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Issues and Options for the Post-2012 Climate Architecture – An Overview

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Abstract. This article provides a background for the 'Developing post-2012 scenarios project', an international study which looks at a range of scenarios that countries may wish to consider for a post-2012 framework to tackle climate change. The purpose of the article is threefold. Firstly, it provides a review of the literature for the future climate regime. Secondly, it provides a set of criteria that are used in order to evaluate whether the scenarios provided in the other articles in this Special Edition are likely to be effective. Thirdly, the article spells out some of the more general policy implications rising from these scenarios.

Key words: climate policy, post-2012, scenarios

1. Introduction

The Kyoto Protocol under the United Nations Framework Convention on Climate Change (UNFCCC) is an important first step in the development of a truly global climate regime. However, even if it enters into force the regime will look different than what was originally assumed. The USA has opted out and currently shows no signs of returning. For future negotiations, views are sharply divided between, and among, developed and developing countries on the issue of burden sharing. While the Protocol schedules another negotiation round beginning from 2005 to set further targets beyond 2012, there is a possibility that countries may be looking to develop alternatives to the current framework, particularly if the world's largest emitters refuse to engage in the Kyoto process. It is essential that we already now make an effort to identify the problems we will face in the coming rounds of negotiations, and explore policy options that can help overcome them. "International Environmental Agreements" has been a forum for discussions about the future of climate policy in the past (Barrett and Stavins 2004; Torvanger 2004), particularly in a special issue "New paths for international climate policy" published in 2002 (Bohm 2002; Michaelowa and Tol 2002; Torvanger and Ringius 2002). These papers either focused on specific theoretical explanations (Barrett and Stavins 2004) or specific aspects of the climate regime such as burden sharing (Torvanger and Ringius 2002) and emissions trading (Bohm 2002). This article provides a background for the 'Developing post–2012 scenarios project' [2]presented in this special issue, a study which looks at a range of scenarios that countries may wish to consider for a post-2012 framework. As visible from the articles published in ''International Environmental Agreements'', up to now little work has focused on developing broad regime scenarios that could serve as a pragmatic basis for post-Kyoto negotiations that are set to begin in 2005. We understand our scenarios as the regime structures that would unfold given specific assumptions about policy drivers. These assumptions differ sharply among the project participants and are often linked to their climate policy background. We want to 'frame' the scenarios by looking at some of the issues and options that emerge when designing a future international climate change regime and also further analyse a range of policy implications that need to be considered simultaneously. Section 2 presents a literature review of issues and options for a future climate policy regime. Section 3 discusses criteria of environmental effectiveness that should be considered for a future global climate regime. Finally, Section 4, drawing on the other articles in this *Special Edition,* presents a set of policy recommendations for policymakers to consider when deciding upon the future regime architecture.

2. Literature Review of Issues and Options

There is a wealth of literature on specific aspects of the climate policy regime. It can be differentiated according to the main possible responses to the threat of climate change that will enter into the policy scenarios:

- a strategy for adaptation to negative economical, social and ecological impacts,
- the reduction of global greenhouse gas (GHG) emissions, including sequestration of carbon dioxide by natural sinks and/or technical storage.

2.1. Adaptation

As is understood today, climate change might have significant impact on economies, society and human infrastructure, although those impacts are expected to be more severe in some regions of the world than in others (IPCC 2001). Thus, there undoubtedly is the need to adapt to the potential impacts of global warming – be it with technical, behavioural or social measures. However, one can imagine that funds needed to both prepare for potential impacts of climate change and to compensate for negative effects in a satisfactory way would need to be incredibly huge. UNDP has commissioned a series of nine Adaptation Policy Framework Technical Papers that look at different aspects of adaptation (UNDP 2003) while UNEP (2001) did an overview work on vulnerability and AFDB et al. (2003) presented a concise multi-donor evaluation of the issue. It can however be stressed that adaptation policy is still in its infancy. An idea first floated by AOSIS (UNEP 1993) to raise funds currently re-enters the debate: insuring against negative impacts of climate change. The idea is to establish a climate-change-insurance on a multi-national or national level to help compensating the poorest people after e.g. floods, storms or droughts. Such insurance systems obviously would need to be established as private–public partnerships – with insurance companies, financial institutions, governments and emitters involved (Linneroth-Bayer et al. 2003). One might even apply the polluters-pays principle in obliging emitters of GHGs – be it nations or companies – to contribute to finance insurance fees according to their contribution to global warming (UNEP 1993).

