

# 05

## Looking Beyond Kyoto

Trade-offs and Disagreements in Climate Policy



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## F O R E W O R D

The Environmental Assessment Institute (EAI) is an independent institution under the Danish Ministry of the Environment. The objective of the EAI is, on the basis of “research at a high, international level, to contribute to reaching environmental objectives in the most economically effective way” [Article II para 1]. The EAI is, therefore, an environmental policy assessment institute that makes assessments on the basis of best available evidence but is not directly involved in experimental scientific research.

This report is the first report on climate change since our new strategy was adopted. The report forms the starting point for further reports on this issue. Combating climate change efficiently depends to a large extent on the possibility of utilising policies that ensure both environmental benefits and economic growth. The Environmental Assessment Institute will in future reports draw attention to those policies, which address both environmental and economic concerns.

The purpose of the report is to make a systematic, critical review of the core issues in the climate change negotiations and to make recommendations on these issues based on judgements. We examine the core negotiation issues in climate policy and evaluate the options for further action within each of the core negotiation issues. The aim is furthermore to examine the main national positions on the core negotiation issues and to assess open and closed doors on options for future action on climate change. In this way the report aims at forecasting future scenarios and directions for the next international climate protocol.

This report is made in co-operation with ECON. ECON has worked extensively in the analysis of climate change issues. ECON has supported the Nordic and other governments in the climate change negotiation process, and analysed the implications of climate policies for a range of actors. They are active in the area of flexible mechanisms under the Kyoto Protocol, capacity building, project development and analysis, both in terms of supporting governments in policy and strategy, and also in the development and analysis of potential investment opportunities.



## EXECUTIVE SUMMARY

With the recent entry into force of the Kyoto Protocol, global climate talks are beginning to address what to do after the expiry of the Kyoto period in 2012. The purpose of this report is to make a systematic, critical review of the core issues in the climate change negotiations and to make recommendations on these issues based on judgements. The aim is to inform those involved in the negotiations and those who are interested observers of the negotiations, and to facilitate the debate by making the trade-offs of the policy options and the negotiation positions of the Parties as transparent as possible.

This report reduces the complex negotiations on a future regime to negotiations on four core issues. How far should we go? How fast should we go? What means of moving forward should be adopted? Finally, how should the burden be divided? Four policy recommendations are made. These recommendations relate to the four core negotiation issues.

### *Recommendations*

#### **1. How far should we go?**

Discussions on stabilisation levels should only take place among experts and in informal political discussions. Formal negotiations on the stabilisation level might put off several Parties and derail the negotiations.

#### **2. How fast should we go?**

Initial commitments are necessary in order to induce awareness and promote technological development which in turn increases efficiency in climate change mitigation. Emissions in the major emitter developing countries (China, India and Brazil) should be addressed.

#### **3. What means of moving forward should be adopted?**

It is essential to provide flexibility in each Party's choice of commitment type. Targets and timetables are appropriate for a range of countries, e.g. in the European Union, but other Parties need to have more options for participation. Participation of the US and developing countries is more likely when offering flexibility in the choice of commitment types. Participation of the US is only likely to be ensured if, for instance, R&D in emission reduction technologies or sequestration of carbon

can be included as part of future commitments. Participation by the developing countries is highly unlikely without the participation of the US, which is the largest and most wealthy emitter.

#### 4. How should the burden be divided?

The burden-sharing should be guided by the Principle of *common, but differentiated responsibilities and respective capabilities*. Industrialised countries should continue to take the lead. Creating a wider agreement on mitigation is not likely without some more meaningful commitments by the industrialised countries (including the US) on adaptation and impacts. Developing countries with relatively high income and /or emissions per capita (for instance South Korea and Mexico) should also take on modest commitments, e.g. policies and measures that ensure at least modest reductions compared to business-as-usual. Other developing countries should commit to inventories of greenhouse gas emissions.

The report draws attention to the central environmental, equity and economic trade-offs that need to be addressed when negotiating the next regime. Furthermore, political conflicts within the negotiation issues imply that optimal policy suggestions should be replaced by pragmatic, second-best policies. There is no such thing as an optimal regime, due to trade-offs, and disagreements between the major emitters. For this reason, the need for a flexible regime is emphasised.

#### *Summary*

The purpose of this report is to explain the main issues and perspectives of climate policy in order to improve understanding of the main reasons behind conflicting viewpoints. The purpose is achieved through two specific aims:

1. The first aim is to *examine the core negotiation issues* in climate policy and to *evaluate the options for further action* within each of the core negotiation issues.
2. The second aim is to *examine the main national positions* on the core negotiation issues and to *assess open and closed doors on options for future action* on climate change.

The report consists of four parts. Parts I, II and III can be read as three independent parts though there are clear relationships between the three parts. Part IV is as a synthesis of Parts I, II and III.

Part I presents the general background to climate change. The background description is divided into three elements, defined as the environmental, equity and economic aspects of climate policy. The three aspects are described briefly to provide a basic understanding of climate policy.

A key environmental point is the fact that climate change is happening. Significant emission reductions and broader participation are needed, and adaptation to the impacts of climate change should be considered.

A key equity point is that several principles suggest that industrialised countries should take the lead. Moreover, high country-wide emissions do not justify the imposition of mitigation burdens, but these emissions should be addressed from an environmental perspective. Important principles in the burden-sharing are: need, equal entitlements, capacities, responsibility, opportunities and comparability of effort. In this respect, emissions per capita and income per capita are important parameters.

Key economic points are that cost-effective policies could substantially reduce mitigation costs and that development of mitigation technology could be an important part of a future climate agreement.

Part II identifies and examines four core negotiation issues and presents and evaluates the most common options suggested in the climate change literature, which in combination create a complete climate change regime. All options are evaluated according to the policy evaluation criteria, which are defined in this part of the report.

There are many negotiation issues on the agenda, but these can be reduced to four fundamental questions. These core questions are presented in a simple manner by comparing the formulation of climate policy with the planning of a journey. The challenge goes like this: 189 countries or so-called Parties of the United Nations Framework Convention on Climate Change (UNFCCC) will over the next years decide

how the journey beyond 2012 should be designed. The parties will have to address the four questions given in Box 1.

**Box 1 The four basic and core questions in climate change policy**

- 1) At what level should greenhouse gases be stabilised?
- 2) Which emission path should be followed?
- 3) What kind of commitment types should be allowed?
- 4) How should the burden be shared between countries?

In other words, the negotiators should discuss 1) How far should we go? 2) How fast should we go? 3) How should we move forward? 4) How should the burden be divided? There are a number of options for meeting each of the four negotiation issues and these are summarised in Table 1.

**Table 1 The four core negotiation issues of a climate change regime.**

Core negotiation issues	Options
Stabilisation level <i>- How far should we go?</i>	Long term goal Hedging strategy Step by step reductions
Emission path <i>- How fast should we go?</i>	Early aggressive action Early moderate action Postponing action
Commitment types <i>- How should we move forward?</i>	Emission targets Policies and measures Adaptation
Burden-sharing schemes <i>- How should the burden be divided?</i>	Brazilian proposal Contraction and convergence Ability to pay Multistage Approach Triptych Approach Equal mitigation cost

These options are described and evaluated against the policy evaluation criteria. There is no superior option for each of the negotiation issues that will meet the environmental, equity, economic and uncertainty criteria defined in the report.

Part III examines various positions on the core negotiation issues. On the basis of this, options for progress are considered.



Clear differences in the negotiation positions exist. The EU supports a long-term goal, relatively aggressive action now and absolute emission targets. The US has not begun to discuss a long-term goal, does not favour early aggressive action, but favours R&D measures. Developing countries have not engaged in formal discussions on long-term targets; in part because some fear this would open up for reduction or limitation commitments by developing countries. Some developing countries demand early aggressive action by the developed countries, which they argue could reduce adverse effects of climate change in their regions. The type of commitment, however, is of minor importance so long as the developed countries show leadership. Other developing countries, e.g. those in OPEC, have no policy on the emission path. The discussion of burden-sharing reveals two contrary positions. The developing countries demand continued leadership by the developed nations, while the majority of the developed countries are pressing for at least some developing countries to take on commitments.

There are open and closed doors in the negotiations on the second commitment period (2013-2017). When it seems more than likely that the Parties will not reach agreement on an issue, we refer to the door being closed. When, on the other hand, agreement on a range of issues seems plausible, the door is described as open. Table 2 shows a summary of the assessment of open and closed doors.

**Table 2 Open and closed doors in the climate policy negotiations.**

	Closed door	Open door
How far should we go?	<ul style="list-style-type: none"> <li>• Long-term target</li> </ul>	<ul style="list-style-type: none"> <li>• Step by step reductions</li> </ul>
How fast should we go?	<ul style="list-style-type: none"> <li>• Early aggressive action</li> </ul>	<ul style="list-style-type: none"> <li>• Continuation of modest emission reductions</li> </ul>
How should we move forward?	<ul style="list-style-type: none"> <li>• Harmonised policies and measures</li> </ul>	<ul style="list-style-type: none"> <li>• Binding emission targets</li> <li>• Bottom-up policies and measures</li> <li>• Adaptation measures</li> </ul>
How should the burden be divided?	<ul style="list-style-type: none"> <li>• Formula based-commitments</li> </ul>	<ul style="list-style-type: none"> <li>• Bottom-up political decisions</li> </ul>

Important “closed doors” include agreement on the long-term target, early aggressive action, harmonised policies and measures and formula-based burden-sharing. Negotiations on, for instance, what the stabilisation level should be would be likely to derail the negotiations. The Parties have different views on the ultimate stabilisation level and trying to focus negotiations on a long-term target is likely to prove

a waste of time and negotiation effort. In the worst case scenario, the negotiations could either disintegrate or reach stalemate, particularly since there is a risk of putting off several Parties.

There are “open doors” to a future climate regime despite trade-offs between the environmental, equity and economic aspects of climate change and despite the tensions between countries. These open doors include agreement on step-by-step reductions, continuation of modest emission reductions in the near future, absolute emission reduction and bottom-up political decisions on burden-sharing.

Seven main conclusions are drawn:

**1. There are four core negotiation issues.**

In general, the climate change challenge can be reduced to four fundamental questions: 1) At what level should greenhouse gases be stabilised? 2) Which emission path should be followed? 3) What kind of commitment types should be allowed and required? 4) How should the burden be shared between countries? Our policy recommendations are addressing these four negotiation issues.

**2. There are trade-offs between the environmental, equity and economic aspects.**

Climate policy is characterised by trade-offs between environmental, equity and economic concerns. The main aim is to achieve a substantial environmental outcome, to take account of various equity principles, to secure economic effectiveness and efficiency and to act wisely in the presence of scientific uncertainty.

**3. Second-best policies must be adopted.**

All nations are sovereign and agree to a future climate regime voluntarily. Each nation has different positions on options for a future climate regime with profound disagreements among nations in all of the core negotiation challenges. A future regime will therefore be characterised by second-best policies that balance the environmental, equity and economic concerns of participating nations.

**4. There are open doors in the upcoming negotiations.**

There are ‘open doors’ to a future climate regime despite the trade-offs between the aspects of climate change and despite the profound disagreements between countries. These open doors include agreement on step-by-step reductions, continuation of modest emission reductions in the near future, bottom-up policies and

measures, and bottom-up political decisions on burden-sharing. These open doors will most likely frame the next climate regime.

#### **5. There are closed doors in the upcoming negotiations.**

Negotiations on issues leading to ‘closed doors’ (e.g. on the long-term stabilisation level and/or aggressive action now) are likely to prove a waste of time and negotiation effort. Negotiations on these issues could derail negotiations. In the worst-case scenario, the negotiations could either disintegrate or reach stalemate, particularly since there is a risk of pulling off several Parties.

#### **6. Flexible commitments are needed to ensure broad participation.**

The next regime should achieve broader participation. Kyoto’s “one-size-fits-all” implementation of targets and timetables should be replaced by a more flexible approach in which Parties contribute through the most appropriate policies that take country-specific circumstances into account. The report presents four recommendations for broad acceptance of the next climate regime.

#### **7. External incentives for participation should be pursued.**

The climate issue is only one of many issues on the global agenda. When formulating the framework for a climate regime beyond 2012, it is important for the negotiators to realise that the key to success most likely is in creating a connection between the climate area and the most important international policy issues. An area in which everybody is a stakeholder is research and development of new technologies, where the US can play a central role if they are willing and able to see the domestic advantages. The EU may find a central role in establishing global research collaboration, which may foster a number of new technology solutions within energy and environment. Most countries are also interested in the further development of WTO and there is obvious potential in combining the development of WTO and a future climate regime.



## R E S U M E

Med Kyoto-protokollens ikrafttrædelse for nylig handler de globale klimaforhandlinger nu om, hvad der skal ske efter Kyoto-periodens udløb i 2012. Formålet med denne rapport er at lave en systematisk, kritisk gennemgang af kernespørgsmålene i forhandlingerne om klimaforandringer. På baggrund af en vurdering giver rapporten en række anbefalinger om disse spørgsmål. Målet med rapporten er dels at informere politikere og andre interesserede, der enten deltager i eller følger forhandlingerne, og dels at understøtte debatten ved at gøre kompromiserne i valget af politik og landenes forhandlingspositioner så gennemsikkelige som muligt.

Denne rapport sammenfatter de komplekse forhandlinger om den fremtidige klimaaftale i fire kernespørgsmål. Hvor langt skal vi gå? Hvor hurtigt skal vi gå? Hvilke midler skal vi tage i brug? Og endelig: Hvordan skal byrden fordeles? Der gives anbefalinger til valg af politik på disse fire kernespørgsmål i forhandlingerne.

### *Anbefalinger*

#### **Hvor langt skal vi gå?**

Diskussioner om stabiliseringsniveauer bør kun finde sted mellem eksperter og ved uformelle politiske drøftelser. Formelle forhandlinger om stabiliseringsniveauet kan skræmme flere lande væk og afspore forhandlingerne.

#### **Hvor hurtigt skal vi gå?**

Det er nødvendigt at vedtage og gennemføre forpligtelser på et tidligt tidspunkt for at skabe øget opmærksomhed og fremme den teknologiske udvikling, som baner vejen for en mere effektiv indsats mod virkningerne af klimaændringerne. Udledningen fra de ulande, der har det største udslip (Kina, Indien og Brasilien), bør tages i betragtning.

#### **Hvilke midler skal vi tage i brug?**

Det er af afgørende betydning at skabe et fleksibelt grundlag for hvert lands valg af forpligtelsestype. For en række lande, f.eks. EU-landene, vil det være på sin plads at have målsætninger og tidsplaner for implementering af forpligtelserne, mens andre lande skal have flere valgmuligheder for deres deltagelse. Det er mere sandsynligt, at USA og ulandene er villige til at deltage, hvis de bliver tilbudt fleksibilitet i valget af forpligtelsestype. Det er kun sandsynligt, at USA's deltagelse sikres, hvis

f.eks. forskning og udvikling inden for teknologier til begrænsning af udslip eller binding af CO<sub>2</sub> kan blive omfattet af de fremtidige forpligtelser. Det er endvidere meget usandsynligt, at ulandene vil deltage uden USA, som er det rigeste land og det land, der har den største udledning.

### Hvordan skal byrden fordeles?

Fordelingen af byrden bør styres af princippet om *et fælles, men differentieret ansvar fordelt efter evner*. De rige lande bør fortsat gå forrest. Det er ikke sandsynligt, at der kan opnås en bred aftale om reduktion af drivhusgasser uden forpligtelser fra i-landenes side (herunder USA) om emissionsreduktioner, tilpasning og klimapåvirkninger. De ulande, der har forholdsvis høje indkomster og/eller udslip pr. indbygger (f.eks. Sydkorea og Mexico), bør også påtage sig beskedne forpligtelser, f.eks. i form af politikker og tiltag, der i det mindste sikrer beskedne reduktioner. Alle ulande bør forpligte sig til at foretage en opgørelse af deres udslip af drivhusgasser.

Rapporten gør opmærksom på de centrale miljømæssige, fordelingsmæssige og økonomiske kompromiser, der skal tages hensyn til, når den næste aftale forhandles på plads. Hertil kommer politiske kontroverser i forbindelse med forhandlingspunkterne, der betyder, at de optimale forslag til politikker bør erstattes af mere pragmatiske politikker. På grund af kompromiser og uoverensstemmelser mellem landene findes der ikke noget optimalt regime. Derfor fremhæver rapporten behovet for en fleksibel aftale.

### ***Sammenfatning***

Formålet med denne rapport er at præsentere klimapolitikens hovedtemaer og perspektiver med henblik på at skabe en bedre forståelse af hovedårsagerne bag de modstridende synspunkter. Dette søges opnået gennem to specifikke mål:

3. Det første mål er at ***undersøge kernespørgsmålene i forhandlingerne*** omkring klimapolitikken og at ***vurdere mulighederne for en yderligere indsats*** inden for hvert kerneområde.
4. Det andet mål er at ***undersøge de overordnede nationale holdninger*** til kernespørgsmålene i forhandlingerne og at ***vurdere åbne og lukkede døre for mulighederne for en fremtidig indsats*** mod klimaændringer.

Rapporten består af fire dele. Del I, II og III kan læses uafhængigt af hinanden, om end der er en klar sammenhæng mellem de tre enkelte dele. Del IV er en syntese af Del I, II og III.

Del I præsenterer den videnskabelige baggrund for klimaændringer. Beskrivelsen er opdelt i tre dele, der defineres som klimapolitikens miljømæssige, fordelingsmæssige og økonomiske dimension. Der gives en kort beskrivelse af den underliggende problemstilling bag hver af de tre dimensioner.

Det er et væsentligt *miljømæssigt* argument, at der sker klimaændringer. Der er behov for væsentlige reduktioner af udledningerne og større deltagelse fra flere lande. Tilpasning til virkningerne af klimaændringer er en faktor, der bør overvejes.

Det er et væsentligt *fordelingsmæssigt* argument, at flere lighedsprincipper peger på, at i-landene skal gå forrest. Det pointeres at et højt nationalt udledningsniveau ikke nødvendigvis retfærdiggør indførelse af reduktionsforpligtelser. Ud fra et miljømæssigt perspektiv skal det store udslip af drivhusgasser i udviklingslandene dog tages i betragtning. Blandt de vigtigste principper inden for byrdefordeling er behov, lige rettigheder, evner, ansvar, muligheder og sammenlignelighed af indsatsen. I denne henseende er udledning pr. indbygger og indkomst pr. indbygger vigtige parametre.

Det er et væsentligt *økonomisk* argument, at indførelse af omkostningseffektive politikker i høj grad kan nedbringe de omkostninger, der er forbundet med begrænsning af udslip, samt at udvikling af teknologier til begrænsning af udslip vil kunne udgøre en vigtig del af en fremtidig klimaaf tale.

I Del II identificeres og gennemgås fire kernespørgsmål i forhandlingerne, og de mest almindelige svar på disse spørgsmål fra litteraturen præsenteres og vurderes. Alle mulighederne vurderes i forhold en til række evalueringskriterier, der defineres i denne del af rapporten.

De mange forhandlingsspørgsmål på dagsordenen kan opsummeres i fire grundlæggende spørgsmål. Disse kernespørgsmål fremstilles på en enkel måde ved at sammenligne formuleringen af klimapolitik med planlægningen af en rejse. Udfordringen lyder som følger: 189 lande i de Forenede Nationers Rammekonvention om Klimaændringer (UNFCCC) skal i løbet af de næste år beslutte, hvordan rejsen efter

2012 skal foretages. Landene skal forholde sig til de fire spørgsmål, der er angivet i Boks 1.

**Boks 1 De fire kernespørgsmål i de internationale klimaforhandlinger.**

- 1) På hvilket niveau skal drivhusgasserne stabiliseres?
- 2) Hvilken vej mod stabilisering skal følges?
- 3) Hvilke typer forpligtelser skal kræves?
- 5) Hvordan skal byrden fordeles mellem landene?

Forhandlerne skal med andre ord drøfte 1) Hvor langt skal vi gå? 2) Hvor hurtigt skal vi gå? 3) Hvilke virkemidler skal vi tage i brug? 4) Hvordan skal byrden fordeles? Hvert af de fire forhandlingsspørgsmål kan opfyldes på en række måder, jf. Tabel 1.

**Tabel 1 De mulige svar på de fire kernespørgsmål i klimaforhandlingerne.**

Kernespørgsmål i forhandlingerne	Muligheder
Stabiliseringsniveau <i>- Hvor langt skal vi gå?</i>	Langsigtet mål Risikoafdækningsstrategi Trinvisse reduktioner
Valg af reduktionsvej mod stabilisering <i>- Hvor hurtigt skal vi gå?</i>	Hurtig, aggressiv indsats Hurtig, moderat indsats Udsættelse af indsats
Forpligtelsestyper <i>- Hvilke virkemidler skal vi tage i brug?</i>	Emissionsmålsætninger Politikker og tiltag Tilpasning
Byrdefordelingsordninger <i>- Hvordan skal byrden fordeles?</i>	Brasiliansk forslag Indskrænkning og konvergens Evne til at betale Multistage-metoden Triptych-metoden Ens reduktionsomkostninger

Disse muligheder beskrives og holdes op imod de ni evalueringskriterier. Der findes ingen løsning for hvert af forhandlingsspørgsmålene, der entydigt opfylder de miljømæssige, fordelingsmæssige, økonomiske og usikkerhedsmæssige kriterier, der er opstillet i denne rapport. En klimaafteale vil derfor altid skulle gå på kompromis med nogle opstillede idealer.



I Del III gennemgås landenes holdninger til kernespørgsmålene i forhandlingerne. Der er tydelige forskelle i standpunkterne i forhandlingerne. EU støtter en langsigtet klimamålsætning, en forholdsvis aggressiv indsats nu samt absolutte udledningsmål. USA er endnu ikke begyndt at diskutere et langsigtet mål og går ikke ind for en hurtig, aggressiv indsats. USA foretrækker endvidere tiltag i form af forskning og udvikling. Ulandene har ikke deltaget i formelle drøftelser om langsigtede målsætninger. Det skyldes til dels, at nogle frygter, at dette vil kunne føre til, at ulandene i et næste skridt bliver pålagt forpligtelser til at reducere deres emissioner. Visse ulande forlanger en hurtig, aggressiv indsats af ilandene og hævder, at dette kan mindske den negative virkning af klimaændringer i deres regioner. Forpligtelsestypen er dog mindre væsentlig, så længe ilandene viser lederskab. Andre ulande, f.eks. blandt OPEC-landene, har ingen formuleret politik om klimamålsætningerne. Endelig fremgår det af diskussionen om byrdefordeling, at der er to modstridende standpunkter. Ulandene kræver, at ilandene sætter sig i førersædet, mens størstedelen af ilandene kræver, at mindst nogle af ulandene påtager sig forpligtelser.

Der er åbne og lukkede døre i forhandlingerne om den næste forpligtelsesperiode. Når det er vurderes overvejende sandsynligt, at landene ikke kan opnå enighed om et spørgsmål, betegner vi det som, at døren er lukket. Hvis der derimod vurderes at være sandsynlighed for, at der kan opnås enighed om et spørgsmål, betegnes døren som værende åben. Tabel 2 opsummerer vurderingen af åbne og lukkede døre.

Tabel 2 Åbne og lukkede døre i forhandlingerne om klimapolitikken.

	Lukket dør	Åben dør
Hvor langt skal vi?	<ul style="list-style-type: none"> <li>• Langsigtet målsætning</li> </ul>	<ul style="list-style-type: none"> <li>• Trinvise reduktioner</li> </ul>
Hvor hurtigt skal vi gå?	<ul style="list-style-type: none"> <li>• Hurtig, aggressiv indsats</li> </ul>	<ul style="list-style-type: none"> <li>• Fortsættelse af beskedne reduktioner</li> </ul>
Hvilke virkemidler skal vi vælge?	<ul style="list-style-type: none"> <li>• Harmoniserede politikker og tiltag</li> </ul>	<ul style="list-style-type: none"> <li>• Bindende emissionsmålsætninger</li> <li>• Nationale / regionale initiativer og politikker</li> <li>• Tilpasningsinitiativer</li> </ul>
Hvordan skal byrden fordeles?	<ul style="list-style-type: none"> <li>• Formelbaserede forpligtelser</li> </ul>	<ul style="list-style-type: none"> <li>• Nationale / regionale politiske beslutninger</li> </ul>

Blandt de væsentlige lukkede døre er aftaler om den langsigtede målsætning, hurtig, aggressiv indsats, harmoniserede politikker og tiltag samt formelbaseret byrdefordeling. Forhandlinger om stabiliseringsniveauet ville sandsynligvis afspore

forhandlingerne, da landene har forskellige opfattelser af det ultimative stabiliseringsniveau. Det vil derfor sandsynligvis vise sig at være et spild af tid og forhandlingsindsats at forsøge at fokusere forhandlingerne på at opnå en langsigtet målsætning. I værste fald vil dette kunne medføre et sammenbrud eller et dødvande i forhandlingerne, især fordi der er en risiko for, at adskillige lande kan blive skræmt væk fra forhandlingsbordet.

Der er åbne døre til en fremtidig klimaaftale på trods af de afvejn timer, der sker mellem den miljømæssige, fordelingsmæssige og økonomiske dimension og på trods af spændingerne mellem de forskellige lande. Disse åbne døre omfatter aftaler om trinvis reduktion, fortsættelse af beskedne udledningsreduktioner i nær fremtid, absolutte udledningsreduktioner, samt politiske forhandlinger om virkemidler og byrdefordeling, der baserer sig på nationale / regionale målsætninger.

Der drages syv hovedkonklusioner:

### **1. Der er fire kernespørgsmål i klimaforhandlingerne.**

Overordnet set kan udfordringen ved klimaændringer sammenfattes i fire grundlæggende spørgsmål: 1) Hvilket niveau skal drivhusgasserne stabiliseres på? 2) Hvilken vej mod stabilisering skal følges? 3) Hvilke typer forpligtelse skal tillades og kræves? 4) Hvordan skal byrden fordeles mellem landene? Vores anbefalinger forholder sig til disse fire kernespørgsmål.

### **2. Der er kompromiser mellem miljømæssige, fordelingsmæssige og økonomiske hensyn.**

Klimapolitikken kendetegnes ved kompromiser mellem miljømæssige, fordelingsmæssige og økonomiske hensyn. Hovedformålet er at opnå et væsentligt miljømæssigt resultat, at tage diverse fordelingsprincipper i betragtning, at sikre økonomisk effektivitet samt at handle klogt i lyset af den videnskabelige usikkerhed.

### **3. Der er behov for en pragmatiske aftale.**

Alle nationer er suveræne og indvilliger frivilligt i at deltage i en fremtidig klimaaftale. Hver nation har forskellige holdninger til mulighederne for en fremtidig klimaaftale, og der er dyb uenighed mellem landene på alle kerneudfordringerne i forhandlingerne. Derfor vil en fremtidig aftale være karakteriseret af ikke-optimale, pragmatiske politikker, som er en afvejning af hvert deltagerlands miljømæssige, fordelingsmæssige og økonomiske hensyn.

#### **4. Der er åbne døre i de kommende klimaforhandlinger.**

Der er "åbne døre" til en fremtidig klimaaftale på trods af de afvejninger, der sker mellem dimensionerne i klimaændringerne, og på trods af den dybe uenighed mellem de forskellige lande. Disse åbne døre omfatter aftaler om trinvis reduktion, fortsættelse af beskudne udledningsreduktioner i nær fremtid samt politiske forhandlinger om virkemidler og byrdefordeling, der tager udgangspunkt i nationale / regionale målsætninger. Disse åbne døre vil sandsynligvis udgøre rammen for den næste klimaaftale.

#### **5. Der er lukkede døre i de kommende klimaforhandlinger.**

Forhandlinger om spørgsmål, der fører til "lukkede døre" (f.eks. om det langsigtede stabiliseringsniveau og/eller aggressiv indsats nu), vil sandsynligvis vise sig at være et spild af tid og forhandlingsindsats. Forhandlinger om disse emner vil kunne afspore forhandlingsprocessen. I værste fald vil dette kunne medføre et sammenbrud eller et dødvande i forhandlingerne, især fordi der er en risiko for at adskillige lande kan blive skræmt væk fra forhandlingsbordet.

#### **6. Der er behov for fleksible forpligtelser.**

Den næste aftale bør opnå bredere deltagelse. Kyoto's "en-størrelse-passer-alle" implementering af målsætninger og tidsplaner bør erstattes af en mere fleksibel tilgang, hvor landene bidrager gennem de mest hensigtsmæssige politikker, der tager højde for de enkelte landes specifikke forhold. Rapporten præsenterer fire anbefalinger, der skal sikre bred accept af den næste klimaaftale.

#### **7. Der er behov for at se klimaspørgsmålet i sammenhæng med andre globale udfordringer.**

Klimaspørgsmålet er kun et af mange spørgsmål på den globale dagsorden. Når rammerne for en klimaaftale efter 2012 skal opstilles, er det vigtigt at forhandlerne gør sig klart, at nøglen til succes ligger i at skabe en sammenhæng mellem klimaområdet og de vigtigste internationale politiske spørgsmål. Et område, hvor alle har interesser, er forskning og udvikling af ny teknologi, hvor USA vil kunne have en central rolle, hvis de vil og kan se de nationale fordele ved dette. EU kan have en central rolle i at få et globalt forskningssamarbejde etableret, som kan være grundstammen til en række nye teknologiløsninger på energi- og miljøområdet. Et andet område, som har de fleste landes interesse, er den videre udvikling af WTO, og der ligger åbenlyse muligheder i at se udviklingen af WTO og en fremtidig klimaaftale i en sammenhæng.



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## A C K N O W L E D G E M E N T S

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The Environmental Assessment Institute is solely responsible for the report's contents, and opinions expressed.





## 1 INTRODUCTION AND OUTLINE

With the entry into force of the Kyoto Protocol, discussions on global climate policy beyond the Kyoto period (2008-2012) have started in earnest among scholars; the issue is also starting to be addressed by decision-makers. According to the United Nations Framework Convention on Climate Change, formal negotiations between the Parties of the Convention should start during 2005.

The challenge for decision-makers seems clear. There is a need for a climate regime that is broader (participation) and deeper (further cuts in greenhouse gases) than the Kyoto Protocol. At least in the longer run. The experience of the Kyoto process shows that negotiating a regime based on an even broader and deeper effort will be an immense task.

Most of the considerations in this report are of general relevance for the negotiation of climate policy.

This chapter defines the purpose of the report (Section 1.1), presents the structure and outline (Section 1.2), delimits the report (Section 1.3) and defines and clarifies a number of central terms (Section 1.4).

### 1.1 Purpose of the report

The purpose of the report is to make a systematic, critical review of the core issues in the climate change negotiations and to make recommendations on these issues based on judgements. The aim is to inform those involved in the negotiations and those who are interested observers of the negotiations, and to facilitate the debate by making the trade-offs of the policy options and the negotiation positions of the Parties as transparent as possible. No conclusions on the optimal way forward will be drawn; the report will highlight why it has been, and will be, so hard to negotiate a global climate regime. However, some recommendations on the next climate regime will be presented at the end of the report.

The purpose is achieved through two specific aims:

1. The first aim is to *examine the core negotiation issues* in climate policy and to *evaluate the options for further action* within each of the core negotiation issues.
2. The second aim is to *examine the main national positions* on the core negotiation issues and to *assess open and closed doors on options for future action* on climate change.

The first aim has a clear theoretical perspective, while the perspective of the second aim turns to the practical policy-making arena. The phrase “options for further action” in the first aim refers to specific ways of addressing each of the core negotiation issues. The phrase “open and closed doors on options for future action” in the second aim refers to which specific ways of addressing the core negotiation issues might lead to agreement or disagreement between nations. That is, when it seems more than likely that the Parties will not reach agreement on an issue, we refer to the door being closed. On the other hand, when agreement on a range of issues seems plausible, the door is described as open. The assessment of open and closed doors is considered important since climate change negotiations will derail unless realistic levels of ambition for the next regime are set.

Based on the identification of core negotiation issues and the assessment of open and closed doors, the report offers some recommendations on the principles upon which the next climate regime should be built.

## **1.2 Structure and outline of the report**

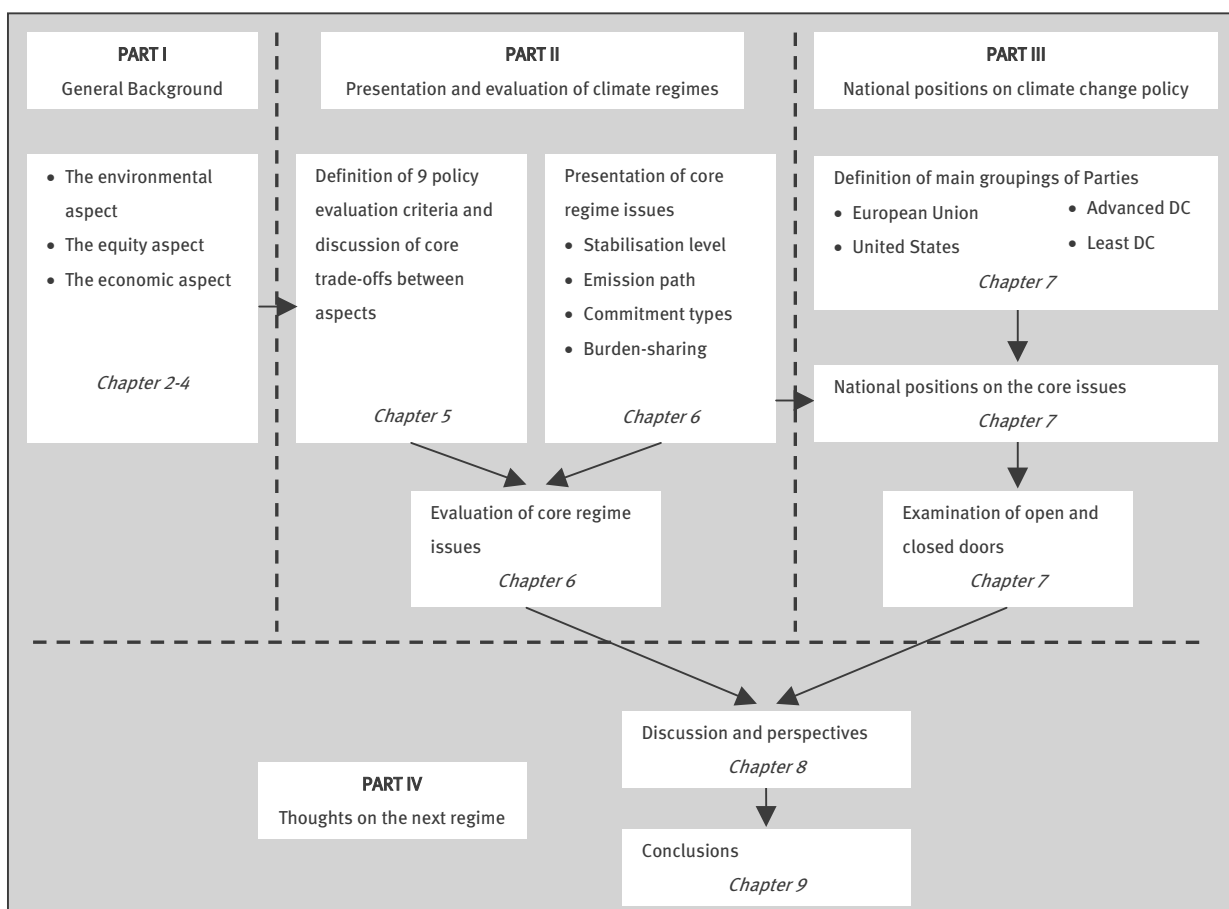
The report is divided into four main parts.

- I. The scientific background: the environmental, equity and economic aspects of climate policy.
- II. Presentation and evaluation of climate regimes.
- III. National positions on climate change policy and assessment of open and closed doors in the negotiations.
- IV. Recommendations on a future climate regime: discussion and conclusions.

Parts I, II and III can be read as three independent parts even though there are clear relationships between the three individual parts. Part IV is as a synthesis of Parts I, II and III.

The structure of the report is illustrated in Figure 1.1. The relationship between the four parts of the report and the chapters within each of the four parts is also shown in Figure 1.1. The structure is elaborated below by presenting an outline of the full report. For each of the parts a number of analytical questions are defined.

**Figure 1.1. Report structure and the relationship between the four parts of the report.**



### ***Part I (Chapters 2 to 4): The general background***

The analytical questions raised are:

- What drives climate change and what are the consequences?
- Who are the major emitters and who should pay for greenhouse gas mitigation?
- What are the economic costs of climate change mitigation?

The general background provides a brief description of the environmental, equity and economic aspects of climate policy. Based on this description, a number of policy evaluation criteria are defined in Part II.

***Part II (Chapters 5 and 6): Presentation and evaluation of climate regimes***

The analytical questions raised are:

- What are the basic elements of a climate regime?
- What are the main trade-offs in the formulation of climate policy?
- How well do specific regime options measure up to a set of evaluation criteria?

Part II describes the basic elements of a climate regime which constitute the core negotiation issues. These are the decisions on stabilisation level, emission path, commitment types and burden-sharing principles. For each of these negotiation issues, a number of options are presented. These options are evaluated against ten policy evaluation criteria, which are also defined in Part II. The criteria are based on the environmental, equity and economic aspects as well as the crosscutting issue of uncertainty. The inherent trade-offs between environmental outcome, equity principles and economic efficiency are analysed.

The national positions on each of the four identified negotiation issues are presented in Part III.

***Part III (Chapter 7): National positions and open and closed doors for future policies***

The analytical questions raised are:

- What are the main positions on the core negotiation issues?
- What open and closed doors can be identified for the next regime?

The national positions on the UNFCCC Objective and Principles and core negotiation issues are mapped and the conflicts arising due to differing national perspectives on each of the elements of a climate regime are identified and discussed. Based on these tensions, the open and closed doors in the negotiations – that is, which discussions would lead to a dead end and which discussions could lead to new agreements – are assessed.

***Part IV (Chapters 8 and 9): Thoughts on the next climate regime***

The analytical questions raised are:

- Upon which principles should an optimal regime be built?
- What are the constraints for such an optimal regime and what incentives should be provided in order to achieve broad participation?
- What other major political issues might influence the success of negotiating a climate regime?
- How can broader participation be ensured?

