should be supplemental to domestic action. Controversies exist on whether and how to regulate this supplementarity at the international level. Proposals are on the table (UNFCCC, 2000) to establish quantitative restrictions on the purchase and sales of allowances and credits, while others firmly resist international regulation.

The issue of supplementarity to domestic actions has a number of dimensions: economic efficiency, the influence on technological innovation, the "hot air" phenomenon[8], the local benefits of domestic action and the credibility of the Annex-I countries.

As far as *economic efficiency* is concerned there is general agreement in the literature that unlimited use of the Kyoto Mechanisms would yield the best results in term of cost-effectiveness. Unrestricted Emission Trading among Annex-I countries would cut compliance costs by more than a third (Yamin et al, 2000; Bollen et al, 1999; Weynant, 1999; OECD, 1999). Adding full use of JI and CDM could potentially reduce the overall cost to Annex-I countries to very low levels ($4-$20 per tonne C), even when sinks are excluded from the CDM (Grubb, 2000; Reilly, 2000). Unlimited use would also reduce adverse economic impacts on developing countries and even bring substantial gains for key developing countries such as China. Low cost implementation of the Kyoto Protocol would hence not only provide incentives for ratification, but also build confidence for further emission reductions in the future and future participation of developing countries. The benefits of unrestricted use, in particular the large cost advantages, remained unchallenged by policy stakeholders.

The influence of restrictions on the use of the Kyoto Mechanisms *on technological innovation* is controversial. The literature is ambiguous: depending on the models used and

[8] "Hot air" is a term used for the excess assigned amounts of emission right in certain countries, present because of general economic downfall. Especially in Eastern European countries and Russia, emission levels are much lower than expected under the 1990 "business as usual" developments. The excess "rights of emissions" are called "hot air", which is an interesting sellers option in case of setting up an ET system.

assumptions made, studies find a smaller or bigger positive effect on so called induced technological change of domestic investments and development of new technologies (Yamin et al, 2000). Such technological innovation could be important in order to be able to undertake further emission reductions in the period after the first budget period of the Kyoto Protocol. Contrary to a general feeling, industry experiences with internal pricing of carbon emissions makes it questionable whether lower costs for emission reductions (through the Kyoto Mechanisms) would stifle technological advance. As an example, at the workshop the case was mentioned of a company, where carbon is being traded at the low price of around $10 per ton and this price was still driving technological change in the company. Another aspect that warrants attention is that JI and CDM are instruments that can enhance technology transfer to countries with economies in transition and developing countries. Restrictions on Kyoto Mechanisms would diminish those transfers. From the point of view of making worldwide progress with technological change this dimension could be as important as technological innovation. The discussion showed that there is still limited understanding of the impact on technological innovation and technology transfer. Therefore, this critical issue deserves further research and analysis, although an important start has already been made (Metz et al., 2000a)

The literature generally agrees about a substantial (positive) difference between assigned amounts and actual emissions under "business as usual" conditions for countries in Eastern Europe and the former Soviet Union, the so called *"hot air" phenomenon*. For Russia and the Ukraine the OECD GREEN model estimates "hot air" of about 120 million tons of carbon (Yamin et al, 2000). Using this amount in an Emission Trading system is seen by many as undermining the environmental effectiveness of the Kyoto Protocol, since the average 5.2% reduction compared to 1990 for the Annex-I countries is roughly equivalent to 200 million tons of carbon.[9] It has inspired the EU to propose a cap on selling excess assigned amounts (EU, 1999).
This issue led to a fierce debate at the workshop, in which several arguments were made against a linkage of supplementarity with "hot air":

1. It was noted that "hot air" is not "free". The phenomenon happens at huge economic costs for the countries involved, because it is a direct result of the severe economic downturn in Eastern Europe, Russia, Ukraine and other countries with economies in transition.
2. "Hot air" would, if traded, sell at a regular market price, although of course the volume would influence the market.
3. "Hot air" is not something that only concerns economies in transition, but is also playing a role in countries like Germany and the UK. Here developments unrelated to climate change mitigation (German unification and massive shifts from coal to gas use respectively) have led to a significant decline of emissions. This would imply that a certain amount of "hot air" is already available within the EU.