2.2. Reduction of Global Greenhouse Gas Emissions

Although adaptation is an important, and an unavoidable issue, most of the existing research activities on post-Kyoto issues have narrowly focused upon target settings among countries, such as alternative target formulae or legal nature of the targets. An economist would frame the task of international climate policy as follows: minimise net costs of climate policy. Costs would be generated by the mitigation of greenhouse gases and adaptation to climate change while benefits would accrue from reducing impacts of climate change. Minimisation of costs would mean that marginal costs of mitigation and adaptation would have to be equal to marginal benefits from avoided climate change. This seemingly easy task becomes complex due to several factors:

- Discounting of future costs and benefits leads to interminable debates among economists about the appropriate level of the discount rate. Given the multi-century nature of climate change, even a tiny difference in the discount rate leads to hugely differing outcomes.
- Uncertainty of current mitigation costs on an aggregated level. Detailed information on costs and potential only is available to emitters themselves, not to national/international bodies.
- Development of mitigation costs over time is uncertain due to the unpredictable course of technological progress. If for example a technological breakthrough occurs that allows greenhouse gas emission-free electricity generation at costs below those of fossil fuel plants, mitigation costs fall dramatically.
- Adaptation costs depend on the overall level and pace of development of a society that is uncertain over the long run. Impacts of climate change depend on non-linearities that are currently not well understood.

2.3. Concentration Targets

If economists cannot use a cost-benefit approach, they use the standard-price approach as a second best (Baumol and Oates 1971).

A pure standard-price approach for international climate policy would consist of the following elements:

- Political definition of a maximum tolerated level of climate change at a specific time. Usually, global temperature change is used as a parameter.
- Political definition of a maximum tolerated rate of climate change until the maximum level is reached. This is necessary because damages from climate change increase with its rate.
- Derivation of a maximum concentration and a concentration path.
- Definition of a global emissions path that generates the concentration path.

The German Advisory Council on Global Change (WBGU) has used this approach to define a 'tolerable window' of a temperature increase beyond 16.6 °C global average temperature and a maximum rate of 0.2 °C per decade. This would approximately mean a stabilisation at 450 ppm (WBGU 1995, p. 111ff). Bruckner et al. (2001) further elaborate this approach. They not only define a temperature 'guard-rail' which is set at a temperature increase of 2 °C and the decadal rate specified by WGBU (1995) but also an economic one expressed as a maximum global emission reduction rate of 4% per year. Continuation of a global business-as-usual scenario until 2010 leads to Annex B countries having to implement the maximum reduction rate for three decades.

A famous controversy about the shape of the emissions paths leading to a stabilisation of concentrations arose between Wigley et al. (1996) and Ha Duong et al. (1997). The former argue for delayed mitigation action due to the high economic costs of premature retirement of emissions-intensive capital stock while the latter contend that early action is warranted as current capital stock can only be replaced after a time lag of several decades. Thus the Ha Duong et al. emissions path is flatter that the Wigley et al. one.

2.4. Expanding the Circle of Countries with Emission Targets

Currently, only the industrialised countries and countries in transition listed in Annex B of the Kyoto Protocol have legally binding emission targets. The expansion of the group of countries having such targets is a hot issue. Depledge (2002) argues that emission targets should be taken up once countries reach e.g. a level of wealth or of emissions comparable to the current Annex B countries. Such a threshold approach might help to ensure that countries contribute to fight global warming in a 'fair' way. Since the exact definition of 'fairness' or 'equal contribution' not only is a very complex task for lawyers but also a very sensitive one in political terms, so far no consensus on a concrete definition has been possible. Consequently, there are several options how to define thresholds triggering target negotiations for Parties:

- financial indicators, as e.g. GDP/GNP per capita,
- emissions per capita,

- cumulative past emissions ('historical responsibility for climate change'), and
- institutional indicators.

2.5. Quantification of National Emission Targets

Once the methods to determine which countries take up a target and the global emission target in a given period (e.g. by means of a GHG-concentration path) have been defined, the target level has to be specified for every country. Several principles have been developed over the last decade to avoid an *ad hoc* 'oriental bazaar' bargaining, as was very much the case during the negotiations of the Kyoto Protocol.