Part IV synthesises the first three parts of the report. Based on Parts I, II and III of the report, some thought is given to a future climate regime. First of all, principles for a theoretical “on-paper” and optimal regime are presented. However, such a regime will not be negotiable and therefore we discuss what might bind together a regime that would gain broad participation. This is a discussion of climate change related incentives, but also of some global political issues besides climate change such as the WTO negotiations. These incentives are discussed in order to identify non-climate criteria that will increase the chances for negotiating a broad regime. Finally, some recommendations and perspectives on the most promising and feasible principles for the next climate regime are given.

**1.3 Restrictions**

The number of reports and articles on climate change is considerable, all with different purposes and scopes. The purpose of this report is presented above (Section 1.1), but in order to avoid misunderstandings and to make the purpose of the report more clear, a number of restrictions to the report are outlined below. The restrictions are by no means exhaustive.

- There will be no specific guidelines on the optimal climate regime beyond Kyoto. The report identifies the core negotiation issues as well as the main contentious issues in the formulation of climate policy. The report offers some recommendations on the essential and underlying principles upon which the next climate regime should be built.
- There are no specific recommendations on how and by how much greenhouse gases should be reduced, or by whom and by when.

- An important aspect of a regime is that it should be relatively simple to participate in and comply with. The report focuses on the principles of climate policy why operational implementation of the principles is not analysed.
- There are no considerations on the forum in which negotiations should take place. It is assumed that the UNFCCC is the appropriate forum. However, other settings are possible.
- In Part III of the report, national positions are identified – not national interests. There may be great differences between stated positions in international negotiations and the true national interests that lie behind positions. However, it is argued that a number of proposals for burden-sharing schemes are based on economic interests rather than equity principles.

Part I presents the general background to climate change. The background description is divided into three aspects, defined as the environmental, equity and economic aspects of climate policy. The sciences for each of the three aspects are described briefly to provide a basic understanding of the science behind climate policy. A summary of Part I is presented below.

## **Chapter 2 – The environmental aspects**

The brief review of the environmental science is based on the IPCC's Third Assessment Report (TAR). Anthropogenic climate change is happening and global warming will in all scenarios take place at a faster pace in the coming century than in the 20th century. The impact of future climate change depends to a large extent on the concentration of greenhouse gases and the eventual stabilisation level.

## **Chapter 3 – The equity aspects**

Equity cannot be reduced to a single dimension. Important dimensions of equity are need, equal entitlements, capabilities, responsibilities, opportunities and comparability of effort. The final burden sharing should be robust across all the equity dimensions. Chapter 3 also presents the major differences between historical emissions, annual emissions, per capita emission and per capita income across central countries. There are huge differences in income per capita and (current and historical) emissions per capita between industrialised and developing countries.

## **Chapter 4 – The economic aspects**

The cost of achieving different stabilisation levels varies enormously. The adoption of cost-effective policies and measures can reduce the mitigation costs significantly for any given stabilisation level. Mitigation will become cheaper in the future as new technology evolves. However, initial commitments are necessary in order to jumpstart the critical process of technological development.

## 2 THE ENVIRONMENTAL ASPECTS

In this chapter a very brief review of the science of climate change is given. The chapter does not intend to cover the science or the disputes over the science of climate change in any detail. Reference will be made to the main consensus conclusions reached by the Intergovernmental Panel on Climate Change (IPCC), e.g. the likely impacts of different mitigation scenarios and stabilisation levels. The implications for climate policy will be outlined shortly at the end of this chapter.

Climate change is defined differently by the IPCC and in the United Nation Framework Convention on Climate Change (UNFCCC) (IPCC 2001b, p.3):

*“Climate change in IPCC usage refers to any change in climate over time, whether due to natural variability or as a result of human activity. This usage differs from that in the UNFCCC, where climate change refers to a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods.”*

Climate impacts depend on the atmospheric concentrations of greenhouse gases. Atmospheric concentrations have been rising and the UNFCCC objective is to stabilise concentrations at a “safe” level as stated in Article 2, Objective (UNFCCC 1992, p. 9)<sup>1</sup>:

*“The ultimate objective...is to achieve...stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change...”*

In this report, the environmental aspect of climate change policy refers to the environmental outcome of an internationally agreed climate regime. The environmental outcome is defined as avoided climate change attributed to human activity compared with the business-as-usual scenario, where no action is taken to either mitigate greenhouse gas emissions or to adapt to the environmental impacts of human-induced climate change. Changes in the climate affect all sorts of ecosystems, as well as the conditions for human activities such as agriculture.

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<sup>1</sup> The UNFCCC Objective and Principles are discussed in Appendix 2.



To some, mainly non-economists, this means that the action needed reflects the statement “the more greenhouse gases are reduced the better”, irrespective of a comparison of costs and benefits. Behind this reasoning lies a strict focus on the environmental outcome and thus the benefit side of the climate change challenge. The environmental outcome is of course very central and relevant, but it should be balanced against equity and cost criteria, and against environmental criteria other than climate change criteria. Emission reductions can for instance be achieved by greater use of hydropower generation and nuclear power, which are measures that also have a negative environmental outcome. However, information on the environmental outcome is crucial for decision-makers.

## **2.1 The science of climate change**

The science of climate change is described briefly in order to outline the major implications for climate policy (section 2.1.3). In section 2.1.1 the causes of climate change is described. Section 2.1.2 describes the climate change projections and potential impacts of different emission and stabilisation levels.

The description is based on the consensus literature reviewed by the IPCC<sup>2</sup>. Climate change refers to statistically significant variations in climate that persist for a period of decades or longer. It includes shifts in the frequency and magnitude of weather events and the slow continuous rise in global mean surface temperatures.

### *2.1.1 The causes of climate change*

Climate change is happening. As an overall conclusion, the IPCC argues that:

*“The Earth’s Climate System has demonstrably changed on both global and regional scales since the pre-industrial era.” (IPCC 2001c, p.4)*

The evidence is based primarily on the Mann Curve<sup>3</sup> (Figure 2.1). The curve is referred to as the Hockey Stick, because of its form; it shows a weak decrease in temperatures from 1000 to around 1900 where the temperature rises steeply. Based on the curve, the IPCC concludes that the 20<sup>th</sup> century was the warmest century and the 1990s the warmest decade, in the last 1000 years (IPCC 2001c, p.5).

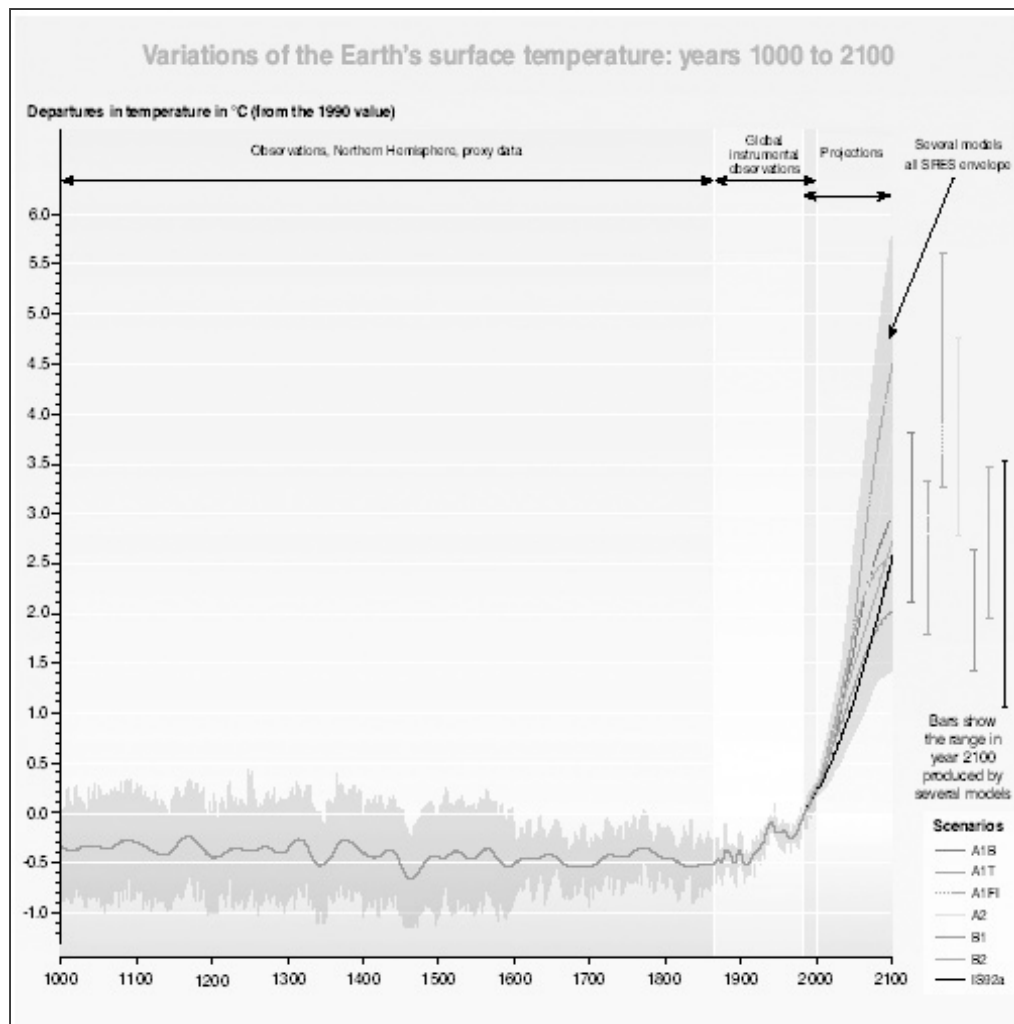
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<sup>2</sup> A critical review of the climate change literature is not attempted here.

<sup>3</sup> The Mann Curve is continuously being debated, see Storch article (Storch et al. 2004).

Figure 2.1 shows that the temperature has been relatively stable in the period from 1000 AD to 1860. In the period from 1860 to 2000 the surface temperature has in average increased 0.6 degrees Celsius. Finally, the potential temperature increase from 2000 to 2100 as projected in the six illustrative SRES scenarios and IS92a scenario is shown.

**Figure 2.1. The Mann Curve showing variations in the Earth's surface temperature from 1000-2000 and projections from 2000-2100. The temperature scale shows deviations from the 1990 value.**



SOURCE: (IPCC 2001c, P.34). WITH PERMISSION FROM IPCC

Climate is variable because it is affected by natural phenomena, such as solar cycles and volcanic activity, and human actions, such as emitting greenhouse gases.

The change in average surface temperatures of 0.6 degrees from 1860 until 2000 is partly attributed to human activity (IPCC 2001c). Anthropogenic forcing provides a

plausible explanation for a substantial part of the observed temperature change over the past century. Because of the variability of the climate it is difficult to prove that human actions are changing the climate, but scientists are increasingly confident that this is the case. The IPCC expresses greater confidence than earlier that human activities are altering climate patterns (IPCC 2001c, p.5).

There are 6 greenhouse gases: CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, SF<sub>4</sub>, HFC and PFC.<sup>4</sup> These gases are emitted in different quantities and have different global warming potentials (GWP), expressed in CO<sub>2</sub> equivalents. The GWP<sup>5</sup> is a measure of the potency of each gas relative to an equal weight of CO<sub>2</sub>.

Greenhouse gases have relatively long atmospheric lives, decades to millennia. Due to the circulation of the air, a molecule released to the atmosphere can be anywhere else in the atmosphere within two years. Since this is a small fraction of its atmospheric life, emissions anywhere have effectively the same impact on the climate. That is, one tonne of CO<sub>2</sub> emitted in for instance India contributes as much to global warming as one tonne of carbon emitted in the US or anywhere else in the World.

The timing of emission reductions (the stabilisation level given) is important for the rate of temperature change. The faster the rate of temperature change, the more difficult it is for natural and human systems to adapt (IPCC 2001a). There are relatively few studies on the rate of temperature change.

In general, the greater the rate and magnitude of temperature change, the greater the likelihood that the critical thresholds of systems will be surpassed, such as the disintegration of the west Antarctic ice sheet or a partial shutdown of the North Atlantic Thermohaline Circulation (IPCC 2001a, pp.68).

### *2.1.2 Climate change projections*

Climate change projections are based on socio-economic projections of future greenhouse gas emissions, which are used as input in the biophysical climate models. Human influences will continue to change atmospheric composition throughout the 21st century (IPCC 2001c). The change depends on future emis-

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<sup>4</sup> Emissions from fossil fuels are measured in CO<sub>2</sub> or C. The C/CO<sub>2</sub> ratio is 12/44, that is, C emissions should be multiplied by 44/12 to calculate CO<sub>2</sub> emissions.

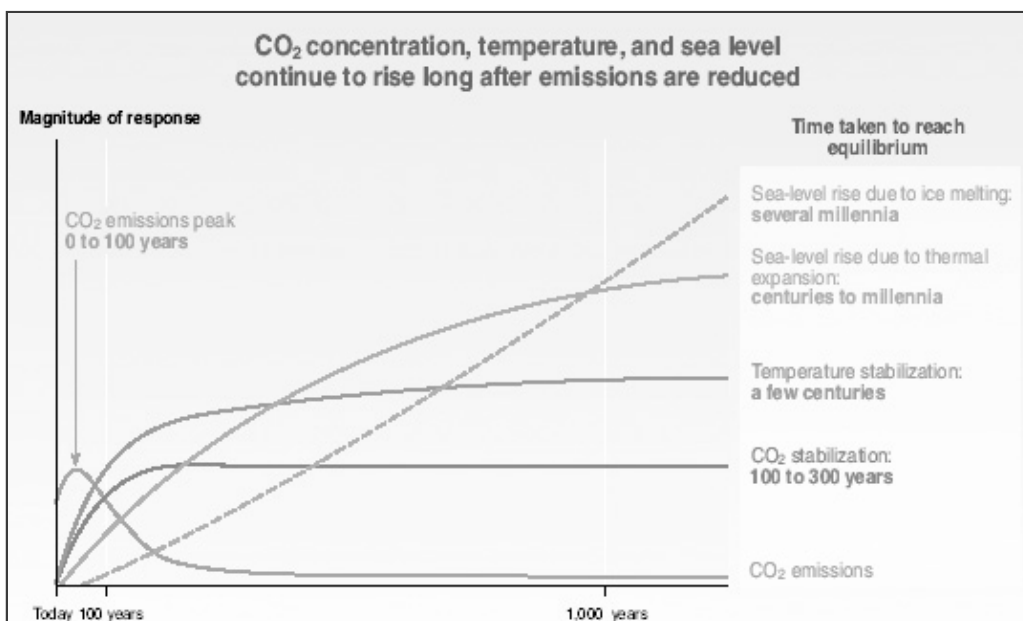
sions, which are described in 35 emission scenarios. Six of these scenarios are the so-called illustrative SRES-scenarios are presented in Appendix 1.

Global carbon emission currently stands at around 9 GT/year and the scenarios show carbon emission of between 5 and 27 Gt C/year in 2100. According to the scenarios, CO<sub>2</sub> concentration will rise from today's 370 ppm to somewhere between 540 and 970 ppm (IPCC 2001c). Data on historical and future emissions are presented in Chapter 3.

The climate system is extremely complex, with multiple atmospheric, terrestrial and oceanic components, and therefore no precise predictions can be made. Besides uncertainty of future greenhouse gas emissions, the climate system is characterised by uncertain parameters and complex issues, with the result that the output from climate models is a temperature range. The full envelope of the 35 SRES scenarios gives a temperature range between 1.4 °C and 5.8 °C (IPCC 2001c).

An important aspect of climate change science in relation to greenhouse gas mitigation is the inertia in climate systems, which is exemplified below and illustrated in Figure 2.2.

**Figure 2.2. The inertia in climate systems.**



SOURCE: (IPCC 2001c, P.17).

<sup>5</sup> The 100 year GWPs are used by the UNFCCC.

Figure 2.2 shows that greenhouse gas concentration in the atmosphere and temperatures will continue to rise for centuries, and sea levels will continue to rise for millennia after emissions are reduced/stabilised.

Climate models provide information on the relationship between stabilisation level, the timing of greenhouse gas emissions and climate change impacts. Table 2.1 illustrates the relationship between projected stabilisation levels, temperature change and CO<sub>2</sub> emissions.

**Table 2.1: Comparison of atmospheric concentrations and implications in terms of impacts, timing and degree of effort required.**

Stabilisation concentrations by 2100 (CO <sub>2</sub> )	Projected rate of temperature change by 2100	Required limit on fossil fuel carbon emissions T/year 2000 level: 6.29 billion tonnes	Per capita carbon emissions in 2100 T/capita/year* 2000 level: 1t/capita/year	Total cumulative carbon emissions 1990 to 2100 (1000tC)	Timing when CO <sub>2</sub> emissions must drop below 1990 levels and steadily decrease thereafter
1000 ppm	2.0-3.5°C				Two centuries
750ppm	1.9-3.4°C	12 billion tonnes	1.2	1200-1300	
650 ppm	1.7-3.2°C	9 billion tonnes	0.9	1030-1190	Within the period 2090 and 2150
550 ppm	1.6-2.8°C	6 billion tonnes	0.6	870-990	Within the period 2040 to 2100.
450 ppm	1.2-2.3°C	3 billion tonnes	0.3	630-650	Within the period 2010 to 2040

SOURCES: (IPCC 2001C, P.100).

\* ASSUMING A WORLD POPULATION STABILISED AT 10 BILLION PEOPLE

It is evident from Table 2.1 that a lower stabilisation level requires global emissions to drop below 1990 levels at an earlier point in time and that by 2100 global emissions must be lower.

The potential damage of climate change increases at a faster rate the higher the ultimate stabilisation level. In summary, the IPCC concludes the following on some of the potential impacts of different stabilisation level ranges (IPCC 2001c):

- Concentration of 750 to 1000 ppm (1.9-3.5 °C): severe effects, coral death, loss of valuable and unique ecosystems, market sector effects negative for most countries, risk of large scale high impact events in future centuries.

- Concentration of 550 to 650 ppm (1.6-3.2 °C): coastal wetland loss, decrease in crop yields in most regions, adverse impacts mainly on developing countries.
- Concentration of 450 ppm (1.2-2.3 °C): impacts significantly reduced.

The impacts of climate change are not distributed evenly across populations and countries. All projections show that impacts are greater in arctic and tropical areas compared with relatively modest changes at mid-latitude degrees (IPCC 2001c).

## **2.2 Key points and implications for climate policy**

The key messages from the environmental aspect of climate change are summarised and the main implications for climate policy are outlined.

There are four sets of key messages and major policy implications:

1. Significant reductions from current global emissions, and in particular from emission projections, are needed. Therefore emissions in more countries should be addressed and considered for control. But the science does not provide answers to questions on what is a “safe” stabilisation level and how quickly emissions need to be reduced. The emission budgets can be calculated and the potential climate impacts for different stabilisation levels (450 to 1000 ppm) can be projected. Deciding an ultimate stabilisation level is a political task.
2. It does not matter where the emission reductions geographically are achieved. The issue of burden sharing is therefore a major issue.
3. Climate change is happening, and the world will face inevitable climate change. Thus, adaptation to the impacts of climate change should be considered.
4. The environmental outcome of a climate regime can only be described within the uncertainty of the climate models. The task of projecting future climate change is extremely complex and there are inevitably profound uncertainties and gaps in knowledge at the biophysical level of analysis. Much uncertainty still remains<sup>6</sup> and more knowledge is needed in order to improve continuously the basis for decision-making. In Section 5.2.4 the implications of uncertainty in decision-making will be discussed briefly.

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<sup>6</sup> Question 9 in the IPCC’s Third Assessment Report (IPCC 2001c, pp. 30-34) lists robust findings and key uncertainties of climate change research.

### 3 THE EQUITY ASPECTS

A main condition for international agreement on a climate regime beyond Kyoto is that the distribution of burdens is perceived to be fair by all Parties. Countries have sovereignty, which means that involvement in climate regime negotiations is voluntary. If a regime is perceived as unfair and out of line with national interests, the Party will retreat from the negotiations.

Equity refers to what is right, just or fair, while interests represent what is best for the individual nation, defined by the nation itself. Global equity may be a factor in a country's assessment of its interests along with more overriding factors such as the assessment of costs and benefits (Ashton & Wang 2003).

The total cost of climate change to a country is the sum of the mitigation costs, adaptation costs and residual damages it incurs. The equity of the climate change agreement depends on the distribution of the total costs, not just the mitigation costs. Residual damages can not be shared, while some international sharing of adaptation costs is possible. International sharing of mitigation costs through emissions trading is easiest. A small global mitigation effort is likely to shift costs from the countries bearing the mitigation costs (industrialised countries) to those incurring the residual damages (mainly developing countries).

In this chapter, six different equity principles will be described (Section 3.1). More equity principles have been stated in the climate negotiations, but these six dimensions give the broad picture and have attained legitimacy in the eyes of many. In Section 3.2 the historical and current emission profiles of the top 10 emitters are presented.

#### 3.1 Equity principles

There is no single and straightforward definition of equity; countries interpret equity differently according to national self-interest and the concept of equity entails several principles (Ashton & Wang 2003). Important equity principles and perspectives on fairness are:

- Need
- Equal entitlements
- Responsibility

- Capacity (Ability to pay)
- Opportunity
- Comparability of effort

Each of the principles is an operationalisation of the equity concept. The six equity principles are described in Box 3.1.

### Box 3.1 The six equity principles

#### **Need (Basic human needs)**

The principle implies that all countries have the right to emit a minimum quantity of greenhouse gases per capita allowing them to meet their basic needs such as food, warmth and shelter. Simply put, the idea is to define a level below which countries should not have mitigation commitments. There are no straightforward methods for defining a level. The CO<sub>2</sub> emission level allowing for basic needs varies with national circumstances such as environmental conditions and lifestyle.

#### **Equal entitlements**

This principle is based on the understanding that everybody has the same right and entitlement to a common good such as the atmosphere. Climatic stability is a global common good and every human has an equal share of “carbon pollution” available for human activity.

#### **Responsibility (Polluter Pays Principle)**

The countries that have caused the problem of global warming are responsible and must bear the costs of resolving it. The costs concern both mitigation cost, adaptation cost and the burden of unavoided impacts. The principle is also known as the Polluter Pays Principle. However, the uncertain link between cause and consequence blurs the principle. Another question is whether a country can be held responsible for past emissions when the harmful effects of these emissions were not known at the time of emission.

#### **Capacity (Ability to pay)**

The capacity principle suggests that differentiation of commitments should be based on ability to pay. Ability to pay will normally be measured on per capita GDP.

#### **Opportunity**

Some countries have better opportunities for low-cost mitigation than others. These countries are usually developing countries with energy inefficient economies that lack the economic capacity to pay for greenhouse gas emission reductions. The Clean Development Mechanism (CDM), under the Kyoto Protocol, opens up opportunities to implement low-cost mitigation in developing countries where the costs are carried by Annex I countries.

#### **Comparability of effort**

A differentiated commitment may be accepted by a Party in its own right according to the equity criteria outlined above. But any commitment agreed upon a country will be judged in comparison with commitments negotiated by other countries. The US has clearly stated that its refusal to ratify the Kyoto Protocol is based, among other reasons, on the perceived exemption of developing countries.



tiation of commitments are essentially based on one or more equity principles. In the negotiations on the Kyoto Protocol all the equity arguments were stated in a more or less direct manner.

### **3.2 Greenhouse gases are emitted unevenly between nations**

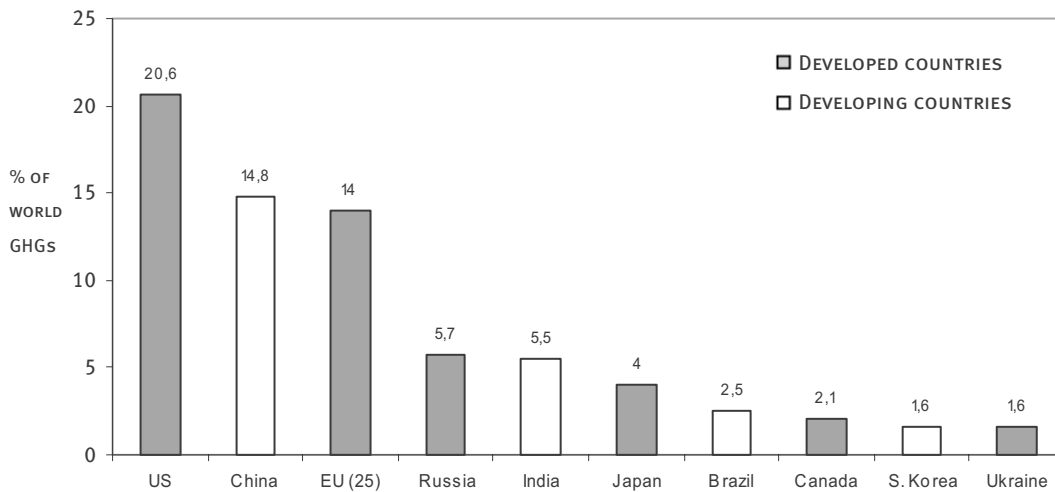
This Section shows the emission and income distributions that are related to the equity principles mentioned in Section 3.1. Using for instance emissions per capita, income per capita or the historic emissions as the guiding equity principle will have different implications. Five figures are presented:

- Who has the highest annual emissions? Figure 3.1 displays the Top 10 countries with the highest annual emissions.
- How are annual emissions distributed among developed and developing countries? And how does this change over a period of 25 years' time? Figure 3.2 displays the current and projected emissions for developed and developing countries.
- How do emissions per capita differ for the Top 10 annual emitters? Figure 3.3 displays the per capita greenhouse gas emissions for the Top 10 annual world emitters.
- Which 10 countries are mainly responsible for global warming? Figure 3.4 displays the Top 10 countries with the highest cumulative emissions.
- How does income per capita differ for the Top 10 annual emitters? Figure 3.5 displays the per capita incomes for the Top 10 annual world emitters.

Emission profiles are characterised by wide disparities in per capita emission levels and current and historic cumulative emissions across countries. Income per capita differs likewise widely across countries. Data presented in this section are from the Climate Analysis Indicators Tool (World Resources Institute 2003). Emissions include CO<sub>2</sub> from fossil fuel and cement only, not land-use changes.

Figure 3.1 shows the top 10 countries with the highest annual greenhouse gas emissions in 2000.

**Figure 3.1 Top 10 highest annual greenhouse gas emissions<sup>1,2</sup>, % of world GHGs, 2000.**



SOURCE: (WORLD RESOURCES INSTITUTE 2003).

NOTE 1: THE TOP 10 ANNUAL EMITTERS ARE RESPONSIBLE FOR 72 PERCENT OF YEARLY EMISSIONS. EU (25) IS CONSIDERED AS ONE EMITTER.

NOTE 2: EMISSIONS INCLUDE CO<sub>2</sub> FROM FOSSIL FUEL AND CEMENT (NOT LAND-USE RELATED EMISSIONS) AS WELL AS FIVE NON-CO<sub>2</sub> GASES

A relatively small number of countries is physical responsible for annual greenhouse gas emissions. The ten countries/regions listed in Figure 3.1 are responsible for 72 percent of total global emissions. These countries have either large economies and/or big populations. Economic growth and population numbers are generally important emission drivers.

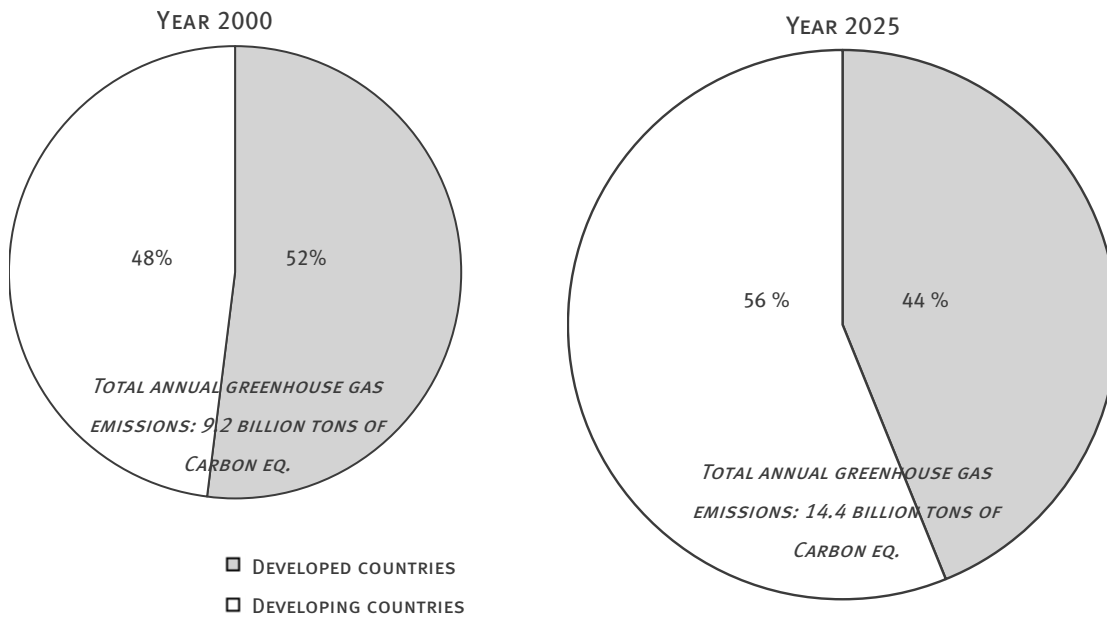
Six out of the top 10 annual emitters are developed countries. If the EU (25) was viewed as 25 emitters, three of those countries would enter the top 10 list (Germany, United Kingdom and Italy). South Korea and Ukraine would then move out of the top 10 list.

In order to achieve an efficient environmental outcome the emissions of these ten countries should be addressed. The environmental outcome is deeply flawed if emissions in for instance the US and China are not addressed by the next commitment period. However, there is an important distinction between who emits the greenhouse gas emissions and who should carry the burden (Müller 2002; Müller et al. 2003). Large countrywide emissions per se do not justify the imposition of mitigation burden. High annual emissions merely indicate that they have to be addressed, but not who should carry the burden. None of the six equity principles would thus imply that countries with high countrywide emissions should undertake

mitigation obligations solely on the basis that the annual emissions are high. A combination of high annual emissions and, for instance, high income per capita or high historic and/or current emissions per capita would on the other hand justify the imposition of a mitigation burden.

Figure 3.2 presents a distribution of greenhouse gas emission between developed and developing countries in the years 2000 and 2025. The projected increase in greenhouse gas emission is also shown.

**Figure 3.2 Current and projected emissions for developed and developing countries<sup>1,2</sup>**



SOURCE: (WORLD RESOURCES INSTITUTE 2003).

NOTE 1: PROJECTIONS ARE BASED ON EIA REFERENCE CASE. EMISSIONS INCLUDE CO<sub>2</sub> FROM FOSSIL FUEL AND CEMENT (NOT LAND-USE RELATED EMISSIONS) AS WELL AS FIVE NON-CO<sub>2</sub> GASES

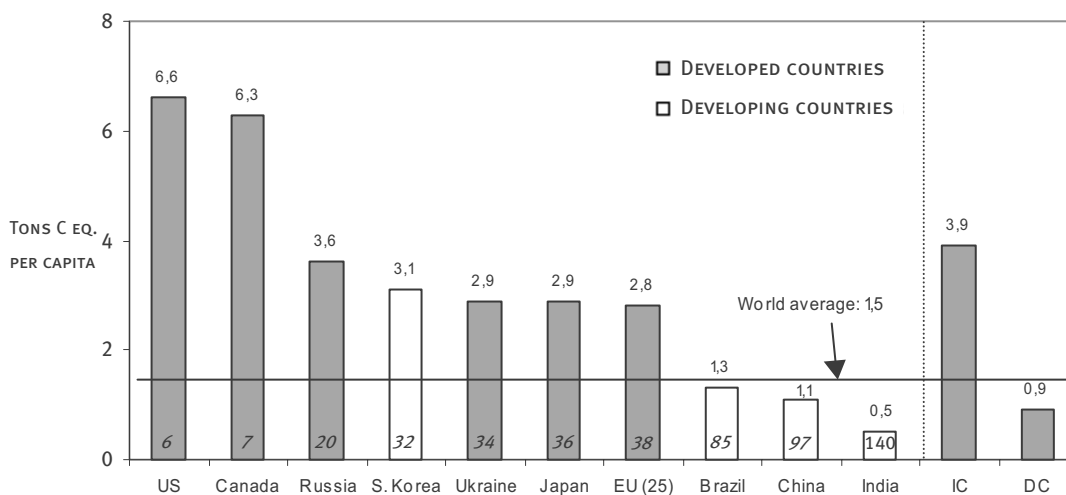
NOTE 2: AREAS ARE CORRELATED TO GLOBAL ANNUAL EMISSIONS.

Greenhouse gas emissions are projected to increase by 57 percent from 2000 to 2025. The growth in emissions is unevenly distributed among developed and developing countries. Emissions will increase 35 percent in developed countries and 84 percent in developing countries. The difference in the growth rates tilts the shares of annual greenhouse gas emissions. The developed countries were responsible for 52 percent of annual emissions in 2000, while the developing countries, according to the projections, will be responsible for 56 percent of the annual emissions in 2025.

These projections are of course highly uncertain, particularly for developing countries, as emission growth rates depend on assumptions about population and economic growth and technological change. Projections developed by the Energy Information Administration (EIA) of the U.S. Department of Energy are among the most widely cited projections (Baumert & Pershing 2004). The EIA low scenario predicts an increase in emission from 2000 to 2025 of 33 percent, while the EIA high scenario predicts a total growth of 93 percent.

Emissions per capita vary widely among countries. Figure 3.3 presents emissions per capita for the top 10 world annual emitters. Their ranking on the emission per capita list is indicated by the numbers placed at the bottom of the bars.

**Figure 3.3 Per capita greenhouse gas emissions for the top 10 annual world emitters<sup>1,2</sup>, 2000**



SOURCE: (WORLD RESOURCES INSTITUTE 2003).

NOTE 1: EMISSIONS INCLUDE CO<sub>2</sub> FROM FOSSIL FUEL AND CEMENT (NOT LAND-USE RELATED EMISSIONS) AS WELL AS 5 NON-CO<sub>2</sub> GASES. EU (25) IS CONSIDERED AS ONE EMITTER.

NOTE 2: NUMBER IN BARS REFERS TO RANK ON LIST OF GHG EMISSIONS PER CAPITA

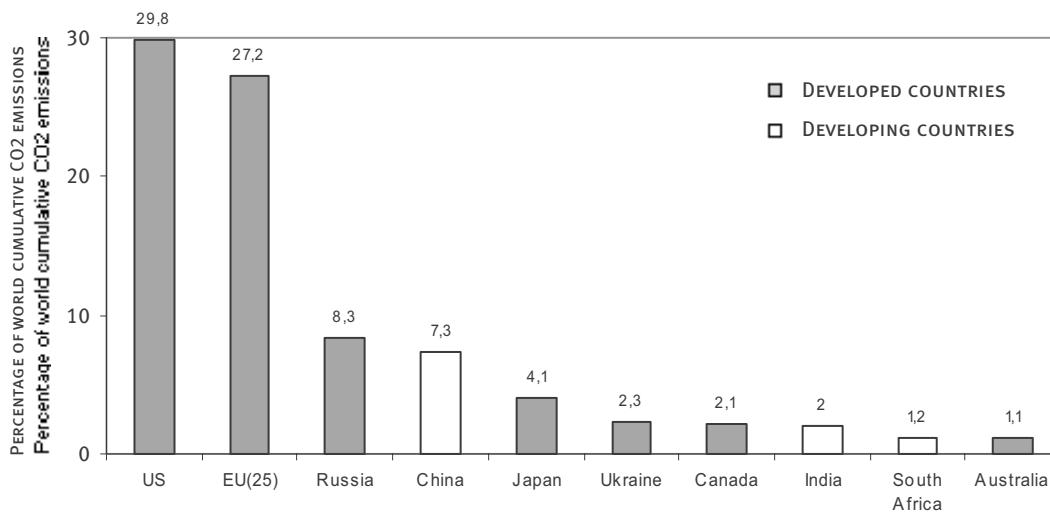
There are wide discrepancies between emissions per capita among the top 10 emitter countries. Brazil, China and India are among the world's top 10 annual emitters, but their rankings on the emissions per capita list are 85, 97 and 140 respectively. The United States and Canada are the only two countries of the world top 10 annual emitters that also feature in the top 10 of the highest emission per capita.

Qatar, United Arab Emirates, Kuwait and Bahrain are the four countries with the highest emissions per capita. Their populations are relatively small and they export

highly greenhouse gas-intensive products. Other states high on the list are a number of small island states (Antigua and Barbuda, Trinidad and Tobago, Nauru and Palau) and several economies in transition (Czech Republic, Russia and Estonia).

The historic contribution varies widely among the countries. Figure 3.4 shows the top 10 countries with the highest cumulative CO<sub>2</sub> emissions.

**Figure 3.4 Top 10 countries with highest cumulative CO<sub>2</sub> emissions, percentage of world, 1850-2000**<sup>1,2</sup>



SOURCE: (WORLD RESOURCES INSTITUTE 2003).

NOTE 1: EMISSIONS INCLUDE CO<sub>2</sub> FROM FOSSIL FUEL AND CEMENT ONLY. EU (25) IS CONSIDERED AS ONE EMITTER.

NOTE 2: THE TOP 10 EMITTERS ARE RESPONSIBLE FOR 85 PERCENT OF TOTAL CUMULATIVE EMISSIONS

Developing countries have significantly lower cumulative emissions, which is one of the most stated facts in discussions of equity. The industrialised countries are responsible for 77 percent of the cumulative emissions since 1850, while the developing countries are responsible for the remaining 23 percent. The United States and the EU (25) account for more than half of the cumulative CO<sub>2</sub> emissions. Including Russia would imply a share of 2/3 of the cumulative emissions.