[9] Calculated from Annex 1 National Communications for 1990.

4. It is a temporary phenomenon because it is unlikely to have this happen again in a future budget period (since the possibility will then be taken into account in the negotiations).
5. The countries involved have the right, according to the Kyoto Protocol, to bank their excess assigned amount for a future budget period, so restricting the sales now would not eliminate this excess.
6. An argument that applies more generally to the use of the Kyoto Mechanisms, is that it lowers permit prices and hence could build trust for future emission reduction commitments and facilitate access of developing countries to an international emission reduction regime.
7. Finally, the real challenge is to change the energy sector over a long-term period.

Arguments were also raised in favour of bringing "hot air" under the regime for dealing with supplementarity, since it would undermine the credibility of industrialised countries of implementing the Kyoto Protocol and hence would delay access of developing countries. Also, it would undermine the environmental credibility of the Kyoto Protocol in general and spark very negative reactions from the environmental community.
In the course of the debate there was a growing convergence towards the view that "hot air" is not the most important aspect of the Kyoto Protocol. "Ceilings" for the use of the Kyoto Mechanisms are not the answer to the "hot air" issue, so these issues should be treated separately. Suggestions were made about possible agreements with countries like Russia and Ukraine about using income from Emission Trading in structural investments in the energy infrastructure in view of future emission reductions or about a substantial JI programme that could achieve the same.

Local benefits are potentially important reasons to limit the use of the Kyoto Mechanisms in implementing the Protocol commitments. There are clear synergies between reducing CO_2 emissions and other pollutants, leading to local environmental improvement and associated health benefits. Employment, traffic decongestion, competitiveness and other considerations are also mentioned. In the literature (Yamin et al, 2000) it is pointed out that these local benefits also apply in places where JI and CDM projects are carried out. Besides, if these are strong reasons for domestic action, they will not need any regulation. In the discussion the issue of the local benefits was not seen as a reason to establish rules on supplementarity under the Kyoto Protocol.

The credibility of Annex-I countries could be undermined when no restrictions on the use of the Kyoto Mechanisms would apply. The issue of equitable distribution of responsibility for mitigating climate change lies at the basis of the carefully crafted balance between commitments of countries in the UNFCCC and the Kyoto Protocol. There is a risk that heavy reliance on the Kyoto Mechanisms by the OECD countries would be perceived as "ducking" their responsibility. More domestic action would demonstrate the international leadership of OECD countries and credibility of their commitments and possibly strengthen their hand in future negotiations about broadening the group of countries committing to limitations or reductions of greenhouse gas emissions.

Workshop conclusions: supplementarity[10]

- Ceilings are probably not effective for ensuring minimum domestic reduction efforts. Many possible alternatives to ceilings were suggested:
  - A "package formula" could be adopted, requiring a balance in reductions from domestic action and those from the Kyoto Mechanisms.
  - Minimum prices (adjustable over time) could be set for emission reduction units for the Parties of the Protocol.
  - Fees on JI and Emission Trading could be established, equivalent to those already agreed upon for the CDM.
  - The scope of the CDM (eligibility of projects) and the scope of the eligible sink categories under article 3.3 and 3.4 could be limited, enhancing the need for more domestic action.

- "hot air" is not regarded to be a very important issue, if looked at in a longer-term perspective. Given the high economic costs paid by countries that may have "hot air" available, emphasis should be on helping them "green" their economies, rather than prohibiting them to sell it.
- Combining a trading system with national and European policies and measures may require substantial changes in environmental legislation.
- Technological innovation is crucial for future emission reductions, but understanding about the influence of domestic action and technology transfer is limited. More research is needed.

[10] These conclusions are mainly distilled from the workshop sessions on Kyoto Mechanisms and Implementation. issues.