The notion of equity is important in this regard. While some analysts argue that "existing theories provide little or no guidance to the equity of any particular international allocation of carbon emission permits" (Beckerman and Pasek 1995), others (Grubb 1995; New Economics Foundation 2002) see some clear recommendations emanating from the equity principles discussed. Table I shows the main equity principles suggested in the last years that allocate targets dependent on different criteria.

Closely connected to the above named principle of 'capacity' is the question if and what kind of targets (in terms of stringency) are economically manageable especially for developing countries. One must be aware, however, that there is no universal answer to this question. A country-specific approach seems necessary since countries' national circumstances and economic needs differ strongly regardless their classification as industrialised or developing country.

Factors that could also be taken into consideration are:

- standards of public infrastructure (social, health, infant mortality),
- availability of natural resources,
- recent pace of development,
- international debt,
- international development aid received, etc.

Table I. Equity principles.

Principle	Criterion
Need for economic development[a]	Equal per capita emissions budget
Responsibility for the problem[a]	Stringency of reduction proportional to cumulated emissions
Capacity, i.e. ability to pay[a]	Stringency of reductions proportional to GDP per capita
Opportunity[b]	Stringency of reductions proportional to availability of cheap reduction potential

[a] Jansen et al. (2001).
[b] Claussen and McNeilly (1998).

In the sum, the task to define national emissions targets based on the degree of development is a very complex one and a highly political issue. In the following, we present the methodological approaches that have been proposed in recent years:

- grandfathering (historical emissions in an agreed reference year),
- per capita allocation,
- contraction and convergence,
- cumulative emissions,
- preference score,
- triptych,
- multi-sector convergence.

For a quantitative comparison of contraction and convergence, Triptych and a threshold-based multi-stage regime see Den Elzen (2003).

2.5.1. *Grandfathering*

'Grandfathering' allocates emission budgets cost-free according to emissions in a specified base year and is obviously preferred by countries that already have high per capita emissions. It was the basis of the UNFCCC targets and is found to a great extent in the Kyoto targets (base year 1990/1995). Grandfathering under a strongly declining emissions path due to a tough concentration target will lead to extremely challenging targets for countries with strongly rising business-as-usual emissions. Thus non-Annex B countries will stiffly oppose global grandfathering. At the same time, grandfathering advantages countries with high emissions in the reference year/period chosen, which basically are industrialised countries. Grandfathering by itself does not take account of the equity issue. However, initial grandfathering is a crucial dimension of most compromise proposals.

2.5.2. *Per Capita Allocation*

Equal per capita allocation has been argued for by representatives of developing countries from the start of the climate negotiation process (Agarwal and Narain 1991). As *immediate* per capita allocation would lead to an enormous shortfall in Annex B emissions budgets and a corresponding surplus in non-Annex B budgets, it is not suggested by any policy proposal currently on the table. However, many proposals contain elements of per capita allocation at a future date. The question is how the transition process is managed.

Some argue that there are natural factors influencing the amount of per capita emissions, e.g. a colder climate or lower availability of renewable resources of a country which could lead to differences of cross-country CO_2 emissions and should therefore be considered to adjust per capita allocation of emissions budgets. Neumayer (2002) has analysed those factors. and concludes that natural factors only explain per capita emission differences to a limited extent. Further research on this issue would be valuable.

2.5.3. *Contraction and Convergence*

The ethically appealing and easy-to-understand approach 'contraction and convergence' has been developed and marketed by the Global Commons Institute and increasingly attracted supporters (see the interesting description of its history in Meyer (2000)). On the basis of a concentration target, a global emissions budget path is developed. A date is negotiated by which budgets are derived on an equal per capita basis. Until then, budgets decrease proportionally from current emission levels. Resulting emissions reductions for Annex B countries are the sharper, the earlier convergence takes place and the lower the target concentration level. The Global Commons Institute provides the model free of charge.

2.5.4. *Cumulative Emissions*

The 'Brazilian proposal' (Brazil 1997) calculates the cumulative warming impact of country emissions and assigns more stringent targets to those countries with the highest cumulative emissions. For a more detailed discussion see La Rovere et al. (2002).

2.5.5. *Preference Scores*

The preference scores approach asks countries to specify their preference for either grandfathering or per capita allocation. The preferences are globally weighted with country population (Bartsch and Müller 2000, p. 259ff). The overall budget is derived from the emissions path that reaches the desired concentration target.