An important determinant of the historic contribution is whether land-use change is included or not. Including land-use change would increase the historic contribution for the developing countries from 27 percent in 1950 to 47 percent in 2000<sup>7</sup>. Adding in land-use changes would specifically increase the historic contribution for Brazil and Indonesia, as major timber producers. Another important determinant

<sup>7</sup> Data for land-use related emissions are not available prior to 1950.

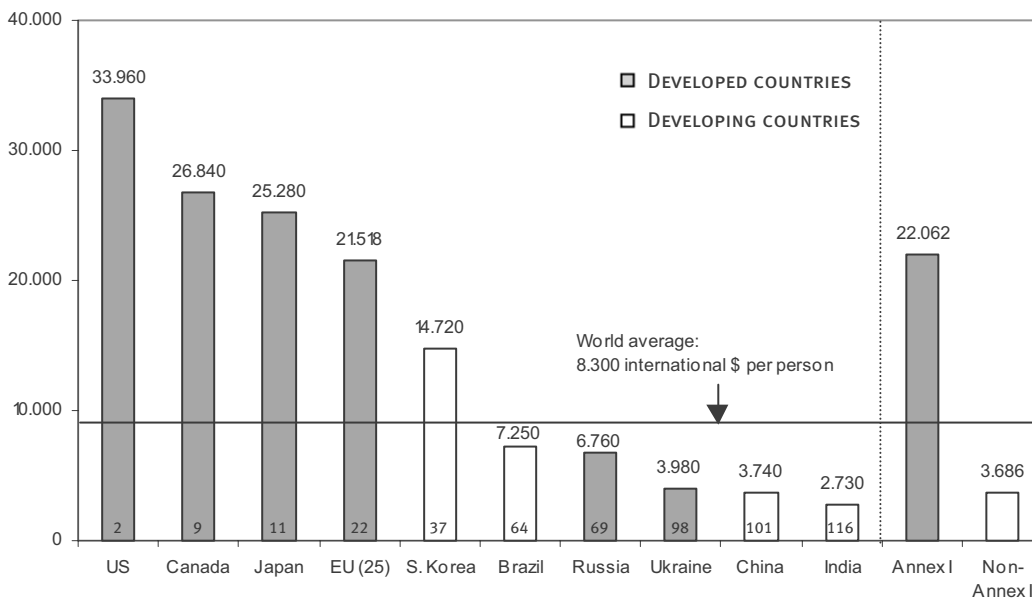
when calculating the historic contribution to global warming is the time period considered. A start period in 1850 implies high relative contributions from the developed countries, while moving the start year to 1990 would increase the relative responsibility of the developing countries from 23 percent to 38 percent.

Emissions are increasing faster in the developing countries compared with the developed countries (see also Figure 3.2). Models predict that the cumulative contribution of developed and developing countries will reach parity sometime between 2030 and 2065 (Baumert & Pershing 2004).

Historic responsibility can be calculated using different methods. Figure 3.4 presents the cumulative CO<sub>2</sub> emissions. Other calculations include the contribution to atmospheric CO<sub>2</sub> concentration or contribution to temperature increase. The historic contribution varies relatively little between the three approaches.

Finally, income per capita varies widely across countries. Figure 3.5 shows income per capita for the top 10 world annual emitters. Their ranking on the income per capita list is indicated by the numbers placed at the bottom of the bars.

**Figure 3.5 Per capita income for the top 10 annual world emitters**



SOURCE: (WORLD RESOURCES INSTITUTE 2003).

NOTE 1: NUMBER IN BARS REFERS TO RANK ON LIST OF INCOME PER CAPITA

Only one non-Annex I country (South Korea) is among the top 50 of countries with the highest per capita income. China and India are both placed outside the top

100. The US, Canada, Japan and the EU (25)<sup>8</sup> are all placed at the top of the list. Relying on the equity principle of ability to pay would thus imply high mitigation burdens to these countries, and low burdens to for instance China and India.

Income per capita is on average almost 6 times higher in developed countries compared to developing countries. Accordingly, ability to pay justifies that developed countries take the lead in combating climate change.

### 3.3 Key points and implications

The key messages from the equity aspect of climate change are summarised and the main implications for climate policy are outlined.

The fact that high emissions per se do not justify imposition of mitigation burdens should be repeated. High emissions from developing countries do not necessarily imply that they should have mitigation burdens. The high emissions merely indicate that they must be addressed in order to ensure the environmental outcome.

There are four sets of key messages and major policy implications:

- Several equity principles (need, equal entitlements, responsibility, and capacity) together suggest that industrialised countries should take the lead as reflected in the UNFCCC.
- Comparability of effort, taking into account other equity principles, suggests that broader participation will require even more differentiation of commitments (type and stringency). The total cost of climate change to a country is the sum of mitigation costs, adaptation costs and residual damages incurred by each country. Comparability of effort should consider all these costs.
- Environmental concerns indicate that broader and deeper participation should be achieved. This will require further reductions from Annex I countries - including the United States, Australia – and participation by a number of developing countries.
- Environmental concerns indicate that the high annual emissions should be addressed, but high countrywide emissions do not justify the imposition of

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<sup>8</sup> There are large differences in per capita income within EU (25). Luxembourg (ranked 1 on the world list), Ireland (ranked 3 on the world list) and Denmark (ranked 6 on the world list) top the internal EU(25) list, while Latvia (ranked 65 on the world list), Lithuania (ranked 59 on the world list) and Poland (ranked 51 on the world list) are the poorest EU-countries according to income per capita.

mitigation burdens. It is important to distinguish between causal and moral responsibility.



## 4 THE ECONOMIC ASPECTS

How much is it going to cost to combat global warming? Ultimately the cost will depend upon the long-term stabilisation target level, the emission pathway towards the stabilisation level and to what extent cost-effective instruments are employed.

This chapter addresses the economic aspect of climate change. The central economic question is *how much, when and where* should emissions be reduced. Section 4.1 considers the cost-benefit approach, while Section 4.2 presents the cost-effectiveness approach and discusses the mitigation costs of combating climate change. Section 4.3 highlights key points from Chapter 4.

### 4.1 Cost-Benefit Approach

The question of *how much* we should reduce emissions is not only an environmental discussion but also an economic one. The environmental discussion is important because of the correlation between industrial activity, emissions, greenhouse gas concentration, temperature and impacts. It is evident that the mitigation cost of lowering the stabilisation level will increase at an increasing rate, while the benefits of lowering the stabilisation level will decrease at a decreasing rate. It is therefore important that economic considerations play a central role when deciding on the optimal level of stabilisation. Neither environmental nor economic arguments alone should be used to decide on the optimal level of effort against global warming.

The mitigation of greenhouse gas emissions has benefits on a global scale due to avoided damages. For any given level of mitigation there will be associated costs and avoided damages (benefits). The cost-benefit approach measures the cost of combating climate change and impacts of climate change (or avoided damages) in monetary values. Future cost and benefits are discounted to present time in order to compare all costs and benefits. In order to find the optimal level of stabilisation, the cost and benefits of different stabilisation levels should be compared. The optimal stabilisation level is identified by equalising the sum of the marginal mitigation costs and marginal adaptation costs with the marginal damages.

In theory, it is therefore possible to identify the optimum level of climate change. In practice this is a very complicated task. It is a huge step from theoretical insight to practical assessment, which must take account of uncertainties, the precautionary principle, the long time scale (and thus the choice of discount rate) and assessment of the value of avoided cost. Such calculations could provide useful insights into the size and scales of benefits and costs, but they could hardly serve as the basis for a government's implementation of specific climate agreements. The scientific community must provide the evidence on climate change including economic impacts. Based on descriptions and conclusions from relevant scenarios, the policy-makers must decide on the long-term stabilisation level.

In conclusion the cost-benefit approach is not sufficiently precise to provide guidance on the optimal level of mitigation. Even if it were, the optimal concentration based on today's calculation would differ from the optimal concentration based on future calculations. However, except with very low probability, it does suggest that some reduction of global emissions is warranted. Available estimates suggest that emission reductions beyond Kyoto are justified assuming global emissions trading.

#### **4.2 The cost-effectiveness approach**

An alternative to the cost-benefit approach is to adopt a cost-effectiveness approach. This approach seeks to minimise the costs of achieving a given target. The costs relate to both adaptation costs and mitigation costs. However, as knowledge on adaptation costs is limited, this Section will primarily discuss mitigation costs.

A cost-effective effort requires that the cheap options to reduce emissions are used. As all greenhouse gases contribute equally to global warming no matter where they are emitted, the place of mitigation is not important. Policies and measures with a low marginal abatement cost should thus be preferred rather than more expensive policies and measures. A cost-effective regime will thus lower the total cost of mitigation for any given level of stabilisation.

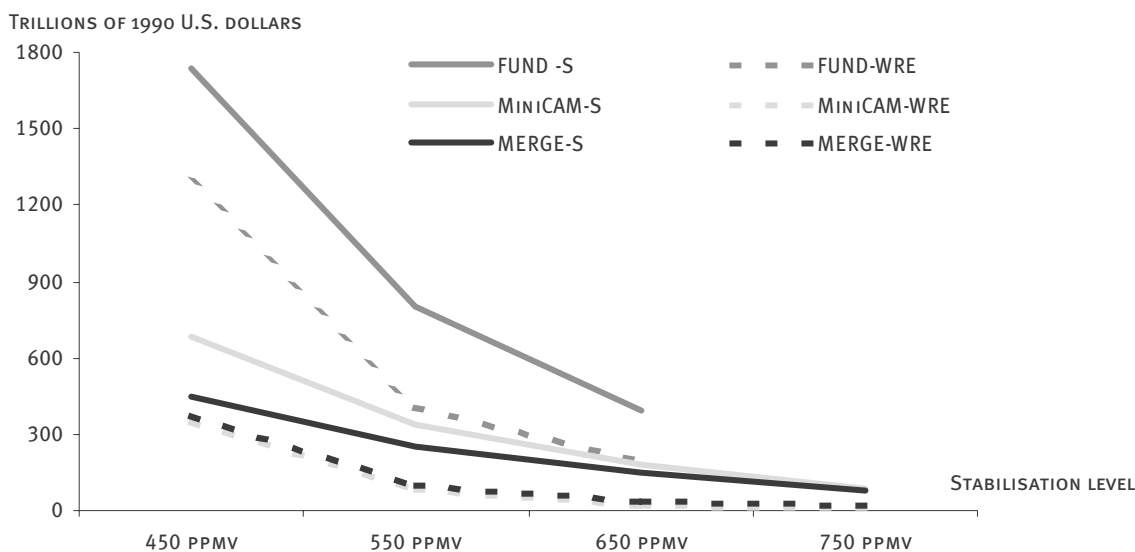
The mitigation costs will depend on

- The level of stabilisation of greenhouse gas concentration,
- What the emissions otherwise would have been,
- The emissions reduction path,
- The adoption of cost-effective policies and measures.

#### 4.2.1 Mitigation costs depend on stabilisation level

Both the mitigation cost, the adaptation cost and residual damages will depend largely upon the chosen level of stabilisation of greenhouse gas concentration in the atmosphere. The IPCC presents estimates of the mitigation cost from three global models, based on different model-dependent baselines (IPCC 2001b). Costs are calculated for four different stabilisation levels. The estimates are presented in Figure 4.1.

**Figure 4.1. What will it cost to stabilise CO<sub>2</sub> concentrations?**



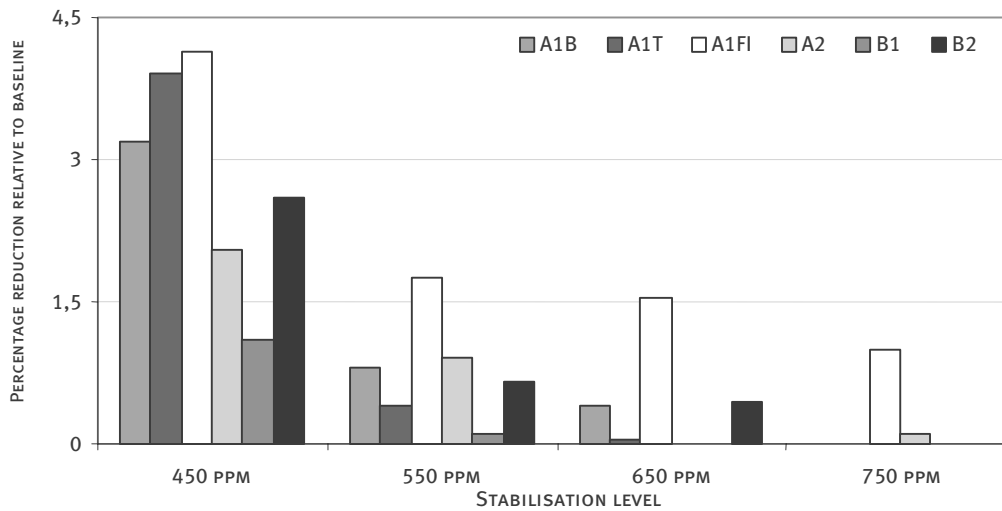
SOURCE: (IPCC 2001B).

There is a moderate increase in mitigation cost when the target is lowered from 750 ppm to 550 ppm. The cost increases even more if the stabilisation level is much lower. The cost of reducing emission to a stabilisation level of 450 ppm is estimated to US\$ 400 – 1800 trillions.

Stabilisation of greenhouse gas concentration at 450 ppm would reduce global GDP by 1-4 percent compared to the business-as-usual level in 2050 (IPCC 2001b).

#### 4.2.2 Mitigation costs depend on the business-as-usual emissions

The estimate depends primarily on basic assumptions about demographic and socio-economic development, and technological change. Figure 4.2 illustrates the difference in estimates of global GDP losses according to the six illustrative SRES scenarios.

**Figure 4.2: Global average GDP reduction in the year 2050.**

SOURCE: (IPCC 2001B).

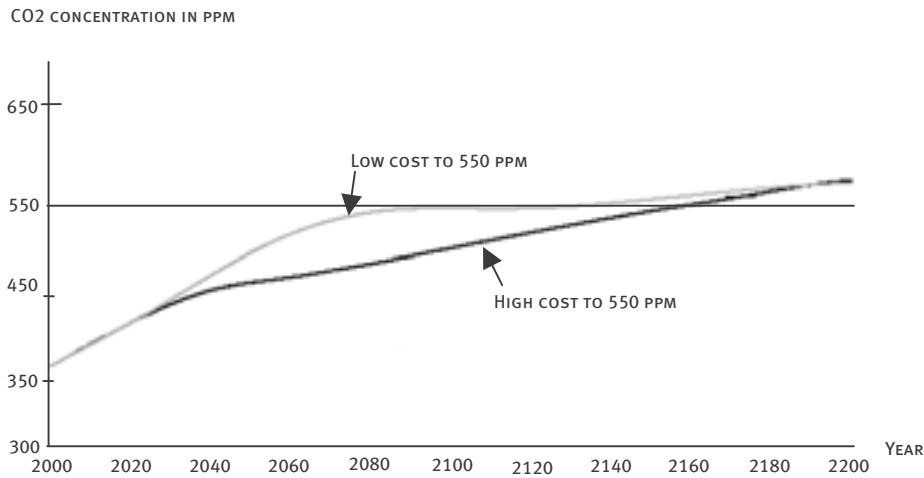
The figure shows that mitigation costs increase at an increasing rate when the level of greenhouse gas concentration is lowered. The figure also highlights the great uncertainties around mitigation cost. Different assumptions behind the six scenarios explain the differences in estimates (see also Appendix 1).

The higher the business-as-usual emissions, the more expensive it will become to reduce emissions to any given stabilisation level. High emission growth rates will increase the gap between projected emissions and the targeted stabilisation level. The total mitigation costs will thus increase the higher the business-as-usual emissions are projected to rise.

#### 4.2.3 Mitigation costs depend on emission path

Any given level of stabilisation can be achieved through different emission paths. There are environmental, social and economic implications from the different pathways. Should emission reductions be undertaken now or later, when technological change makes the costs lower? In this section the economic consequences are discussed.

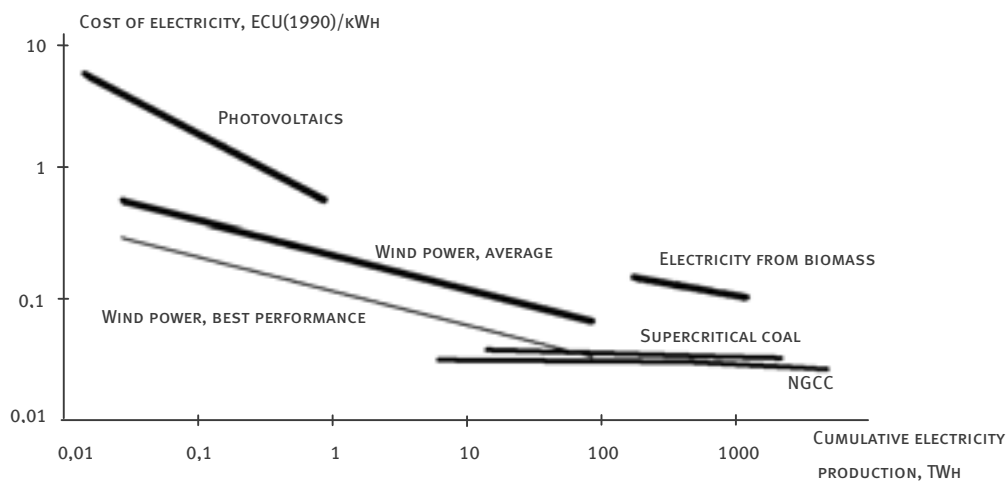
Figure 4.3 shows two emission paths towards a stabilisation level of 550 ppm. In the low-cost scenario, stabilisation is achieved via emission reductions after 2080. In the high-cost scenario, more drastic emission reductions are initiated more rapidly. The projections are based on the GREEN model (OECD 1999).

**Figure 4.3 Illustration of the costs of different emission pathways.**

SOURCE: THE GREEN MODEL, (OECD 1999).

The figure shows that early action in the GREEN model is associated with higher total cost, but it is a debatable whether total cost will actually decrease or increase as a consequence of early action. Some economists claim technological progress can be promoted via firm short-term commitments. Others believe that mitigation should be postponed until technological development has reduced mitigation cost. A delay in mitigation will provide more time to develop new technologies and to gradually replace existing energy infrastructure.

Technological change is the key to cheaper mitigation in the future. Experience curves can be used to analyse the trends in cost reduction of new technologies. The curves describe how unit costs decline with cumulative production. Empirical evidence from a range of technologies strongly indicates a price-experience relationship. The economic cost of reducing greenhouse gases will therefore decline as experience is accumulated over time. Figure 4.4 shows learning curves for electric technologies in Europe.

**Figure 4.4 Learning curves for electronic technologies.**

SOURCE: OECD/IEA, 2000.

The data indicate a steady, progressive decline in cost through cumulative production, which is an indicator of accumulated experience in the industries. For each of the technologies, an increase by a fixed percentage in cumulative production gives a consistent percentage decline in costs.

The crucial question is whether climate policy can affect this relationship? Climate policies can induce technological change through either “push” policies that boost development and innovation processes or through “pull” policies where direct regulations stimulate new technologies into the market (Goulder 2004). A “push” policy could rely on funding of R&D whereas “pull” policies could be based on carbon taxes.

Adopting push or pull policies induces technological change and lowers the cost of mitigation. Goulder (2004) concludes that neither an R&D policy alone (“push”) nor emission reduction targets alone (“pull”) yields the best result. A combination of the two is better. The implication for post Kyoto is that more stringent emission reduction targets will help stimulate innovation. The impact is particularly evident when policies are declared in advance. A second implication is that technology development could be an important part of a future regime.

It is important to note that technological change also will occur in the absence of these policies. The induced technological change is additional compared to business-as-usual technological change. Business-as-usual technological change and

induced technological change will increase the abatement effort. The emissions reduction path and its cost are thus interdependent due to technological change. The emission path towards stabilisation should be reviewed periodically in response to technological change and to drive further change.

The existence of induced technological change affects the overall timing of the climate policy. Model-conclusions differ with regard to the timing and use of pull- and push-policies (Ha-Duong et al. 1996; Wigley et al. 1996), but all models find that some abatement must begin early in order to jumpstart the critical process of technological change (Goulder 2004). The emission path towards stabilisation must include initial action to induce technological growth and thus minimise the total cost of mitigation.

#### *4.2.4 Mitigation costs depend on the use of cost-effective instruments*

Finally, mitigation costs depend on the use of cost-effective instruments. Equalising the marginal abatement costs across sectors and countries can reduce the total mitigation costs significantly. The marginal abatement cost is defined as the cost of reducing emissions with one additional unit.

A number of models have been used to calculate marginal abatement cost. Table 4.1 shows the results from these studies.

**Table 4.1 Marginal abatement costs, 1990 US\$/tC, 2010 Kyoto targets.**

MODEL	NO TRADING				ANNEX I TRADING	GLOBAL TRADING
	UNITED STATES	OECD-EUROPE	JAPAN	CANADA, AUSTRALIA & NEW ZEALAND		
ABARE-GTM	322	665	645	425	106	23
AIM	153	198	234	147	65	38
CETA	168				46	26
FUND					14	10
G-CUBED	76	227	97	157	53	20
GRAPE		204	304		70	44
MERGE3	264	218	500	250	135	86
MIT-EPPA	193	276	501	247	76	
MS-MRT	236	179	402	213	77	27
RICE	132	159	251	145	62	18
SGM	188	407	357	201	84	22
WORLDSCAN	85	20	122	46	20	5
ADMINISTRATION	154				43	18
EIA	251				110	57
POLES	136	135	195	131	53	18

SOURCE: (IPCC 2001B).

The models clearly differ on the estimates of the marginal abatement cost for a given region. The estimates of the US cost are, for instance, in the interval US\$76 to 322 pr ton carbon, while the estimate for European OECD countries is in the interval US\$20 to 665 pr ton carbon. This implies that the results should be interpreted with great caution.

The marginal abatement cost with Annex I trading is in the interval US\$14 to 135 pr ton carbon, while the estimate decreases to US\$10 to 86 pr ton carbon with global trading.<sup>9</sup> There is again disagreement on the size of the estimates.

<sup>9</sup> These estimates of marginal abatement costs could be compared to the estimates of marginal damage costs. Tol analysed 103 estimates of the marginal damage costs of carbon dioxide emissions from 28 published studies (Tol 2005). The uncertainty is strongly right-skewed, implying that negative surprises are more likely than positive surprises of the same size. The estimates vary considerably due to differences in scenarios, impacts estimates aggregation, discounting and differences in methods. The highest estimate is global benefits of US\$1.666 per ton carbon (equivalents) mitigated, while the lowest estimate is US\$ -7 per ton carbon. A substantial part of the marginal damage costs is due to impacts on developing countries. Tol concludes that, "One can therefore safely say that, for all practical purposes,

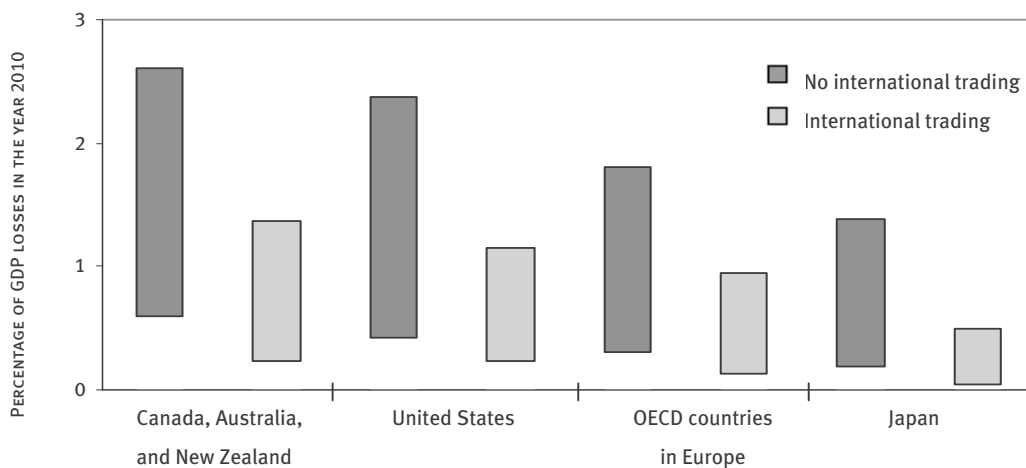


The fact that the marginal abatement cost for Annex I trading is lower than the marginal abatement costs for any of the four Annex I regions shown is due to the low marginal abatement costs in Russia and eastern Europe and at least partly due to the "hot air".<sup>10</sup> The fact that the marginal abatement cost for global trading is lower still reflects the impact of low cost Clean Development Mechanism projects.

Instead of comparing the estimates *across* the models it is possible to analyse the relationships between the estimates of marginal abatement cost *within* each of the models. This reveals that trading among Annex I countries will reduce the marginal abatement cost for the industrialised countries by 15.9 to 61.9 percent compared to the domestic marginal abatement cost (excluding the WorldScan model). Introducing global trading will decrease the marginal abatement cost by a further 10 to 30 percent (excluding the WorldScan model). Using averages from the 13 models produces the following result: industrialised countries can reduce 6 times more emissions with global trading compared with spending the money on domestic mitigation.

The reduction in the marginal abatement cost will lower the total abatement cost. Figure 4.5 illustrates the projections of GDP losses with and without emission trading.

**Figure 4.5 Projections of GDP losses with and without emission trading, 2010.**



SOURCE: (IPCC 2001B).

climate change impacts may be very uncertain but is unlikely that the marginal damage costs of carbon dioxide emissions exceed \$50/tC and are likely to be substantially smaller than that." (Tol 2005)

<sup>10</sup> Hot air refers to a situation where initial quota allocation exceeds a country's emissions. Substantial changes in political and economic systems since 1990 in for instance Russia implies that sales of AA units will exceed emission reductions because of active climate mitigation policies

Figure 4.5 clearly shows that international emission trading can lower the total mitigation cost. All the regions included will gain from emission trading.

Table 4.1 and Figure 4.5 suggest that the future climate regime should be based on a cost-effective approach. This will lower the marginal abatement cost and thus the total mitigation cost. The regime should thus offer opportunities for exploring the cheap mitigation options.

#### **4.3 Key points and implications from chapter 4**

Chapter 4 discusses the economic aspect of climate change. Much uncertainty still remains and more knowledge is required in order to achieve continuous improvement in the foundations of decision-making. Four key points and implications are highlighted:

- Cost-benefit analysis to determine the optimal concentration is not practical due to the uncertainties in the estimates, but the available estimates suggest that emission reductions beyond Kyoto are justified assuming global emissions trading.
- Cost-effective policies, such as international emissions trading, substantially reduce the cost of any agreed emissions path.
- The emissions reduction path and its cost are interdependent due to technological change. Thus the path should be reviewed periodically in response to technological change and to drive further change.
- Development of mitigation technology could be an important part of a future climate agreement.

Part II presents and evaluates the most common options suggested in the climate change literature. In combination the options create a climate change regime. The climate regime proposals in the literature are a combination of 14 options, which can be divided into four elements according to the four climate policy issues. All options are evaluated according to 9 policy evaluation criteria, which are defined in this part of the report. A summary of Part II is given below.

### **Chapter 5 – Evaluation criteria and trade-offs in climate policy**

The criteria are defined based on the science of climate change reviewed in Part I. In total 9 criteria are defined. Furthermore, the crosscutting issue of uncertainty is described in this chapter. There are uncertainties due to gaps in our knowledge of the processes of the environmental and socio-economic systems as well as the interlinkages between them and due to inherent complexity and variability in the systems themselves. Uncertainty can be used as an argument for or against action.

In the formulation of climate policy there are trade-offs between the aims of achieving environmental outcome, equity and economic efficiency. There are the traditional policy trade-offs between costs and environmental outcome and between equity (broad participation of countries that perceive a regime as being fair) and total greenhouse gas reductions. There are also trade-offs in the distribution of costs between present and future generations.

### **Chapter 6 – Presentation and evaluation of climate regime options**

Several regimes are proposed in the literature on climate change. Instead of evaluating all regimes, the regimes reduced to four issues that are common to all regime proposals. These issues concern stabilisation level, emission path towards stabilisation level, choice of commitment types and finally distribution of the burden. Specific options for action for each of these four issues vary across the regimes, but in essence the proposed regimes are a combination of 14 options. These options are described and evaluated against the criteria defined in Chapter 5. This analysis reveals that no options meet all of the criteria. Different options serve different purposes. Some options reach specific goals but compromise other important aims.

## 5 EVALUATION CRITERIA AND TRADE-OFFS IN CLIMATE POLICY

Part I of this report presented the three aspects of climate change policy. The three aspects are environmental outcome, equity and economic efficiency. Any climate change regime must build upon and include all three aspects in order to be a comprehensive, feasible and acceptable regime. Of course, there is still plenty of room for dispute among negotiating parties depending on the level at which the aspects are integrated in climate policy and how the aspects are balanced against each other. The most fundamental dispute arises from two issues: the mitigation level (by how much should we reduce greenhouse gases?) and burden sharing (who should pay the mitigation costs, who should pay the costs of adaptation, who should benefit from adaptation measures?).

In this chapter, nine policy evaluation criteria will be defined (Section 5.3) and the inherent trade-offs between them will be discussed (a presentation and evaluation of specific climate regime components is presented in Chapter 6)<sup>11</sup>. The criteria will be applied to evaluate to what extent the main options for each of the four climate regime components are consistent with the three aspects of climate change policy. Furthermore, a criterion relating to the crosscutting issue of scientific uncertainty stemming from the environmental and economic sciences will be defined<sup>12</sup>. The role of uncertainty is discussed in Section 5.2. That is, the criteria are defined in order to analyse how the regime options comply with environmental outcome, equity, economic efficiency and uncertainty from a theoretical perspective. Meeting the evaluation criteria increases the chance for broad participation. However, there are trade-offs between the criteria and the challenge is to balance the degree to which the criteria are met. Trade-offs between the aspects of climate change are discussed at the end of this chapter (Section 5.4).

Prior to the definition of the nine policy evaluation criteria and the discussion of uncertainty there will be a description of participation incentives (Section 5.1).

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<sup>11</sup> Several studies have evaluated climate regimes. See for instance (Aldy et al. 2003), (Höhne et al. 2003) and (Wicke 2005).

<sup>12</sup> There is another aspect of operational feasibility, which relates to the technical aspects, such as the complexity or simplicity of, for example, inventories of greenhouse gases and commitment types. Such issues are not dealt with in the report.

There is a link between participation incentives and the evaluation criteria in the sense that the general incentives for a country to participate in a global climate regime are essentially motivated by the three climate change aspects of environmental outcome, equity and economic efficiency. There may also be a number of external incentives for participating that have nothing to do with climate policy. For instance, Russian ratification of the Kyoto Protocol is seen by many observers as a consequence of the EU being friendlier towards Russia in the WTO negotiations. Other external incentives are debt relief and agricultural subsidy removal. Such informal incentives will not be dealt with in this chapter, but will be raised in the discussion at the end of the report. What will be raised are some general considerations on participation incentives, while the more specific participation incentives are discussed in Part IV of the report.

### **5.1 Participation and compliance incentives**

The effect of combating climate change is a public good. Access to a public good is non-excludable, meaning that nobody can be excluded from consuming it. All nations will therefore benefit when one country reduces emissions, although the costs of mitigation (or providing the public good) accrue only to the mitigating country. The public good nature of the climate change problem and the presence of individual nations with full national sovereignty mean that 'free rider' behaviour could undermine a global climate regime. Countries only have an incentive to undertake a mitigation effort up to the point where their own marginal benefit equals their marginal cost. The fact that global marginal benefits exceed every nation's own marginal benefits will not induce countries to undertake effort beyond their own optimal level of effort. This reluctance, or non-existing participation incentive, is strengthened by the fact that most of the adverse impacts of climate change mainly affect developing and low-emitting countries. The challenge of a climate change regime is therefore to deter free riding to the greatest possible extent by changing the focus on the national interest to include global environmental, equity and economic interests.

Climate change can also be viewed as a "tragedy of the commons" problem. Countries emit greenhouse gases without considering the negative impacts on the rest of the world. Again, there is a difference between the optimal national mitigation effort and the optimal global mitigation effort, as global damages from emissions are greater than national damages from emissions. This is the nature of interna-

tional environmental problems in general. An international agreement is thus a prerequisite for avoiding sub-optimal levels of mitigation.

Countries can engage in free rider behaviour through either non-participation or non-compliance. For instance, customary international law requires that countries comply with agreements to which they are parties, but any country can withdraw their signature. Or, countries can easily and legally avoid the need to comply simply by failing to participate. The available evidence suggests that non-compliance is common. Keohane (1995) concludes that compliance with multilateral environmental agreements is not very adequate.

There are several incentives for countries to participate. Kameyama (2003) suggest an incentive typology with three main types of incentives to participate in a multilateral climate regime, see Box 5.1. Furthermore, there are also political incentives with a moral aspect, which can be characterised as responsibility for natural and cultural values such as endemic species, unique ecosystems, and protection of vulnerable societies, e.g. the Maldives.

### **Box 5.1. General incentives for global participation**

#### **Environmental Incentives**

- A country may participate if it could avoid the adverse effects of climate change by entry into the regime.
- A country may participate if the adverse effects of climate change could be compensated by entry into the regime.
- Being a host of CDM projects may lead to the reduction of other pollutants such as sulphur.

#### **Political Incentives**

- A country may participate if it considers an agreement as “fair” or “relatively advantageous”.
- A country may participate in the regime if it considers taking a leadership role in tackling climate change to be beneficial.
- A country may participate in the regime if it gets external pressure to participate.

#### **Economic Incentives**

- A country may participate if it considers the agreement would lead to economic benefits such as technological innovation, reduction of costs due to energy efficiency, increase in the export of less carbon-intensive goods, etc.
- A country may participate if it could sell the emission permits at a high price. At the same time, a country may participate if it could buy emission permits at a low price.
- For developing countries: hosting CDM projects may lead to economic development, enhanced technology transfer and improved access to funding for implementing emission mitigation policies.

SOURCE: (KAMEYAMA 2003)

Essentially, these general incentives will shape national interests to a greater or lesser extent and by extension the expressed national positions presented in Chapter 7. The general incentives are to some extent integrated into the definition of the criteria below and therefore no separate evaluation criteria for participation incentives have been defined.

## 5.2 Scientific uncertainty

There is a crosscutting issue of scientific uncertainty, which stems from uncertainties in both environmental and economic science. The issue of environmental uncertainty in the impacts of climate change was briefly considered in Section 2.3 and valuation uncertainty was briefly addressed in Section 4.1. A more general discussion of scientific uncertainties in climate change research relating to policy flexibility in the presence of new information is given below.

Because considerable complexity (lack of knowledge) and scientific uncertainty characterise both climate and socio-economic systems, assessment of the costs and benefits of climate change policy is uncertain. In Table 5.1 various risks are shown according to the two types of uncertainty. Uncertainty in monetary valuation increases from left to right, and uncertainty in biophysical and socio-economic systems increases from top to bottom.

**Table 5.1 Risk matrix of increasing uncertainties in estimating the costs of inaction (benefits of avoided damages due to action).**

		<i>Increasing valuation uncertainty</i> ⇒		
		Market	Non Market	Socially Contingent
<i>Increasing impacts uncertainty</i>	Projection	Coastal protection Loss of dryland Energy (heating/cooling)	Heat stress Loss of wetland	Regional costs Investment
	Bounded risks	Agriculture Water Variability (drought, flood, storms)	Ecosystem change Biodiversity Loss of life Secondary social effects	Comparative advantage & market structures
	System change and surprise	As above, plus Significant loss of land and resources Non – marginal effects	Higher order social effects Regional collapse Irreversible losses	Regional collapse

SOURCE: (DOWNING & WATKISS 2004).

In the upper left-hand corner of the table risks (or impacts) are relatively certain and they can be valued relatively easily. Towards the bottom right-hand corner of the figure, impacts are more uncertain and costs become more difficult and uncertain to quantify.

All these levels of uncertainty force decision-makers to formulate policies with incomplete knowledge. This creates a risk of, on the one hand, premature or unnecessary actions that aggressively cut global greenhouse gas emissions, or, on the other hand, a risk of inaction that subsequently proves to be inefficient. The challenge for decision-makers is to compare and balance the risk of doing “too much” with the risk of doing “too little” (Aldy et al. 2003). In essence, the challenge is to balance environmental outcome, equity (between generations) and the economic costs and benefits of climate change. Adopting ambitious targets for environmental outcome will reduce the risk of severe climatic impacts, but abatement costs might prove to be too high compared to the benefits in terms of avoided impacts of climate change.

The climate change problem is characterised by uncertainty in estimating costs and benefits. Moreover, the problem is intertemporal in nature, and there is risk of irreversible impacts of increased greenhouse gas concentration (temperature change is irreversible over 100-300 years, and sea level rise over millennia, see Chapter 2). Furthermore, capital generally represents substantial investments that can only be scrapped before write-off at equal substantial costs. Changes in long-lived stock include, for instance, residential buildings (60-100 years) and electricity generators (50-70 years). These elements create the conditions for decision-makers to judge whether investments in greenhouse gas mitigation should fall now or later. This depends on the trade-off between the risk of under-investment and severe climate impacts on one side, and over-investment and climate change impacts to a substantially lesser degree on the other<sup>13</sup>.

Whether or not uncertainty compromises environmental outcome depends on which arguments for and against action in the presence of uncertainty carry the

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<sup>13</sup> The real option approach assesses the value of delayed investment decisions until more information is available. The real option approach takes into account that most investments are irreversible under uncertainty and stresses the option-like characteristics of the investment decision. In more plain terms the real option theory recognises that delay of investment decisions can be priced (Dixit & Pindyck 1994).



most weight. Uncertainty is used as an argument for both early action and inaction (Swedish EPA 2002). The arguments are illustrated with two examples in Box 5.2.

**Box 5.2 The role of uncertainty in mitigating climate change - Arguments for and against early action.**

Assume that the international community decides on a 550 ppm stabilisation target in year 2005. Broad and intensive investments in climate change are initiated.

*Argument for early action:*

In 25 years' time the international community decides to aim for a 450 ppm target due to new information on the adverse impacts of climate change. The costs of changing the target are definitely much lower because early action has already been implemented and an abrupt reduction in emissions is not needed.