6 Sinks[11]

Sinks take in a special position in the Kyoto Protocol. It implies increasing the uptake of excess greenhouse gases (CO_2) in biospheric sinks, in addition to decreasing the anthropogenic emissions of greenhouse gases. Sequestering additional carbon in the biosphere and in products from the biosphere ("sinks") is seen as an important option for Annex-I countries to achieve the committed reductions of GHG emissions. As such it can be part of domestic actions and be part of the Kyoto Mechanisms. The Kyoto Protocol includes several articles dealing with issues related to sink activities:

- Article 3.3 deals with afforestation, reforestation and deforestation in Annex-I countries[12];
- Article 3.4 deals with additional human induced activities leading to changes in carbon stocks in Annex-I countries[13];
- Article 6 deals with JI in Annex-I countries, including sinks projects,[14] and
- Article 12 deals with the Clean Development Mechanism in non-Annex-I countries. This article does not specifically mention sinks, an issue that is still prone to debate.

Many issues with respect to the sink issue are still to be resolved, including definitions, selection of additional activities, whether sinks projects are eligible under the CDM. These will have to be discussed at CoP-6 in The Hague. The IPCC Special Report on Land Use, Land Use Change and Forestry (Watson et al, 2000) gives a state-of-the-art of the scientific knowledge on these issues. The decisions are complicated by the uncertainties that exist in the basic data. Present knowledge regarding sinks, mainly deals with the distribution of sinks among the world's ecosystems, the accuracy of estimation of the current sink potential, future

[11] The session on sinks was chaired by Leo Meyer (Ministry of Housing, Spatial Planning and Environment, The Netherlands. Bernhard Schlamadinger (Joanneum Research, Austria), lead author of the IPCC Special Report on Land Use, Land Use Change and Forestry and of the workshop's Sinks assessment, set the scene by presenting the current scientific state-of-the-art, also on behalf of the assessment's co-authors Wolfgang Cramer (Potsdam Insitute for Climate Impacts Research, Germany) and Igino Emmer, (Face Foundation, Netherlands). The panel consisted of representatives from business (Pedro Moura Costa from Eco Securities Ltd.), policy (Klaus Radunsky from the Federal Environment Agency in Austria) and environmental NGOs (Sible Schöne from WWF Netherlands).

[12] Article 3.3: includes in the Protocol "removals by sinks resulting from direct human-induced land use change and forestry activities, limited to afforestation, reforestation, and deforestation since 1990."

[13] Article 3.4: includes in the Protocol, that "The Conference of the Parties (…) shall (…) decide upon modalities, rules and guidelines as to how and which additional human-induced activities related to changes in greenhouse gas emissions and removals in the agricultural soil and land use change and forestry categories, shall be added to, or subtracted from the assigned amount for Parties included in Annex I, taking into account uncertainties, transparency in reporting, verifiability, the methodological work of the IPCC (…)."

[14] Article 6 includes in the Protocol, that "Any Party included in Annex I may transfer to, or acquire from, any other such Party emission reduction units resulting from projects aimed at reducing anthropogenic emissions by sources or enhancing anthropogenic removals by sinks of greenhouse gases in any sector of the economy (…)."

saturation of areas that are now a carbon sink, influence of climate change on carbon uptake and release, the permanence of the land cover in these areas, and the additionality of possible measures on the build-up and preservation of the sinks. The potential range of sinks under the Protocol article 3.3 is between 5 and 140 Mt C/yr, whereas application of article 3.4 increases the range to 50 – 300 Mt C/yr (Metz et al., 2000b).

The discussion in this session was based mainly on the findings of the IPCC Special Report on Land Use, Land Use Change and Forestry (Watson et al, 2000), focusing on the areas of uncertainty. Debate was organised around three types of activities that can lead to an increase of carbon storage:

- *carbon sequestration*: enhancing carbon uptake and reducing carbon loss from soils and vegetation;
- *carbon conservation*: protection of existing forest, prevention of land use change that will lead to carbon loss from soils and vegetation;
- *substitution*: replacing fossil fuels by biomass energy and replacing materials with a high energy content with wood and bio-materials (e.g. replacing steel and concrete in buildings by wood).