2.5.6. *Triptych*

The Triptych approach defines three sectors – electricity generation, heavy industry and households (Groenenberg et al. 2001). For each sector, a variable is deemed to linearly converge to a uniform global value at a future date – greenhouse gas intensity of electricity production, energy efficiency of industry and per capita emissions. So the Triptych is essentially a sectoral and linear contraction and convergence approach. It has been successfully used within the EU to reallocate targets within the bubble. Groenenberg (2002) defines a global Triptych for 2020. A decisive input necessary to apply a Triptych are estimates for the growth rates of electricity generation, production of heavy industry and population; Groenenberg uses World Energy Council and U.N. projections. One needs to be aware that uncertainties are the higher, the farther the target year is in the future. Key elements of the approach are shown in Table II.

Table II. Determinants of global Triptych.

	Electricity generation	Heavy industry	Households
Variable addressed	Emissions intensity[a]	Energy efficiency[b]	Per capita emissions[c]
Convergence year	2050	2050	2050
Convergence level	200[d]	0.67[e]	2[f]
US 1995	580	1.8	10.3
Japan 1995	400	1.3	4.6
Western Europe 1995	390	1.2	4.6
Former Soviet Union 1995	700	2.0	4.1
Middle East 1995	640	1.6	2.6
Latin America 1995	230	1.5	1.7
East Asia 1995	790	1.9	1.0
South East Asia 1995	610	1.6	0.8
South Asia 1995	860	1.7	0.5
Africa 1995	590	1.6	0.6

[a] g CO_2/kW h.
[b] Best practice in 1995 = 1.
[c] t CO_2.
[d] Derived from the estimate that 50% of the gap between the current best practice and the thermodynamic minimum can be closed.
[e] Derived from an assessment of basic energy needs on European consumption level of the 1970s that leads to an average of 1.5 kW per capita.
[f] Derived from the assumption of 60% renewables and 13.3% each of oil, gas and coal.

The Triptych has already shown its usefulness in the EU. It avoids the extremes of grandfathering and per capita allocations and thus is a suitable compromise candidate, especially if the growth assumptions are regularly checked and recalculations done accordingly. Some assumptions may be too optimistic but convergence dates and levels can be adjusted.

2.5.7. *Multi-sector Convergence*

The multi-sector approach (Jansen et al. 2001) has some similarities with the Triptych. It starts with the definition of seven sectors – power generation, households, transport, industry, services, agriculture and waste. For these sectors global 'emission standards' are set on a per capita basis derived from a set concentration target; they converge at a set future year. The sectoral standards are then converted into indicative national targets; all countries that have a per capita emission above the world average have to make that target binding. Specific national circumstances can be addressed through *ad hoc* adjustments, which, of course reopens the whole regime and is not advisable. Countries that have to take up targets can apply an adjustment period of one commitment period before the targets become binding.

2.5.8. *Other Approaches*

Baumert and Llosa (2002) propose a dual target consisting of a stringent target from which emissions trading can be done, and a considerably weaker target that triggers non-compliance procedures. Targets could be linked to an international price cap per tonne of CO_2 equivalent. This presumes an international emissions trading system. When the market price rises above the threshold value, governments can issue an unlimited quantity of additional allowances (Kopp et al. 1999; Victor 2001; Philibert and Pershing 2002).

2.6. Coverage of International Transport

Emissions from air and sea transport that are not covered under the Kyoto Protocol could be allocated to the countries where trips originate and end. Alternatively, the International Maritime Organisation (IMO) and the International Civil Aviation Organization (ICAO) would be allocated a distinct target (see Bode et al. 2002). Emissions from air travel should be accounted for by using a special conversion factor that includes the indirect effects due to the specific chemistry of aircraft emissions in the high troposphere. Using IPCC results, this factor amounts to 2–4 (IPCC 1999). Contrail effects are not included in this estimate but should enhance this factor further as recent findings have reconfirmed their significance (Travis et al. 2002).

2.7. Harmonised Policies and Measures

A common set of policies would be a possible alternative to absolute emissions targets and might enhance developing country participation. In fact in the early stages of international climate policy the discussion concentrated on policy harmonisation. The EU supported such an approach against US opposition until Kyoto.