*Argument against early action:*

In 25 years' time the international community realises that the concerns about climate change were overestimated and decides to aim for a 750 ppm target due to new information on the adverse impacts of climate change. Most of the costs of mitigating climate change over the last 25 years have been a waste of money.

Either of the two scenarios might prove to be the case in 25 years' time. For this reason a sequential decision-making approach that would facilitate the modification of climate change policies as new research increases the certainty of the assessment of costs (mitigation and adaptation measures) and benefits (avoided damage) of climate change (see also Section 6.2.1) is inevitable. Such new information is potentially of great value and flexible policies that allow for future refinements and adapt to new information have significant advantages over more rigid policies (Aldy et al. 2003). Sequential decision-making is therefore inevitable. The question is how to make efficient decisions in such a context given the potential irreversibilities associated with both climate change impacts and mitigation (and adaptation) investments. Efficient regimes can hardly be formulated with the knowledge available at present (see Section 8.2 for discussion).

The need to alter the emission target in the future is caused by the current lack of knowledge and the inherent uncertainty. The role of uncertainty under the UNFCCC is addressed in Article 3, Principle 3 (UNFCCC 1992, p. 9):

*“The Parties should take precautionary measures to anticipate, prevent or minimize the causes of climate change and mitigate its adverse effects. Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing such measures, ...”*

At first sight, the UNFCCC principle seems to be very concise on the issue of scientific uncertainty. However, there are different interpretations possible of the terms “threat” and “serious”. At what confidence level does a climate change impact become a threat and when is damage serious? These are relatively open questions, which will be addressed according to the political adoption of the precautionary principle<sup>14</sup>.

### **5.3 Evaluation criteria**

The policy evaluation criteria will be defined in this Section based on the background chapters on environmental outcome, equity and economic efficiency, and on the uncertainty aspect.

#### *5.3.1 Environmental criteria*

Basically only two considerations, which are the stabilisation level (safe level) and the rate of change per decade (speed) determine the environmental outcome of a climate regime. There is also a much more relaxed criterion on “moving in the right direction”. However, any climate regime would comply with this criterion – otherwise it would not qualify as a climate regime at all. Therefore, only two meaningful basic environmental criteria exist, which are related to stabilisation level and rate of change. Furthermore, there is a related criterion addressing emission reductions in developing countries. The environmental criteria are formulated as:

1. Is a long-term stabilisation target addressed?
2. Is a maximum rate of change addressed?
3. Are developing countries emissions being taken into account?

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<sup>14</sup> The last part of the quotation from UNFCCC, Principle 3, above, is more or less identical with the 15<sup>th</sup> Principle in the Rio Declaration (UNCED 1992), which says *“In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.”*

The first two criteria encompass the essentials of the environmental outcome of climate policy. No specific optimal stabilisation level or optimal rate of change will be defined here.

The third criterion addresses the fact that about half of global emissions are emitted in developing countries and that this share will grow rapidly over time. China, India and Brazil are already among the top 10 world annual emitters. Future emissions from the developing countries are projected to increase rapidly over time.

### 5.3.2 Equity criteria

Equity concerns are an important part of climate policy and much disagreement in international climate change negotiations arises from discussions on burden sharing. All options within the four components of climate change are therefore evaluated with respect to how well they relate to the equity aspect (see Chapter 6).

Three central equity evaluation criteria can be defined based on the UNFCCC Principles (Article 3.1 and 3.2) and the background description of the equity aspect. The criteria should thus include references to *“common but differentiated responsibilities and respective capabilities”*, and *“the specific needs and special circumstances of developing country Parties”* (UNFCCC 1992, p.9). The criteria include considerations on need, equal entitlements, responsibility, capacity, opportunity and comparability of effort. The agreement should be robust across competing equity claims (see also Ashton & Wang (2003)).

The three evaluation criteria for the equity part of the climate policy are:

4. Are the six equity principles being addressed? E.g. do developed countries continue to play a leadership role?
5. Do developing countries receive assistance for adaptation measures?
6. Are country-specific circumstances considered?

Continued leadership by the developed countries is a primary equity concern. The issue of continued leadership is firmly stated in the Convention and the developed countries have higher historic responsibility, higher per capita emission and better capacity to finance action. The richer developing countries should also take on commitments. Some developing countries will also have to take on commitments even though they have a low historic contribution to climate change, low per capita

emission and low ability to act. This will change over the coming years. Countries with high economic growth rates such as China, India and Brazil are already among the top 10 world annual emitters. If the commitments can be constructed so they do not impede economic growth, then new commitments for important developing countries will not necessarily violate equity concerns. Not all developing countries should necessarily be requested to take on commitments. Countries, particularly the poorest and least developed ones, should be able to meet basic needs before commitments are imposed.

Another important criterion is support and assistance to developing countries in terms of adaptation measures or funding. Climate change is already happening and the developing countries are especially vulnerable to these changes, and therefore the next climate regime should face up to managing unavoided impact. Adaptation should be given considerable attention (see also Müller (2002)). The developed countries have a responsibility to assist the poor countries to adapt to the consequences of global warming. Assistance from the developed nations could be a precondition for the developing countries to take on mitigation commitments.

The final equity criterion is the need to incorporate country-specific circumstances in the distribution of emission reductions and adaptation funds. Country-specific circumstances can be used to justify either a strengthening or a relaxing of commitments. Parties could resist participation if their specific circumstances are not taken into account.

### 5.3.3 *Economic criteria*

Based on the background description of the economic aspect, it is possible to highlight two basic economic evaluative criteria:

7. Is dynamic efficiency considered?
8. Is cost effectiveness across sectors and nations achieved?

A global climate regime that achieves maximum aggregate net benefits is said to be (dynamically) efficient (Aldy et al. 2003). Such an efficient regime complies with the dynamic efficiency criterion, which is by far the strictest criterion of the economic criteria. It is an attractive concept, but it has limited practical applicability. The reason is that the calculation of dynamic efficiency requires a considerable amount of information on both costs and benefits. That is, knowledge of future

climate change damages, future mitigation costs taking into account endogenous technological change, climate and economic irreversibilities, and the appropriate discount rate for very long time horizons. None of which is known fully. However, taking account of the uncertainties and knowledge gaps and by addressing the preconditions for the calculations in a transparent manner, it seems reasonable to analyse, whether the gains outweigh the losses of climate policy. Particularly important is a consideration on the emission path: assuming mitigation in the near future has the same impact on the ultimate goal of stabilisation as mitigation does now, then mitigation projects with the lowest (discounted) marginal abatement cost should be preferred, irrespective of whether the project is initiated now or later. Furthermore, the dynamic efficiency criterion provides the basis for discussion of the “optimal” climate regime, which frames the discussion in Chapter 8.

The presence of cost effectiveness in the agreement ensures that the cost of combating climate change is minimised for a given environmental objective, which may or may not be efficient (comply with the dynamic efficiency criterion). Static cost effectiveness implies that cheap mitigation projects should be preferred to more expensive projects. The aim is to equalise marginal abatement costs between sectors and countries.

#### *5.3.4 Flexibility criteria*

It is not the intention of this report to evaluate in any detail “extent of climate policy flexibility” or whether one regime is more flexible than another is. Checks will be made on whether the options for addressing the core negotiation issues implicitly or explicitly include considerations on policy flexibility in the presence of new information and whether these options allows for future refinements.

#### *5.3.5 Summary of criteria*

The nine criteria are presented in Box 5.3. From a strict theoretical perspective, all criteria must be met to achieve an optimal climate regime. However, a regime is not disqualified if not all criteria are met. An important point is that there is no such thing as an “optimal” regime for the time being. For instance, the Kyoto Protocol does not address stabilisation level (long-term target) and emission path (rate of change) after 2012. Furthermore, the Protocol is not (for obvious reasons) based on dynamic efficiency calculations, which implies that Kyoto should be characterised as a sub-optimal regime. Sub-optimal regimes will most likely be the rule rather than the exception for a long period of time into the future.

The term “optimal” is used throughout the report to emphasise the theoretical perspective of an ideal climate regime. Thoughts on the optimal regime will frame the discussion in Chapter 8.

### Box 5.3 The nine policy evaluation criteria

#### *Environmental criteria*

1. Is a long-term stabilisation target addressed?
2. Is a maximum rate of change addressed?
3. Are developing countries emissions being taken into account?

#### *Equity criteria*

4. Are the six equity principles being addressed? E.g. do developed countries continue to play a leadership role?
5. Do developing countries receive assistance for adaptation measures?
6. Are country-specific circumstances considered?

#### *Economic criteria*

7. Is dynamic efficiency considered?
8. Is cost effectiveness across sectors and nations achieved?

#### *Flexibility criterion*

9. Does the regime allow for flexibility in the presence of new information?

### 5.4 Trade-offs between the aspects of climate change

Each aspect presented in Part I of the report can be seen as an isolated entity with individual criteria for what shapes an optimal regime in terms of environmental outcome, equity and economic efficiency respectively. But none of the nine evaluation criteria can stand alone. A climate regime that gains broad acceptance must balance the different aspects and their aims. In the following section, various numbers of inherent and general trade-offs between environmental outcome, equity and economic efficiency are identified and discussed. The discussion starts by taking a utilitarian perspective on the climate change challenge, followed by a discussion of the major trade-offs.

Based on the general trade-offs presented in this chapter, a number of specific trade-offs between specific options for climate change regime components is identified and discussed in Chapter 6.

#### 5.4.1 *The ultimate criterion of dynamic efficiency*

According to utilitarian economic theory, a dynamically efficient climate change regime should secure full participation by all countries, with each and every country mitigating its emissions to the point where its own marginal abatement costs equal the sum of marginal benefits globally. In theory, this implies that the environmental outcome criteria become redundant<sup>15</sup>. The dynamic efficiency criterion and the cost-benefit analysis will deliver the socially optimal environmental outcome. The environmental outcome is not neglected in a cost benefit analysis. Environmental quality is simply one among other aspects that contribute to human welfare.

International climate negotiations show that there is much more interest in environmental outcomes (in terms of emission reductions) than in economic efficiency (Aldy et al. 2003). There are several examples of focus on environmental outcomes that do not explicitly consider the costs. Many EU-countries and the EU official position have pledged long-term stabilisation targets (centuries) and set aggressive medium-term targets (decades) as well as national reduction targets for the Kyoto period. For example, Denmark has a domestic target of a 21% cut in greenhouse gases in the period 2008-2012 compared to 1990 emissions<sup>16</sup>. The focus on environmental outcome is based on implicit considerations of the stabilisation level and a “safe level” of greenhouse gases in the atmosphere, which relate to the (politically) acceptable risk of human induced climate change. Safe level is mostly referred to by the terms ‘stabilisation level’ and ‘rate of change’.

It is reasonable to determine whether society as a whole is better off as a result of climate policy. The information in a comprehensive cost-benefit analysis is of great value in decisions on climate policy, but there are two fundamental questions, which are not addressed in a conventional cost-benefit analysis. First, the distribution of impacts as well as mitigation commitments (burden sharing) and second,

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<sup>15</sup> Traditional utilitarian economics fails to take into account the equity aspect. Ability-to-pay and polluter-pays principles of equity would probably exempt many developing countries from taking on mitigation commitments. The trade-offs between equity on the one side and economic efficiency and environmental on the other will be discussed below.

the level of acceptable risks. For this reason, most economists see the role of cost-benefit analysis as merely a tool to assist in decision-making.

The first aspect not covered by cost-benefit analysis and the dynamic efficiency criterion is the distribution of the costs and benefits of mitigation. Equity issues are considered to be a political problem outside economic analysis<sup>17</sup>, but the constraint of sovereignty probably makes the dynamic efficient climate regime out of reach.

Second, scientific uncertainty is not treated sufficiently in a cost-benefit analysis according to some views. Risk should not be dealt with from a utilitarian perspective only, but should be managed in line with investment theory and/or the precautionary principle (see Section 5.2 for more details).

#### 5.4.2 *Major trade-offs*

The trade-offs between the three aspects are listed below and discussed.

1. The trade-off between total economic costs and environmental outcome.
2. The trade-off between equity and environmental outcome.
3. The trade-off between economic costs and equity, between future and current generations.

Equity refers to three issues. First, the equity (burden-sharing) principles defined in the report. Second, the sharing of the burden of impacts. And third, the overall sense among all countries that the regime is so fair that most – if not all – countries will participate and thus take on mitigation commitments and thereby achieve full participation.

#### **The trade-off between economic costs and environmental outcome**

The trade-off between environmental outcome and economic costs is the classic trade-off seen for environmental problems in general. Environmental outcomes as well as economic costs will increase with increasing cuts in greenhouse gas emissions. This effect is strengthened by the fact that marginal mitigation costs increase as environmental marginal damages decrease.

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<sup>16</sup> National positions on environmental outcome are described in Chapter 7.



If commitments are too heavy, some countries will not take part in an international agreement, due to concerns about their economic growth. Therefore possible agreements must fit between two opposing alternatives. One alternative is a “broad-but-shallow” agreement where countries participate with modest reduction commitments and the second alternative is a “narrow-but-deep” agreement where a few countries participate with substantial per-party mitigation. A “broad-but-shallow” regime is more likely to satisfy the dynamic efficiency criterion, because emission leakage (explained below) is avoided to a greater extent, and because marginal emission costs increase steeply (Aldy et al. 2003).

International emission trading (the three Kyoto mechanisms or their equivalent) reduce the scope of the trade-off, because the cost of achieving a given target significantly lowered and so facilitates broader participation. It also means that countries become responsible for a share of the overall mitigation cost rather than implementing the emission reductions domestically, so countries with high domestic marginal abatement costs can agree to more stringent commitments.

The economic costs and the environmental outcome are related through technological change. Technological change (and hence marginal abatement cost) will be affected by the emission path (and investments in research and development) and, in turn, will affect the cost effective future emission path. Therefore some view the trade-off between environmental outcome and economic costs as being unclear, particular in the longer run. This is also known as the Porter hypothesis (Porter 1996; Porter & Lind 1995). It is argued that greenhouse gas mitigation to some degree should be seen as an opportunity for growth and not an impediment to it. That is, there is no clear (or deep) trade-off between the costs of greenhouse gas mitigation and environmental outcome. The argument goes that investment in more efficient technologies will improve global welfare irrespective of the environmental benefits obtained. Ideally, technological change is so large that emissions decline and economic growth increases.

The trade-off between environmental outcome and economic cost is explicitly addressed in the Convention. The concern is stated as follows in the Convention’s chapeau “... responses to climate change should be co-ordinated with social and

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<sup>17</sup> There is no consensus on how to use weighting to incorporate distributional considerations into determinations of efficiency.

*economic development in an integrated manner with a view to avoiding adverse impacts on the latter...*”(UNFCCC 1992). Heavy commitments imposed on countries could thus discourage participation for economic reasons. This is especially true for the developing countries, but developed nations are also aware of the economic burden and the economic impact on development.

### **The trade-off between equity and environmental outcome**

The trade-off goes like this. An agreement must have a large number of participants to minimise leakage, which affects the environmental outcome negatively. The prerequisite for a large number of participants is that the regime is perceived equitable. However, a regime that is considered equal and fair by all parties might be watered down to very low mitigation commitments. The trade-off is elaborated below and emission leakage is described.

From an environmental point of view, the geographical location of emission reductions is irrelevant. From a social point of view, the location of the mitigation might not be irrelevant. According to the polluter-pays-principle, developing countries could claim that developed countries should “put their own house in order” before paying for mitigation projects (or “picking the low-hanging fruits”) in the developing countries. Following this argument, the developing countries will only take on commitments if developed countries impose national mitigation targets. However, the US and other developed countries may not allow developing country participation exclusively through the CDM mechanism in the next period of climate change mitigation. That is, a regime that is considered equal and fair by all parties might be “broad-but-shallow”. Such a regime may very well be diluted to next to no mitigation and thereby compromise environmental outcome.

A regime that does not gain support from all countries, because of deep greenhouse gas cuts (a “narrow-but-deep” regime), may simply redistribute part of the emissions rather than reduce global emissions. This is called “emission leakage”, which is defined as the increase in emissions in non-abating countries as a result of reduction policies in abating countries divided by the reduction of emissions in abating countries (Sijm et al. 2004). Measurement of emission leakage is rather problematic, because it is difficult to decompose the increase in non-abating countries into increases that are (i) a result of abatement policies in abating countries, and (ii) increases that are a result of other driving forces. Sijm et al. (2004) identify four distinct channels of emission leakage, which are described in box 5.4.

### Box 5.4 The four channels of emission leakage

In the literature, a number of distinct mechanisms or channels of carbon leakage have been identified, including:

*1. International trade in energy goods.* Carbon reduction policies in a large region may well have a significant negative effect on the world demand for carbon-rich fossil fuels, causing a possible fall in their world market prices. Falling prices could increase the demand for carbon-rich fuels in the rest of the world, thus increasing foreign CO<sub>2</sub> emissions and enlarging carbon leakage.

*2. International trade in other goods and services.* Carbon reduction policies may increase the production costs of carbon-intensive industries in abating countries and may therefore increase the selling prices of their goods. The demand for these goods may shift to relatively cheaper sources in non-abating countries whose costs have not been affected by carbon reduction policies. Hence, comparative advantage would shift to industries in non-abating countries and this would affect production and trade. All else equal, this would increase CO<sub>2</sub> emissions in these non-abating countries.

*3. International trade in factors of production.* Carbon reduction policies can reduce the productivity of factors that are employed in the production of fossil fuels or energy-intensive commodities. This may lead to an international reallocation of such factors to countries without such policies. In the political arena, the effect of climate and energy policies on international capital reallocation is the channel that is most discussed and feared.

*4. International interaction among government policies.* Carbon reduction policies in a certain Annex I country may affect the income levels and cost/benefit balances of climate policies in other (non-Annex I) countries, thereby leading to a response of these policies and, hence, to a change in the levels of CO<sub>2</sub> emissions by these countries. This change may be either positive or negative, implying that the carbon leakage due to the initial carbon reduction policies may also be either positive or negative.

SOURCE: (SIJM ET AL. 2004, P. 13).

That is, a “narrow-but-deep” regime may not turn out to be that deep at all, when seen in a global perspective, because emission leakage is offsetting global reductions. Such a regime might rather be characterised as a “narrow-and-shallow” regime.

There seems to be agreement that the first channel (International trade in energy goods) is quantitatively the most important channel in the short to medium term (Sijm et al. 2004).

### **The trade-off between economic costs and equity**

The typical policy trade-off between economic cost and equity also characterises the climate change problem. Equity and costs issues relate to both equity and costs sharing between current generations (intragenerational equity) and between the present and future generations (intergenerational equity). Intragenerational equity is related to both dynamic efficiency and cost-effectiveness, while intergenerational equity relates to achievement of the most efficient emission path. In essence, equity and efficiency cannot be separated because the number of participating countries affects the compliance cost each bears and the compliance cost affect the number of participating countries (Carraro 2000).

An efficient and cost-effective regime requires participation by all countries, including developing countries, while ability-to-pay and polluter-pays principles of equity would probably exempt many developing countries from taking on mitigation commitments. This conflict can be addressed by loosening commitment levels, which will affect environmental outcome negatively.

The achievement of cost effectiveness requires that all countries participate (and take part in emission trading) in order to ensure that reductions take place where the marginal abatement costs are lowest. A regime therefore needs to be considered fair by all countries in order to achieve cost-effectiveness. But the criteria on cost effectiveness cannot stand alone. Ideally, dynamic efficiency should also be considered. But since the optimal level of abatement cannot be estimated with the present level of knowledge, it is inevitable that the initial efforts will not be optimal. Achieving those (inefficient) reductions cost effectively uses fewer resources than implementing the reductions in a non-cost-effective manner. Achieving cost effectiveness is therefore important whether the environmental outcome is either too low or too high and thus inefficient.

Equity should also be addressed between present and future generations. The present (and earlier) generations are responsible for damage that harms future generations. Invoking the responsibility aspect would imply mitigation effort on the part of the present generation.<sup>18</sup> However, Schelling highlights the trade-off between reducing the damage for the future (rich) generation at the expense of the

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<sup>18</sup> Another key factor with regard to how much mitigation one is willing to do is the threat of impact liability.

present (poor) generation (Schelling 1998)<sup>19</sup>. Helping the future generation, which is presumed to be materially better off than current generations, means that fewer resources are available for helping poor people in the present generation. Schelling (1998) thus draws on the need and capacity aspects in his argument. A fundamental methodological problem is that explicit markets for intergenerational trade-offs do not exist (the preferences of the future generations are not known and no appropriate discount rate for long time horizons is agreed upon).

In summary, three core trade-offs have been considered. The discussion shows that climate policy negotiations will involve balancing of the three aspects. The nine evaluation criteria – which originate in the three aspects and result from the presence of uncertainty - should function as important guiding principles, but it is most unlikely that all the criteria will be fully met.

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<sup>19</sup> Schelling's theory does not work in the presence of catastrophic events.



## 6 PRESENTATION AND EVALUATION OF FUTURE ARCHITECTURES

In this report the formulation of climate policy is compared with the planning of a journey. 189 countries will decide over the next few years how the journey beyond 2012 should be designed. The core climate policy issues concerns the level of greenhouse gases stabilisation, choice of emission path towards stabilisation, choice of commitment types (including both mitigation and adaptation measures) and the distribution of the burden. The Parties will thus have to address the following questions:

**Box 6.1 The core questions in the formulation of climate policy explored in terms of the journey metaphor described in the text.**

- How far should we go?
- How fast should we go?
- How should we move forward?
- How should the burden be divided?

The first question relates to the ultimate goal of climate policy, which is the long-term stabilisation level. The UNFCCC provides guidelines for the goal of the journey, but the Parties will have to translate the UNFCCC objective into a more specific aim. The Parties have agreed on the direction in which we need to travel (reduce global emissions to the level of natural removals in order to stabilise atmospheric concentrations) but we do not know how far (the ultimate concentration and hence cumulative emissions budget between now and then). The second question relates to which emission path should be followed to reach the long-term stabilisation level. The Parties will have to discuss the speed of the journey.

The third question addresses what in this report is called the ‘commitment types’ of a climate regime. In terms of the metaphorical journey the Parties must decide on the means of transport.

The fourth question relates to burden sharing. Is it possible that some countries walk slowly while others run? The Parties must decide on who should carry the burden.

This Chapter focuses on these questions and provides a range of possible options. Section 6.1 provides an overview of the basic components of future climate policy. It is argued that the climate regimes proposed in the climate change literature can be reduced to four elements. The categorisation into these four elements provides the reasoning behind the formulation of the four basic questions presented in Box 6.1, above. In the next three sections the basic settings, commitment types and burden-sharing principles respectively are described and evaluated. The main options are described in more detail and evaluated against the criteria listed in Chapter 5. The six burden-sharing schemes are assessed according to the six equity principles discussed in Part I in order to analyse to what extent the burden-sharing schemes are robust across the various equity principles.

### **6.1 The elements of a climate regime**

Parties have been discussing major issues as well as details for more than a decade and the negotiations on a coming regime will probably be the most complex so far. The wide room for interpretation of the UNFCCC principles and objectives leaves a blurry and confusing picture of the climate policy negotiations, but the discussions can actually be simplified into a few topics, see for instance Baumert & Kete (2002), Bodansky (2003) and Torvanger et al. (2004).

Even though there are many proposals on how to construct the next protocol it can be argued that the proposals are based on a few building blocks, which will be referred to here as the elements of a climate regime. In Bodansky (2004) a total of 44 approaches to international climate effort beyond 2012 are described. All regimes can be characterised by the following four elements: stabilisation level, emission path, type of commitment and burden sharing. Some regimes address only a few topics while others are more comprehensive. Some proposals are very comprehensive and advocate specific options for several of the components. Some of the proposals therefore include positions on stabilisation level, timing, commitment types and burden sharing. Other proposals focus on only one of the components and advocate one of the available options.

For these reasons the evaluation of climate regimes is achieved by evaluating the options within each of the four elements. Table 6.1 presents the climate policy issues as well as possible options for each of the climate policy issues.



**Table 6.1 Four main elements in the climate policy architecture.**

ELEMENTS OF ARCHITECTURE	OPTIONS	SECTION OF REPORT
STABILISATION LEVEL <i>- HOW FAR SHOULD WE GO?</i>	LONG TERM GOAL, HEDGING STRATEGY, STEP BY STEP reductions.	6.2
EMISSION PATH <i>- HOW FAST SHOULD WE GO?</i>	EARLY AGGRESSIVE ACTION EARLY MODERATE ACTION POSTPONING ACTION	6.3
COMMITMENT TYPES <i>- HOW SHOULD WE MOVE FORWARD?</i>	EMISSION TARGETS POLICIES AND MEASURES ADAPTATION	6.4
BURDEN-SHARING SCHEMES <i>- HOW SHOULD THE BURDEN BE DIVIDED?</i>	BRAZILIAN PROPOSAL CONTRACTION AND CONVERGENCE ABILITY TO PAY MULTISTAGE APPROACH TRIPTYCH APPROACH EQUAL MITIGATION COST	6.5

There are four primary elements in climate policy architecture. Each of these components needs to be confronted by the policy makers of a new agreement. For each component there is a range of options, listed in the second column of Table 6.1.

The discussions on stabilisation level and emission path are presented and evaluated in Section 6.2 and 6.3. The parties to the Convention will have to agree to these basic decisions in their common climate policy. If the parties have completely different views on the ultimate stabilisation level and/or the emission path towards the stabilisation level, the parties are also likely to disagree on the relevant commitment types.

The next step of the agreement concerns commitment types and burden sharing. Commitments can be constructed in several ways. The central issue is whether emission targets should again be at the centre of the commitment and whether some binding policies and measures should be defined for groups of countries. Burden sharing can likewise be constructed in different ways. Central principles are the polluter pays principle, responsibility, equal entitlements and the ability to pay.

Commitment types are presented and evaluated in Section 6.4, while Section 6.5 presents and evaluates burden-sharing schemes.

## 6.2 Stabilisation level

How far should we go?<sup>20</sup> Article 2 of the UNFCCC states that *“The ultimate objective...is to achieve...stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.”* (UNFCCC 1992). The Parties will thus have to define what stabilisation level is associated with dangerous interference.

Höhne et al. (2005) argue that there are three ways to handle the issue of stabilisation level. The Parties could agree on

- Long term goal,
- Hedging strategy,
- Step-by-step reductions.

With a long-term goal the Parties agree to a specific ultimate objective. This could be formulated in terms of annual emissions, greenhouse gas concentration, maximum temperature increase or impacts. The advantages and disadvantages of having a long-term target are listed in Box 6.2. It will be argued in Chapter 7 that it is unlikely that the Parties can agree to a specific long-term goal.

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<sup>20</sup> Some may ask: “Why should we go? There are many journeys to be made, so why should we join this one?” They ask why combating climate change is relevant, when there are other important problems such as HIV/AIDS, hunger, lack of clean water and sanitation and the threat of terrorism. This report will not deal with this discussion. We assume that the Parties have agreed to move forward and this report clarifies the conflicts and options in this discussion. Given current scientific evidence of climate change and the political will, mainly from the European Union, it is likely that Kyoto will be followed by some international agreement on climate policy.

### Box 6.2 Arguments for and against a long-term target

The rationales put forward by advocates of an internationally agreed long-term target are (Pershing & Tudela 2003):

- Providing a concrete goal for current and future climate efforts. When starting a journey it makes sense to know where you are going.
- Increasing awareness of the long-term consequences of our actions.
- Limiting future risks derived from climate change: might ensure that specific undesirable outcomes will not occur.
- Calibrating short-term measures and measuring progress: being on track can only be determined if the final destination is known.
- Inducing technological change: markets will be given a clear signal, which could favour investment in technologies that are developed over decades.
- Mobilising society including the private sector, individuals and NGOs.
- Promoting global participation: atmospheric concentrations cannot be stabilised without global action.

Despite these strong rationales for a long-term target, there are a number of technical and political obstacles:

- Lack of knowledge at all levels. Could imply aiming for the incorrect target.
- Implicitly an exercise in defining acceptable risk/change, which differs extremely among countries.
- Explicitly an exercise in differentiating commitments (allocating rights and obligations) over the long term.

Another alternative is to adopt a hedging strategy. This implies setting a short-term goal from where it would still be possible to achieve a range of desirable long-term targets. This approach acknowledges that the ultimate goal could be a moving target that should be redefined when new scientific knowledge is uncovered. More and better information would be used to adjust and specify a new target.

The final approach is to adopt reductions step by step. The Kyoto Protocol is meant as a first step in such a step-by-step process. The agreement is composed of emission reductions proposed by each of the Parties. Each country's stated willingness to reduce provides the input to the negotiations. This approach runs the risk of missing out on some long-term targets, which become unattainable or at least very expensive to fulfil.

The three options for dealing with the stabilisation level can be evaluated from an environmental, equity and economic aspect. The environmental perspective of the stabilisation level refers to the outcome of the specific option. Is it possible to achieve the optimal environmental outcome with any of these approaches? The equity perspective on the stabilisation level concerns the ‘unfair’ distribution of damages from climate change and the responsibilities for global warming. The industrialised countries have the primary responsibility for current global warming (see also Chapter 3). At the same time the damaging impacts from climate change are concentrated in the developing countries. The economic perspective on the three options refers to the economic consequences, e.g. what mitigation costs are associated with different stabilisation levels? Table 6.2 shows the consequences for the three aspects.

**Table 6.2 The environmental, equity and economic implications of different stabilisation strategies.**

Option	Implication for stabilisation level	Environmental, equity and economic consequences
Long term goal	Aims for one specific stabilisation level	Environmental, equity and economic outcome depends on whether the long-term goal is equal to the optimal target. It is extremely unlikely that with today's knowledge negotiators would adopt the optimal concentration target. The target would need to be revised, as new knowledge became available. Could mobilise early action and R&D and thus decrease long-term economic costs.
Hedging strategy	Keeps the choices for a range of stabilisation levels open	We do not have the probability distributions for key variables over the long-term future to calculate an efficient hedging strategy. Could ensure the most favourable environmental and equity outcome. Lack of clear target could weaken the motivation for technological change.
Step-by-step reductions	Limits the range of achievable stabilisation levels	If the initial steps are too small, then at some point it could be too late to achieve a certain environmental outcome. There would be high economic cost of achieving stabilisation at last minute. If the initial steps are too large, economic resources are wasted. Lack of target could harm the motivation for technological change.

Table 6.2 reveals that the three options have different environmental, equity and economic implications. None of the options fares well on all three aspects.

A long-term target brings the environmental outcome to the top of the agenda by emphasising the need for a well-defined environmental outcome, while in the step-by-step process targets will be created in a political process where mitigation costs and burden sharing will strongly determine agreed mitigation commitments. A hedging strategy is a more balanced approach, in which environmental, economic and equity concerns are all taken on board. However, lack of probability distributions for key variables over the long-term future could make the hedging strategy similar to the step-by-step strategy in practice.

### **6.3 Emission path**

How fast should we move forward? Should emissions be reduced evenly over the period or should we emphasise early or delayed action? Article 2 in the Convention addresses the issue of emission path: “Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change...”

Choosing between emission paths implies a fundamental choice of timing of effort. There are, in principle, an infinite number of emission paths towards a specific stabilisation level. These could broadly speaking be reduced to three basic categories of timing of effort:

- Aggressive action
- Early moderate action
- Postponing action

Aggressive action would imply tough commitments in the near future, while postponed action would delay effort for any given stabilisation level. The three emission paths can be evaluated according to environmental, equity and economic consequences. The implications for environmental outcome and equity and the economic costs of the different emission paths are discussed in Part I. Table 6.3 present an evaluation of choosing aggressive action versus postponing action.

**Table 6.3 Environmental, equity and economic implications of different emission paths.**

	Aggressive or postponed action for a given stabilisation level
Environmental aspect	Postponing effort is likely to result in a more rapid increase in temperature initially. This will, for instance, affect the possibilities of adaptation for plant and animal species.
Equity aspect	Postponing effort would shift the economic burden of mitigation to future generations. Mitigation now would, on the other hand, put pressure on the current generation's ability to help poor parts of the world at the expense of helping future (richer) generations.
Economic aspect	Mitigation costs depend to a large extent on the available technology. Neither initial emission targets nor R&D effort can alone ensure effective technological change. Cost-efficient mitigation is achieved when both technology-push and technology-pull policies are employed.

Table 6.3 shows the effects of the choice of emissions path on the three aspects. The important difference between moving fast initially or moving faster later concerns temperature increase, who will shoulder the economic burden and to what extent new technology can be forced forward.

The timing of effort in the first commitment period of Kyoto has been criticised as being “too little, too fast” (Aldy et al. 2003). This reflects the concern that the commitments are insufficient to have much effect on the climate change problem, but excessively ambitious in the short term. The costs are high and the environmental outcome is modest. Better timing would imply moderate commitments in the short term and much more stringent commitments in the long run (Aldy et al. 2003).

#### 6.4 Commitment types

When the policy-makers have decided on the basic setting, they know the goal of the journey and their speed of travel. They then have to decide on the means of moving forward and how the burden should be divided. This section explores the options for moving forward. Table 6.4 presents an overview of the commitment types and a number of more specific options within each of the three main types. A country's commitment can be composed of a mix of the options.

**Table 6.4 Overview of commitment types.**

Commitment type	Option
Quantified emission commitments <i>(see section 6.4.1)</i>	Absolute emission targets Flexible emission targets
Policies and measures <i>(see section 6.4.2)</i>	Co-ordinated policies and measures
Adaptation measures <i>(see section 6.4.3)</i>	Anticipatory of expected changes Damage repair, restoration and compensation Enhancement of adaptive capacity

There are basically two (non-exclusive) ways to commit to mitigation: countries can take on quantified emission targets and/or commit to certain policies and measures. The third main commitment type relates to adaptation measures.

The emission targets can be designed in several ways. Section 6.4.1 presents a range of emission targets. The most important issue is whether there are absolute emission targets or flexible emission targets.

Different policies and measures could be adopted to comply with the emission target. These instruments do not need to be determined in a global setting. Each country can thus engage in the most cost-effective activities. The policies and measures can be viewed as means to reach the emission target.

Policies and measures can also be defined as a target. In that case countries commit to implementing certain types of policies and measures. Section 6.4.2 presents possible policies and measures.

Adaptation measures could also be viewed as part of an international commitment. The developed countries could, for instance, commit themselves to contribute to adaptation funds, while the developing countries can commit to mainstreaming adaptation into their sustainable development strategies. Section 6.4.3 presents different adaptation measures.

In Section 6.4.4, all the commitment types presented are evaluated. Before the presentation and evaluation of commitment types, different ways of defining the legal status of commitments are presented. For any kind of commitments the legal

aspect/status must be defined. Commitments can be defined legally as non-binding, one-way, binding and enforceable (see Box 6.3).

### Box 6.3: Types of legal commitments

#### *Non-binding commitments*

This is an aim rather than a legal requirement. It is therefore somewhat misleading to use the term commitment. The UNFCCC emission target is non-binding (4.2a, b), which is why many countries signing the Convention did not reduce emissions to 1990 levels in the year 2000.

#### *One-way commitments*

This is an extension of non-binding commitments, where a country can sell surplus emissions to other countries if it reduced more than its non-binding target. Baselines established in CDM projects are an example of such a “commitment”. It can also be applied nation-wide.

#### *Legally Binding Commitments*

If a country accepts a binding target it must comply with the commitment. The reporting requirements in the UNFCCC and the targets and timetables in the Kyoto Protocol are of legally binding nature. Even legally binding commitments depend on the good faith of the Party.

#### *Enforceable commitments*

Enforceable commitments are stronger than legally binding commitments. They can be subject to a compliance system establishing a procedure including consequences for non-compliance.

A stronger legal commitment would provide greater assurance of compliance but might discourage parties from undertaking mitigation commitments. There is a trade-off between broad participation and enforceable commitments providing increased certainty on emission reductions. Consequently, non-binding commitments for developing countries might be a better choice, because global emission reductions may be higher compared with binding targets, which might discourage parties from ratifying a post-Kyoto protocol. However, it could also be argued that there are only minor differences between legally binding and non-binding targets in the international context. This is true, if Parties are very unlikely to enter any kind of target regime if they are uncertain about whether they can comply, or if they think it is unfair.



#### 6.4.1 *Emission targets*

There are two basic types of emission target: absolute emission targets and flexible emission targets.

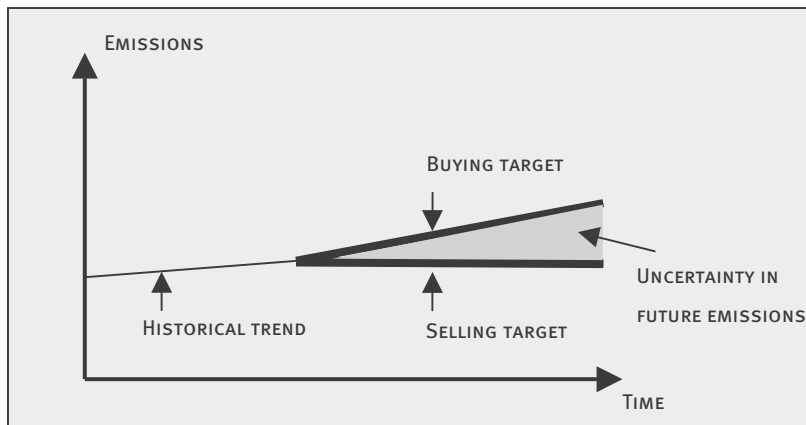
Absolute emission ceilings are emission targets fixed at national level relating emissions to a base-year. This is the basic commitment principle in the Kyoto regime, which requires ratifying countries to achieve fixed levels of reductions in emissions in the commitment period 2008-2012 relative to 1990-emission levels. The major advantage of quantified emission targets is that the emission reductions are known. On the other hand there is no certainty as to the costs of achieving the commitment.

Flexible emission targets are an alternative to absolute emission targets. Flexible targets address the cost-uncertainty disadvantage of absolute targets. The increased certainty of costs is traded against an increase in uncertainty in the environmental outcome. Examples of flexible targets are fixed targets with a different baseline, indexed targets (including intensity targets and performance targets), no-lose targets, dual intensity targets, conditional targets, sectoral targets, safety valve and long-term cumulative targets (see also Bodansky (2004)). The following sections briefly explain dual-intensity targets and the safety valve approach.

