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## **Types of future commitments under the UNFCCC and the Kyoto Protocol post 2012**

Briefing paper

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## Forword

Over the last years there have been numerous *informal* discussions on the structure and content of a post-2012 regime. WWF asserts that due to the urgency of the issue and the legal requirements of the Kyoto Protocol, *formal* negotiations will be launched at the first Meeting of the Parties to the Kyoto Protocol in Montreal this year. Such a decision would require serious reviews, analysis and negotiations taking place over the next three years. In order to inform that process, WWF requested Ecofys, to assess the various ideas and proposals currently being informally discussed. Divided into two sections – one on Annex I and one on non-Annex I, the paper analyses approaches based on three criteria; environmental effectiveness, economic efficiency and the principle of common but differentiated responsibilities. Our hope is that this analysis will spur further thoughts and ideas on how countries can join together to ensure that global average temperature does not exceed 2 degrees, in comparison with pre-industrial levels. This will require an overall strengthening of effort of all Parties so that each “does its part” to tackle climate change.

WWF offices around the world would be very keen to convene meetings to exchange ideas on how to achieve this goal.

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# 1 Introduction

## 1.1 Required emission reductions to stay below 2°C warming

The ultimate objective of the UNFCCC is to stabilize greenhouse gas concentrations to avoid dangerous interference with the climate system. After thorough consideration of the existing scientific literature, several countries, including the European Community, and many environmental NGOs have agreed that global average temperature increase should be limited to 2°C above pre-industrial levels to avoid such dangerous interference.

A number of studies have analysed the emission allocations or requirements on emission reductions and time of participation in the international climate change regime to be able to ensure different stabilization targets, including the 2°C threshold<sup>1</sup> (Jacoby, 1999; Berk and den Elzen, 2001; Blanchard, 2002; Winkler et al. 2002; Criqui et al., 2003; Den Elzen and Meinshausen, 2005a; Den Elzen and Meinshausen, 2005b; Den Elzen and Berk, 2003; den Elzen et al., 2005a; den Elzen and Lucas, 2005; Den Elzen et al., 2005b; Groenenberg et al., 2004; Höhne, 2005; Höhne et al., 2003; Höhne et al., 2005; Michaelowa et al., 2003; Nakicenovic and Riahi, 2003; Persson et al., 2005; WBGU, 2003). They analysed a large variety of system designs for allocating emission allowances / permits (before emissions trading), including contraction and convergence, multistage, triptych and intensity targets.

Several parameters and assumptions influence these results: future emissions, population, GDP development of individual countries or regions, global emission pathways that lead to climate stabilization (including the uncertainty about the climate sensitivity for different concentration stabilization targets), parameters about thresholds for participation or ways to share emission allowances. The cited studies have used different parameters and assumptions, some have varied them in a plausible range.

The conclusions of these studies can be summarized as follows:

- Under the considered regime designs that aim at a maximum temperature increase of 2°C above pre-industrial levels, i.e. a range of associated levels of greenhouse gas concentrations, developed country greenhouse gas emissions would need to be reduced substantially during the next century. To ensure that staying below the 2°C threshold is more than 50% likely, developed countries as a group would need to reduce their emissions below 1990 levels in 2020 (in the order of -15% to 30% below 1990 levels) and to low levels by 2050 (-75% to -90% below 1990 levels).
- Under the considered regime designs that aim at a maximum temperature increase of 2°C above pre-industrial levels, developing country emissions need to deviate from what we believe today would be their reference emissions as soon as possible. For the advanced developing countries this should occur even as of 2020 (mostly Latin America, Middle East, East Asia). Actions from developed countries, such as technology transfer or financial contributions, should assist Non-Annex I countries.
- Reaching lower levels of greenhouse gas concentrations requires earlier reductions and faster participation compared to higher levels of greenhouse gases.
- A delay in action of only 5 to 10 years requires extensively more efforts afterwards to reach the same environmental goal. E.g. keeping CO<sub>2</sub> concentrations below 450 ppmv after implementation of the Kyoto Protocol would require global emissions to decrease by 1% to 2% per year over several decades. Delaying reductions until 2015 would require global reductions of 3 to 4 % per year afterwards. Delaying global

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<sup>1</sup> Most of the studies use stabilization of CO<sub>2</sub> concentration at 450 ppmv as a proxy for the 2°C threshold, but which may lead to higher temperature increase. Several studies also look at a range of concentration targets.

action until 2020 would make it virtually impossible to keep CO<sub>2</sub> concentrations always below 450 ppmv. (Den Elzen and Meinshausen 2005a, Höhne 2005).