Carbon sequestration

Depending on the definition used, the *size of the world's sink potential* is very large. There is a current net carbon uptake by the biosphere ("sink"), the difference between net primary production and C release due to various return processes (mainly soil respiration and deforestation), currently about 0.7Gt C/yr. Current deforestation rates are equivalent to a loss of about 1.6 Gt C/yr. Eliminating deforestation would therefore lead to a net terrestrial uptake of about 2.3 Gt C/yr, representing the maximum sink capacity. How much of this flux can be used as a carbon sink under the Kyoto Protocol largely depends on definitions,[15] as well as on choices related to article 3.4 and article 12 of the Protocol. A complicating factor for the first budget period under the Kyoto Protocol is, that the choices can lead to significant changes for individual Annex-I countries in the cost of compliance compared to others. However, allowing sinks for the second budget period might be an option, also because further research could reduce current uncertainties.

Carbon sequestration also involves problems with leakage and additionality. *Leakage* refers to the crediting of reductions, while emissions occur elsewhere, and relates to the issue of *additionality*. These phenomena are potentially important for JI and CDM projects. In JI projects leakage would automatically be taken care of through the national inventories, whereas in CDM leakage and additionality might be hard to detect and avoid. Because of these problems, many hold the opinion that carbon sequestration activities should be excluded from CDM projects. Amongst the workshop participants, however, there was some common ground to include sinks in CDM, because leakage and additionality of sink projects

[15] e.g.: as part of article 3.3, e.g. FAO definition of reforestation differs strongly from the IPCC definition; and 3.4, e.g. the definition of "direct human induced"

in the CDM were not regarded to be fundamentally different from projects in other sectors. Another consideration was that the inclusion of sinks has many potential side-benefits (water management, biodiversity, soil conservation) that can contribute to a politics of sustainable development.

There are still large *uncertainties* related to sinks. Examples are the measurement of current and future carbon stocks. A practical solution suggested implied to credit only the lower boundary of the range of uncertainty. This would imply a limitation/restriction of carbon credits where uncertainties are evident, and an incentive to perform more research in order to decrease the range of uncertainties.

The problem of the *permanence* of increased carbon sequestration (the risk of future disturbances, such as forest fires, future land use change decisions or loss of carbon due to a changing climate) as well as the issue of *saturation* were seen as important, but not as reasons to forego the potential of sinks in implementing the Kyoto Protocol. According to the majority of the participants, the system of monitoring, verification and crediting could be managed in such a way as to make beneficiaries fully aware and responsible for less than projected carbon results of projects.

Carbon conservation
Ecosystem conservation (incl. avoidance of deforestation and preventing land use and land use change that would lead to carbon loss) can prevent large carbon stocks in the soil and vegetation to be released to the atmosphere. The current rate of deforestation for instance leads to a carbon release of about 1.6 Gt C/yr, which could be avoided in a proper conservation system. The question whether these carbon conservation activities could be credited under the Kyoto Protocol largely depends on what activities will become accepted under article 3.4 of the Kyoto Protocol. How, for example, should avoided deforestation be considered in a crediting system of carbon accounting? Politically this already is a very contested issue. Other important questions deal with issues such as (forest) management and conservation activities such a fire and pest control. Can they be quantified in terms of their avoided carbon loss? The workshop offered no clear conclusion on this issue, except that an accounting scheme should be based on full accounting (i.e. including both sinks and sources). A potentially useful suggestion was to link the issue of forest conservation (and afforestation) to the (much less controversial) problem of adaptation to climate change. Forests could play an important role in improving water management where significant changes in precipitation can be expected.

Substitution
The substitution of fossil fuels and materials by biomass fuels is a third option of using biomass to reduce atmospheric CO_2 concentrations. Until now, this option has not received full attention, but it may well become the focal point of increased notice for a number of reasons:

- Biomass can continuously be produced, even from a saturated forest, and be used to replace fossil fuel. This can lead to significant amounts of avoided carbon;
- Biomass projects (in either replacing fossil energy or material substitution) under the CDM could be less controversial than projects for carbon sequestration, because problems like permanence and verification are significantly smaller. Thus it opens the possibility of including forestry activities in CDM, without having to resolve the more complex issues;
- Biomass could account for an important extra benefit in addition to carbon sequestration, making it attractive to combine the two;
- Biomass energy can have a number of co-benefits in terms of lower air pollution, local availability and reducing import dependence.