##### *Dual-Intensity targets*

The dual-intensity target regime involves two national targets with differing legal positions: one binding target, the other non-binding (Yong-Gun & Baumert 2002). The binding target would permit a relatively high level of emissions in order to avoid the risk of constraining economic growth. On the other hand the non-binding target would be based on a more stringent level.

The binding target acts as a “buying target”. If the country cannot comply with the less stringent limit, it is obliged to buy permits in the market. The non-binding target can be considered as a “selling target”. The non-binding target serves as an extra incentive to reduce emissions below limit as emission reductions below target can be sold on the market. The non-binding target is set more stringently than the binding target in order to avoid hot air. The dual-intensity target regime is illustrated in figure 6.1 below.

**Figure 6.1 Dual-intensity targets.**

The advantage of the system is that it provides a framework to handle the uncertainty of the projected emissions. The Dual-Intensity target is thus a low-risk strategy to enable developing countries to participate fully in climate policy. The system provides incentives for mitigation, like the absolute cap regime, but the concerns of hot air - which impair the environmental outcome - are dealt with.

#### *The safety valve approach*

The safety valve approach is way of deviating from the pure emission cap system (Pizer 1999). The safety valve is therefore an addition to the emission trading system whereby an international authority offers to sell an unlimited amount of permits at a predetermined price. The approach is illustrated in figure 6.2.

**Figure 6.2 The safety valve approach.**

The safety valve approach provides security for the total cost of mitigation, as a ceiling on the permit price of carbon is introduced. If the permit price exceeds the

safety valve threshold, then permits will be offered at the safety valve price. The extra supply of permits will reduce the environmental impact of the system.

#### 6.4.2 *Policies and measures*

Policies and measures can be included in the next protocol in two ways:

- Instrument-based policies and measures
- Co-ordinated policies and measures

Policies and measures can be perceived as an instrument, employed in order to comply with an emission target commitment. Commitments on policies and measures can also be perceived as a commitment on their own. In this respect, policies and measures would be an obligation of conduct requiring parties to perform in a certain way. Policies and measures could be either a supplement to or an alternative to emission targets.

This section is divided into two parts. The first part lists some of the policies and measures that could work as instruments to ensure compliance with the quantitative emission targets in a cost-effective manner. The second part discusses the design of co-ordinated policies and measures. Several of the policies and measures listed in the first section could in principle be co-ordinated on an international level.

#### **Instrument-based policies and measures**

Fixed targets for participating countries will not provide cost-effective mitigation unless flexible instruments are introduced. The flexible mechanisms included in the Kyoto Protocol were emission trading, Joint Implementation and the Clean Development Mechanism. The rationale of the instruments is to ensure cost-effectiveness - the use of market-based mechanisms ensures that mitigation takes place where the cost of reduction is lowest. The overall cost of combating climate change is thus minimised.

The Emission Trading Scheme (ETS), Joint Implementation (JI) and Clean Development Mechanism (CDM) are presented in this section. These types of policies and measures are instruments which only specify the means of reaching a target without being a target themselves.

The Parties will also adopt a range of other policies and measures to comply with their emission targets. Examples are presented in Box 6.4.

#### **Box 6.4 Policies and measures**

##### ***Technology and performance standards***

Technology or performance standards aim to ensure the use of low carbon-intensity technologies. The commitment can require the use of specific technologies such as renewable energy sources or low carbon-intensity energy production. Otherwise, the commitment can specify standards relating to appliance efficiency or residential insulation. Technology standards have the disadvantage of technology 'lock in' while performance standards have the advantage of flexibility in the choice of technology.

##### ***Subsidy removal***

Energy production and consumption are subsidised in many developing and developed countries. Commitments that require countries to remove such subsidies will reduce CO<sub>2</sub> emissions. The International Energy Agency estimates that removing energy subsidies in eight transition and developing countries will reduce their emissions by 17% (ref.).

##### ***Taxes***

A tax commitment requires countries to add a tax on greenhouse gas emissions. The tax revenue could be transferred domestically or to a global carbon fund. The commitment is satisfied regardless of the level of emission reductions.

##### ***Technology R&D and incentives***

R&D commitments require a country to participate in and contribute to (co-operative) technology R&D, e.g. an international hydrogen initiative or new climate-friendly technologies.

##### ***Financial support/ technology transfer***

Financial targets are specified in financial terms as an amount set aside to support mitigation rather than focusing on emissions. The target can be domestic or international and it can be absolute, indexed or conditional.

Besides technology and performance standards, subsidy removal, taxes, R&D, technology transfer, etc., countries could most likely also use the flexible mechanisms. Given the investments made into the EU ETS and the Kyoto trading mechanisms, it is almost certain that these components of the Kyoto Protocol architecture are going to be carried over into the next phase. The mechanisms are described below.

### *Emission Trading*

Emission trading is a central part of the Kyoto Protocol. The European Union has introduced a comprehensive emission trading system in order to lower the cost of mitigation (see Box 6.5). Participating companies are allocated permits, each permit representing a tonne of CO<sub>2</sub>. Companies with too few allowances compared to emissions are allowed to purchase extra permits from the market. Similarly, companies with excess permits can sell the permits on the market. The system provides incentives to seek the cheapest mitigation options.

The system provides flexibility in the sense that each company can meet emission reduction targets according to its own strategy. Some companies will choose to take on abatement measures or cut output to avoid purchasing permits or in order to sell excess permits. This flexible approach ensures cost-effective mitigation and the environmental outcome is not affected, as the total amount of permits distributed is fixed. The emission trading system furthermore encourages technological developments compared to a more rigid command-and-control regulation.

#### **Box 6.5 The European Trading Scheme**

The European Trading Scheme is the first international trading system for CO<sub>2</sub>. The scheme was initiated in January 2005. It covers close to half of Europe's emissions of CO<sub>2</sub>. Emissions from more than 12,000 installations in the EU-25 are included. Plant included in the scheme are combustion plants, oil refineries, coke ovens, iron and steel plants, and factories making cement, glass, lime, brick, ceramics, pulp and paper. In large Member States between 1,000 to 2,500 plants are involved, while in most other Member States the number of plants included is between 50 to 400.

The total annual cost is projected at €2.9 to €3.7 billion (less than 0.1 % of EU-GDP). Without emission trading the costs are projected at €6.8 billion. The introduction of emission trading will therefore roughly halve the cost of reducing emissions. The obvious reason is, of course, that low-cost abatement firms carry out cost-efficient mitigation. A further instrument to achieve cost effective mitigation is provided via The Linking Directive. The purpose is to allow companies to carry out mitigation projects outside the EU through JI or CDM. The credits earned in those projects could be turned into allowances that can be used for compliance under the Emissions Trading Scheme.

### *Clean Development Mechanism*

The Clean Development Mechanism (CDM) allows industrialised countries to transfer emission reductions from investments in mitigation projects in developing

countries (Article 12 of the Kyoto Protocol). The developed countries can use the emission reductions generated by the CDM projects to meet their own emission targets. The emission reductions obtained in a CDM project have to be additional, meaning that emissions must be reduced below those that would have occurred in the absence of the project.

In the Kyoto Protocol, CDM projects are only to be used as a supplement to domestic actions. No specific cap has been specified, but Annex 6 of the Bonn Agreement states that domestic emission reductions must constitute a significant portion of a party's total mitigation commitment.

The advantages of the mechanism are threefold. First, CDM projects contribute to meeting the emissions limitation commitments. Second, CDM projects help the developed countries to comply with their commitments in a cost-effective manner. Third, CDM projects assist the developing countries in achieving sustainable development through transfers of environmentally sound technology and know-how.

#### *Joint Implementation*

Joint Implementation (JI) is another instrument under the Kyoto Protocol. The mechanism provides opportunities for developed countries to earn "emission reductions units" when helping to finance mitigation projects in another developed country. The investor country can use the emission reduction units generated by the project towards meeting their own commitment. Most JI projects have taken place in countries with economies in transition in Eastern Europe. Projects could include utilising renewable energy sources for generating electricity, modernising a power plant, reducing electricity consumption by integrated resource planning, or reforestation programmes.

The same advantages accrue to JI projects as with CDM projects. The JI mechanism provides a triple win-win-win situation, as there is a contribution to meeting the emissions limitation commitments, an opportunity for cost-effective mitigation and assistance for sustainable development in transition economies.

#### **Co-ordinated policies and measures**

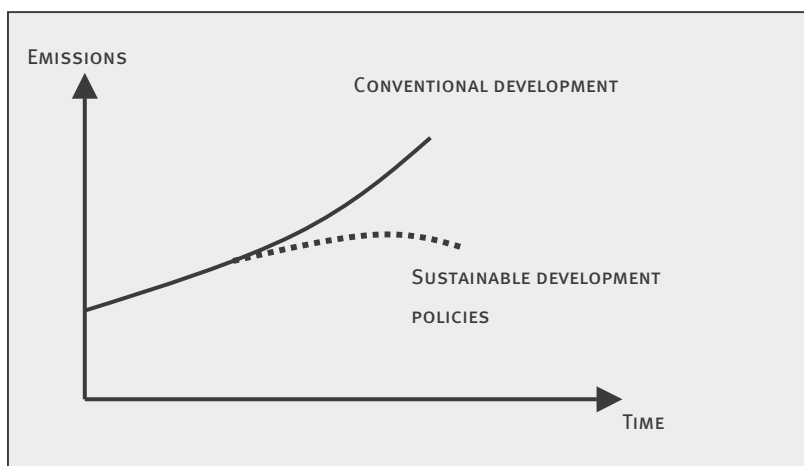
As part of the future climate policy, countries can agree on some co-ordinated policies and measures. The policies and measures would then act as an obligation of conduct. Possible co-ordinated policies and measures include technology stan-

dards, subsidy removal, taxes, best practice policies and measures, and finally, research and development in new technologies. A range of policies and measures were described in Box 6.4.

Policies and measures could be a particularly attractive commitment for developing countries which reject emission targets. Development is the key priority for developing countries and the challenges of meeting basic needs are viewed as more important than the challenge of combating climate change. It is therefore important that sound incentives are created for the developing countries to participate in the common process towards stabilising the concentration of greenhouse gases.

Besides the specific co-ordinated policy and measures presented above a more general and comprehensive approach is described. Sustainable Development Policies and Measures (SD-PAM) is a pledge-based approach to securing the participation of developing countries (Winkler et al. 2002). The aim is to achieve synergies between development objectives and climate change objectives in order to realise sustainable development. The SD-PAM approach can be individually designed to fit each country's specific needs and concerns. The approach is illustrated in Figure 6.3.

**Figure 6.3 Sustainable Development Policies and Measures approach.**



SOURCE: (WINKLER ET AL. 2002).

Figure 6.3 illustrates a situation in which SD-PAM is successful in separating emissions from economic growth. The major advantage of the SD-PAM is the bottom-up approach that allows different implementation strategies in each developing coun-

try. The purpose of the SD-PAM is thus to review each country's specific development objectives in order to achieve sustainable development. The possibility of designing the commitment according to specific needs increases incentives for participation. The SD-PAM approach could therefore be an effective first step towards including developing countries in global climate policy. An initial non-binding commitment could be the necessary price to pay for securing deeper participation in the future. One shortcoming of the approach is that mitigation of greenhouse gases is not guaranteed. Furthermore, considerable financial resources are needed to implement the SD-PAM.

#### *6.4.3 Adaptation measures*

The negative impacts of climate change hit the developing countries, while the developed countries are responsible for global warming. This makes adaptation a key concern for the developing countries. A most likely prerequisite for the developing countries to join the journey towards stabilisation would thus be for the developed countries to pave part of the way with adaptation measures (Müller et al. 2003).

Adaptation reduces the damaging impacts of climate change in a proactive way. Höhne et al. (2005) divide adaptation actions into three categories. The three categories are presented in Table 6.5.



**Table 6.5 Possible actions to advance adaptation.**

Category	Action	Committed actors	Commitment	Forum
Anticipatory of expected changes	Implementing first adaptation projects identified in NAPAs and national communications	Annex II countries	Provide co-funding	UNFCCC
	Designing insurance schemes	Developed country governments	Provide guarantees	UNFCCC possibly ISDR
Damage repair, restoration and compensation	Mainstreaming adaptation into international disaster relief	Developed country governments	Provide co-funding	ISDR
	Mainstreaming adaptation into sustainable development efforts	Developed country governments	Commit a percentage of GDP to climate change related development aid	To be discussed
Enhancement of adaptive capacity		Developing country governments	Developing countries commit to including adaptation in their sustainable development strategies	

SOURCE: (HÖHNE ET AL. 2005).

The three adaptation options are measures that anticipate explicit changes in the climatic conditions, measures that are taken to ensure damage repair, restoration or compensation (the impact response measures) and finally measures that are taken to strengthen the general capacity to adapt to unexpected or future changes in climate. For each of the three measures it is possible to identify more specific actions and specify the committed actors and the commitments. The three options can be adopted in parallel or in combination.

There is often a choice between the level of adaptation and the level of residual damage. Thus alternative adaptation policies should be compared on the basis of combined adaptation cost and residual damage although the latter is often difficult to monetize.

#### 6.4.4 Evaluation of commitment types

Along with the presentation of the commitment types, some central advantages and disadvantages were mentioned. In this section the various commitment types

are evaluated in a more integrated and systematic way. Or to phrase it another way: the means of moving forward towards our goal have been identified, but how well do they score against the evaluation criteria?

Table 6.6 gives a brief overview of the evaluation.

**Table 6.6: Evaluation of commitment types.**

	Environmental Outcome	Equity concerns	Economic effectiveness	Flexibility to adjust
Emission targets	✓ Targets ensure environmental outcome.	X Are seen as an obstacle to economic growth.	(✓) Potential for cost-effectiveness if combined with economic instruments. Requires full participation	✓ Flexible, but depends on time horizon.
Policies and Measures	(✓) Might be difficult to assess.	(✓) Depends on PAM. Policies can address equity concerns, e.g. technology transfer.	(✓) Policies can be cost efficient. Risk of inefficiency due to technological lock-in. Potential for efficiency due to leap-frogging.	(✓) Inertia depends on policies. Risk of technological lock-in.
Adaptation	(✓) Reduce the damaging impacts from global warming.  Cannot stand alone	✓ Could address equity concerns directly.  Depends on DC funding	(✓) Efficient to weigh funding against mitigation and inaction.  Depends on measures adopted	(✓) Flexibility depends on the life-time of the adaptation measure.

*NOTE 1: THE EVALUATION AGAINST THE EQUITY CRITERIA IS ESSENTIALLY ABOUT BURDEN SHARING AND ONLY TO SOME EXTENT A QUESTION OF THE TYPE OF COMMITMENT.*

✓ MEETS CRITERIA

(✓) MIGHT MEET CRITERIA, DEPENDS ON OTHER ISSUES, DIFFICULT TO ASSESS

X CRITERIA NOT MET

Table 6.6 reveals that none of the three commitment types meets all of the criteria. The choice of commitment type will thus imply a trade-off between important aspects of the climate policy. The comments in the table are elaborated upon in the text below.

### ***Environmental outcome***

How does environmental outcome depend on commitment type? Firstly, the environmental outcome will differ across commitment types. Adopting different kinds of emission target or agreeing to some specific policies and measures will imply differences in the certainty of the environmental outcome. Secondly, adaptation

has no effect on the environment as such, but adaptation reduces climate induced welfare losses. The specific commitment options are commented on below. Absolute targets (emission caps) provide certainty on emission levels within the participating countries. However, leakage might undermine the results obtained. It is estimated that leakage from mitigation efforts among the ratifying Kyoto Parties is from 5 to 20% (IPCC 2001b). For every 100 MtC emission reduction within the ratifying countries, there is consequently an offsetting increase of 5 to 20 MtC in the non-ratifying countries. The 5 to 20% leakage estimates (almost all are under 10%) are for the Kyoto Protocol commitments with the United States participating. These numbers may be a too pessimistic outlook for the potential leakage (see for instance Sijm et al. (2004)). However, if the agreement after Kyoto includes more countries, as has been argued it should, the leakage should be lower. Flexible targets provide less certainty on emissions due to uncertain parameters such as population and GDP growth. However, it could be argued that flexible targets could be used to achieve a better environmental outcome compared to absolute targets. Flexible targets ensure a higher degree of cost certainty, and Parties might therefore be willing to commit to a tougher reduction under the flexible approach. In conclusion, the adoption of emission caps could be a secure way to move forward if one is concerned about environmental outcome.

Policies and measures can be perceived either as instruments adopted to achieve a certain emission target or they can be defined as a commitment on their own (co-ordinated policies and measures). Here we focus on the latter since the former has implications for cost-effectiveness only (which again could create broader participation and consequently a better environmental outcome).

Co-ordinated policies and measures can potentially ensure the environmental outcome. However, environmental outcome is very uncertain and depends on the specific type of policy and measure. Technology and performance standards provide certainty on emission per driven kilometre or produced kWh, for example. Such mitigation types are more uncertain than absolute emission targets because of uncertainty about transport sector development projections and future energy demand. The environmental effect of subsidy removal, financial targets and taxes are likewise difficult to assess. For example, given the lack of perfect information on the marginal abatement cost and marginal benefits of emission reductions, it is unlikely that a tax would yield the prescribed environmental outcome. R&D investments in carbon-friendly or carbon-free technologies are even more difficult to

assess, but there is potential for a high degree of environmental effectiveness (Aldy et al. 2003). It is uncertain when (or if) a certain technology will be available for the world market, if it has the potential for substantial mitigation of greenhouse gas emissions and whether it will be competitive with carbon-intensive technologies. R&D investments definitely have the potential to ensure the environmental outcome, but this is a more uncertain strategy compared to adopting emission targets.

Adaptation does not contribute to environmental outcome. Adaptation increases preparedness for different climate conditions. It could thus be an efficient means of reducing the damage from global warming. Changing agricultural practices, improving drainage facilities, building stronger houses and higher dykes etc., are all necessary arrangements to some extent.

In summary, the certainty of environmental outcome decreases from quantified emission targets to policies and measures depending on the specific policy and measure. However, the absolute level of emission reductions globally depends on the aggressiveness with which each of the various commitment types is implemented.

### ***Equity***

Are the means for moving forward equally addressing the issue of equity? The equity concern is primarily connected to burden sharing (between countries and generations), but it might also be worth discussing equity concerns with regard to the three types of commitment. Could any of the commitment types therefore be especially designed to deal with equity?

Emission caps are as such not intended to ensure equity in climate policy. Their aim is to achieve an environmental outcome, and unless remedies are adopted, emission targets can be perceived as an obstacle to growth. The major shortcoming of absolute emission caps – and any other mitigation type – is the reluctance among developing countries to take on commitments. These countries are of course concerned with their own development. Seen in this context, the commitments could serve as an impediment to their economic growth. Adoption of absolute emission caps, for instance, would be a particular tie if the emission projection were underestimated due to more rapid growth.

Other commitment types building more explicitly on needs or development objectives may be more acceptable. For example, policies and measures could be designed to address equity concerns up front. Technological transfers from the industrialised countries to the developing countries focus on equity concerns but are of course also a means of ensuring sustainable development and inexpensive mitigation. Other policies and measures such as taxes or subsidy removals are, on the other hand, less concerned with equity.

Adaptation is a simple way to address equity. The industrialised countries bear the primary responsibility for global warming and the negative impacts of climate change are primarily occurring in the developing countries. Adaptation funds from the rich countries are a direct way of implementing an equity-based commitment.

### *Economic effectiveness*

The means for moving forward should also be evaluated against whether they are economically effective. Are we travelling unnecessarily expensively towards our goal?

The cost-effectiveness approach is applied when the journey's goal is defined. The aim is to identify and make use of mitigation projects with the lowest marginal mitigation (or adaptation) costs. Cost effectiveness is achieved when the marginal abatement costs are equalised across all sectors. In theory, the approach will reveal that some commitment types are superior to others with regard to economic effectiveness.

Adopting emission targets could provide cost-effectiveness, but this relies on the use of economic instruments and the amount of emissions covered by the caps. The market-based mechanisms employed in the Kyoto Protocol could, in theory, ensure that mitigation is achieved cost-effectively, as marginal abatement costs are equalised. In practice the Kyoto Protocol suffers from non-participation by key Parties, which reduces the scope for cost-effectiveness (Aldy et al. 2003). If all sectors in the economies are not included, marginal costs will not be equalised across sectors. Economic measures such as taxes and subsidy removal also have the potential to ensure cost-effectiveness. A common tax regime would equalise costs across nations and sectors.

Adopting technology and performance standards could impair the potential for cost effectiveness. Marginal abatement costs are not equalised across sectors, and there is a risk of technological lock-in. R&D into new technologies has great potential for being a cost-effective strategy in the long run. Using time and money to upgrade the technologies at the beginning of the journey can save expenses later in the journey and reduce the total travel costs. The challenge is to identify the right horses as they run towards the goal. Risk of technological lock-in is therefore an obstacle.

Since climate change is happening and future climate change is unavoidable irrespective of actions, society will need to adapt. An effective response to climate change would therefore include adaptation measures. Central cost effectiveness questions are: what type of adaptation should be adopted (forecasting, warning, evacuation, dykes, land-use, stronger buildings, draining, air-conditioning, drought-resistant crops etc.) and to what extent, where is adaptation most needed and what should the weighting be between adaptation and mitigation commitments?

### ***Flexibility to adjust***

If the journey's destination is changed, will the means of moving forward still be appropriate? The flexibility to adjust concerns whether the three commitment types can be altered to fit a new direction of the journey.

Some commitments are more flexible than others. Emission targets, technology standards and taxes can easily be adjusted. Other measures such as changes in energy infrastructure and construction of sewage systems are associated with great inertia. How flexible are adaptation measures? The answer will depend on the different kinds of measures. Measures with a long time horizon will be very inflexible.

## **6.5 Burden-sharing schemes**

The baggage must be brought along on the journey, but who should carry it? This section addresses the different ways of sharing the burden among the Parties. Whatever mix of commitments is employed, it will be necessary to distribute obligations between the participating countries. This refers to the so-called burden-sharing scheme.

Articles 3.1 and 3.2 of the Convention address the equity issue and thus the task of dividing the burden (see also Chapter 3). The core equity elements in these articles concern need, equal entitlements, responsibility, capabilities, opportunities and comparability of effort. The challenge is thus to construct a regime that is robust across all of these equity aspects.

This section reviews methods of allocating commitments in an emission cap regime. The basic elements are presented, while national positions on the approaches are discussed in Section 7.6. Six approaches are presented: the multi-stage approach, the contraction and convergence approach, the Brazilian Proposal, the ability to pay approach, the triptych approach and the equal mitigation cost approach.

None of the approaches will prevail in pure form in the final burden-sharing scheme. Each approach is only one way of operationalising the principles of fairness and equity in the convention. The negotiated scheme will thus probably draw on different elements from the respective approaches. The concept of equity or fairness cannot be reduced to a single factor. So even though the principle of equal per capita emission, for instance, is a strong and easily understood ethical argument, the scheme could be opposed by nations who would rely on other definitions of equity. The burden-sharing principles will be evaluated according to different definitions of equity in Section 6.5.7. In this section therefore, the principles will only be explained.

#### 6.5.1 *The Multistage approach*

The multistage approach directly addresses the equity principle of *need*. Countries participate in several stages according to a certain threshold, e.g. per capita GDP. A low per capita GDP could thus result in a commitment to follow business as usual, while a higher per capita GDP would imply gradually moving from business as usual to decarbonisation (stage 2), stabilisation (stage 3) and ultimately reduction commitments (stage 4).

The multistage approach does not express burden sharing in the final stage. The approach could thus be combined with other approaches based on equal entitlements, responsibility, capabilities, opportunities and comparability of effort. The important component in the multistage approach is acknowledgement of the needs

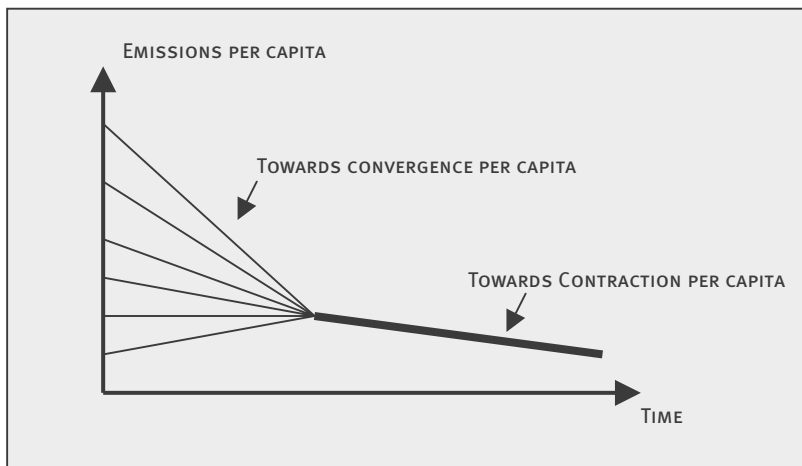
of poor countries. The primary concern for these countries is growth, and they are thus exempted from commitments to reduce emissions.

### 6.5.2 Contraction and Convergence

The contraction and convergence scheme, which is based on per capita indicators, addresses the equity principle of *equal entitlements* (Meyer 2000). One obvious option is to allocate commitments based on emissions per capita. Convergence would imply moving towards equal per capita emissions and contraction would imply a total reduction of emissions towards a given stabilisation level. The per capita entitlements of the developed countries would thus decrease, while most developing countries would be allowed to increase emissions. The contraction and convergence scheme is a compromise between Grand fathering and Per Capita entitlements, where the latter is mixed into the former over the convergence period. Another compromise is the Preference Score proposal, which allocates the mixture according to social preference, see Müller (2001).

The scheme is illustrated in Figure 6.4.

**Figure 6.4 Illustration of contraction and convergence.**



The major advantage of using per capita indicators in the burden-sharing scheme is the simplicity of the concept and the strong ethical basis, which is consistent with the major guiding principles of the UNFCCC. It would not require developing countries to shift their focus away from their basic needs and, by emphasising entitlements as well as commitments for high-emission countries, it addresses responsibility and capacity. Broad participation would increase the possibilities of cost-effective mitigation as long as flexible mechanisms are available. The contraction



and convergence approach would also be flexible in the sense that changes in the scientific evidence could be accommodated. Environmental effectiveness could thus be ensured.

The major challenges are on two fronts. Firstly, important countries will incur large losses from the contraction and convergence regime. Secondly, the per capita approach lacks the flexibility to accommodate varying national circumstances. Climatic conditions and economic structure, including the energy supply, have an important impact on emissions. The system would thus have adverse effects on nations with cold climates and favourable effects on nations with high endowments of, for instance, hydro resources. As a consequence of these shortcomings, some proposals allow for country-specific characteristics that explain significant variations in emission per capita (Gupta & Bhandari 1999; Ybema et al. 2000).

Ultimately, almost any conceivable long-term solution to the climate change problem will embody a high degree of contraction and convergence. Greenhouse gas concentration cannot stabilise unless total emissions contract and emissions cannot contract unless per capita emissions converge. The question in the coming negotiations is not whether this is reasonable within an equity perspective, but whether to base the negotiations explicitly on it (Ashton & Wang 2003).

### 6.5.3 *Brazilian Proposal*

Distributing commitments in accordance with relative historic responsibility was originally a Brazilian proposal from July 1997.<sup>21</sup> Burdens are allocated according to each country's relative responsibility for the global temperature increase. The framework is built on the concepts of "common but differentiated responsibilities and respective capabilities" and the "polluter pays principle".

The collective responsibility of the Annex I countries is equal to 77 percent of the historic temperature increase of 0.6 degrees (World Resources Institute 2003). The remaining 23 percent relates to historic GHG emissions in developing countries (see also Chapter 3). It should be noted that the exact responsibility ratio is influ-

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<sup>21</sup> Besides the responsibility-sharing framework, the Brazilian Proposal also promoted a total reduction of greenhouse gases to 30 percent below 1990 level for Annex I countries.

enced by scientific and model uncertainties.<sup>22</sup> The ratio is also dependent on the cut-off point of the temperature increase. The Brazilian Proposal only takes into account the temperature increase that has already occurred and excludes the warming potential of the present increase in greenhouse gas concentration. This design will thus weight past emissions significantly higher than emissions in recent years, which will disadvantage the early-industrialised countries in particular.

The design of the responsibility for climate change is crucial. The indicator can be based on emissions, concentration, radiative forcing, temperature increase or impacts. Possible indicators are, in consequence, responsibility for the post-1990 temperature increase (as in the Brazilian Proposal), responsibility for temperature increase associated with cumulative emissions including recent emissions, contribution to the greenhouse gas concentration level and so on. Each of the indicators confirms that industrialised nations are primarily responsible for climate change. However, if temperature increase or impacts are chosen as indicators, a larger share of responsibility for the industrialised nations will be implied because of the time lags of their emissions. Choosing emissions would, on the other hand, increase the responsibility of the developing countries.<sup>23</sup>

Using historic responsibility in a burden-sharing scheme presents several advantages and obstacles. On the positive side, the regime is a continuation of the principles of common, but differentiated, responsibilities and the polluter pays principles. It is also based on science and not on strong bargaining power. The framework is thus a useful reference for the developing countries, when industrialised nations put the focus on their economic losses from combating climate change.

The challenges of the burden-sharing scheme include the crucial design discussion. The question is not only how the most appropriate proxy for a country's responsibility should be defined but also the implications for burden sharing. Using present temperature increase, future temperature increase or historic contribution to the concentration triggers different equity impacts. Moreover, some industrialised nations state that responsibility should be calculated from post-1990 only, when the IPCC stated that human beings were influencing the climate system.

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<sup>22</sup> The ratio depends on, for example, whether all greenhouse gases are included or not and whether all sources of CO<sub>2</sub> are included or not. If CO<sub>2</sub> from fossil fuels only is included the collective responsibility of the Annex I countries is increased to 81 percent.

The argument is, of course, that they should not be held responsible for actions they did not know were harmful. They would also argue that going further back into the 19<sup>th</sup> century would present serious data problems due to lack of reliable emission data. The closer to the present, the higher the quality of data will be.

Flexible targets are not part of the Brazilian Proposal. As noted in the previous section, this could be viewed as unfair to the developing countries. The solution could be to use the relative responsibility of the developing countries when calculating the flexible targets. Historic emissions could then still play a central role in the burden-sharing scheme.

#### 6.5.4 *Ability to pay approach*

The basic equity principle behind this burden-sharing scheme is the concept of *capacity*. Responsibilities should thus be allocated according to per capita GDP. Article 3.1 refers to “respective capabilities” implying that ability to pay should be incorporated in the final burden-sharing scheme. Article 3.1 also note that the “developed country Parties should take the lead in combating climate change”. The scheme would allocate the majority of the costs to the developed countries. As the developing countries become wealthier over time they would increasingly be able to pay for mitigation.

The ability to pay approach could be interpreted as all countries bearing the same reduction in GDP per person *or* as some countries bearing a proportionally smaller burden. The two definitions of ability to pay will of course affect the other equity principles. Allocating targets according to equal income reductions per person could, for instance, violate the principle of need.

The advantage of this approach is the direct link to the principle of “respective capabilities”. The approach also addresses the issue of whether the developed countries should take the lead. The disadvantage of the scheme is that it is a top-down approach. Country-specific circumstances could thus justify meaningful divergence from the principle.

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<sup>23</sup> This explains why the Brazilian Proposal is based on temperature increase and not emissions or concentration

#### 6.5.5 *The triptych approach*

The triptych approach is yet another method of distributing emission allowances among a group of countries. This approach addresses the equity principle of *opportunities*. The methodology was originally developed to allocate commitments to the Member States within the European Union. This approach decides the emission obligations based on the emission structure of the countries. The triptych approach thus analyses energy intensive industry, the power producing sector and the domestic sector.

Ecofys has extended the original triptych approach to include more sectors and more emissions besides carbon (Höhne et al. 2003). This makes it more relevant if developing countries were to be included.

A similar approach is the multi-sector convergence approach adopted by the joint Cicero/Ecn research project (CICERO/ECN 2001). The analysis is extended to seven sectors and aims for converging per capita emissions. The inclusion of more sectors makes the multi-sector approach more flexible since more country-specific circumstances could be managed. Extending the number of allowable factors into the approach will increase the likelihood of achieving a fair result, but it will also make the result less transparent.

In the multi-sector convergence approach, non-binding standards for each sector are determined in per capita terms. The national emission targets are based upon both the sector characteristics and the population. The approach is flexible in the sense that each country is free to allocate their mitigation effort between the sectors.

Both the triptych and the multi-sector convergence approach are bottom-up approaches. They avoid the disadvantages of the simple per capita indicators, as country-specific characteristics are included. On the other hand, the need for data is usually greater compared with the top-down methods.

#### 6.5.6 *Equal mitigation cost*

Equalising relative mitigation cost is another burden-sharing scheme. The approach originates in the equity principle of *comparability of effort*. Targets are constructed to distribute the economic burden equally over all countries. The economic burden could include both mitigation and adaptation costs and it could be calcu-

lated relative to GDP. The relative economic cost as a percentage of GDP would thus be equalised.

The approach should mainly be seen as a theoretical guiding principle, which could only be employed for developed regions. The approach therefore faces two serious challenges. Firstly, there are technical problems, as countries would have to agree in advance on a model that could calculate the inferred cost of commitments. Using this model, it would be possible to allocate targets to equalise the cost across countries. It is highly unlikely, however, that countries could agree on such a model. Second, this approach does not address the needs of the developing countries. An approach based on equalising the mitigation cost relative to GDP would place the same economic burden on developed and developing countries alike. The principle of common but differentiated responsibilities and respective capabilities is thus violated. The polluter pays principle is likewise not addressed as historic emissions are ignored.

A global burden-sharing scheme based on equal mitigation cost is thus seriously flawed. The approach could nevertheless be an important guiding principle when developed countries are to distribute commitments within a new bubble, for instance. Economic cost is central for the developed nations and equalising relative costs could be perceived as a fair burden-sharing scheme within the developed nations. The equal mitigation cost approach would not operate as a leading burden-sharing principle, but given that per capita indicators and historic emissions are in the same range, the equal mitigation approach could become valuable.

#### *6.5.7 Evaluation of the burden-sharing principles*

Equity can be defined in many ways. Section 3.3 highlights six important aspects: need, equal entitlements, responsibility, capacity, opportunities and comparability of effort. In this section, the six burden-sharing principles, which were explained in Sections 6.4.1 - 6.4.6, are evaluated according to these aspects.

The burden-sharing principles could also be evaluated against some of the criteria listed in Chapter 5: environmental outcome, economic efficiency, etc (see for instance Höhne et al. (2003)). However, it makes more sense to evaluate the burden-sharing principles against the equity aspect. Environmental outcome and economic efficiency are of course dependent on burden sharing because burden sharing is an important aspect of the participation discussion. Unfair burden sharing can pre-

clude participation, a possible prerequisite for an acceptable environmental outcome or cost-effective mitigation. Instead of evaluating the burden-sharing principles against environmental and economic criteria, it makes more sense to evaluate them according to national positions. This is done in Section 7.5. The analysis will determine which burden-sharing approach might receive wide support among the Parties to the Convention. The six burden-sharing approaches are evaluated against the six equity aspects in Table 6.7.

**Table 6.7: Evaluation of burden-sharing principles.**

APPROACH	NEED	EQUAL ENTITLEMENTS	RESPONSIBILITY	CAPACITY	OPPORTUNITIES	COMPARABILITY
MULTISTAGE	✓	<i>DEPENDENT ON SPECIFIC BURDEN-SHARING RULES FOR COUNTRIES IN STAGE FOUR</i>				
CONTRACTION AND CONVERGENCE	**	✓	**	**	-	*
BRAZILIAN PROPOSAL	**	**	✓	**	-	*
ABILITY TO PAY	**	-	*	✓	-	**
TRIPTYCH	-	**	-	*	✓	*
EQUAL MITIGATION COST	-	*	-	**	-	✓

✓ INDICATES THAT THE BURDEN-SHARING APPROACH IS CONSTRUCTED TO ADDRESS THIS SPECIFIC EQUITY ASPECT.

\*\* INDICATES THAT THE EQUITY ASPECT IS LARGELY FULFILLED BY THE APPROACH,

\* INDICATES THAT THE EQUITY ASPECT IS ONLY PARTLY FULFILLED BY THE BURDEN-SHARING APPROACH.

- INDICATES THAT THE EQUITY ASPECT IS NOT FULFILLED BY THE APPROACH.

Each of the six burden-sharing principles has a specific starting point in one of the six equity aspects. The multistage approach is thus an operationalisation of the equity concept of need, while the contraction and convergence approach addresses the equity principle of equal entitlements. Each of the six burden-sharing principles thus matches a specific equity definition, which explains the ✓ in the cross diagonal.

Each of the burden-sharing principles also addresses the other equity aspects to some extent. The top-down approaches (contraction and convergence, the Brazilian Proposal, the ability to pay approach and the equal mitigation cost approach) do not allow for country-specific variation, which could imply that some countries are imposing strict reduction commitments even though they lack good domestic mitigation opportunities. However, country opportunities are not restricted to national

opportunities – all countries have access to the same pool of opportunities when flexible mechanisms are adopted. The alternative bottom-up approach (the Triptych approach) allows for country-specific variation and the starting point for the commitments are thus the mitigation opportunities within each country. Unfortunately the bottom-up approach fares badly on other equity aspects. Commitments based on the triptych approach could thus be independent of the country's historic responsibility or capacities. Russia is an example of a country with good mitigation opportunities, but it is important that commitments are shared according to other equity aspect as well.

The equity aspects of responsibility, capacity and need are to some extent correlated. A burden-sharing principle aimed at historic responsibility or per capita emission, for instance, will imply emission reduction among the rich countries while the developing countries will avoid stringent commitments. There are of course also exemptions, e.g. Russia, which has a high historic responsibility but lacks capacity compared to other industrialised countries. Some countries have also undergone the transition to a high-income country with only a relatively small contribution to global warming.