A macroeconomically efficient perspective to greenhouse gas mitigation would be to take positive local pollution externalities into account ('ancillary benefits', OECD 2000). In severely polluted areas, the externalities can be higher than the costs for greenhouse gas abatement and reach values of above 10 €/t CO_2 eq.

Proponents of an efficient climate policy based on a uniform price signal have long favoured a co-ordinated greenhouse gas tax. It was already proposed prior to UNCED and has been revived from time to time (Schneider and Goulder 1997). The main problem of a tax is the reluctance of policymakers to introduce pervasive new taxation and the issue of revenue recycling. Recycling of revenues collected by each country may be a more acceptable solution than revenue collection by a global institution. However, a problem of the co-ordinated tax is how changes in exchange rates and differences in national abilities to pay are addressed because otherwise 'tax havens' would come into being. Winkler et al. (2002) propose that industrialised countries should subsidise mitigation action in developing countries without getting emission credits; they do not say how the subsidy volume and the donors' shares will be set. Philibert and Pershing (2002, pp. 84–88) and Barrett (2002) suggest a global subsidy programme to develop renewable or carbon-free technologies. The problem with such an approach is that governments have a mixed record in picking technological winners. Other observers (Hoffert 2001) argue "the history of the last 50 years shows that all of the important innovations that have spurred the growth in wealth have all come from government sponsored military R&D, first in World War II and then in the Cold War. It is simply not cost effective, because there is no profit for many years, for the private sector to invest in the development of the kinds of transformative technology that will be necessary to solve this problem". Edmonds and Wise (1999) proposed that all new fossil fuelled power plants should have to sequester the carbon geologically. Such an approach suffers from all the efficiency problems that characterises regulation. Costs may be much higher than under a market-based solution.

2.8. Sequestration of Greenhouse Gases from the Atmosphere

Sequestration of greenhouse gases might be classified as a sub-category of reduction options. The discussion on natural sinks has played a special role in past negotiations and sinks may be crucial for a long-term climate regime.

2.8.1. *Carbon Sequestration by Natural Sinks*

The inclusion of natural sinks in the Kyoto regime was one of the most contentious issues in the recent negotiation process. Environmental NGOs have strongly been fighting against their inclusion due to the issue of permanence and the fact that natural GHG sequestration decreases the pressure on emitters to reduce their GHG emissions. Concerning the future development of the climate policy regime, one can expect increasing efforts to include sinks by many parties the more stringent emission targets become. Therefore, it is crucial that scientifically sound and ecologically integer rules are defined and applied. Natural sinks can be classified in terrestrial sinks and marine sinks.

2.8.1.1. *Terrestrial Sinks.* Terrestrial sinks can be divided in vegetation and soils. The debate so far has focused on the former, but the latter category increasingly takes prominence. The main 'technical' problems of sinks are the issue of permanence and monitoring. The very point about permanence is the following: while any non-emissions of greenhouse gases for energy use are assumed to be of permanent benefit, carbon uptake in soils and vegetation will be reverted at some time in the future. This can happen incidentally, as e.g. due to non-sustainable forest management, cessation of replanting after harvesting, or natural fires and pests. In any case, stored carbon will be released after the natural death of a given tree by biological degradation processes.

The resulting question then is: what is the benefit of temporal carbon storage for the global climate system? In the context of the Clean Development Mechanism, it was decided in 2003 that forestry credits are only created for a certain period of time – e.g. 5 years – after which they expire and need to be replaced by other emission rights. If the project still subsists after this period, the same amount of new credits can be re-issued (tCERs, temporary CERs, for a discussion of the background arguments see Dutschke 2002).

2.8.1.2. *Marine Sinks.* While some experience has been gathered with carbon uptake in forestry, the science around marine sinks is only just in its infancy. A series of experiments has been made where iron is used to fertilise nutrient-poor surface areas of the oceans. The resulting plankton bloom would capture CO_2 and some companies have already started to market this as sink. However, the permanence of this sink and ecological side effects are uncertain and monitoring challenges are huge (Chisholm et al. 2001).

2.8.2. *Geological Storage*

Aquifers, coal seams and empty oil and gas reservoirs constitute large potentials for technical storage of greenhouse gases. For example, carbon dioxide could be separated from the effluent gas of fossil fuel fired plants, collected and stored in those reservoirs. This would allow a 'CO_2-free' power production with fossil fuels. For an overview see IEA Greenhouse Gas R&D Programme (2001).