Despite the benefits of substitution, one has to keep in mind that certain land-use practices to grow biomass crops also can have negative side effects. For example, biodiversity in an area may be reduced due to large-scale biomass plantations. Sustainable forest management would require stronger policy intervention.
It was felt by many of the participants that the inclusion of biomass projects for fuel substitution in CDM could be more feasible than including carbon sequestration projects. This requires, however, further discussions, in particular to elaborate the benefits for developing countries and to connect this discussion to energy policy, both in industrialised as well as in developing countries.

Workshop conclusions: the use of sinks under the Kyoto Protocol

- Large amounts of carbon emissions could in principle be offset by carbon sequestration, carbon conservation and substitution activities, depending on the decisions taken on outstanding issues regarding definitions, additional activities and eligibility of sinks in the CDM. A rough estimate of the sink potential in the short and medium term is about 15% of fossil fuel emissions;
- Permanence of carbon stocks and saturation of forests may primarily be seen as the advance of the beneficiaries, provided the accounting system does take this into account;
- Leakage in sinks projects under CDM could be an important problem, but is not fundamentally different from leakage with other CDM projects;
- The potential of biomass growth as fossil fuel substitution is relatively large and biomass production might be less controversial than carbon sequestration and conservation. Therefore, biomass options in the CDM deserve more attention in addition to sequestration and conservation;
- Uncertainties in measuring carbon stocks are large, but may be managed by only crediting the lower level of the uncertainty range, creating incentives for reducing uncertainties through more expensive monitoring or future research;
- Only full accounting (counting all positive and negative aspects) should be allowed;
- The definition of *direct human induced* activities is crucial for the implementation of article 3.4;
- Avoided deforestation and soil carbon release have important benefits to the capacity to adapt to climate change and could possibly be handled in that context in view of the political sensitivity of the issue.

7 EU leadership in climate policy[16]

Reaching agreement at CoP-6 is again essential to have a chance of having the Kyoto Protocol enter into force after ratification. The prospect that the Protocol might have to enter into force without the USA initially joining poses strong challenges on the EU's capability to build a large enough coalition to make this happen (the so called "Group of 55").

In their paper Gupta and Ringius (2000) discussed possible strategies for entry into force of the Kyoto Protocol in view of the serious reservations that exist in the USA about the Protocol. The resolution of the outstanding issues regarding implementation is important for many countries, but for the USA agreement on the Kyoto Mechanisms may not be sufficient. The provisions in the Protocol that for entry into force the requirement is at least 55 ratifications, which represent at least 55 % of 1990 Annex-I emissions. This opens the possibility of forming a coalition of Annex-I and developing countries to ratify the Protocol initially without the USA (a so-called "Group of 55"). Such a situation would naturally reduce the environmental effectiveness of the Protocol, but the prospect of waiting until the USA is ready to join, might effectively mean that the Kyoto commitments cannot be implemented any more and that a totally new agreement would have to be negotiated.

At the workshop, fears were expressed that the ratifying countries may still leave the Kyoto Protocol arrangements as soon as it would enter into force *without* the USA. The view that the Kyoto Protocol was a dead letter and a wrong approach to the problem in the first place did not get support. For the moment the Kyoto Protocol was considered the only option for early policy action; a failure would set back the whole policy development process for many years. Present imperfections can be addressed in next rounds of negotiations. At the same time, a coalition to get entry into force of the Kyoto Protocol should not be presented as a confrontation to the USA or others. The EU should continue to look for ways to encourage the USA to ratify. Regarding the economic consequences of an entry into force without USA ratification, it was expected these would be limited and could even be advantageous to the EU in the long-term. Entry into force of the Kyoto Protocol without the USA may result in pressure from USA business to ratify in order not to be excluded from the Kyoto Mechanism markets.