Comparability of effort is an important equity aspect for many countries. The equal relative mitigation cost approach addresses this aspect best, but this approach does have many other flaws. The ability to pay approach also fares well on the comparability aspect, as countries contribute to combating global warming according to their GDP. The contraction and convergence approach, the Brazilian Proposal and the Triptych approach all partly fulfil the comparability of effort criteria. Under these burden-sharing principles, the relative effort with similar countries will be the same.

The main conclusion from the analysis in Table 6.7 is that none of the burden-sharing principles fulfil all of the equity aspects. The top-down approaches do well on a range of aspects but fail on the opportunity aspect. The bottom-up approach fares well on the opportunity aspect, but fails on other aspects. So which burden-sharing principle is the best? It depends solely on how countries define and interpret the concept of equity. It is thus ultimately a question of how they weight each of the equity aspects. It is clear that some countries emphasise historic responsibility, while others emphasise capacity or opportunities. National positions on the burden-sharing schemes are discussed in Section 7.5.

The Swedish EPA (2002) has also demonstrated that tradeoffs exist within the equity aspect. They find that the ability to pay approach is the best all-round approach, while the contraction and convergence approach scores higher on the need aspect and the Brazilian Proposal scores better on the responsibility aspect. Torvanger & Ringius (2002) evaluate burden-sharing schemes using nine criteria. Besides three equity criteria (responsibility, need and capacity) they include six operational requirements (universal applicability, easy to make operational, simplicity, allows for future refinements, allows for flexibility and allows for country-specific circumstances). Again, no single burden-sharing approach was able to meet all or even most of the criteria. CICERO/ECN (2001), Rose et al. (1998) and Winkler et al. (2002) also reach the conclusion that no single principle or combination of principles is likely to be acceptable to all countries.

A possible outcome of the discussions on the burden-sharing principles is a scheme that draws on important elements from a range of the burden-sharing approaches. The top-down approaches could serve as guiding principles, while the bottom-up approach could be used to alter the results of the burden-sharing. Even though the Triptych and the equal mitigation approach have some clear weaknesses, they could thus still play a central role in the final burden sharing.

The six approaches are useful tools when constructing a burden-sharing scheme, but the influence of bargaining power on the negotiation process should not be neglected. In this respect, the Kyoto negotiation carries baggage, as the Kyoto commitments were not based on objective criteria but rather on sheer force of bargaining power (Aslam 2002; Depledge 2002). It is also worth mentioning that while the EU used the triptych approach to negotiate a draft burden sharing agreement in advance of the final negotiations in Kyoto, the final burden sharing agreement also reflects the sheer force of bargaining power. If this sets a precedent for the coming negotiations it will greatly limit incentives for participation by the developing countries. The suggested "objective" burden-sharing schemes are thus helpful arguments for the developing countries, which lack bargaining power.

The burden-sharing evaluation is only one assessment of climate policy. The criteria discussed in Chapter 5 are also important measures. A climate policy that fares well on the equity aspect might not necessarily be the optimal choice if the equity criterion is fulfilled at the expense of environmental outcome, economic efficiency,



etc. Burden sharing will, however, be one of the most difficult obstacles to resolve in climate policy.



Part III examines various positions on core elements of national climate policy that affect a Party's position within the climate negotiations. On the basis of this assessment options for progress are issues that are considered against a metaphorical backdrop of a door, and whether that door is open or closed to a particular set or sets of issues. A summary of part III is presented below.

### • **National positions**

The positions of four key groups are discussed. Positions on stabilisation level, timing of effort, commitment types and burden sharing are presented. We then determine which options Parties may agree on (which doors are open and which are closed).

Clear differences in the positions (see for instance table 7.1, 7.3, 7.4 and 7.5) exist. The EU supports a long-term goal, early aggressive action and absolute emission targets. The US has not begun to discuss a long-term goal, does not favour early aggressive action, but favours various policies and measures, including R&D measures. Developing countries have not engaged in public discussions on long-term targets; in part because some fear this would open up reduction or limitation commitments by developing countries. Some developing countries favour early aggressive action by developed countries, which they feel could reduce adverse effects of climate change in their regions. The type of commitment, however, is of minor importance so long as the developed countries show leadership. Other developing countries, e.g. those in OPEC, have no policy on early aggressive action. The discussion of burden sharing reveals two contrary positions. Developing countries demand continued leadership by developed nations, while the majority of developed countries are pressing for at least some developing countries to take on broader commitments.

### • **Open and closed doors**

In this report, when it seems to us more than likely that the Parties will not reach agreement on an issue, we refer to the door being closed. When, on the other hand, agreement on a range of issues seems to us plausible, the door is described as open. Important "closed doors" include agreements on long-term target, early aggressive action, harmonised policies and measures and formula-based burden sharing. Negotiations on these issues could in worst case derail negotiations.

## 7 NATIONAL POSITIONS ON FUTURE CLIMATE POLICY

This chapter maps the positions of the Parties on the climate regime options presented and evaluated in part II of the report. What are the different views on the goal, the road leading to the goal, the different means of moving forward and finally on how the burden should be divided? The Parties' positions on these issues will define the point of departure for the negotiations of the second commitment period.

In Section 7.1 we examine different groupings used within the climate negotiations and positions on various issues. Primary focus, however, is placed on positions of four key groups that have the possibility to tip negotiations in one direction or the other. These are: the EU-25, the US, advanced developing countries and, finally, the rest of the developing countries including the least developed countries. Advanced developing countries (for instance OECD-members South Korea and Mexico) are grouped together as their income per capita and emissions per capita might justify that they should be assigned further commitments. India, China and Brazil are countries with high annual emissions. These countries are placed among 'rest of developing countries' as large per capita emissions and/or income justify the imposition of a mitigation burden, but large country-wide emissions per se do not. High annual emissions merely indicate that they have to be addressed, but not who should carry the burden.

Based on the identification of the positions of the key groups, sections 7.3-7.6 will suggest and discuss open and closed doors on climate policy from 2013. Each of the four negotiation issues identified in part II is associated with a number of doors, which reflect the various options (or solutions) for a future climate policy. The door is defined as "closed" if it based on our judgement is probable that agreement cannot be reached. The door is "open" if based on our judgement there are plausible reasons for coming to an agreement. A distinction is also made between short term and longer term. The short term defines the time period for negotiations for the second commitment period – the short term thus refers to the period from 2005 to the point where negotiations on the second commitment period have been finalised. The longer term refers to the negotiations on the commitment periods beyond 2017.

### **7.1 Country Groupings within the UN climate negotiations**

There are several ways in which countries are/can be grouped in the climate process. The first is through the UN system, which groups countries regionally. Within climate negotiations, regional groupings are used as a way to determine representation on various bodies. These groups are not necessarily the same as a common interest group as discussed below. Regional groupings within the UN system are the Western Europe and Others Group (WEOG), the Africa group, the Asia group (including Japan), Latin America and the Caribbean (GRULAC), and the Eastern Europe group. WEOG includes Australia, Canada, the EU, Iceland, New Zealand, Norway, Switzerland and the US. Countries within the Africa group and GRULAC co-ordinate positions on issues of particular importance to them, such as on the CDM, in addition to co-ordinating within the G-77/China. In general, however, UN groupings are not co-ordinating groups and do not present co-ordinated positions.

The other way in which countries can be grouped is through alliances that evolve based on common interests. A prime example of this is the Umbrella Group which came about as a direct result of negotiations on emissions trading during the late stages of the Kyoto negotiations. The Umbrella Group consists of nine countries with similar positions on the market-based mechanisms in particular. Up through COP-7 the Umbrella Group co-ordinated positions on many issues related to the emissions trading system, including registries, and compliance issues. Since COP-7, the Umbrella Group has focused more on information sharing than co-ordination of positions.

With the exception of the EU countries most groups present and express their own sovereign positions in the negotiations. The effectiveness and cohesiveness of groups also vary. The G-77/China presents co-ordinated positions on many issues and has been very effective in achieving their goal of no new commitments for developing countries. Another example is the Umbrella Group which has shifted its focus and is likely to do so again once the COP/MOP begins to meet. Australia and the US are not Parties to the Protocol and therefore cannot actively participate in COP/MOP negotiations, but they will have the ability to discuss their positions on various Protocol issues through Umbrella Group discussions on these issues.

For the systematic presentation of positions on all the major options of a climate regime, four groups are defined, namely the EU-25, the US, advanced developing countries and finally rest of developing countries including the least developed

countries. Focusing on these four groups will clarify the difference in positions on the four negotiation issues. However, statements from the other groups (or sub-groups) will be presented where relevant.

## 7.2 Assessment of national positions on the UNFCCC principles

The Convention on Climate Change provides an overall framework for the Parties' efforts to tackle the challenges posed by climate change. The Convention describes some basic rules and guidelines for the positions. An example of how principles influence the negotiating process would be the process that led up to the adoption of the Kyoto Protocol. During this process, the principles were used in various ways to justify positions by countries and regional groupings within the climate negotiations. Most countries and negotiating groups do not explicitly base their positions on the principles contained in the UNFCCC, but arguments for and against actions and issues within the climate process can be associated with particular Principles. The Berlin Mandate established the negotiating process and set a frame of reference for what could and could not be included in any follow-on agreement to the UNFCCC. For instance, the "principle" of *common but differentiated responsibilities* was used in the Berlin Mandate as a way for developing countries to insist that no new requirements be placed on developing countries while Annex I Parties took the *first steps* in combating climate change. The EU as a whole accepted that developed countries were required to *take the lead*, but felt that in order to do this, harmonised policies and measures were required by all Annex I Parties in part to *promote an open international economic system*. For the US and other like-minded countries harmonised policies and measures went against the ability of Parties to adopt measures based on *national circumstances* (in order to *promote sustainable and economic development*) and *cost effectiveness*. In addition, these countries felt that *common but differentiated responsibilities* (in combination with the principle of *promoting sustainable development*) required that all countries take on some form of a reduction or limitation target under any new legal agreement depending on their *respective capabilities*.

The Principles have also been used as a way of slowing the negotiating process. For instance, OPEC countries have consistently argued that because the adoption of measures to mitigate climate change would impact the use of fossil fuels their economies would be unduly impacted and therefore their economies should be

compensated for these losses in revenue. This was and remains a major point of contention between OPEC and Annex I Parties.<sup>24</sup>

Appendix 2 contains a full description of the UNFCCC principles and commitments.

### 7.3 National positions on stabilisation level

What are the various positions on the goal of achieving a stabilisation level? Three options were discussed in part II: set a long-term goal, pursue a hedging strategy or adopt step-by-step reductions. The crucial question is whether the Parties can agree to one of the options. Are the doors closed or open? Table 7.1 presents the national positions on the discussion of the ultimate objective.

**Table 7.1: National positions on stabilisation level.**

Stabilisation level	
EU	Long term goal of max. 2 degrees increase
US	Has not engaged in discussion of a long-term goal.
Advanced developing countries	Has not engaged in this discussion as it could put pressure on DC commitments
Least developed countries	Pressure for firm commitments as adverse impacts of climate change hit these countries

Discussions on levels of stabilisation have primarily been relegated to the scientific rather than political sphere. Although some groups or countries have discussed the need to stabilise emissions, the level at which emissions should be stabilised has been left open as has a quantified definition of what constitutes dangerous anthropogenic interference of the climate system.

Negotiations under the Ad Hoc Group on Berlin Mandate (AGBM) process focused on what was then medium term targets de-linked from a particular stabilisation level. Negotiating a target based on a stabilisation level implies taking on a long-term target which many countries in the AGBM process were unwilling or unable to do. First, there remained some scepticism regarding the IPCC Assessment Reports, and second the science was unable to point to a particular target for fulfilling the objective of the UNFCCC.

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<sup>24</sup> OPEC is composed of 11 oil-producing countries that share a concern that their oil revenues will be

National positions had also not changed significantly from the Intergovernmental Negotiating Committee (INC) process, which negotiated and adopted the Convention. Developing countries continued to require Annex I Parties to lead the way and demanded no new commitments for developing countries. A proposal by AOSIS<sup>25</sup> for example called for Annex I countries to reduce CO<sub>2</sub> emissions to 20 percent below 1990 levels by 2005.<sup>26</sup> The US position required national maximum flexibility in meeting medium term targets. In 1996 the European Council stated that it believed the global average temperature should not exceed two degrees above pre-industrial levels and that therefore concentration levels lower than 550 ppm CO<sub>2</sub> should guide limitation and reduction efforts. This was also used as a basis for negotiating the EU's emissions targets for the first commitment period under the Protocol. For countries like the US, taking on a medium term target meant taking a first step rather than committing to a long-term process which a stabilisation level implies.

As the science has become more confident and the uncertainties related to impacts of climate change have reduced and as policy makers have begun to focus on the period after 2012, some countries have once again begun to address the need for a long-term goal. A few European countries have adopted long-term domestic targets independently, see Table 7.2 (EEAC Energy 2004).

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affected by the reduction of fossil fuel use.

<sup>25</sup> AOSIS is an ad hoc group of low-lying and island countries vulnerable to the impacts of climate change, particularly sea level rise. AOSIS commonly co-ordinates its positions and speaks through one representative, although all countries are free to voice their own positions;

<sup>26</sup> In addition, this proposal called for no new/additional commitments for developing countries; development of a comprehensive approach to phasing in other greenhouse gas emissions; and development of a coordination mechanism for cooperation on economic, administrative and other implementations measures



**Table 7.2 Overview of Mid- and long-term Climate Policy Targets of Countries.**

Country	Scope & Conditions	Target	Status	Notes
UK	UK CO2 emissions	-60% by 2050 from current level (2002) (= approx. -63% from 1990 level)	Royal Commission on Environmental Pollution (RCEP) recommendation adopted by Blair on 24 Feb. 2003 and DEFRA paper in Feb. 2003	Consistent with the stabilisation of CO2 at no more than 550 ppm
Germany	German Emissions of all GHGs, only if EU takes 30% reduction	-40% by 2020 from 1990 level	Introduced as coalition agreement, now part of German sustainability strategy	Still conditioned and rather weak language: "will aim for a 40% reduction"
Germany	German emissions of all GHGs	-80% by 2050 from 1990 level	Proposed by parliamentary Enquete Commission in 1990 and 1998	
France	French emissions of all greenhouse gases	-75% by 2050 from 2000 level	Government adopted Climate Plan 2003, sets the goal of reducing French GHG emissions by factor of 4 by 2050	Demands halving of global GHG emissions by 2050 and reducing industrialised country emissions by a factor of 4-5 by 2050
France	Globally	50% from current levels (by the end of the century?)		Statement by Prime Minister, contained in "Factor 4" program
Netherlands	Dutch GHG emissions	-40-60% by 2030 from 1990 levels	Fourth National Environmental Policy Plan (VROM)	
Netherlands	Global GHG emissions	-30% by 2020 from 1990 levels	Speech by NL environment minister Pieter Van Geel, July 2004	Sparked strong conflict with Dutch industry
Czech Republic	Czech per capita CO2 emissions	-30% by 2020 from 2000 level (~. -43% from 1990 level)	National climate change plan adopted by Government in March 2004 (intention to reach today's EU per capita levels by 2020)	Includes 40% per capita reductions in 2030, and 20% renewables share in energy supply by 2030
Sweden	Swedish emissions of all GHGs	-50% by 2050 from current level, decrease per capita emissions from 8t to 4.5t of CO2-eq. by 2050	Point 15 "reduced climate impact" of Swedish sustainability plan approved/acknowledged by The Swedish Riksdag	

SOURCE: (EEAC ENERGY 2004).

France, Germany, Sweden, the Netherlands, and the United Kingdom have clearly demonstrated their intention to adopt a long term goal. In some cases the statements are of a highly binding nature. The European targets are formed in different ways. For instance, the UK target is 20 % by 2010 from 1990 level and 60 % reductions by 2050 from 2002 level, while the German target is 40 % by 2020 from 1990 level and 80 percent by 2050 from 1990 level. If these differences are taken into consideration, the long-term targets of these countries as a group roughly covers a span of reduction to between 50 and 80 percent below 1990 levels of greenhouse gases by 2050, with corresponding goals of at least 30 percent reductions in 2020 (EEAC Energy 2004).

The European Environmental Ministers and The European Council have reaffirmed that overall global annual mean surface temperature increase should not exceed 2 degrees Celsius above pre-industrial levels.<sup>27</sup>

### 7.3.1 *Open or closed door?*

Different strategies, such as setting a long-term goal, adopting a hedging strategy or accepting step-by-step reductions have different environmental, equity and economic consequences.<sup>28</sup> The Parties to the Convention tend to emphasise those consequences which justify their position. Concerns on the environmental impacts of climate change are combined with concerns on the economic costs of combating climate change. In the short term, agreement on a long-term target is unlikely, while agreement on a long-term target may be possible later:

**Agreement on long-term target?**

*Closed door on short term, possibly open on long term*

Negotiations on what the stabilisation level should be would likely fail. First the target would need to be negotiated. Then the emissions path (budget) to that target would need to be negotiated. Then the distribution of emission reductions needed to achieve the path would need to be negotiated. A step-by-step approach goes directly to the distribution of emission reductions. Because of the different items that need to be negotiated, negotiating a long-term target creates a risk that the process will be used by groups opposed to mitigation efforts to thwart agreement on emission reduction commitments by arguing that the target and emissions path must be agreed first.

The Parties have different views on the ultimate stabilisation level and trying to focus negotiations on a long-term target is likely to prove a waste of time and negotiation effort. In the worst-case scenario, the negotiations could either disintegrate, or reach stalemate, particularly since there is a risk of putting off several Parties. The EU position seems to imply that reaching agreement on a stabilisation level is an important battle for them to win, but it is impossible without first winning the support of the developing countries and the United States. COP-10 in Buenos Aires

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<sup>27</sup> See for instance <http://www.eu2005.lu/en/actualites/conseil/2005/03/10Envir/84089.pdf> and [http://ue.eu.int/ueDocs/cms\\_Data/docs/pressData/en/ec/84335.pdf](http://ue.eu.int/ueDocs/cms_Data/docs/pressData/en/ec/84335.pdf)

<sup>28</sup> Unfortunately, there is not sufficient information to determine whether a hedging strategy is an open or closed door.

proved that more time and explanations are required, if broader participation should be obtained. EU Environment Commissioner Dimas has stated that

*“setting ambitious targets at this moment in time risks “leaving others behind” or scaring them off in the climate change negotiations.”<sup>29</sup>*

Whether a stabilisation level can be agreed upon in the long run will depend on whether science can reduce uncertainties, and whether governments including the US and developing countries can agree to reduce or limit emissions in line with the stabilisation level. In the end determining a 'safe' concentration level must be done by society/politicians based on scientific information. Until this happens, there is only one door open, which was also open in the Kyoto negotiations:

**Agreement on step-by-step reductions?**

*Open door on short and long term*

Negotiations for a second commitment period are likely to lead to some sort of political process similar to that which produced commitments for the first commitment period. In addition, divergence from the number of countries or the emissions captured in the commitments is unlikely to change. The total reductions will again be based on the willingness of the countries to set their own reduction number.

Negotiations on a second commitment period will be conducted under the auspices of the COP/MOP<sup>30</sup>; this means that the US can only act as an observer and will not actively participate in these negotiations. Given the absence of the US, it is highly unlikely that developing countries can be persuaded to take on reduction or limitation targets at any level, particularly since there will be insufficient information on the effects (economic and otherwise) of taking on a target on the national economy. It is also unlikely that countries such as Russia will be willing to take on much more aggressive targets until they see whether they can adapt to a carbon constrained economy.

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<sup>29</sup> <http://europa.eu.int/rapid/pressReleasesAction.do?reference=SPEECH/05/163>

<sup>30</sup> Negotiations could take place under the auspices of the COP and/or the COP/MOP. Indeed, since US participation is important, negotiations under the auspices of the COP are preferred. Given that negotiations are placed under MOP, Saudi Arabia (who has ratified the Protocol) might be used as a lieutenant of the US in the MOP.

Negotiations on more stringent action are likely to require a longer timeframe as the US will have to participate in the negotiations in order for the list of countries with targets to expand. Although some countries and regional groupings may state their desire to take on more aggressive targets, the reality of adopting these targets is unclear.

Relying on step-by-step reductions in negotiations beyond the first and second commitments period would clearly be seen as the easy way out. Continuation of an emissions trajectory based on the first Kyoto commitment period would likely be a fall-back position in the event that negotiations on a more stringent stabilisation level fail.

#### 7.4 Positions on timing of effort

Different emission paths lead to the goal irrespective of which stabilisation level is chosen. Three options were discussed in part II with regard to the timing of effort: early aggressive action, early moderate action or delayed action. Table 7.3 presents the Parties' positions on the timing of effort.

**Table 7.3: National positions on timing of effort.**

Timing of effort	
EU	Early action needed
US	Take appropriate action based on state of scientific knowledge and state of domestic economy
Advanced developing countries	Developed countries must act more aggressively to reduce emissions
Least developed countries	Pressure for funding of adaptation. Pressure for early action on mitigation

Most countries generally agree that efforts to reduce and/or adapt to the impacts of climate change are needed now. How this sentiment translates into action, however, varies. And the reality is that most countries do have policies in place that in some way affect the amount of greenhouse gas emissions they emit, including many developing countries.

Developed countries in particular have well established and documented policies to reduce or sequester emissions, support research and development and assist developing countries in a range of climate related issues. Regardless of whether

countries are Parties to the Protocol, they continue to develop climate related policies. Australia, although not a Party to the Protocol has stated that it intends to abide by its Annex B target. The US government, on the other hand, stated that they are committed to

*“an ambitious climate change strategy that will reduce domestic greenhouse gas emissions relative to the size of the American economy. The United States will achieve this goal by cutting its GHG intensity -- how much it emits per unit of economic activity -- by 18% over the next 10 years. This strategy will set America on a path to slow the growth of greenhouse gas emissions, and -- as the science justifies -- to stop, and then reverse that growth.”<sup>31</sup>*

The US administration’s view is that it is taking appropriate actions that will ultimately get them where they need to go, in terms of reducing emissions and growing the economy. Although this position does not preclude taking on a stabilisation target, it first requires that certain other criteria, primarily their understanding of the science, justify the cost of action versus the cost of inaction or limited action.

The European Environmental Ministers have a clear position on the timing of global emission cuts. The Council

*“... underlines the importance of the immediate and effective implementation of agreed policies and measures...”<sup>32</sup>*

and state that

*“... recent scientific research and work under the IPCC indicate that keeping this long-term temperature objective within reach will require global greenhouse gas emissions to peak within 2 decades, followed by substantial reductions in the order of at least 15 % and perhaps by as much as 50 % by 2050 compared to 1990 levels.”<sup>33</sup>*

Within the UNFCCC process, there have been discussions on addressing climate change in the short and medium term, and acknowledging the need to act on a long-term basis. Although the AGBM process addressed the need for a long-term solution, many Parties were unwilling or did not have political support for committing themselves to a long-term emissions reduction path. This was one of the reasons why negotiations on second commitment period targets were left to a later

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<sup>31</sup> US State Department Fact Sheet, Bureau of Oceans and International Environmental and Scientific Affairs, Washington DC, February 27, 2003.

<sup>32</sup> <http://www.eu2005.lu/en/actualites/conseil/2005/03/10Envir/84089.pdf>

<sup>33</sup> <http://www.eu2005.lu/en/actualites/conseil/2005/03/10Envir/84089.pdf>

stage. The Kyoto process, with its five year (renewable) commitment period, enabled countries to commit to a medium-term plan while laying the framework for taking longer-term action, albeit incrementally. This framework acknowledged the political reality, that due to the dynamic within the negotiations (in particular the unwillingness of developing countries to discuss taking on reduction or limitation commitments), there was little support for aggressive action or the adoption of a long-term goal.

#### 7.4.1 *Open or closed door?*

The likely outcome of discussions on a stabilisation level is to rely on step-by-step reductions. This also implies that early aggressive action is unlikely:

#### **Early aggressive action?**

*Closed door on short term*

The European Union is pushing for low stabilisation level and early action, but neither wish seems likely to be fulfilled. The only open door in the discussions on the timing of effort seems to follow the procedure from the first commitment period:

#### **Continuation of modest emission reductions?**

*Open door on short and long term*

Given the limited timeframe for negotiating a second commitment period, and a lack of information on its results (final compliance information is not likely to be available until 2014), countries with targets are more likely to focus on results that are achievable albeit slightly more stringent than the first commitment period.

### 7.5 **Positions on commitment types**

The available options for specific commitment types are mitigation commitments (including emission targets and various policies and measures) and adaptation commitments (including various adaptation measures). The Parties have different views on the means of moving forward. Table 7.4 presents the national positions on the commitment options.

**Table 7.4 National positions on commitment types.**

	<b>Emission targets</b>	<b>Policies and measures</b>	<b>Adaptation</b>
<b>EU</b>	Support emission targets	Against harmonised PAM. Mitigation effort abroad is no longer viewed as only “supplementary”	Adaptation efforts of the poorest and worst-affected countries should be financially supported.
<b>US</b>	Has adopted voluntary intensity targets Cap-and-trade system could be an option on the longer term	Technological change is the key to cheap and effective mitigation.	Adaptation is an important issue, but each country must define their adaptation needs.
<b>Advanced developing countries</b>	See emission targets as impediment to growth	Could agree to some SD PAM	Demand funding from IC
<b>Least developing countries</b>	<i>Economic growth is the primary concern</i>		Demand funding from IC

The statements in Table 7.4 are elaborated in the paragraphs below.

#### 7.5.1 Positions on emission targets

In the early AGBM process, negotiations were stymied by the inability of Parties to agree on whether a follow-on agreement to the UNFCCC should include emission targets and timetables for meeting them. There was also major disagreement among developed countries on how reductions would be implemented. The EU favoured harmonised policies and measures that Parties were required to implement whereas the US held that countries must have the flexibility to adopt and implement the policies and measures that best suit their national circumstances.

This impasse was resolved when the US stated it could take on legally-binding medium-term targets and timetables if countries were given maximum national flexibility. This led to the structure contained in the Protocol, whereby Parties agree to an absolute target (at international level) that can be strengthened over time.

It is important to note that Parties have the ability to devolve their international commitment in whatever way they see fit, as long as it remains in compliance with the international system. This has led to differing domestic systems that by and large include domestic emissions trading schemes based on both absolute and relative targets.

### 7.5.2 Open or closed doors

Kyoto is characterised by absolute emission targets for Annex I countries. What is the potential for expanding this commitment type in future protocols?

#### **Binding reduction and limitation targets?**

*Open door on short and long term for European countries and possibly for some advanced developing countries*

*Closed door on short term for the US but possibly open door on the long term*

The type of targets agreed are likely to be similar in nature to the process that resulted in the first commitment period targets. Countries set their own reduction number/path, and then determine how they will meet it, i.e. absolute versus flexible at domestic level (as opposed to flexible targets at international level). In negotiating a second commitment period, Parties to the Protocol will continue to negotiate second commitment period targets based on the system set up for the first commitment period. The European Commission for instance, has stated that:

*“the post-2012 regime should require further absolute emission reductions from each of the developed countries, defined as a percentage of the base year.” (Commission of the European Communities 2005)*

In addition, developed countries are likely to push at least the more advanced developing countries to take on reduction or limitation commitments. Norway, for example, has been a strong proponent of expanding the number of countries with commitments.

It is highly unlikely that expansion of commitment types to include flexible targets (such as the US's emissions intensity target) would provide enough incentive for the US to join the second commitment period. Participation by developing countries, although highlighted by the US as one of the failings of the Protocol, is also unlikely to interest the US enough for it to rejoin the Protocol, at least on the Bush Administration's watch. This means that it is highly unlikely that the US will join any international climate regime, at least in the short term, since the US position is unlikely to change at least until after 2008. In the longer run a climate regime



based on more realistic targets for the US, expectations of low abatement costs and mitigation commitments for developing countries might be palatable to US domestic interests and gain US support (Christiansen 2003).

Although most of the developing countries are highly unlikely to take on targets, they are likely to object to flexible targets for countries during a second commitment period. There are two reasons for this. The first is their stance that developing countries must not take on any commitments, and flexible targets are likely to be seen as a back door into developing country targets. Second, developing countries continue to contend that Annex I countries must lead the way in reducing emissions, and absolute targets go much further in that direction than flexible targets. Additionally, allowing for flexible targets during the second commitment period has implications for the international trading scheme which would require further negotiations in order to create some sort of gateway between absolute and flexible systems.

Future targets are key to the Post Kyoto regime and the stringency of the targets adopted by developed countries will depend on the commitments of the US and major developing countries. While developing countries will resist targets, some developing countries (for instance OECD members South Korea and Mexico) may agree to some form of flexible target provided that the US adopts a target or equivalent policies.

### *7.5.3 Positions on policies and measures*

As stated previously, harmonised policies and measures were a key focus of negotiations in the early AGBM process. Developed countries were divided on how best to achieve a reduction in emissions. The EU favoured harmonised policies and measures that Parties would be required to adopt, while the US and like-minded countries felt that Parties must have the flexibility to implement measures that met their particular national circumstances. With the introduction of emissions trading into the AGBM process, the EU and many developing countries became concerned that emissions trading would become a way for some countries to avoid taking action domestically. As a result these countries introduced the concept of supplementarity — that emissions trading should be supplemental to domestic action. Originally, the intent by the EU was to ensure that at least a majority of emission reductions were made domestically. This position, however, was modified since no agreement on how to quantify supplemental could be reached without imposing

serious restriction on an international emissions trading system. A final agreement on a definition of supplemental (in the decisions contained in the Marrakech Accords) is based on the Umbrella group approach (a qualitative or descriptive approach) in which Parties provide information on how use of the international emissions trading system is supplemental to domestic action, and how domestic action constitutes a significant element of the efforts made to meet a Party's Annex B commitment.

Since the adoption of the Protocol and development of domestic programmes aimed at meeting international targets, all Parties have accepted the need for flexibility to adopt and implement policies and measures that suit their national circumstances. While the US has never supported harmonised policies and measures, the US recognises the importance that policies and measures play in a domestic context in reducing emissions. For example, when George Bush visited Europe in February 2005 he made his first official comment after the Kyoto Protocol entered into force. He emphasised the need for policies and measures to increase technological progress:

*“Emerging technologies such as hydrogen-powered vehicles, electricity from renewable energy sources, clean coal technology, will encourage economic growth that is environmentally responsible. By researching, by developing, by promoting new technologies across the world, all nations, including the developing countries can advance economically, while slowing the growth in global greenhouse gases and avoid pollutants that undermines public health”<sup>34</sup>.*

#### 7.5.4 Open or closed doors?

The question of harmonised policies and measures was also high on the agenda early in the Kyoto process. It reached a dead end during the Kyoto negotiations and this will also be true in future negotiations.

### **Harmonised Policies and Measures?**

*Closed door on short and long term*

Harmonised policies and measures or any type of universally required action other than emissions trading (which is also voluntary at the international level) will not be easily agreed to by governments. The only possibility for policies and measures

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<sup>34</sup> <http://www.useu.be/TransAtlantic/Feb2105BushSpeechConcertNoble.html>

to gain success is as part of a country or region's own package for reducing emissions.

### **Bottom-up Policies and Measures?**

*Open door on short and long term*

EU Environment Commissioner Stavros Dimas met with Paula Dobriansky, chief US negotiator in April 2005 to discuss further progress in EU-US relations on climate change. Afterwards, Dimas stated that:

*"We moved beyond discussing technological innovation. We explored ways of future co-operation which include issues such as energy efficiency, renewables, the use of market-based instruments and adaptation measures"<sup>35</sup>*

Concretely, agreement was reached to re-launch the EU-US high level group bringing together EU-US representatives to discuss policies combating climate change. This initiative illustrates that the American way to commit to the international combat against climate change will most likely consists of a range of the policies and measures, including also R&D in carbon-free technologies and sequestration of carbon.

#### *7.5.5 Positions on adaptation measures*

Adaptation is an important feature under the UNFCCC. Annex I Parties are to assist developing countries that are particularly vulnerable to the adverse effects of climate change in meeting the costs of adaptation. Implementing this requirement, however, has been difficult. Funding has become a stumbling block under the UNFCCC negotiations. Many developing countries are pressing Annex II countries to keep the existing promises (i.e. to finally fill the Bonn/Marrakech funds), while developed countries are asking for stronger reporting requirements for developing countries in order to get a better and more accurate understanding of what the needs are and how best to meet those needs.

Adaptation also plays a role under the Protocol, but the same problem persists. From a developed country point of view, unless developing countries are willing to take on more responsibility, with required reporting for example, progress on this issue will be difficult.

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<sup>35</sup> <http://europa.eu.int/rapid/pressReleasesAction.do?reference=IP/05/463&format=HTML&aged=0&language=EN&guiLanguage=en>

#### 7.5.6 *Open or closed doors?*

Adaptation is central to many developing countries, particularly small island developing states and Least Developed Countries. Although adaptation plays an important role under both the UNFCCC and the Protocol, it has not as yet had a high priority. The issue of adaptation also overlaps with other Conventions such as the CSD. The UNGA has also addressed this issue in their work on Small Island Developing States.

Currently, adaptation under the climate negotiations is handled through two possible venues. The first is the Global Environment Facility, acting as the UNFCCC's financial mechanism, which funds adaptation projects, and the second is through an adaptation levy on CDM projects. In general, developing countries are asking for more action on adaptation, including through technology transfer and additional funding. Although developed countries agree on the importance of adaptation, there is disagreement on how to proceed. Adaptation requires input at the local level in order to determine the severity of vulnerability, as well as the type of adaptation needed. In the US view, for instance, one of the difficulties of addressing adaptation in an international context is that each country has its own definition of what adaptation means. According to a statement by Harlan Watson:

*“The problem we have with adaptation, of course, is that it's very difficult to define exactly what it is, and so there's much work to be done. The impact, say, of climate variability or potential climate change tends to be very local or regional in magnitude. We don't really have a good way to forecast what those changes might be. Some changes may be positive, some negative. So there are a lot of technical issues underlying that...”*

The technical difficulties are in part due to the way in which models are constructed. Adaptation is viewed as an issue that requires local information. Climate models tend to be regional and /or global and cannot provide sufficient information of potential local impacts, since those impacts are also influenced by many local factors, such as topography, etc.

The European Commission states that

*“adaptation efforts of the poorest and worst-affected countries should be financially supported.” (Commission of the European Communities 2005)*

The Commission acknowledges that developing countries are the most vulnerable given their high dependence on climate-sensitive economic sectors and their low capacity to adapt. Strengthening the adaptive capacity of the developing countries would contribute to their development.

**Inclusion of adaptation measures?**

*Open door on short and long term*

A key message from COP 10 and earlier COPs is that adaptation is very important to many developing countries. It may be possible to have an agreement that does not address adaptation, but it is likely to exclude most developing countries. Some progress on adaptation (and impacts of climate change) is probably necessary to get key developing countries to agree to some form of flexible targets. In other words, adaptation and flexible targets for some would be offered as a package for G77 and China.

The US is unlikely to commit to adaptation funding as part of their commitment. The US position is that adaptation is an important issue, but each country must define their adaptation needs. The US will more likely pursue bilateral adaptation programmes and seek win-win solutions for both Parties.

#### **7.6 Positions on burden sharing principles**

The final negotiation issue concerns burden sharing. Part II listed six different methods for dividing the burden. These schemes can be viewed as solutions or doors in the negotiation process. Some doors will be locked, while others will be open.

This section will discuss the Parties' positions on the burden-sharing principles and identify the open and closed doors. The crucial task is to identify which burden-sharing scheme would receive the widest support. In addition it is relevant to discuss which burden-sharing schemes are doomed due to lack of support from central actors. Table 7.5 presents the positions towards the burden sharing.

**Table 7.5 Positions on burden sharing.**

	<b>Position</b>
<b>EU</b>	Calls for a better differentiation between countries and their possible contributions in a future global scheme
<b>US</b>	Action must be based on scientific knowledge and protecting the US economy. Moreover, the US only accepts commitments if the developing countries would also be committed to reducing emissions (Byrd-Hagel resolution).
<b>Developing countries</b>	The developed countries should take the lead

Two positions are very clear in the burden sharing discussion. These are the views of the developed countries versus the views from the developing countries.

The US Senate Byrd-Hagel resolution from 1998 is essential in the burden sharing discussion<sup>36</sup>. The resolution states that

*“the United States should not be a signatory to any protocol to, or other agreement regarding, the United Nations Framework Convention on Climate Change of 1992, at negotiations in Kyoto in December 1997, or thereafter, which would (A) mandate new commitments to limit or reduce greenhouse gas emissions for the Annex I Parties, unless the protocol or other agreement also mandates new specific scheduled commitments to limit or reduce greenhouse gas emissions for Developing Country Parties within the same compliance period, or (B) would result in serious harm to the economy of the United States.”<sup>37</sup>*

The Senate passed the resolution by 95 votes to nil. Every burden-sharing approach therefore faces the fact that the US will only accept commitments if the developing countries would also be committed to reducing emissions.

Another crucial element in the burden sharing discussion is the stance of developing countries on commitments. Their position is based on two arguments. First, industrialised countries have generated the majority of anthropogenic greenhouse gas emissions responsible for climate change. Second, the developing countries must have the same opportunities for growth as the developed countries have had. Commitments should therefore not be an impediment to growth. This means that the industrialised countries must take the lead in reducing greenhouse gas emis-

<sup>36</sup> Byrd-Hagel is a non-binding resolution of the Senate. It has been defied by the Clinton Administration by signing the Kyoto Protocol. It is not an obstacle to meaningful participation by the US, but at most to Senate ratification.

sion and developing countries must be able to grow their economies, reduce poverty, etc in the manner they best see fit.

The European Union emphasises that the industrialised countries cannot combat climate change alone (Commission of the European Communities 2005). Huge differences in per capita emissions and income levels within the non Annex I countries

*“call for a better differentiation between countries and their possible contributions in a future global scheme” (Commission of the European Communities 2005)*

The European Commission suggests a staged approach for participation, reflecting the stage of development a country has reached. A staged approach would provide flexibility and opportunities for more countries to contribute to the reduction effort.