## 1.2 Current discussion on possible next steps

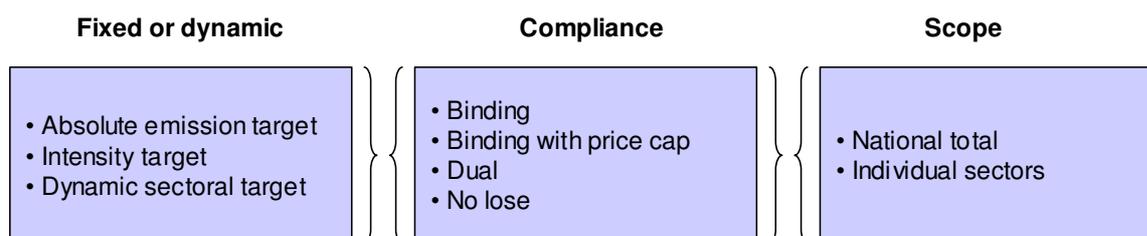
The UNFCCC includes as the first principle that countries should take action on the basis of their “common but differentiated responsibilities and capabilities”. It states that accordingly Annex I countries should take the lead in taking action.

The obvious future pathway would be to continue on the basis of the agreements made with the Kyoto Protocol, that the absolute binding national emission targets of Annex I countries are renewed and strengthened for the second commitment period. These targets would have to be very ambitious in order to meet the long-term stabilization goal (see section 1.1). However, some Annex I countries are starting to open up the question whether they should continue with the Kyoto type commitments or could take on different types of commitments, which usually would result in weaker or postponed reductions.

In addition, there are discussions on which types of commitments would be assumed by Non-Annex I countries to encourage and achieve gradually more comprehensive participation in the system. A precondition for Non-Annex I countries taking on any further commitment would be significant action by Annex I countries, e.g. through ambitious absolute binding national emission targets.

In this discussion many theoretical alternatives to absolute binding national emission targets have been proposed that all weaken the requirement of reducing absolute emissions, see Figure 1. First, targets could be dynamic, expressed as a function of GDP (intensity targets) or other variables (e.g. gCO<sub>2</sub>/ t steel). Second, the consequences of non-compliance could be less strict, e.g. allowing a price cap (additional allowances at a fixed price) or targets that would not be binding at all. Third, it was proposed to apply a target on only selected sectors and not on the whole economy of a country. Figure 1 provides an overview of the various possible combinations of these three aspects. Finally, it has been proposed to abandon emission targets altogether and to agree on qualitative actions such as cooperation on specific technologies.

**Figure 1. Dimensions of emission targets**



## 1.3 Outline of this paper

This paper systematically assesses the different types of commitments and describes the rationale behind them and why they are proposed by various actors. This discussion is split into types of commitments for Annex I and for Non-Annex I countries as their starting points and responsibilities are fundamentally different. The paper aims at distilling those types of targets that are best suitable to satisfy three criteria in a balanced manner: environmental effectiveness, economic efficiency and the principle of common but differentiated responsibility.

**Environmental effectiveness** includes whether these types of commitments ensure that emissions are substantially reduced to ensure that the global temperature increase is kept below 2°C. If the environmental criterion is not met, the impact of the lack of emission

reductions will have a significant economic effect though the damages caused by climate change, e.g. extreme weather events. Due to this, and the high risk to society and nature, the environmental criterion is most important.

**Economic efficiency** includes whether a type of commitment is initiating emission reductions where they can be achieved at the least costs. In particular emission trading, Joint Implementation (JI) and the Clean Development Mechanism (CDM) would allow flexible use of emission reduction potentials in different countries. As drastic reductions are necessary, it seems necessary to find the most efficient way to achieve them. This criterion does not include the aspect of economic damage due to lack of action.

**The principle of common but differentiated responsibility** would include, whether the type of commitment would clearly demonstrate that Annex I countries are taking the lead in reducing emissions and that commitments of Non-Annex I countries are also differentiated according to their respective responsibility. This is important for the overall acceptability of the approach.

Based on the analysis, the paper draws conclusions on which types of targets are best suitable to achieve the environmental goal in an efficient manner and according to the principle of common but differentiated responsibilities.