Participation of Russia in a coalition Group of 55 would be crucially important. Distilled from the workshop, the Russian perspective is that a lot will depend on the credibility of the EU towards Russia. So far, the EU is not very convincing in its credibility, since the current emission stabilisation is largely an ancillary benefit of non-environmental policies. Instead of trying to limit the Russian hot air sales, the EU could provide much more help in building up

[16] This paragraph refers mostly to the same workshop session as the session mentioned in paragraph 2.

capacity in Russia, in order to effectively accomplish energy efficiency improvements. Support in the form of JI projects could be very important, because many current pilot projects fail or are of low quality. Support of setting up monitoring and verification systems would also be strategically important.

It was pointed out in the discussion that there are risks involved for the EU when it pursues a Group of 55 coalition, because at the same time agreements are being negotiated on the outstanding issues of the Protocol. Many countries of the so-called "Umbrella Group"[17] are solidly behind the USA in the negotiations towards CoP-6, and also countries have different opinions on different issues still to be negotiated. This means that coalitions will depend on the issue at hand. Decisions at any Conference of Parties can only be reached by consensus. Ratification is however to be decided by each Party itself and a Group of 55 coalition would necessarily have to include many Umbrella Group members (mainly to reach the point of 55 % of world emissions). A worst case outcome would be a CoP-6 deal considered bad by the EU public, which would subsequently hinder ratification of the EU.

Workshop Conclusions: EU leadership in climate change policy

- EU leadership is relatively weak in terms of structural or instrumental leadership; opportunities exist for strengthening instrumental leadership by working with developing countries on issues regarding CDM, technology transfer, adaptation and capacity building on scientific infrastructure
- EU directional leadership is depending on credibly implementing the Kyoto commitments. Strengthening the integration of climate policies with transportation, industry, energy and agricultural policies is important. Raising awareness among the business community and the public may be necessary. Taking initiatives in developing effective compliance policies and applying those within the Union first could help to show leadership.
- Credible implementation is a key condition for the EU to exercise directional leadership to help reach agreement at CoP-6 on an environmentally effective Protocol.
- EU credibility will be judged inside the EU and by environmental NGOs internationally on the basis of the success of the EU at CoP-6 to defend the environmental effectiveness of the Kyoto Protocol. A poor result in this respect may endanger ratification by the EU.
- the problem of USA ratification should not distract from the need for a CoP-6 agreement that is environmentally credible,
- the EU should invest in building trust with key countries for getting the necessary support for entry into force of the Kyoto Protocol without the USA (the Group of 55 coalition), particularly with Russia and the Ukraine.

[17] The "Umbrella Group" consists of non-EU (and non-Eastern European) Annex-I countries: Japan, USA, Canada, Australia, Norway, New Zealand, Iceland, Russia and the Ukraine.

8 Remaining issues

There are strong linkages between the Kyoto Mechanisms (the degree to which they may be used as well as the scope of the CDM), the "hot air" issue, the extent to which sinks may be used to implement the Kyoto commitments and domestic action to reduce emissions. They all determine the costs of compliance. It became clear during the workshop that taken together, these options represent a large potential for cheap reductions. The exact size of this reduction potential is difficult to determine. Efforts should be undertaken to quantify the potentials and costs of the Kyoto Protocol options to enable informed choices on the trade off between lowering compliance costs and the risks of diminishing the environmental effectiveness of the Protocol.[18]

Last but not least the literature assessment and the workshop discussions revealed critical gaps in knowledge. For supporting decision making, additional research would be particularly valuable on several questions, such as:

- the importance of domestic action for long term technological innovation and future emission reductions;
- reducing uncertainties on measuring carbon stocks;
- understanding the relation between CDM projects, technology transfer and sustainable development;
- how to combine emissions trading with policies and measures;
- how to combine efficiency and equity in building an international partnership to address climate change.