Several Annex B countries, primarily the US (US DoE 2003), are spending huge amounts of research funds to develop technological options for capture and storage, to assess the overall scale of storage and its costs. Currently, only in specific circumstances such as offshore oil and gas exploration or generation of coal bed methane geological storage is viable. This situation might change in the long-term. Geological storage might become an attractive option for sectors/economies based on fossil fuel burning. Similar to natural sinks, permanence might become a problem if places for CO_2-storage are not selected and monitored carefully.

2.8.3. *Ocean Storage*

Another type of storage is the disposal of CO_2 in the sea. Depending on the circumstances, CO_2 can exist in the marine systems for hundreds to thousands years. For an overview see IEA Greenhouse Gas R&D Programme (2002). Similar caveats apply as to the terrestrial sink. The permanence of such storage and its ecological impact will need considerable research before implementation.

3. Will the Future Regime be Effective?

As illustrated in the literature review above, a wide range of options and issues are being discussed as building blocks for the post-2012 regime. As will be shown in the other articles in this Special Issue, the negotiations of the regime could take many different directions, implying that the 'package', i.e. the portfolio of instruments and commitments in an international treaty could take many forms. A central question that will be addressed in the scenarios is: To what extent will the future global climate regime that eventually is developed be effective? Obviously, the concept of regime effectiveness is both complex and multi-faceted, but for the purpose of assessing the scenarios in the following articles in this *Special Edition*, we choose to look at the following indicators[3]:

- Environmental outcome: How large are the emission reductions that are expected to be achieved?
- Cost-effectiveness: Will targets be met at the lowest possible economic costs?
- Innovation: Will the regime bring forward ideas, technologies and institutions that will lessen the costs of reducing emissions?
- Institutional resilience: Is it easy to gear the system for larger reductions when needed?
- Participation and political acceptability: How great is the assumed participation? Is it realistic?

The large numbers of possible future climate regimes are not easily comparable along these indicators. Also, purely adding the scores on the different indicators does not produce an overall score *per se*. For example, a scenario with strong reduction targets runs the risk of losing many participants, something that will reduce its overall effectiveness. Hence, the success of the theoretical regime does not depend solely on how it scores along the above indicators, but rather by the extent to which the regime is likely to be accepted and implemented by a large number of parties. Thus, the discussion of effectiveness under the various scenarios very much boils down to the level of participation in the regime and activities taken under the regime. The extent to which parties will be willing to take on commitments is of course extremely difficult to foresee, and it can be argued that currently the most important task is to build up a political momentum that can remain robust under many scenarios.

3.1. Environmental Effectiveness

Any future scenario will have distinctive merits when it comes to environmental effectiveness. Clearly, a regime with strong targets will result in large short-term reductions as illustrated in the scenario by Michaelowa et al. (2004) presented later in this edition. However, there is a risk that participation under such a regime will be fairly limited, if many countries do not accept ambitious targets. Other ways of setting targets, for example through establishing effective emission markets through hard or soft links, could be an effective way of reducing emissions (see the scenarios developed by Sugiyama 2004; Tangen and Hasselknippe 2004). Strategies to imbed climate policy in a development context could also be an environmentally effective way of bringing the climate policies of developing countries forward. Focusing on long-term technological change might also result in high scores on environmental effectiveness. In the end, it is difficult to conclude which strategies may be better than others in terms environmental effectiveness. A strategy with extremely demanding reduction targets and no participation is equally ineffective as a strategy endorsing business-as-usual and having universal participation. The political question is now how to deal with the trade-off between degree of participation and stringency of policy measures/targets.

3.2. Cost-effectiveness for Short-term Emission Cuts

In the current Kyoto Protocol emissions trading and the project-based flexibility mechanisms are key instruments for reaching emissions targets in a cost-effective manner. Trading can be seen as crucial in order to reduce costs and thereby promote stronger targets, and hence expand the regime. However, participation in emissions trading can be different depending on what types of markets that are developed (Tangen and Hasselknippe 2004). In particular, what type and coverage of commitments are present, what level of flexibility is expected, and how ambitious are the targets. Sugiyama (2004) argues that another way of addressing the cost-effectiveness issue is to assume larger participation for a cap-and-trade regime by avoiding the process of internationally imposing caps. Also, high levels of diffusion of proven technologies to developing countries, thus avoiding double investments in technological development, could provide a key to efficient emission cuts.