## 2 Commitment types for Annex I countries

This chapter provides an overview and brief assessment of several types of commitments (emission reduction actions) that are currently being debated informally by some Annex I countries for a future international climate treaty.

When the Kyoto Protocol was negotiated, two basic options were on the table: “common and coordinated policies and measures” and “targets and timetables”. One set of countries, led by the EU, was supporting that all countries implement specific policies. Another set of countries, led by the USA, was arguing for limits on national emissions. This group argued that all countries are diverse and would be able to decide best themselves which kind of policies would be most effective in reducing their emissions. With the Kyoto Protocol, all countries agreed to adopt the “targets and timetable” approach with binding absolute national emission targets for Annex I countries and the option of emission trading.

In the informal discussion on the second commitment period, alternatives to the Kyoto system are currently broad forward, of which most seem to be a weaker requirement to reduce emissions. Some options seem to return to the concept of “policies and measures” such as some sectoral proposals or technology cooperation agreements. The following sections will assess these alternatives.

In addition to these different types of approaches it was proposed that not all Annex I countries would have the same type of target but that they could have different types of targets (a “menu” if it is at their choice). Such a proposal would add a further level of complexity to the already difficult negotiation process and would make it less likely that the three criteria are met.

### 2.1 Absolute binding national emission targets

In the Kyoto Protocol countries have committed themselves to keep their absolute national greenhouse gas emissions in a target year below a fixed amount (a “cap”). The target is binding, meaning that if the absolute emission level is not reached, countries will have even tougher targets in the next commitment period. Such a target can be reached in a very flexible manner across greenhouse gases and sectors as well as outside of the national territory through emission trading, JI and CDM. Each country determines its own national strategy to meet the target.

**Environmental effectiveness:** Absolute binding national emission targets provide certainty on the future emissions. Their implementation is ensured by their binding nature. They cover all emissions of a country and would not leave emissions uncontrolled.

**Economic efficiency:** Absolute binding national emission targets are perfect for emission trading. The maximum amount of emissions is fixed and can be shared among the participants in the emission trading system. It allows that emissions are reduced in sectors, gases and countries where the costs are the lowest. Whether such targets raise competitive concerns between Annex I countries depends on the way the targets are differentiated. Several methods have been proposed that share emission allowances between countries so that all have a similar burden.<sup>2</sup>

**Common but differentiated responsibility:** Binding and stringent absolute emission target targets for Annex I countries have shown that these countries are taking the lead.

**Conclusion:** Absolute binding emission targets have proven viable in the Kyoto system and the EU emission trading system. They safeguard level of emissions in a target year for all participating countries and can be set in a way that necessary ambitious emission reductions are achieved. Emission trading, Joint Implementation and the Clean Development Mechanism ensure that reduction costs are kept as low as possible.

## 2.2 Intensity targets (Emissions/GDP)

As an alternative to absolute targets, it has been proposed that the national emission intensity (greenhouse gas emissions per GDP) in a target year is set at a fixed amount. For example, an improvement of intensity by e.g. 4% could be reached by a *reduction* of absolute emissions by 1% and an *increase* of GDP by 3%. The target would also be binding and consequences have to be faced, if the level is not reached. Emission trading could also be applied but would require additional rules.

**Environmental effectiveness:** One disadvantage of intensity targets is that the future emission level is uncertain: it depends on the future level of the GDP. As reducing absolute emissions of Annex I countries in the short term it is essential, it seems a risky strategy to keep open the possibility of having higher emissions than expected. In particular, under higher economic growth, more resources should be available to reduce emissions.

The second disadvantage is that the stringency of proposals have usually been lower for intensity targets than for absolute emission targets. E.g. the National Climate Plan of the Bush administration requires a 2% improvement on intensity per year in the USA and the US National Commissions on Energy Policy proposed a 2,4% intensity reduction target per year, both effectively resulting in growth of absolute emissions in the likely event of GDP growth of around 3%. However, the 2°C threshold would require immediate reductions of absolute emissions of Annex I countries and a reduction of intensity of around 4% per year *globally*. Theoretically, intensity targets could be as stringent as absolute targets, but given these examples it seems unlikely to happen in the negotiations.

**Economic efficiency:** Emission trading would still be possible with an intensity target. The dynamic nature of the target requires additional rules, as the total amount of allowances will only be known when the GDP in the target year is known. Either trading can only take place at the end of the commitment period or the amount of allowances is adjusted at the end of the commitment period, both options reducing liquidity in the market.