[18] A workshop on the issue of *Quantifying Kyoto was* held from 30-31 August 2000 at Chatham House, London. Some of the main results of this workshop have been included here as well.

References

Barker, T., T. Kram, S. Oberthür and M. Voogt (2000). "The role of domestic greenhouse gas mitigation options." *International Environmental Agreements – Politics, Law and Economics.* Vol.1, No. 2. (special issue).

Bollen, J.C., A. Gielen and H. Timmer (1999). "Clubs, ceilings and CDM: macroeconomics of compliance with the Kyoto Protocol." *The cost of the Kyoto Protocol: a multi-model evaluation, special issue of the Energy Journal.* pp. 177-206.

European Commission (1999). *From Cardiff to Helsinki and beyond. Report to the European Council on integrating environmental concerns and sustainable development into Community policies.* Commission Working Document, SEC (1999) 1941. Brussels.

European Commission (2000a). *Green Paper on greenhouse emissions trading within the European Union.* COM (2000) 87. Brussels.

European Commission (2000b). *EU policies and measures to reduce greenhouse gas emissions: towards a European climate change programme (ECCP)*. Communication from the Commission to the Council and the European Parliament, COM (2000)88. Brussels.

Grubb, M. (2000). *Economic context: a review of model results and sensitivities.* Paper presented at the workshop on Quantifying Kyoto, 30-31 August 2000, London: Royal Institute of International Affairs. http://www.riia.org/research/eep/quantifying.html#papers

Grubb, M., D. Brack, and C. Vrolijk (1999). *The Kyoto Protocol, a guide and assessment.* Royal Institute of International Affairs, London.

Gupta, J., and L. Ringius (2000). "EU leadership: between ambition and reality." *International Environmental Agreements – Politics, Law and Economics.* Vol.1, No. 2. (special issue).

Metz, B., O. Davidson, J.W. Martens, S. van Rooyen and L.van Wie (eds.) (2000a), *IPCC Special Report on the Methodological and Technological aspects of Technology Transfer*. Cambridge: Cambridge University Press.

Metz, B., M. Berk, M.T.J. Kok, J.G. van Minnen, A. de Moor and A. Faber (2000b). "How can the European Union contribute to a CoP-6 agreement? – an overview for policy makers." *International Environmental Agreements – Politics, Law and Economics.* Vol.1, No. 2. (special issue).

Michaelowa, A., and R. Betz (2000). "Implications of EU enlargement on the EU greenhouse gas 'bubble' and internal burden sharing." *International Environmental Agreements – Politics, Law and Economics.* Vol.1, No. 2. (special issue).

OECD (1999). *Action against climate change, the Kyoto Protocol and beyond.* Paris: OECD.

Reilly, J. (2000). *The Kyoto Protocol and non-CO_2 Greenhouse Gases and Carbon sinks.* Paper presented at the workshop on Quantifying Kyoto, 30-31 August 2000, London: Royal Institute of International Affairs. http://www.riia.org/research/eep/quantifying.html#papers

UNFCCC (1997). *Kyoto Protocol to the United Nations Framework convention on climate change.* 3rd Conference of the Parties, Kyoto, 1-10 December 1997. http://www.unfccc.int/resources

UNFCCC (2000). *Procedures and mechanisms relating to compliance under the Kyoto Protocol.* FCCC/SB/2000/MISC.2. http://www.unfccc.int/resources

Watson, R., B. Bolin, I. Noble, N.H. Ravindranath and D. Verardo (eds.). (2000). *IPCC Special Report on Land Use, Land Use Change, and Forestry.* Cambridge: Cambridge University Press.

Weyant, J.P. (1999). "The costs of the Kyoto Protocol: a multi-model evaluation." *Special issue of the Energy Journal.*

Yamin, F., J.M. Burniaux and A. Nentjes (2000). "Kyoto Mechanisms: Key issues for policy makers for CoP-6." *International Environmental Agreements – Politics, Law and Economics.* Vol.1, No. 2. (special issue).