The European Environmental Ministers emphasise the need to reduce emissions in the order of at least 15 % within two decades and perhaps as much as 50 % by 2050 compared to 1990 levels (see also section 7.4). The Ministers state that<sup>38</sup>

*“...joint efforts are needed in line with the Principle of common, but differentiated responsibilities and respective capabilities, including significantly enhanced aggregated reduction efforts by all economically more advanced countries.”*

Moreover, the Ministers believe that

*“...reduction pathways by the group of developed countries in the order of 15-30 % by 2020 and 60-80 % by 2050 compared to the based line envisaged in the Kyoto Protocol should be considered.”*

The G-77/China group comprises many diverse interests. OPEC, AOSIS, GRULAC, the African Group etc have very different stakes in the climate change negotiations. Despite these differences, the G-77/China group has been able to maintain a fairly united front on this issue, i.e., no new commitments for developing countries. This is due in part to its relatively low historic contribution, low per capita income and low per capita emissions, but also due to the way in which the G-77/China participates in the negotiations. Since they adopt many positions as a group, they also participate in the negotiations as a group. Although countries do speak on an individual basis, the G-77/China generally assigns a spokesperson who takes the lead

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<sup>37</sup> <http://www.nationalcenter.org/KyotoSenate.html>

on particular issues. This serves a practical purpose in that many of the national delegations are small and cannot cover all of the issues under the UNFCCC. Nor do delegations always have sufficient expertise in all of the areas. It also enables G-77/China and in particular, hardliners on issues such as ‘no new commitments’ to maintain a greater level of control over positions adopted by the group. By some accounts, COP-10 showed (as it has in past sessions) a split in the group between hard-liners and some members more open to forward-leaning language. It is unclear, however, whether this split will be maintained or whether (as in the past) the G-77 will negotiate compromises in these areas in order to maintain a coordinated front.

Finally, it should be possible to gain some insight on the Parties positions on the burden-sharing scheme by looking at the proposals for burden-sharing methods made by the Parties to the Ad Hoc Group on the Berlin Mandate negotiations. (Ringius et al. 2002) provide an overview of these proposals, see Bx 7.1

**Box 7.1 Overview of proposals for burden sharing methods made by parties in the Ad Hoc Group on the Berlin Mandate (AGBM) negotiations.**

Proposal	Fairness principle	Type
France	Need (rights) (undifferentiated)	Convergence
Switzerland	Need (rights) (+ equal obligations)	Convergence
EU	Need (rights)	Convergence
Brazil	Responsibility (polluter pays)	Historical responsibility
Brazil-RIVM	Responsibility (polluter pays)	Historical responsibility
Norway	Need, responsibility, and capacity	Multi-criteria formula
Iceland	Need, responsibility, and capacity	Multi-criteria formula
Australia	Need (rights), capacity, and responsibility	Fossil-fuel dependency
Iran	Mixture: need + acquired rights	Fossil-fuel dependency
Japan I	Equal obligations	Menu approach
Japan II	Equal obligations, modified by responsibility	Menu approach
The Netherlands	Need, on a sector-specific basis	Sector approach
Poland et al.	Responsibility and capacity	Ability to pay
Estonia	Responsibility and capacity	Ability to pay
Poland, Russia	Capacity and responsibility	Ability to pay
South Korea	Responsibility and capacity	Ability to pay
New Zealand	Not specified	Cost-effectiveness

Source: (RINGIUS ET AL. 2002).

<sup>38</sup> <http://www.eu2005.lu/en/actualites/conseil/2005/03/10Envir/84089.pdf>



Box 7.1 lists the 17 proposals for differentiating the burden. It is evident that there is a clear relationship between the suggested fairness principle and the hidden interests of the proponents of the methods. The proponents of, for instance, the ability to pay approach thus have relatively high historic responsibility and high emissions per capita, but relatively low income per capita. Brazil has relatively low historic responsibility and would thus favour a polluter pays principle.

#### 7.6.1 *Open or closed doors?*

The six burden-sharing schemes that were presented in Part II all describe methods for dividing the burden. Each of the schemes is based on some kind of formula, e.g. income per capita (the ability to pay scheme), emissions per capita (the contraction and convergence approach) or historic emissions (the Brazilian Proposal/polluters pays principle). A contrast to these formulas would be to adopt a burden-sharing scheme based solely on the Parties' willingness to mitigate plus the relative bargaining power of these Parties. This refers to a bottom-up political process. The question is, which solutions are applicable in the negotiations on burden sharing?

#### **Bottom-up political decision?**

*Open door on short and long term*

Any second commitment period will be based on the same type of political process that occurred in Kyoto. Within the UNFCCC process and in the long term, this is likely to be the least divisive method for determining how reduction and limitation targets will occur.

#### **Agreement on Formula based-commitments, i.e. polluter pays, equal entitlements, ability to pay or historic responsibility?**

*Closed door on short term and possibly on long term*

In the short term, there is no formula that Parties could easily or willingly agree to. As regards the long term it is difficult to determine whether the door is open or closed. The more elements or circumstances that a formula incorporates, the less likely that agreement will be reached since Parties negotiate in large part on the best interests of the country and its people and not on what is best for the global environment. One of the primary difficulties with climate change is that it has been presented in primarily environmental terms which generally takes second place to

other more urgent issues such as water or health, as well as economic, food, energy and national security (which are of course all related to climate change).

For regional groupings, formula-based commitments are likely to be easier to develop and adopt. Possibilities exist for combinations of bottom-up political decisions based on formulaic distribution of commitments within groupings.

#### *7.6.2 National interest behind the burden-sharing positions*

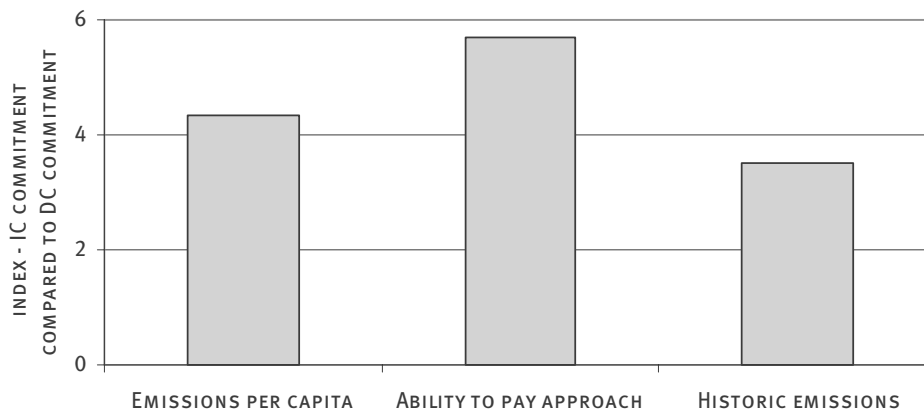
Part II presented several methods for burden-sharing, but few Parties have expressed their views directly on these specific burden-sharing schemes. This section takes a look behind the (non-existing) positions, which to some extent is based on the countries' ability to pay, emissions per capita and historic emissions.

There are multiple ways of dividing the burden. The preferred burden-sharing scheme will depend on the relative size of income per capita and the current and historic emissions. This section compares the equity profiles for central countries. The country equity profile is composed of three indicators:

- The per capita emissions
- The per capita income and
- The historic responsibility.

The implications of choosing one of three indicators will be different. This is true for each of the countries, but also true for the relative burden-sharing between industrialised and developing countries. Figure 7.1 shows the burden sharing for each of the three burden-sharing approaches for the developed and developing countries.

**Figure 7.1 Burden sharing between developed and developing countries depends on burden sharing principle.**



SOURCE: DATA FROM (WORLD RESOURCES INSTITUTE 2003).

NOTE: THE PER CAPITA BARS REFLECT THE RATIO BETWEEN THE DEVELOPED COUNTRIES PER CAPITA INDICATOR COMPARED TO THE DEVELOPING PER CAPITA COUNTRIES INDICATOR. THE BRAZILIAN PROPOSAL BAR REFLECTS THE DEVELOPED COUNTRIES CUMULATIVE EMISSION COMPARED TO THE DEVELOPING COUNTRIES CUMULATIVE EMISSION IN THE PERIOD 1850-2000.

Dividing the burden according to emissions per capita, income per capita or historic emissions would in all three cases place the biggest burden on the industrialised countries. The *highest* relative burden on the developed countries is produced if the burden is allocated to the countries according to income per capita. Income per capita is thus almost six times higher in developed countries compared to income per capita in developing countries.

The *lowest* relative burden on the industrialised countries is produced if the burden is allocated according to historic responsibility. Adopting this burden sharing method would place a burden on the industrialised countries that is almost 4 times higher than the burden accruing to the developing countries.

Adopting the emission per capita approach would place a burden on the industrialised countries, that is more than 4 times the burden on the developing countries. This reflects the fact that emissions per capita for developed countries are on average 3.9 tons carbon equivalent, whereas emissions per capita for developing countries are 0.9 tons carbon equivalent.

Figure 7.1 shows that burden-sharing differs for the industrialised and developing countries according to which burden-sharing scheme is adopted. Likewise, there are different burden implications within these groupings. The three methods will thus have different implications for each of the Parties. The implications for each

Party will again depend on the ability to pay, the historic emissions and the current emissions per capita.

The position will essentially depend on the relative size of each of the above-mentioned indicators. If, for instance, per capita income is relatively low compared to per capita emissions and historic emissions, then the Party (e.g. Russia) would prefer the ability to pay approach. If income per capita and emissions per capita are relatively high and the historic emissions are relatively low, the Party (this could be Australia or Canada) would prefer the Brazilian Proposal. By assuming a high or low level for each of the indicators it is possible to divide the countries into eight groups. This is done in Table 7.6.

**Table 7.6: Grouping of countries according to burden-sharing indicators.**

		<i>Emission per capita</i>	
		Low	High
<i>Income per capita</i>	Low	<i>Low historic emissions</i> More or less indifferent between principles. Depends on the relative size on the three indicators  <b>A range of developing countries</b>	<i>Low historic emissions</i> Would favour ability to pay and Brazilian Proposal Would oppose contraction and convergence  <b>Countries in beginning of industrialisation</b>
		<i>High historic emissions</i> Would favour ability to pay and contraction and convergence Would oppose Brazilian Proposal  <b>China, India</b>	<i>High historic emissions</i> Would favour ability to pay Would oppose contraction and convergence and Brazilian Proposal  <b>Russia</b>
	High	<i>Low historic emissions</i> Would favour contraction and convergence and Brazilian Proposal Would oppose ability to pay  <b>Few developed countries</b>	<i>Low historic emissions</i> Would favour Brazilian Proposal Would oppose ability to pay and contraction and convergence  <b>Newly industrialised countries</b>
		<i>High historic emissions</i> Would favour contraction and convergence Would oppose ability to pay and Brazilian Proposal  <b>Post-industrialised countries</b>	<i>High historic emissions</i> Depends on relative size of the three indicators  <b>Most developed countries, e.g. United States, EU, Australia, Canada, Japan</b>

The burden-sharing principle preferred depends on the level of the per capita indicators and the level of the historic contribution. Countries with relatively low historic emissions would - all else being equal - prefer the Brazilian Proposal, coun-

tries with low per capita income would - all else being equal - prefer the ability to pay scheme, while countries with low emissions per capita would - all else being equal - prefer the contraction and convergence approach. It is of course also relevant to explore which countries potentially would oppose a burden-sharing scheme. These positions are likewise reported in Table 7.6.

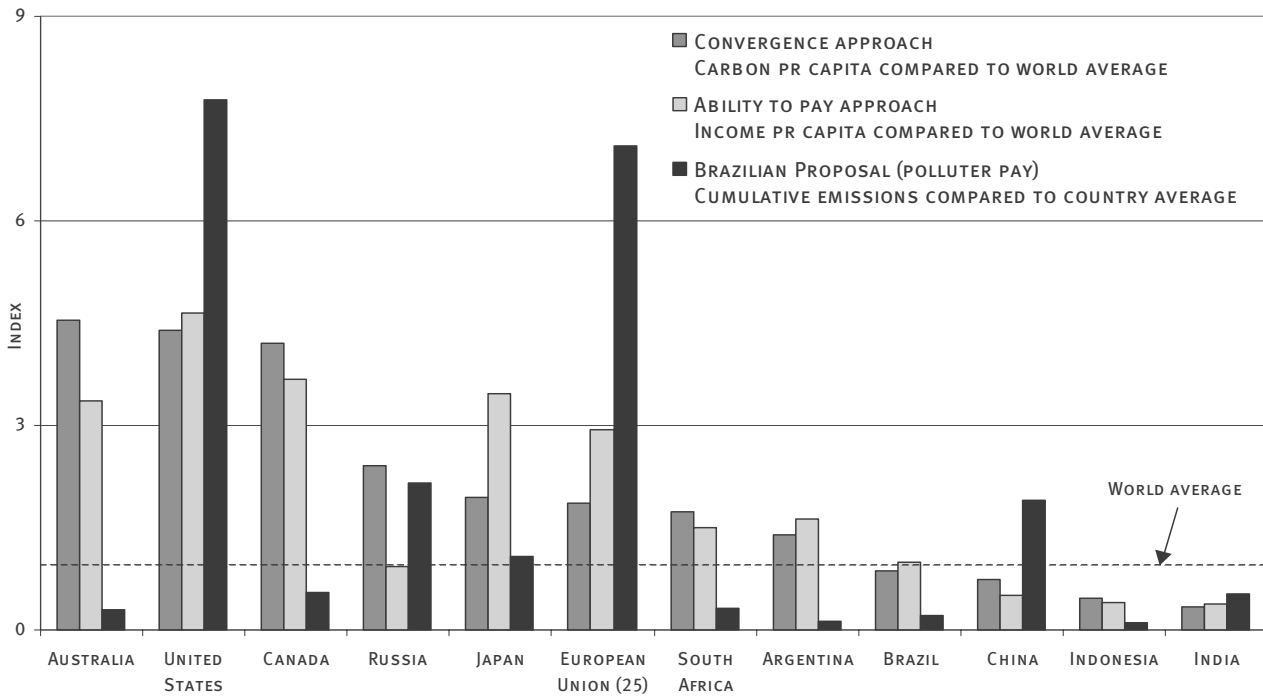
It should be noted that some groupings of countries in theory could be in favour of more than one principle. India and China both have relatively low emissions per capita and relatively low income per capita and could thus support either the contraction and convergence approach or the ability to pay scheme. Likewise, some countries could in theory oppose more than one principle. Newly industrialised countries with rising income and emission would thus oppose the contraction and convergence approach or the ability to pay scheme.

The relative size of the three indicators is needed in order to determine which approach is the best. An empirical indication of this relationship is presented in figure 7.2. The figure presents the differentiation of burdens under a emissions per capita approach (first, blue bar for each country), ability to pay approach (second, grey bar for each country) and the historic responsibility (third, black bar for each country).

The numbers should be interpreted with caution, as top-down approaches do not flawlessly uncover the mitigation potential and the expected mitigation cost. The size of the commitments can not be compared *between* countries, as the strength of the commitment will depend on the mitigation options in the specific countries. The US burden under the Brazilian Proposal is therefore not necessarily more tough compared to the EU burden under the Brazilian Proposal even though the US should reduce more emissions (US black bar is higher than European black bar).

Nevertheless the figure provides useful insight into how the national burden varies according to burden-sharing principle.

**Figure 7.2: Differentiation of burden using per capita emission, ability to pay and cumulative emission.**



SOURCE: DATA FROM (WORLD RESOURCES INSTITUTE 2003).

NOTE: THE BARS ARE CONSTRUCTED TO REFLECT EACH NATION INDICATOR RELATIVE TO THE WORLD AVERAGE. THE WORLD AVERAGE IN THE BRAZILIAN PROPOSAL IS CONSTRUCTED AMONG THE 25 BIGGEST EMITTERS (THE REMAINING COUNTRIES ACCOUNT FOR 8 PERCENT OF THE CUMULATIVE EMISSIONS).

The emissions per capita approach, the ability to pay approach and the historic responsibility approach will imply different burden sharing. Carbon per capita, income per capita and cumulative emissions vary disproportionately across countries, so the preferred scheme is also likely to differ.

On the basis of table 7.6 and figure 7.2 it is possible to identify the countries that potentially would be in favour of or in opposition to the three burden-sharing principles. Table 7.7 presents the important countries' potential position.

**Table 7.7: Each burden sharing principle potentially has countries in opposition or in favour of the principle.**

	Emissions per capita approach	Ability to pay approach	Historic responsibility
Countries potentially in favour of principle	United States*	Russia*	Australia
	European Union*	China*	Canada
	China*	India*	Japan*
	India*		South Africa
			Argentina
			Brazil
			Indonesia
Countries potentially in opposition to principle	Australia	Australia	United States*
	Canada	Canada	European Union*
	Russia*	Japan*	Russia*
	Japan*	European Union*	China*
	South Africa	United States*	India *
	Argentina	South Africa	
	Brazil	Argentina	
	Indonesia	Brazil	

NOTE: THE TOP 6 EMITTERS OF TOTAL GLOBAL EMISSION ARE MARKED WITH AN \*.

Table 7.7 reveals that none of the approaches would get wide support. Each principle has both potential advocates and opponents. Attaching weights to the countries simplifies the picture. Assuming that we are primarily interested in involving the top six emitters,<sup>39</sup> the Brazilian Proposal is faced with heavy opponents. The contraction and convergence approach is, on the other hand, blessed with important countries which are not against this scheme. The ability to pay has both important advocating and opposing countries.

In summary, a country's carbon profile offers interesting insight into its potential positions on the burden-sharing principles. Few Parties have expressed their views directly on the specific methods for differentiating the burden. Table 7.7 shows what their position might be. Furthermore, an important conclusion is that there is no single principle that will be acceptable to all, thus burdens will be negotiated.

<sup>39</sup> The top 6 emitters have a share of approximately 2/3 of global emission in the year 2000





Part IV is a synthesis bringing Parts I, II and III of the report together to discuss and conclude on the perspectives for formulating the next regime. A summary of Part IV is given below.

### **Chapter 8 – Discussion and perspectives**

Based on the scientific background and the policy evaluation criteria, a number of general considerations for an optimal regime are given. The optimal regime is robust across the environmental, equity and economic criteria. However, national positions are constraining the road to this optimal regime. Such a regime cannot be achieved in a “second-best” world. In order to achieve as many of the general recommendations as possible, a number of incentives must be provided as part of the next regime. These incentives are divided into environmental, economic and political incentives. Different incentives must be provided for the Parties.

Broad participation is a key concern. The recommendations on the next regime for each of the four negotiation issues are in short:

1. Discussions on stabilisation level should only take place among experts and in informal political discussions.
2. Initial commitments are necessary in order to induce awareness and technological development.
3. It is essential to provide flexibility in each Party's choice of commitment type.
4. Strength of the commitment should be guided by the Principle of common, but differentiated responsibilities and respective capabilities.

### **Chapter 9 – Conclusion and policy recommendations**

Seven main conclusions are presented. These concern 1) the core negotiation issues, 2) the trade-offs between the environmental, equity and economic dimensions, 3) the adoption of second-best policies in the presence of political conflict, 4) the open doors in the upcoming negotiations, 5) the closed doors in the negotiations, 6) the need to allow for flexible commitments in order to ensure broad participation and finally, 7) the need to include external incentives for participation.

Finally, recommendations on the four core negotiation issues are summarised.

## 8 DISCUSSION AND PERSPECTIVES

Parts I, II and III of the report provide the basis for a discussion of the core negotiation issues for the formulation of a climate regime following the Kyoto Protocol (the structure of the report is shown in Figure 1.1).

The discussions and perspectives in this chapter are a synthesis of Parts I, II and III of the report. The science of climate change (Part I) is combined with the theoretical evaluation of proposed climate regimes (Part II) and the positions of the major politically powerful groups in 2005 (Part III). Based on these foundations, the discussion will include:

- Considerations as to which basic principles an optimal climate regime should be built upon in theory.
- How to provide participation incentives so these principles are adopted to the greatest possible extent in order to achieve broad participation.
- Recommendations on which basic principles the next regime should build upon to ensure broader participation.

It is argued that an optimal design (“on-paper”) of the next regime will have to be replaced by a second-best regime in order to allow for national interests. Furthermore, participation incentives are crucial if broad participation is to be achieved. Finally, flexibility is needed; one size does not fit all, so participation depends on the potential to undertake commitments, which take account of country-specific circumstances.

Section 8.1 shortly summarises the four core negotiation issues identified in the report as well as the environmental, equity and economic aspects of the climate change problem and the trade-offs between them. Section 8.2 presents considerations on the four core negotiation issues, based on the policy evaluation criteria. These considerations represent general recommendations for what an optimal future regime should entail in *theory*.

However, the climate regime will be negotiated between countries with national sovereignty, which generally pay more attention to national (economic) interests than global efficiency. The outcome of the negotiations is only likely to be a “sec-

ond-best” regime. It is important to recognise these differences of opinion, in order to suggest feasible and viable regimes for future action. Section 8.3 briefly summarises the main positions on the core negotiation issues and the associated open and closed doors.

The conflicting national positions can be seen as barriers to the optimal regime. Section 8.4 offers perspectives on how to break down some of these barriers by providing incentives to join the next commitment period. There are incentives related to the climate problem itself and there are external incentives which arise from global political aspects other than climate policy - such as the WTO negotiations. Both types of incentives influence to what degree the doors will be open.

Finally in section 8.5, some general recommendations are given to a new regime that achieves broad participation from at least the major emitters.

### **8.1 Core negotiation issues in climate policy**

The complex negotiations of future climate regimes can be reduced to negotiations on four core issues:

1. How far should we go?
2. How fast should we go?
3. How should we move forward?
4. How should the burden be divided?

That is, negotiations will relate to questions on the long-term stabilisation level, the emission path, the commitment types (mitigation and adaptation), and the distribution of burdens (emission reductions).

The parties to the UNFCCC will have to decide on these central issues, but there are major splits between the positions of the parties along all four elements. The disagreement arises from different perspectives on three aims, which stem from the environmental (environmental outcome), equity (burden sharing) and economic (efficiency) aspects and from the crosscutting issue of uncertainty (how to act in the presence of uncertainty).

The environmental aim is to avoid adverse effects from a changing climate. The International Panel of Climate Change has predicted that mean temperature will increase between 1.4 - 5.8 degrees Celsius by the end of this century.

The second aim is to formulate a regime that is fair. Equity cannot be reduced to a single aspect, and burden sharing must be robust across all the equity principles (polluter pays principle, ability to pay, need, opportunity, equal entitlements and comparability of effort) in order to take account of differences in historical emissions, annual emissions, per capita emission and per capita income across countries.

The third aim is to reach environmental goals cost-effectively and efficiently. The cost of reaching different stabilisation levels differs enormously and the cost-effectiveness of measures for short-term mitigation also varies. The presence of significant uncertainty in both the climatic and the economic system complicates the formulation of a climate regime. A balance between the risk of under-investment and severe climate impacts on the one hand, and over-investment and no severe impacts on the other, must be found.

There are three main trade-offs between the environmental, equity and economic aims. First, there is a trade-off between the total cost of climate policy and the environmental outcome. Second, the environmental outcome is compromised by equity concerns implying that some countries should have no commitments at all. Finally, equity (and the related exclusion of some countries) means that economic efficiency is compromised due to emission leakage or missed opportunities for achieving the most cost-effective measures.

## **8.2 Considerations on an optimal climate regime**

The trade-offs and opposing perspectives on a climate regime form the point of departure for the climate change negotiations on climate policy after 2012. Given the inherent trade-offs between the different environmental, equity and economic aims of climate policy and the conflicting views on climate regime, there is no easy way to formulate a climate regime. This is also the case from a theoretical point of view.

In this section, considerations are given to an optimal climate regime. The term "optimal regime" refers to a regime that is formulated "on-paper" and in a theo-

retical manner takes account of the policy evaluation criteria defined in Chapter 5 as well as the trade-offs in climate policy. Thus, the general recommendations should be followed in order to formulate a regime proposal consistent with the policy evaluation criteria. The considerations are presented as guiding answers to the four core negotiation issues.

***Core negotiation issue 1: How far should we go?***

- Ideally, a long-term target should be defined. However, the uncertainties and knowledge gaps are too profound and the definition of a long-term target is therefore out of reach and essentially, science can not tell us what a safe level is. Therefore the ideal action must be seen in relation to the knowledge gaps and uncertainties upon which decisions must be made. If the Kyoto-road is continued with step-by-step reductions this might imply high economic, environmental and/or distributional costs. If the initial steps are too small, then at some point it could be too late to achieve a certain environmental outcome. There would be high economic cost of achieving stabilisation at last minute. On the other hand, if the initial steps are too large, economic resources are wasted.
- Considerations on a strategy that keeps various stabilisation concentrations achievable (open) must be made<sup>40</sup>. Moreover, considerations on the cost and benefits of different stabilisation levels must be brought explicitly into the debate.
- Further research into climate change is needed, particularly into the long-term impacts of climate change. Methodologies for estimating and evaluating the trade-offs between cost and benefits in different time periods and in the presence of significant uncertainty must be developed and improved by economists. This implies that considerations on a long-term target, by time, should be brought into the negotiations.

***Core negotiation issue 2: How fast should we go?***

- Short-term action must take place at some level. The longer action is delayed in general, the more rigorous action will be needed to meet almost any long-term target.
- Early action could reduce the total mitigation costs in the long run. Initial commitments serve as a necessary signal to induce technological change. Given

that most technologies are developed in the OECD, the need to stimulate R&D is primarily a need for Annex II countries.

- Emission paths leading to the same temperature increase in the longer term should be given full attention. The rate of temperature change must not exceed critical thresholds.

***Core negotiation issue 3: How should we move forward?***

- A broad range of technology options needs to be employed. In the short term, cost-effective mitigation with the best technology available is needed in both developed and developing countries. Technological transfer from developed to developing countries is crucial. R&D in new cleaner and carbon-free energy technologies must intensify over time in order to achieve efficient reductions in the medium and longer term.
- The way forward should be based on cost-effective mitigation. This involves an increasing and continued use of market-based instruments. National programmes must, moreover, include reductions in all greenhouse gases, not only CO<sub>2</sub>, and cover all sectors of the economy. The aim is to equalise marginal abatement costs across sectors and nations.
- Adaptation must be addressed. Climate change is already happening, and the only efficient response is to include action on adaptation. Particularly, the issue of unavoidable impacts should be addressed.

***Core negotiation issue 4: How should the burden be divided?***

- Full, or at least broad, participation must be achieved in order to ensure the environmental outcome and economic efficiency. Negotiations on mitigation sharing, regardless of the forum, will have to include a broad range of countries regardless of their state of development. Also negotiations on impacts and adaptation should be included in the negotiations.
- Emissions in all countries, or at least in the major-emitting countries, must be addressed. The US and China, for instance, will have to participate. The US should have commitments, while China with a low per capita income and emissions should not necessarily have commitments.
- Industrialised countries must still show the way and demonstrate that mitigation can take place without harming economic growth (significantly).

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<sup>40</sup> Conceptually this is a cost-effectiveness analysis with option values for different concentrations.

- Most developing countries must, at some point in time take on emission commitments. The richest developing countries must in the next period (2012-2017) take on modest commitments (e.g. head-room or safety valve) in order to get a carbon mitigation system running (inventories, monitoring and identification of mitigation possibilities).
- The poorest countries must be given compensation for both mitigation (technological transfer), adaptation (financial funding) commitments and unavoids impacts (disaster relief and capacity building)

The formulation of an optimal regime that takes account of the policy criteria defined in Chapter 5 is not achievable for the time being. The trade-offs between the three aspects (environmental outcome, equity and economic efficiency) of climate change and the underlying and opposing ethical principles make it a complex challenge which cannot be solved without at least some value judgement. Bringing this complex theoretical problem into the real-world international arena will self-evidently be a challenge of major proportions, already experienced in the climate negotiations.

In an ideal world, with countries maximising global welfare, the above considerations would be adopted as guiding principles for the formulation of optimal climate policy. However, national interests as well as uncertainties and knowledge gaps are constraints to such an optimal regime, compromising the efficient outcome of a climate regime.

### **8.3 Open and closed doors in the negotiations**

Given the fact that a climate regime is negotiated between nation states with full sovereignty, disagreements play a vital role in the formulation of future climate policy. Common understanding of the positions of the various parties might therefore be of crucial importance in achieving a fruitful outcome in the negotiations on future climate policy.

189 countries have signed the UN convention on climate change. The Convention provides the overall framework for the Parties to address the challenge of climate change. The principles define the (wide) scope for positions in climate policy.

The Parties' positions on the core issue of climate policy produce open and closed doors in the negotiations on future action. What are the prospects for achieving

agreements on the core issues of setting a goal, defining the road to the goal, deciding on the means of moving forward and finally, distributing the burdens of combating climate change? There are clearly some open and closed doors in these discussions. Table 8.1 presents a summary of the open and closed doors.

**Table 8.1: Open and closed doors in the climate policy negotiations.**

	Closed door	Open door
How far should we go?	<ul style="list-style-type: none"> <li>• Long-term target</li> </ul>	<ul style="list-style-type: none"> <li>• Step by step reductions</li> </ul>
How fast should we go?	<ul style="list-style-type: none"> <li>• Early aggressive action</li> </ul>	<ul style="list-style-type: none"> <li>• Continuation of modest emission reductions</li> </ul>
How should we move forward?	<ul style="list-style-type: none"> <li>• Harmonised policies and measures</li> </ul>	<ul style="list-style-type: none"> <li>• Binding emission targets</li> <li>• Bottom-up policies and measures</li> <li>• Some adaptation measures</li> </ul>
How should the burden be divided?	<ul style="list-style-type: none"> <li>• Formula based-commitments</li> </ul>	<ul style="list-style-type: none"> <li>• Bottom-up political decisions</li> </ul>

Negotiations on a common long-term target, early aggressive actions, harmonised policies and measures and formula-based burden sharing will lead to dead ends. The United States and the major developing countries are not interested in discussing a long-term target. Negotiations on what the stabilisation level would thus serve only to derail the negotiations. The same argument holds for the prospects for adopting aggressive actions in the next commitment period. In time, when the science of climate change is more settled and the United States and several developing countries are ready to take on commitments, there will be a basis for agreement on a long-term stabilisation target and the emission path towards this goal.

The negotiations on the Kyoto Protocol have proved that harmonised policies and measures will not be part of a Protocol. The European Union pressed for harmonised policies and measures, was met with clear resistance from the United States and others, and has since shifted their focus to other issues. Likewise, negotiating a burden-sharing scheme based on a formula, whether top-down or bottom-up, would meet opposition.

The open doors in the future negotiations relate to a continuation of the process identified in the Kyoto negotiations. Step-by-step reductions will again be the way to address the ultimate goal, while modest emission reductions will be considered once again. Two differences could potentially come through. First, some developing



countries might take on different types of commitments, including measures towards adaptation. One possible outcome is burden sharing based on a political bottom-up process, in which Parties put offers or bids on their future commitments into the negotiations. Second, there is some basis for discussions on other means of moving forward. Discussions on targets and timetables would thus be supplemented by discussion on other types of commitments. Adaptation commitments might be part of a package offered to the developing countries in return for their commitment to undertake mitigation and adaptation efforts.

In general, it is important to recognise the opposing positions discussed above and, specifically, to accept and acknowledge that world leaders simply will not agree to significant reductions in living standards in order to achieve climate change targets in a regime after Kyoto.

#### **8.4 Perspectives on incentives for participation**

What incentives can be provided to get the Parties to join the journey? In order to achieve the general recommendations for an optimal regime to the greatest extent possible, provision of incentives for participation (and compliance) are of essential importance. The incentives for participation are divided into two categories:

- Incentives related to the climate negotiation process.
- External incentives, which put climate change negotiations into a global political context.

The climate-related incentives could be adopted as part of the climate policy regime, while the external incentives for participation relate to the correlation between climate policy and other international policies, e.g. WTO negotiations.

The general incentives for participation within the climate policy context are presented and discussed in Section 8.4.1. Section 8.4.2 offers a discussion of the external incentives.

##### *8.4.1 Provision of climate-related incentives for participation*

The incentives for participation are divided into three groups representing environmental, economic and political (equity) incentives. Major incentives are presented in Table 8.2 below.

**Table 8.2 Major incentives for participation and compliance.**

	Environmental incentives	Economic incentives	Political incentives	
European Union	Precautionary principle, moral obligation to protect global natural values	If agreement lead to economic benefits	Moral obligation to avoid adverse impacts in DCs	Leadership role
United States				External pressure
Advanced developing countries and major emitters	Damages primarily hit developing countries	Side-payments: Technological transfers	External pressure	
Rest of developing countries including least dev. countries		Access to adaptation funds Headroom permits	No political pressure	

A country's participation can be motivated by environmental, economic and/or political incentives. The potential of the specific incentives depends on its assessment of the extent of the associated benefits of participation.

The *environmental* incentive to participate is greatest for the developing countries, as the negative effects of global warming primarily hit these countries. The industrialised countries will also have environmental incentives to take on commitments, but to a lesser extent. In the longer term, countries might participate for precautionary reasons, an argument put forward several times by the European Union. The richer countries are also participating because of a moral obligation to protect global natural values, which might be at stake due to global warming.

Both industrialised and developing countries could have *economic* incentives to participate. This will be true for industrialised countries if it is possible to identify policies and measures that reduce greenhouse gas emissions and at the same time bring economic benefits. The existence of win-win situations could pave the way for further international commitments. However, the scope for exploring win-win situations is properly limited. Industrialised countries do not expect substantial commitments under an climate agreement to yield economic benefits, and will want to limit their commitments to an affordable economic impact, so policies and measures to minimise the economic costs will be important to them. Possible trade sanctions or other external incentives imposed on non-parties may also encourage participation.

The developing countries also have incentives to explore the win-win opportunities, which arise when, for instance, resources are utilised more efficiently for the benefit of the environment and the economy. Therefore it is more likely that developing countries can pursue win-win solutions. More up-front economic incentives arise if developing countries are offered various side-payments, e.g. technology transfers, access to adaptation funds or the option of selling headroom permits (see Section 6.4.1). Possible trade sanctions or other external incentives imposed on non-parties may also encourage participation.

The final incentives to participate arise from the *political* aspect. A motivation for the European Union to participate in the international climate policy is the potential to become a world leader in this area. This incentive is, of course, reinforced by the fact that the industrialised countries are responsible for a major part of the historic greenhouse gas emissions. The industrialised countries – including the United States – have a responsibility to take the first step in combating climate change. External pressure based on the polluter-pays principle could force further actions in the United States. However, the US has so far demonstrated that it is acting unilaterally.

External pressure could also be the motivation that prompts some developing countries to take a more active role in the future climate policy. The principle of *common, but differentiated responsibilities and respective capabilities* puts pressure on several developing countries. Even though their historic responsibility is low, their emissions and income per capita are increasing. All Parties must acknowledge that international effort is needed to ensure efficient results.

One important point is that economic incentives might be expected to dominate the decision to participate. Some countries refer to leadership and moral incentives. Such incentives might put pressure on other countries, but they will almost certainly be marginal compared to economic incentives. One major economic incentive for developing countries is compensation in the form of side-payments, which is a prerequisite for obtaining the participation of those countries. Focus should also be drawn to the win-win opportunities in all countries. More research is required on the relationship between climate policy and economic growth.

The next climate regime should build upon the incentives listed in Table 8.2. Particularly, various types of side-payments to mainly developing countries might

pave to the road to broader participation. A number of external incentives are discussed in the following section.

#### *8.4.2 Reflections on external incentives*

The background for the Climate Convention and the Kyoto Protocol was the 1987 Brundtland report and the growing concern in scientific communities about the possible consequences of the greenhouse effect. The current climate regime is the result of a process which primarily focused on creating an international agreement to set an international agenda for climate issues. In addition, the agreements were, to a large degree, created by a relatively small circle of climate and environment experts.

On a global scale, many things have changed since the first negotiations in Chantilly in 1991, the parties' first meeting at the Climate Convention in Berlin in 1995, the meetings in Kyoto in 1997 and Marrakesh in 2001. Both the climate area and the global political scene have been affected by these changes.

History must be taken into account and carry significant weight when developing the future climate regime for the period beyond 2012. The global nature of the climate issues makes it evident that also in relation to the continued development of UN work in the climate area, we must take into account other global conditions which have a direct or indirect bearing on the global development.

Globally, questions such as terrorism, the continued development of the WTO, globalisation, opening of agricultural markets, the debt burden of the developing countries and stability of supply in the energy sector are among the challenges on the agenda. These are areas with a possible influence on the design of a future climate regime. They may be included in the negotiations as important trade-offs between various national and regional interests on the current global agenda.

#### ***Terrorism***

Since 11 September 2001, terrorism has acquired a new meaning and is now high on the global agendas of not least the US and Europe. Even though there is no direct link between terrorism and the climate, insecurity about the climate's impact of the future climate conditions in a number of regions around the world bears on the insecurity about the future which is one of the many reasons for terrorism. Factors that may contribute to reducing the insecurity about the future will thus be

factors that may contribute to reducing the risk of terrorism; elements which both the US and Europe will have an interest in.

### ***WTO and standards***

Another global challenge, which will have a very central position over the decades to come, is the development of WTO. The WTO will guarantee that trade opportunities and free trade – and thus also globalisation - can develop in an optimal manner. For this reason, new member countries are met with a number of requirements, for instance in relation to defining standards for products destined for international trade. Standards benefit from being developed over time in an international agreement system which most countries are monitoring. Consequently, standards will also constitute a relevant instrument in the energy and environment areas and may impact future reductions of greenhouse gasses on a global level, as they can place requirements on the technological development of the individual products and technologies in the energy and environment sectors.

#### *Russian ratification of the Kyoto Protocol*

As part of the EU's pressure to get the Kyoto Protocol started, a number of meetings and negotiations between the EU and Russia were held. Among the items on the agenda was closer energy collaboration between Russia and the EU. The crucial breakthrough came after President Putin's meeting with Chancellor Schröder and President Chirac in September 2004 at which it was agreed that these countries would actively promote Russia's admission to WTO and that President Putin would ratify the Kyoto Protocol.

### ***Agriculture***

Agriculture is one of the trade areas that is expected to receive much attention over the coming years. Today, the area is characterised by very substantial subsidies in the EU, the US and other OECD countries, which makes it very difficult for competing products from third party countries to penetrate the OECD markets. Africa is among the continents that suffer greatly from this situation, but also countries in South and Latin America and Asia are affected. It must be expected that not only the African nations, but also other countries, will rank this issue high on the agenda and that they will want to link it to other global negotiations, for instance on the climate.