**Common but differentiated responsibility:** Intensity targets for Annex I countries at the moderate stringency as they have been proposed would not demonstrate that these countries are taking the lead. In addition, the uncertainty of the actual emissions reductions could undercut confidence.

**Conclusion:** In theory, an intensity target could be set as stringent as absolute targets, but still then the emission outcome would remain uncertain. The proposed reductions thus far are much too small to reach the stabilization goal. It seems therefore that intensity targets for

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<sup>2</sup> E.g. the Triptych approach has been applied as a basis to share the Kyoto targets among the member states of the European Union. This approach applies one rule per sector to all countries, resulting in an overall fixed target per country.

Annex I countries would not be a viable option that could ensure staying below the 2°C threshold.

### 2.3 Absolute binding emission targets with price cap

As a further adjustment to absolute binding emissions targets, an unlimited number of additional emission rights could be made available at a given price (“price cap” or “safety valve”). This would ensure the emission reductions would only occur if they are cheaper than this price cap, otherwise one would buy these additional allowances. The revenue could be used for emission reductions or invested in research and development.

When discussing the rules for non-compliance under the Kyoto Protocol in The Hague in the year 2000, a price cap and a possible level was already discussed but rejected in the end, as countries were unable to agree that this was a credible approach and noted the potential for gaming of the system through the level of the price cap.

**Environmental effectiveness:** Similar to intensity targets, a price cap would introduce uncertainty on future emission levels. As reducing absolute emissions of Annex I countries in the short term it is essential, it seems a risky strategy to keep open the possibility of having higher emissions than expected.

In the Kyoto system already the Clean Development Mechanism serves essentially the same purpose as a price cap: Additional allowances can be introduced in the system. The exact price of these additional credits is not known but will be determined by the CDM market. But the advantage is that they represent real reductions elsewhere.

The proposed level of the price caps has usually been lower than necessary for staying below the 2°C threshold. The US National Commissions on Energy Policy also proposed a price cap of 7 US\$/tCO<sub>2</sub>eq. A much higher value would have to be chosen to keep the 2°C threshold within reach. Theoretically, price caps could be set at sufficiently high levels, but given this example it seems unlikely to happen in the negotiations.

**Economic efficiency:** Emission trading would still be possible but would occur only up to the level of the price cap. A price cap could introduce problems of adoption in some countries, as the cap can be perceived as a tax.

**Common but differentiated responsibility:** Binding emission targets with a low price cap (e.g. 10 US\$) for Annex I countries would not show that these countries are taking the lead, only if a substantially higher price cap is agreed.

**Conclusion:** Price caps would be introduced to overcome barriers to taking on stringent binding targets such as the uncertainty of economic growth or of abatement costs. But a low price cap would compromise the environmental integrity and would not be sufficient to stay below the 2°C threshold. A high price cap is an unlikely result of the negotiations. In addition, the Clean Development Mechanism already serves essentially the same function. Hence, a price cap would complicate the system and would not add a significantly new element.

### 2.4 Sectoral approaches

Sectoral approaches are discussed quite actively in various fora, but their exact specification is often unclear. The common goal of sectoral approaches is to avoid competitiveness concerns across countries by applying the same rules for one sector to all countries.

One option would be that the industry in one global sector would assume a target. For example, the automobile industry agrees to implement a standard for greenhouse gas emission per person kilometre. The responsibility to implement the target would be with the automobile industry and not with the national governments. All global automobile producers would be on the same level.

Another option is that the responsibility remains with national governments but that the same rules for one sector are applied to all countries. This could be an emission standard or benchmark for a particular sector described, e.g., in gCO<sub>2</sub>/t steel. The commitment would be

the implementation of the standard, not to reach a certain emission level and emission trading would not be possible. Such targets can also only be applied for a few sectors with defined products, such as iron and steel or cement, but already there the difficulty lies in the detail of, e.g., defining which products belong to the sector and which do not. In addition, it has to be ensured that all sectors are covered.

A further option would be that *emission targets* are defined for all individual sectors as function of their respective output (e.g. t of steel, kWh produced, etc.). Although the emission targets are defined for specific sectors, they can still be reached in a flexible manner across greenhouse gases and sectors and well as through emission trading. In this case the final allowable amount of emissions depends on the respective outputs in the target year (e.g. t of steel, kWh produced, etc.).