Appendix 1 Workshop programme

Tuesday 18 April, 2000

9.00 Start of workshop at Royal Dutch Academy of Sciences. Reception and administration
9.30 introduction by **conference chairman Bert Metz**

9.45 **FIRST BLOCK: KYOTO MECHANISMS**
chair: Carlo Carraro
assessment team: Farhana Yamin, Andries Nentjes, Jean-Marc Burniaux
panel members: Sylviane Gastaldo, Mike Wriglesworth, Stefan Singer, Adam Rose

9.45	presentation by lead author
10.15	panel discussion
10.45	coffee break
11.15	plenary discussion
12.45	wrap up by chairman

13.00 buffet lunch
book presentation by Michael Grubb

14.30 **SECOND BLOCK: SINKS**
chair: Leo Meyer
assessment team: Bernhard Schlamadinger and Igino Emmer. Contributions by Wolfgang Cramer
panel members: Pedro Moura Costa, Klaus Radunsky, Sible Schöne

14.30	presentation by lead author
15.00	panel discussion
15.30	tea break
16.00	plenary discussion
17.30	wrap up by chairman

17.45-19.15 canal tour to dinner venue
19.45 dinner offered for all invitees

Wednesday 19 April, 2000

9.00 **THIRD BLOCK: IMPLEMENTATION ISSUES**
chair: Nigel Haigh
assessment team: Monique Voogt, Terry Barker, Sebastian Oberthür, Tom Kram
panel members: Dimitri Lalas, Nuno Lacasta, Ewaryst Hille, Hans-Eike von Scholz

9.00	presentation by lead author
9.30	panel discussion
10.00	coffee break
10.30	plenary discussion
12.00	wrap up by chairman

12.15 buffet lunch

13.45 **FOURTH BLOCK: EUROPEAN INTERNATIONAL CLIMATE STRATEGIES / LEADERSHIP**
chair: Pier Vellinga
assessment team: Joyeeta Gupta and Lasse Ringius
panel members: Jos Delbeke, David Moorcroft, Karla Schoeters, Igor Bashmakov

13.45 presentation by lead author
14.15 panel discussion
14.45 tea break
15.15 plenary discussion
16.45 wrap up by chairman

17.00 Overall conclusions by conference chairman
17.30 End

See the list of participants (appendix 4) for the background of the persons mentioned.

Appendix 2 Policy questions addressed

Session 1: Kyoto mechanisms

What is the effectiveness of caps to control hot air trading? Are there alternatives?
What are the implications of (un)restricted use of flexible instruments?
What can be said about important design aspects of the flexible mechanisms? (compatibility, monitoring and compliance)
What is known about the various approaches to liability?
What are the impacts of flexible mechanisms on developing countries?
What are the long-term implications of different regimes for flexible mechanisms?
What can be the impact of flexible instruments on international trade?
What design of CDM could best contribute to sustainable development?
What design of CDM could promote future burdening of participation?

Session 2: Sinks

What are the short and long term implications of possible definitions in art. 3.3?
What are the short and long term implications of possible additional categories in art. 3.4?
How can baseline issues be dealt with?
How can sinks be monitored and verified? How to integrate sink policies into land/agricultural policies?
What is the potential of sinks as part of the national climate strategies on the short and long term?
What are the implications of including/excluding sinks in the CDM?
What are the impacts of sinks policies on developing countries?
How can sink policies fit in with sustainable development in developing countries?
How to deal with liability issues related to risk of loss of sinks?

Session 3: Implementation issues

How to take account of preparing for future emission reductions in implementing the Kyoto Protocol?
What are the consequences of liberalisation of the energy market?
Will the current burden sharing agreement hold?
How to optimise climate policies to maximise secondary benefits?
What policy measures are needed at the European level; what can be left to the national policy level?
How to deal with liability for compliance in the EU?
What are the consequences of international regimes for sinks and flexible instruments for European implementation?
What are the impacts of European implementation policies on developing countries?

Session 4: European leadership

What can be done to promote USA ratification?
What could Europe do if the USA does not ratify Kyoto?
What can Europe do to promote future broadening of participation / differentiation of commitments?

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