3.3. Innovation and Long-term Technological Change

A future regime explicitly addressing the need for instruments for changing technologies and promotion of climate friendly innovation will score high along this indicator. Future carbon prices could become fairly high in other regimes without reaching levels that will significantly change technological paths. Hence, even in the presence of a fairly ambitious cap-and-trading scheme, additional instruments are necessary in order to spur technological progress. However, there is a clear link between caps and technological change. Once agreed upon, binding caps could serve as powerful political instruments to foster implementation of technological change programs within countries.

3.4. Institutional Resilience

Experience gained over the past decade of negotiating the Kyoto Protocol shows that it takes time to get the institutional structures in place that are needed in order to effectively manage greenhouse gas emissions. This institutional system consists of technical features such as registries, legal framework and inventories, as well as organisational structures such as government bodies, regulators and climate units in private companies. When these institutions have been developed, it will be easier to adapt the system to achieve larger emission cuts as scientific evidence becomes compelling.

A climate regime with high coverage of parties by a cap-and-trade system results in a large number of countries required to get institutional systems in place, at least for specific selected sectors (Tangen and Hasselknippe, 2004). If broader participation in cap-and-trade is assumed, it is probably also easier to gear the climate regime towards larger reductions when deemed necessary by countries, provided that emission markets are the key instruments in the future. However, it is unclear whether developing countries can overcome institutional and human capacity constraints to effectively implement emissions trading (Gupta 1997, p. 25).

If diverse views from countries are considered from the outset to make them partners in the regime, the regime will be accommodative in terms of change of political will and attitude by countries. Once political attitudes change, the regime might shift to a more rigid structure (Sugiyama 2004; Tangen and Hasselknippe 2004). Likewise, regimes accommodating country-specific concerns might be geared up when the international political will deems it necessary. A potential danger for any future accommodative regimes is that they will have higher costs and more time will be needed for gearing up to a rigid regime.

4. Policy Implications

In sum, the discussions in the previous chapters bring forward important policy implications that policymakers should consider when taking action in order to advance the negotiations on the future global climate regime:

Parallel paths. Suggestions for future climate regimes represent ideas and approaches that can be pursued parallel to each other, and parallel with the UNFCCC negotiations. Countries could start bilateral talks in order to link up and make national emissions trading schemes more effective (e.g. Tangen and Hasselknippe 2004). Multilateral talks to establish technology treaties could also very well be pursued outside the UNFCCC process. Such parallel processes can be advantageous for several reasons. First, the parallel processes could be mutually reinforcing. For example, if climate issues are well mainstreamed into the development process, the climate regime will be more powerful. Furthermore, bilateral or regional negotiations in smaller groups of countries might move faster than the multilateral talks under the UNFCCC, and hence provide valuable input to this process as well. Second, negotiations outside the UNFCCC will represent fallback opportunities if the multilateral track should fail. Likewise, if the efforts to build a binding cap system under UNFCCC fail, the less intrusive systems of grouped emission markets and technological development may serve as a fallback.

It can be argued that extending the negotiation arenas will be problematic in terms of negotiation resources, particularly for the least developed countries. However, the climate issue is complex by nature and negotiations on the parts will be necessary anyway – be it under or outside the UNFCCC.

Nevertheless, this does not point in the direction of leaving the UNFCCC and starting from scratch. Substantial energy and effort have been put into negotiating the current framework, and negotiating a completely new and effective framework from scratch will take long time and there is a high risk of failure. However, pursuing the multilateral track under the UNFCCC and at the same establishing other negotiation processes is a way to reduce the risk of total collapse.

Build on existing resources. Although the Kyoto Protocol and the UNFCCC negotiations should not be the only option considered for developing an international climate regime, these agreements still contain many essential elements of mechanisms and institutions, developed through a decade of lengthy and hard negotiations. In all the scenarios presented in this edition, the Kyoto mechanisms, or variations thereof, constitute important building blocks, and it seems likely that any effective succeeding regime will draw upon the lessons learned during the negotiations and implementation of the Kyoto mechanisms.