***The debt burden***

Even though the World Bank and IMF launched a number of initiatives in 1996 for the debt-ridden developing countries, the debt burden remains a considerable problem for a number of the least developed countries. The issue is often discussed in formal and less formal global fora without reaching any stable solutions, particularly for the African nations. The large deficit built up by the US is also a problem in this respect as it drains a substantial portion of the liquid lending market. This leads to restrictions on the developing countries' access to the cheapest loans on the global lending market. Loans which should lay the foundation for investments in a sustainable economic development.

***Energy***

The energy area has been on the global agenda several times, primarily during the oil crises of 1973 and 1979, but also in connection with the comparatively substantial oil price hikes during the last few years. Indications are that the increasing demand for energy in Asia as well as the growing dependence of the industrialised countries and the large developing countries on oil from politically instable areas have had a large impact on the price development in recent years. As the oil price contributes to fixing prices on the entire energy market, it has a large impact on the global economic development. Stability of supply has become ever more important in the US and Europe in recent years, and not least for the US, it will be important to secure a greater degree of independence in the energy area during the next decades.

***What is most important to the USA?***

All indicators point to the fact that the main issues of President Bush's second term will be the same as during his first term, only carrying more weight. On the international arena, the fight against terrorism will thus receive top priority, and the US will retain its reserved position in respect of global agreements negotiated by the UN whilst attaching greater weight to bilateral agreements. Domestically, the large deficit on the federal budget will constitute an important political theme, where the issue of greater stability of supply will receive much attention. Focus will be on obtaining cheap and stable energy as well as to support research and development in this field.

***What is most important to Europe?***

To Europe, globalisation and the continued development of the EU remain at the top of the agenda. Internationally, security and growth receive high priority, and internally in the EU, the development of stable economic cooperation is prioritised. With a number of initiatives, the EU has also placed sustainable development on the agenda, both internally in the EU and internationally. Energy, environment and development of new technologies are important elements of these initiatives and also form part of the EU programmes. At the same time, the EU is a strong advocate for an ambitious policy on the climate area, and the EU pushed the Kyoto Protocol forward to enter into force on 16 February 2005.

***What is most important to the developing countries?***

Even though the developing countries have many different, and not always shared, political interests, ensuring the best potential for development and economic growth will be a shared ambition. This means that all international processes that may contribute towards achieving this goal will have their interest. In relation to the climate, transfer of technology is an area that enjoys substantial interest because most developing countries have acknowledged the inherent potential for better resource utilisation, a reduction of local and regional environment and health problems and the fact that new technologies can help ensure rural development.

***Reflections in summary***

A very substantial challenge lies in establishing a new UN regime in the climate area over the next few years.

There are many important policy issues on the global agenda including climate change, terrorism, WTO, the debt burden and energy. The US, the EU and the developing countries each put different emphasise on these issues. An area in which everybody is a stakeholder is research and development of new technologies, where the US can play a central role if they are willing and able to see the domestic advantages. The EU may find a central role in establishing global research collaboration, which may foster a number of new technology solutions within energy and environment. Developing countries have high interest in technology transfer. Most countries are also interested in the further development of WTO and there is obvious potential in combining the development of WTO and a future climate regime.

When formulating the framework for a climate regime beyond 2012, it is essential for the negotiators to realise that the key to success is in creating a connection between the climate area and the other, important international policy issues. Those who understand this link and who can establish a connection will also have the key to the future climate regime.

### **8.5 Recommendations on a flexible approach**

The considerations on the optimal regime, the constraints in terms of various national interests and the importance of provision of incentives for participation create the foundation for general recommendations on the next regime. The basic requirement is to ensure broad participation or at least participation from the major emitters.

The recommendations on the next regime for each of the four negotiation issues are in short:

1. Discussions on stabilisation level should only take place among experts and in informal political discussions.
2. Initial commitments are necessary in order to induce awareness and technological development.
3. It is essential to provide flexibility in each Party's choice of commitment type.
4. Strength of the commitment should be guided by the Principle of *common, but differentiated responsibilities and respective capabilities*.

Such a regime would not be truly efficient, but actions against climate change are inevitably characterised by high political costs. The recommendations on the four negotiation issues are elaborated below.

#### ***Core negotiation issue 1: How far should we go?***

There are reasonable arguments for a long-term target, but formal negotiations on a long-term target should not take place. Agreement on such a goal as a formal part of the next regime is highly unlikely, and putting pressure on opponents might derail negotiations. It would be a waste of effort and would likely jeopardise the aim of achieving broad participation. Alternatively, discussions on long-term tar-



gets could take place in informal political discussions, e.g. at the Greenland-meeting proposed by Danish Minister of Environment Connie Hedegaard. Moreover, effort should be allocated on further research into the long-term impacts of climate change.

Agreement on a specific long-term environmental outcome should therefore be postponed to later negotiations.

***Core negotiation issue 2: How fast should we go?***

Initial commitments are necessary to induce awareness and technological development. Adopting any type of commitment will indirectly add a price on carbon. The aim is to ensure that economic incentives are given to all sectors of society, for example carbon emitters, firms and households. A carbon price (a tax or quotas as the EU emission trading scheme) would imply that firms are motivated to increase research and development in low-carbon technologies. Moreover, consumers and firms are given incentives to change consumption and production patterns.

Increasing awareness and initiating the long process of technological development increases efficiency in climate change mitigation.

***Core negotiation issue 3: How should we move forward?***

The next regime should expand *flexibility* in the Parties' choice of commitments. "One-size-fits-all"-commitments (like Kyoto's targets and timetables) should be replaced by commitments which are differentiated according to national circumstances. These relate to perspectives on technical feasibility and economic, environmental and social concerns. Adopting commitments on the basis on national/regional circumstances will most likely ensure wider support.

Commitments could include various policies and measures, national emission targets and adaptation measures. Targets and timetables are appropriate commitments for several Parties (including the European Union), but other types of commitment have to be allowed if broad participation is to be achieved. Developing countries could contribute by adopting a range of policies and measures that ensure sustainable development. The incentive to undertake these measures should be supported by the industrialised countries via, for instance, CDM projects and technological transfers. Commitments could also be directed at adaptation measures. Commitments of industrialised countries could be aimed at national cost-

effective policies and measures, research and development in low-carbon energy technologies, and financial and technological transfer to developing countries. Participation of the US is only likely to be ensured, if for instance R&D in emission reduction technologies or sequestration of carbon can be included as part of future commitments.

Each country or each region put forward their contributions to next commitment period during negotiations. Commitments are formed on the basis of these national proposals for mitigation and adaptation. The level of emission reductions and commitment to adaptation measures for each country is a burden-sharing issue.

Relying on bottom-up proposals increases the potential to achieve broader participation, as commitments account for country-specific circumstances.

***Core negotiation issue 4: How should the burden be divided?***

The depth of commitments should be guided by the principle of common, but differentiated responsibilities and respective capabilities. The industrialised countries must continue to take the lead. And the US has to rejoin the process and commit to reductions. It is unlikely to have a more widespread agreement on mitigation without some more meaningful commitments by industrialised countries on adaptation and impacts. Developing countries with relatively high income and /or emissions per capita should also take on commitments. For instance OECD members South Korea and Mexico should take on commitments, since their ability to pay and responsibility is increasing. Emissions in developing countries with relatively high current (and future) emissions should be addressed, e.g. in China, India and Brazil. Commitments for these countries could include adoption of measures that result in modest reductions compared to their business-as-usual emissions. Further action in these countries should be financed by the industrialised countries, e.g. by technology transfer. Least developed countries, for example many African countries, should only be subject to commitments under the Convention, e.g. submitting inventories of their greenhouse gas emissions.

## 9 CONCLUSIONS AND POLICY RECOMMENDATIONS

This report has reduced the complex negotiations on a future regime to four core negotiation issues. The report has drawn attention to the central environmental, equity and economic trade-offs that need to be addressed when the next regime is negotiated. Furthermore, political conflicts within the negotiation issues imply that optimal policy suggestions should be replaced by pragmatic, second-best policies. There is no such thing as an optimal regime, due to the trade-offs and due to disagreements between the major emitters. For this reason, the need for a flexible regime that gains broad acceptance and participation is emphasised. Particularly US participation is crucial as well as addressing emissions from major developing country emitters.

Seven main conclusions are drawn followed by four policy recommendations:

### **1. There are four core negotiation issues.**

In general, the climate change challenge can be reduced to four fundamental questions: 1) At what level should greenhouse gases be stabilised? 2) Which emission path should be followed? 3) What kind of commitment types should be allowed and required? 4) How should the burden be shared between countries? Our policy recommendations are addressing these four negotiation issues.

### **2. There are trade-offs between the environmental, equity and economic aspects.**

Climate policy is characterised by trade-offs between environmental, equity and economic concerns. The main aim is to achieve a substantial environmental outcome, to take account of various equity principles, to secure economic effectiveness and efficiency and to act wisely in the presence of scientific uncertainty.

### **3. Second-best policies must be adopted.**

All nations are sovereign and agree to a future climate regime voluntarily. Each nation has different positions on options for a future climate regime with profound disagreements among nations in all of the core negotiation challenges. A future regime will therefore be characterised by second-best policies that balance the environmental, equity and economic concerns of participating nations.

**4. There are open doors in the upcoming negotiations.**

There are 'open doors' to a future climate regime despite the trade-offs between the aspects of climate change and despite the profound disagreements between countries. These open doors include agreement on step-by-step reductions, continuation of modest emission reductions in the near future, bottom-up policies and measures, and bottom-up political decisions on burden-sharing. These open doors will most likely frame the next climate regime.

**5. There are closed doors in the upcoming negotiations.**

Negotiations on issues leading to 'closed doors' (e.g. on the long-term stabilisation level and/or aggressive action now) are likely to prove a waste of time and negotiation effort. Negotiations on these issues could derail negotiations. In the worst-case scenario, the negotiations could either disintegrate or reach stalemate, particularly since there is a risk of pulling off several Parties.

**6. Flexible commitments are needed to ensure broad participation.**

The next regime should achieve broader participation. Kyoto's "one-size-fits-all" implementation of targets and timetables should be replaced by a more flexible approach in which Parties contribute through the most appropriate policies that take country-specific circumstances into account. The report presents four recommendations for broad acceptance of the next climate regime.

**7. External incentives for participation should be pursued.**

The climate issue is only one of many issues on the global agenda. When formulating the framework for a climate regime beyond 2012, it is important for the negotiators to realise that the key to success most likely is in creating a connection between the climate area and the most important international policy issues. An area in which everybody is a stakeholder is research and development of new technologies, where the US can play a central role if they are willing and able to see the domestic advantages. The EU may find a central role in establishing global research collaboration, which may foster a number of new technology solutions within energy and environment. Most countries are also interested in the further development of WTO and there is obvious potential in combining the development of WTO and a future climate regime.

It is extremely important to recognise that there is no easy fix for an optimal climate regime from 2013. It will even take a lot of negotiation effort to reach agreement on a sub-optimal climate regime. The negotiations are confronted with many diverse interests. Political disagreement between nations within all the negotiation issues implies that optimal policies should be replaced by second-best policies. The Kyoto process was a political process and the coming climate regimes will probably be negotiated the same way. With time, it is important that costs and benefits (as well as uncertainties) are evaluated thoroughly for all parts of a regime and that environmental, equity and economic arguments are brought explicitly into the negotiations. That is, with time, more attention should be devoted to “on-paper” design of optimal climate policy. For the time being, an agreed direction, which includes broader participation and keeps future options open, is important. Such a regime is not truly efficient, but actions against climate change are inevitably characterised by high political costs.

Economic concerns on jobs, growth and competitiveness are of paramount importance for both industrialised and developing countries, which implies that the most important incentives for participation are economic. Therefore, broad participation could ideally be reached by win-win policies. Useful insights into this area can be provided by more research into the relationship between environmental outcome and economic growth. The Environmental Assessment Institute will focus its effort on this research area in general and future reports will draw attention to those policies which address both environmental and economic concerns.

### **9.1 Policy recommendations**

The basic requirement for the next commitment period is to ensure broad participation or at least participation from the major emitters. Disagreements between the Parties and trade-offs in the formulation of the next regime are serious obstacles in the negotiations on the next commitment period. The various national interests and the conflicting environmental, equity and economic goals constrain the possibilities to form a successful second commitment period. The recommendations for the next regime on each of the four negotiation issues are in short:

### 1. How far should we go?

Discussions on stabilisation levels should only take place among experts and in informal political discussions. Formal negotiations on the stabilisation level might put off several Parties and derail the negotiations.

### 2. How fast should we go?

Initial commitments are necessary in order to induce awareness and promote technological development which in turn increases efficiency in climate change mitigation. Emissions in the major emitter developing countries (China, India and Brazil) should be addressed.

### 3. What means of moving forward should be adopted?

It is essential to provide flexibility in each Party's choice of commitment type. Targets and timetables are appropriate for a range of countries, e.g. in the European Union, but other Parties need to have more options for participation. Participation of the US and developing countries is more likely when offering flexibility in the choice of commitment types. Participation of the US is only likely to be ensured if, for instance, R&D in emission reduction technologies or sequestration of carbon can be included as part of future commitments. Participation by the developing countries is highly unlikely without the participation of the US, which is the largest and most wealthy emitter.

### 4. How should the burden be divided?

The burden-sharing should be guided by the Principle of *common, but differentiated responsibilities and respective capabilities*. Industrialised countries should continue to take the lead. Creating a wider agreement on mitigation is not likely without some more meaningful commitments by the industrialised countries (including the US) on adaptation and impacts. Developing countries with relatively high income and /or emissions per capita (for instance South Korea and Mexico) should also take on modest commitments, e.g. policies and measures that ensure at least modest reductions compared to business-as-usual. Other developing countries should commit to inventories of greenhouse gas emissions.

Such a regime would not be truly efficient, but actions against climate change are inevitably characterised by high political costs.

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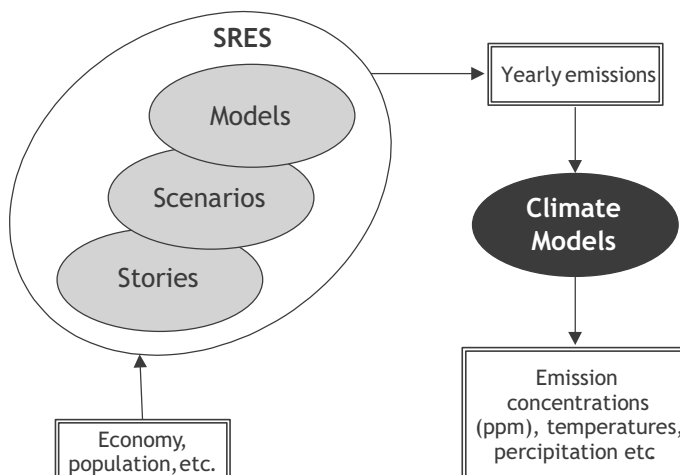
## APPENDIX 1: IPCC EMISSION SCENARIOS

The main purpose of the IPCC's emissions scenarios as described in (Nakicenovic et al. 2000) is to establish more or less likely scenarios of greenhouse gas emissions. The emission scenarios are typically labelled SRES after the report Special Report on Emission Scenarios. The focus is on emissions determined by human activity. The main driving forces are demographic and socio-economic development, and technological change. In the simplest functional way, all other things being equal, population growth will increase emissions. On the other hand, technological change will reduce emissions. The so-called Kaya identity captures this as (where focus is only on CO<sub>2</sub>):

$$CO_2 = Population \cdot \frac{GDP}{Population} \cdot \frac{Energy}{GDP} \cdot \frac{CO_2}{Energy}$$

The SRES play a very important role as they so to say sets the scene of possible outcomes. The process is roughly illustrated in Figure A1.1.

**Figure A1.1. Schematic link from SRES via climate models to temperature change.**



The SRES, through the socio-economic driving forces, feed into the climate models that again produces temperature change scenarios as a result of changes in emissions concentration. In this way the underlying assumptions on for instance economic growth becomes central to the climate scenarios.

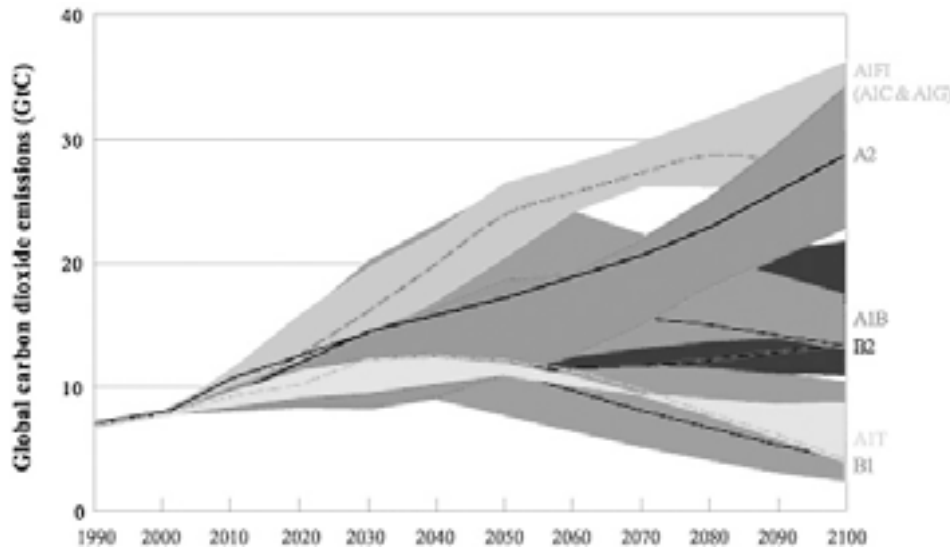
In the SRES process it was decided to produce four different scenarios or storylines as they are also presented with the aim of illustrating possible emission paths. The main driving forces of the scenarios are population, economy, technology, energy and land-use. The four scenarios are very generally characterised as:

Label	Type	Growth rate / characteristics
<i>A1</i>	<i>Convergence between regions, high world-wide interaction.</i>	
	Economy	High
	Technological progress	High
	Population	Low
<i>A2</i>	<i>Non-convergence, self-reliance and high regional interaction.</i>	
	Economy	Slower than A1
	Technological progress	Slower than A1
	Population	High
<i>B1</i>	<i>Global economic solutions, environmental sustainability, higher equity, but without additional climate initiatives.</i>	
	Economy	High towards service and information economy
	Technological progress	Clean technologies introduced rapidly
	Population	Low as A1
<i>B2</i>	<i>Local economic solutions, environmental sustainability, higher equity.</i>	
	Economy	Intermediate (lower than B1)
	Technological progress	Clean technologies introduced slower than B1
	Population	Moderate (higher than B1)

Furthermore the A1 scenario have three commonly used sub-specifications, namely A1FI (fossil-intensive), A1T (high non-fossil fuel) and the balanced A1B.

The resulting CO<sub>2</sub> emissions are shown in Figure A.2. It is obvious that the range is broad spanning from around 8 to 25 GtC in 2050.

Figure A1.2. Global CO<sub>2</sub> emissions (GtC/yr, standardised) from all sources for the four scenario families from 1990 to 2100. Each coloured emission band shows the range of the scenarios within one group that share common global input assumptions for population and GDP. The scenarios remaining outside the six groups adopted alternative interpretations of the four scenario storylines.



From: (Nakicenovic et al. 2000).

One of the main intrinsic weaknesses of the scenarios is the very long time horizon. A second weakness is the strong reliance on a few central driving forces. On the other hand, it is inevitable that long-run socio-economic scenarios must rely on parameters such as growth and technological change.



## A P P E N D I X 2 : U N F C C C P R I N C I P L E S A N D C O M M I T M E N T S

This Appendix presents the principles and commitments of the UNFCCC. It is necessary with a clear understanding of the principles and commitments as they provide the ground rules and background for the international climate policy. The proposals for future action can be interpreted as an operationalisation of the principles and commitments of the UNFCCC. First, the appendix presents the Principles and discusses the environmental, equity and economic aspect of the Principles. Next, the Commitments of the convention is presented.

### Principles in the UN climate process

The UN Framework Convention on Climate Change (UNFCCC), its Kyoto Protocol and the actions taken by Parties under these Agreements are to be guided by the principles embedded in the UN FCCC. The principles are listed in Bx A2.1.

#### Box A2.1 Principles in the UNFCCC

- Protection of the climate system for present and future generations on the basis of *equity* and *common but differentiated responsibilities* and *respective capabilities*, with developed countries to take the lead in combating climate change and its adverse effects (*first steps*).
- Specific needs and *special circumstances of developing country Parties*, especially those that would have to bear a disproportionate or abnormal burden under the Convention, should be given full consideration.
- Precautionary measures (*the precautionary principle*) should be taken to anticipate, prevent or minimise the causes of climate change and mitigate its adverse effects...taking into account that policies and measures should be *cost effective* so as to ensure global benefits at the lowest possible cost.
- Parties have a right to and should *promote sustainable development*. Policies and measures should be appropriate for the specific conditions of each Party (*national circumstances*) and be integrated with national development programmes, while taking into account that *economic development* is essential to adopting measures.
- Parties should cooperate to *promote a supportive and open international economic system* that would lead to sustainable economic growth and development in all Parties, particularly developing countries, thereby enabling them to address the problems of climate change. Measures taken to combat climate change should not constitute a means of arbitrary or unjustifiable discrimination of a disguised restriction on international trade.

These principles evolved through the policy and scientific debate that lead up to the adoption of the UNFCCC. The purpose for their inclusion is to (arguably) provide Parties with a common understanding of how, who and under what circumstances Parties should address and combat climate change. In reality, however, the areas addressed by these principles constitute some of the largest areas of debate within the climate negotiating process, and how these principles are interpreted depend to a large degree by who is reading them.

How negotiators act or react to these principles depends a great deal on where they are located within a document. If it is in a chapeau of a document it is merely a guiding principle but is not binding (it is generally laudatory), where as if a principle is embedded within declarative paragraphs it may be binding and require some sort of action to be taken by Parties. When particularly contentious or difficult issues cannot be resolved and a group of Parties insists on its inclusion in a document, it is sometimes placed in the chapeau as a guiding principle.

The environmental, equity and economic aspect of the UNFCCC is elaborated upon below.

### ***The environmental aspect of the UNFCCC***

The environmental aspect of the UNFCCC, Article 2 (Objective) and the principles set out in Article 3 are outlined and discussed in this section.

Article 2, Objective (UNFCCC 1992, p. 9):

*“The ultimate objective...is to achieve...stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change...”*

There are two fundamental concepts within the environmental aspect of climate change in the UNFCCC Objective. These are (1) Stabilisation level of greenhouse gases. The absolute increase in the concentration of greenhouse gases in the atmosphere must not exceed a level that causes dangerous interference with the climate system. This level will be referred to as the “safe level”. And (2) Rate of climate change. The speed of climate change should allow ecosystems to adapt naturally.



The environmental challenge of climate change lies in the approach to these two main concepts. However, in real-world politics this is no simple matter, as there is plenty of room for differing perspectives on safe level and rate of change, making the UNFCCC objective somewhat vague. The UNFCCC objective raises a number of contentious questions:

First, what is “*dangerous...interference*”? The term ‘dangerous’ is subjective, as is the related term ‘safe level’.

Second, how should “*dangerous...interference*” be measured? Dangerous interference can be measured by the impact of climate change. But the impacts of climate change usually have other supplementary causes besides climate change. The relative impact of climate change may therefore be difficult to quantify. One example is increasing economic losses due to extreme weather, mainly caused by the concentration of economic values in vulnerable areas such as coasts and river plains (Busk et al. 2003).

Third, what is “*anthropogenic interference*”? The climate system is characterised by natural variability (time scale of years to decades) and natural change (time scale of decades to centuries). It is an ongoing issue how much change is contributed by human activity compared to natural change. However, the IPCC is expressing greater confidence than before that human activities are altering climate patterns (IPCC 2001c, p.5), see figure 2.2.

Fourth, how is ecosystem change measured? Ecosystems change naturally for a number of reasons besides climate change. Are reversible changes allowed and for how long? And which ecosystems should be taken into consideration?

The environmental aspect of the principles of the UNFCCC raises the same questions as above. The principles, which include environmental considerations, are outlined below.

Article 3, Principle 1 (UNFCCC 1992, p. 9):

*“The Parties should protect the climate system for the benefit of present and future generations....”*

The term ‘protect’ refers to safe level and rate of change. The issue of equity between generations and dynamic efficiency is also implied.

Article 3, Principle 3 (UNFCCC 1992, p. 10):

*“The Parties should take precautionary measures to anticipate, prevent or minimise the causes of climate change and mitigate its adverse effects. Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing such measures....”*

The phrases “minimise the causes of climate change” and “mitigate...adverse effects” refer to safe level and rate of change. In addition, there is a core issue of uncertainty, which is discussed in Section 5.2.

To sum up, the UNFCCC objective and principles leave much room for differing positions on the environmental outcome of a climate regime. There are no quantified targets and signing parties are only committed to subjective targets such as *“preventing dangerous interference with the climate system”*.

### ***The equity aspect in the UNFCCC and Kyoto***

The equity issues in the Convention are addressed in article 3.1 and 3.2:

Article 3.1 (UNFCCC 1992, p. 9):

*“The Parties should protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities. Accordingly, the developed country Parties should take the lead in combating climate change and the adverse effect thereof.”*

There are clear references to two equity principles, which are the responsibility (polluter pays) principle and ability-to-pay principle (capacity). The notion of common but differentiated responsibilities and respective capabilities is a fundamental principle of the Kyoto Protocol, where developing countries have no commitments. The commitments under the Kyoto Protocol are presented in Table A2.1. Also the issue of equity between generations is addressed.

Differentiation of commitments is a key principle in the UNFCCC and in the Kyoto Protocol. Commitments are differentiated in the Kyoto Protocol, see Table A2.1.

Only Annex I countries (see Appendix 3) have commitments. These are differentiated according to the Protocol, and within the EU also according to the internal EU Bubble. The EU has a common commitment of a 8% reduction, but there are huge differences in commitments within the EU bubble with Luxembourg, Germany and Denmark reducing by about ¼, while Greece and Portugal are allowed to increase emissions by around ¼.

**Table A2.1: Emission commitments in the 2008-2012 period by country.**

COUNTRY	EMISSION CEILING 2008/12 TO 1990	COMMENTS
LUXEMBOURG	-28%	EU BUBBLE
DENMARK, GERMANY	-21%	EU BUBBLE
AUSTRIA	-13%	EU BUBBLE
UK	-12,5%	EU BUBBLE, NATIONAL TARGET OF 20% BY 2010 WILL PROBABLY NOT BE MET
BULGARIA, CZECH, ESTONIA, LATVIA, LIECHTENSTEIN, LITHUANIA, MONACO, ROMANIA, SLOVAKIA, SLOVENIA AND SWITZERLAND	-8%	
BELGIUM	-7,5%	EU BUBBLE
US	-7%	HAS NOT AND WILL MOST PROBABLY NOT RATIFY. NOT ON TRACK.
ITALY	-6,5%	EU BUBBLE
NETHERLANDS, CANADA, HUNGARY, JAPAN, POLAND	-6%	NETHERLANDS UNDER THE EU BUBBLE
CROATIA	-5%	
FINLAND, FRANCE, NEW ZEALAND, RUSSIA, UKRAINE	0	FINLAND AND FRANCE UNDER THE EU BUBBLE
NORWAY	+1%	
SWEDEN	+4%	HAS A MORE STRICT NATIONAL TARGET OF -4%
AUSTRALIA	+8%	HAS NOT AND WILL MOST PROBABLY NOT RATIFY EVEN THOUGH THEY ARE ON TRACK. COAL INDUSTRY INTERESTS.
ICELAND	+10%	
IRELAND	+13%	EU BUBBLE
SPAIN	+15%	EU BUBBLE
GREECE	+25%	EU BUBBLE
PORTUGAL	+27%	EU BUBBLE

Source: Kyoto Protocol, [www.dti.gov.uk/ccpo/glossary\\_targets.htm](http://www.dti.gov.uk/ccpo/glossary_targets.htm).

In Article 3.2 (UNFCCC 1992, p. 9) there are references to the equity principles of need and opportunity:

*“The specific needs and special circumstances of developing country Parties, especially those that are particularly vulnerable to the adverse effects of climate change, and of those Parties, especially developing country Parties, that would have to bear a disproportionate or abnormal burden under the Convention, should be given full consideration.”*

The principles also apply to the effects of climate change, in terms of the allocation and financing of adaptation measures.

### ***The economic aspect of the convention***

The economic aspect of the UNFCCC convention is addressed in Principles 3.3 and 3.5.

Article 3.3 (UNFCCC 1992, p. 9):

*“...taking into account that policies and measures to deal with climate change should be cost-effective so as to ensure global benefits at the lowest possible cost. To achieve this, such policies and measures should take into account different socio-economic contexts,...., and comprise all economic sectors.”*

Article 3.5 (UNFCCC 1992, p. 10):

*“The Parties should cooperate to promote a supportive and open international economic system that would lead to sustainable economic growth and development in all Parties, particularly DC Parties, thus enabling them better to address the problems of climate change. Measures to combat climate change, including unilateral ones, should not constitute a means of arbitrary or unjustifiable discrimination or a disguised restriction on international trade.”*

There is one central economic aspect: the achievement of cost-effectiveness. The mitigation target should be reached in a cost-effective manner by including all economic sectors and international co-operation.

### **Commitments in the UN climate process**

The principles of the UNFCCC are reflected in the commitments contained in the Convention. Chief among these is the common but differentiated responsibilities placed on Parties. All Parties to the UNFCCC have some type of commitment related to emissions of greenhouse gases, and these are contained primarily under Article 4. Article 4 contains ten paragraphs, which are a mix of actions Parties should or must undertake, under different conditions.

#### ***Articles 4.1 and 12 (reporting)***

Article 4.1 contains commitments that are common to all Parties. These pertain to development of national inventories of greenhouse gases, developing and implementing domestic and regional climate change mitigation programmes, and pro-

moting and co-operating on a broad range of issues including technology, and sustainable development. A further commitment, under Article 12, requires Parties to report on activities under 4.1—to the extent a country’s capacity (financial and otherwise) permits. These reports are known as national communications, and are an important feature under the UNFCCC process since they are the basis for reviewing implementation of commitments under the Convention.

Based on the principle of “common but differentiated responsibilities”, reporting requirements for national communications differ in terms of content and frequency. Annex I Parties must submit their national communications every three to five years, while reports from non-Annex I countries are dependent on availability of funding (through the GEF) and LDCs are only required to report at their discretion. While Annex I countries are required to submit a national inventory of greenhouse gases annually and undergo in-depth reviews, non-Annex I countries have no such requirements. Although Annex I Parties are required to submit national communications and national inventories, there are no compliance consequences for late reports or failing to fulfil these commitments. This will change (for Annex I Parties that are Party to the Protocol) under the Protocol, since compliance requirements include fulfilling reporting requirements in a timely manner.

***Articles 4.2 (d) and 7.2 (a) (adequacy of commitments)***

An important feature of the UNFCCC is the ability of the COP to review the commitments under the Convention. This can be done in two ways:

- Article 4.2 (d) required the first session of the COP to review the commitments contained in paragraphs (a) and (b) of Article 4.2—pertaining to Annex I Parties, to undertake a second review by 31 December 1998 and thereafter to keep these commitments under regular review.
- Article 7.2 (a) enables the COP to “periodically examine the obligations of the Parties ...in light of the objective of the Convention, the experience gained in its implementation and the evolution of scientific and technological knowledge.”

Reviewing the adequacy of commitments is a highly contentious issue and only the first review contained in Article 4.2 has occurred (at COP-1 in 1995). This review ultimately resulted in the adoption of the Kyoto Protocol. The reason for contention is the difference in opinion between Annex I and non-Annex I Parties on this issue.

Annex I Parties, to varying degrees, have argued that in order to fulfil the ultimate objective of the Convention, more needs to be done by all Parties. But non-Annex I Parties counter that more needs to be done by Annex I Parties, including on technology transfer, funding and in reducing Annex I emissions first. This issue will not become any less difficult. The G-77/China, for example, made clear in their opening statement at COP-10 in Buenos Aires, that non-Annex I Parties will not take on any new commitments—that Annex I Parties must fulfil their commitments on funding and the development and transfer of technology. This will make negotiations for a second commitment period under the Protocol extremely difficult. The US is highly unlikely to participate in these negotiations and therefore non-Annex I Parties are equally unlikely to engage in discussions that would result in expanded commitments for even the largest developing countries. No action has been taken under Article 7.2 (A).

***Article 4.3 and 4.4 (funding requirements)***

Article 4.3 and 4.4 requires all Annex I Parties (OECD country Parties in particular) to provide financial resources to enable non-Annex I Parties to meet their reporting obligations in two ways: Annex I Parties are to provide the full cost (in the form of new and additional resources) incurred by non-Annex I Parties in meeting reporting requirements under Article 12.1 (inventory reporting). In addition, Annex I Parties are to provide financial resources, including transferring technologies, so that non-Annex I Parties can meet the incremental costs associated with implementing measures listed under Article 4.1 (for priorities or objectives related to measures to mitigate climate change or for adaptation). This “funding” is provided through the financial mechanism to the UNFCCC, which is located in the GEF.

Annex I Parties must also assist developing countries that are particularly vulnerable to the adverse effects of climate change in meeting the costs of adaptation.

***Article 4.5 (development and transfer of environmentally sound technologies)***

Development and transfer of technologies has also been a difficult issue under the UNFCCC process. Although recent years has seen some movement on this issue (primarily through development of a consultative process), non-Annex I Parties continually call on Annex I Parties to fulfil their commitments under this issue. One of the reasons for the difficulty on this issue is a difference of opinion on how this commitment can be fulfilled. Throughout the climate negotiations, many non-Annex I Parties have felt that Annex I countries have a moral obligation to transfer

technology to non-Annex I countries/governments on a preferential, non-commercial basis. Annex I Parties, however, argue that technologies are owned primarily by the private sector; and that although governments support research and development into new technologies, it is the private sector that ultimately owns the technology and therefore the private sector should be the main vehicle for technology transfer.

#### ***Article 4.6***

This paragraph simply provides countries with economies in transition with flexibility in meeting their commitments under Article 4.2

#### ***Article 4.7***

Article 4.7 is essentially linked to all commitments under Article 4. It does not specify actual commitments, but rather links the ability of non-Annex I Parties to fulfil their commitments to the actions of Annex I Parties in fulfilling their financial resources and technology transfer requirements. It also provides non-Annex I Parties with a loophole as far as taking on mitigation measures is concerned, in that it clearly states that mitigating climate change does not have to be a priority for these countries: "...that economic and social development and poverty eradication are the first and overriding priorities of the developing country Parties."

#### ***Article 4.8 and 4.9 (adverse effects)***

Originally referred to as "compensation" by some Parties, "adverse effects" is an issue under the UNFCCC and the Protocol. Officially known as "Implementation of Article 4.8 and 4.9 of the UNFCCC and matters relating to Protocol Article 3.14", this issue has been considered in relation to both the review of implementation of the UNFCCC and preparation for COP/MOP-1.

Implementation of Article 4.8 and 4.9, was introduced as an issue during the AGBM process by OPEC as a way to compensate countries for any revenue lost due to mitigation measures undertaken to meet Annex I commitments (hence the term "compensation"<sup>41</sup>). Since then, discussions have expanded to include addressing the specific needs and concerns of developing countries (including the least developed countries) arising from the adverse effects of climate change and/or the im-

part of implementation of response measures. Discussions related to Article 4.8 and 4.9 have been extremely difficult.

Annex I countries have been unified in their approach on the issue of implementing Article 4.8 and 4.9, particularly as it relates to the issue of compensation of oil producing countries. Annex I countries do acknowledge that less developed countries have legitimate concerns related to the adverse impacts of climate change which need to be addressed. However, the issue of “compensation” to oil producing countries has been seen as a “poison pill” by some Parties.

#### ***Article 4.10***

This article simply requires Parties to take into consideration, when implementing commitments under the Convention, the impact that implementing mitigation measures would have on economies that are highly dependent on fossil fuels, either as a producer or consumer.

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<sup>41</sup> The concept of compensation for loss of oil revenues was introduced in the early INC (the negotiating process that led to the creation and adoption of the UNFCCC) process. It was, as it continues to be, an issue that primarily serves to slow the process down since there is no middle ground on this issue.



## APPENDIX 3: ANNEX I AND II COUNTRIES

Below the Annex I and Annex II countries respectively are listed (IPCC 2001b).

**Table A3.1 Annex I and Annex II countries.**

<b>Annex I:</b>			
Australia	Finland	Lithuania	Slovenia
Austria	France	Luxembourg	Spain
Belarus	Germany	Monaco	Sweden
Belgium	Greece	Netherlands	Switzerland
Bulgaria	Hungary	New Zealand	Turkey
Canada	Iceland	Norway	Ukraine
Croatia	Ireland	Poland	United Kingdom of
Czech Republic	Italy	Portugal	Great Britain and
Denmark	Japan	Romania	Northern Ireland
European Union	Latvia	Russian Federation	United States of
Estonia	Liechtenstein	Slovakia	America
<b>Annex II:</b>			
Australia	France	Luxembourg	Switzerland
Austria	Germany	Netherlands	Turkey
Belgium	Greece	New Zealand	United Kingdom of
Canada	Iceland	Norway	Great Britain and
Denmark	Ireland	Portugal	Northern Ireland
European Union	Italy	Spain	United States of
Finland	Japan	Sweden	America

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### **About the report**

With the recent entry into force of the Kyoto Protocol, global climate talks are beginning to address what to do beyond Kyoto. How far should we go? Which road should be followed? What means of moving forward should be adopted? Finally, how should the burden be divided?

This report examines the trade-offs and disagreements that arise when countries try to answer these fundamental questions. The report concludes that it is essential to provide flexibility in each Party's choice of commitment type. The report recommends that "one-size-fits-all" should be replaced by more flexible commitments. This could ensure broader participation, which is necessary to fight climate change effectively.

The report is a part of the IMV focus on environment and economic growth.

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