New negotiation arenas. International climate negotiations almost exclusively take place under the umbrella of UNFCCC and the Kyoto Protocol. These negotiations are characterised by the many parties involved and their conflicting interests. (Sugiyama 2004; Tangen and Hasselknippe 2004). As the international negotiations take place in a single arena, it makes the regime very vulnerable if these negotiations should fail. Hence, as a fallback in case of a multilateral collapse, alternative negotiation arenas should be developed. The scenarios point to some very obvious complementary negotiation arenas, namely: bilateral or regional negotiations for soft- or hard-linked emission markets; technology cooperation; and development cooperation (Pan 2004; Sugiyama 2004; Tangen and Hasselknippe 2004). Bilateral/regional agreements in these areas might constitute an effective alternative regime if the multilateral process fails, but might also form the basis for a multilateral agreement at a later stage.

Reframe the core issues. While the Kyoto Protocol frames the issue as allocation of emission quota, this is not the only way to frame the climate issue. To avoid stalemate, it might be instrumental to reframe the issue so that countries can cooperate in common issue areas where national priorities lie, without conflicting with their sovereignty concerns. Examples include hard-link and soft-link of emission markets among like-minded countries, cooperation for long-term technological change, and climate-wise development. Negotiation on quota allocation would be far more productive once countries build confidence in climate policy and mutual trust through such experience (Sugiyama 2004; Tangen and Hasselknippe 2004).

Greater variation of emission targets. Extending the Kyoto Protocol into a second commitment period may face high barriers of establishing binding targets and timetables for the world's largest emitters. These barriers could be overcome by widening the scope of the Kyoto mechanisms (Michaelowa et al. 2004). If this still does not help, a regime consisting of alternative and more flexible commitments may be the way to reduce global greenhouse gas emissions. Complimentary voluntary targets, and binding targets for sectors could be two alternative paths to explore (Pan 2004; Sugiyama 2004). More flexibility in terms of target-types and coverage is likely to lower entry-barriers, foster learning-by-doing and allow for a gradual expansion of the regime (Tangen and Hasselknippe 2004).

Differentiation of non-Annex I Parties' commitments. In the current negotiations, developing countries are treated as one single block, e.g. as non-Annex I parties in the UNFCCC, and as G77/China in the negotiations. Nevertheless, the differences between the non-Annex I countries are more striking than the similarities; there are enormous variations when it comes to human development, emissions level and economic wealth (Gupta 2003, Michaelowa et al. 2004; Pan 2004). In this regard, a differentiation of developing country commitments seems fair by all standards, in a similar manner to the differentiation of targets for Annex I countries. Hence, the large differences between G77-countries will be gradually acknowledged and reflected in any future agreements, as well as when negotiators approach developing countries with demands for commitments. Moreover, least developed countries will lose if they continue supporting more developed G77-countries which block the negotiation process in order to protect themselves, something that in the end is likely to hurt the least developed countries most.

Mainstream climate issues into the process of human development. It is essential to acknowledge country-specific circumstances of developing countries in the formulation of a climate regime. For adaptation, aid agencies are already pursuing a mainstreaming approach (Sperling 2003). Pan (2004) argues in the scenario presented later that climate change cannot be separated from socio-economic development processes, it should be integrated into the process of human development. Among the basic elements that can be addressed are basic human needs, technologies, and economic efficiency. Diffusion of proven technologies is the key for developing countries in order to cut emissions efficiently, massively, and immediately.

Extend cooperation for technological change. The weak price signals of the current climate regime are likely to have limited effects in terms of spurring innovation and technological change in long term (Sugiyama 2004; Tangen and Hasselknippe 2004). Moreover, it can be questioned whether carbon prices will ever reach a level where they become a potent technological driver. Nevertheless, technological change with a subsequent massive diffusion of the newly developed technology, particularly in the developing countries, is crucial for efficiently and massively reducing emissions in the future, and could be a key to increasing participation by developing countries. Exploration of international arrangements to foster technological change should be pursued, because it is important in order to reduce emissions in the long term, and might be an avenue for expanding the regime.

Notes

1. The definition of 'largest emitters' differs depending on what approach is used e.g. per capita, per unit of GDP, and/or aggregate amount per political entity. For simplicity, the political entity approach is used here, although it hides the huge variations with respect to per capita and per unit GDP emissions.
2. For more information about the project see the other articles in this special issue and the project website www.fni.no/beyond2012.
3. Partly based on criteria given by Aldy et al. (2003).

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