**Environmental effectiveness:** As reductions in total emissions of Annex I countries are required, concentrating on some sectors and leaving other sectors uncontrolled would not be sufficient to stay below the 2°C threshold. Defining emission standards or dynamic sectoral emission targets would also leave the total emission level open.

**Economic efficiency:** In the case sectoral technology standards are agreed, emissions trading would not be possible and this degree of flexibility would be lost. Only if emission targets are defined (as function of output) would emission trading be possible. If sectoral targets are applied equally on the global level, they would decrease competitiveness concerns.

**Common but differentiated responsibility:** Applying the same rule for one sector for all countries is explicitly a conflict with the concept that Annex I countries take the lead. In addition, if Annex I did not reduce overall national emissions they could be perceived as significantly reducing their level of effort.

**Conclusion:** Sectoral approaches intend to decrease competitiveness concerns within one sector, but create new complications in return. With sectoral technology standards, emission trading could not be applied and coverage of all sectors would be difficult. Dynamic sectoral emission targets would require a lot of negotiation time. Applying sectoral targets to all countries violates the concept of common but differentiated responsibility. Although sectoral approaches are en vogue in the current discussion, they all have their downsides when looking at them more closely and do not seem appropriate for Annex I countries.

## 2.5 Technology cooperation

As an alternative to binding emission targets, some proposals have been made to develop agreements on technology cooperation. They could be developed to enhance the implementation of existing technologies such as electricity from biomass or solar water heaters, but they are often geared towards long-term development of new technologies such as carbon capture and storage, hydrogen or fuels cells.

**Environmental effectiveness:** Implementation of technology cooperation agreements does not provide certainty on future emission levels. Technology cooperation on the development of new technologies focuses on reductions in the long term and alone would be unable to achieve short-term reductions.

**Economic efficiency:** Any technology agreement would pick winners and losers from the broad set of possible technologies. Market mechanisms such as emission trading cannot be applied.

**Common but differentiated responsibility:** Annex I countries already have the obligation under the UNFCCC to cooperate on technology development. Only a very comprehensive and stringent set of cooperation agreements would show that these countries are taking the lead, but still would fail to reduce emissions in the short term.

**Conclusion:** Technology cooperation agreements alone would not be able to ensure that the 2°C threshold is met. Such agreements would also not provide the flexibility of emission

targets. Technology development is essential to be able to reduce emissions drastically in the long term, but it needs to be supplemented with measures to reduce emissions in the short-term.

### 3 Commitment types for Non-Annex I countries

According to the principle of common but differentiated responsibility, Annex I countries first aimed voluntarily to reduce emissions with the UNFCCC and later adopted binding absolute emission targets with the Kyoto Protocol. Similarly, Non-Annex I countries could move into commitments in a staged fashion, delayed compared to Annex I countries and differentiated among them according to their responsibility. Due to the urgent need of global reductions to stay within the 2°C limit, this movement would have to happen very soon.

This chapter provides an overview and brief assessment of several types of commitments (emission reduction actions) that could be applied to Non-Annex I countries in the future. The group of Non-Annex I countries is very diverse, not all countries would necessarily take on the same type of target at the same time.

A small number of non-Annex I countries have reached the development or emission level of some Annex I countries and hence could at one point move into Annex I and assume similar target as Annex I. Those countries would carry certain responsibility and would have to participate in the reduction effort.

Some other countries have clearly lower development and emission levels compared to Annex I, but are due to their size important for the urgent global emission reduction effort. For these countries types of commitments have to be found that are to the advantage of those countries in meeting their development goals and that are not perceived as capping their economic growth.

Finally, least developed countries would not receive any further obligation under a future climate treaty, but could participate if so desired.

#### 3.1 Absolute binding national emission targets

There are some Non-Annex I countries that could take absolute binding national emission targets. Due to the principle of common but differentiated responsibility this would only apply for countries with a level of development, economic power and historical responsibility similar to those of Annex I countries, e.g., those countries whose Human Development Index, GDP per capita and cumulative emissions per capita are in the range of Annex I countries.

#### 3.2 Absolute binding emission targets with price cap

As adjustment to absolute binding emissions targets, an unlimited number of additional emission rights could be made available for selected Non-Annex I countries at a given price ("price cap" or "safety valve"). In section 2.3 we concluded that a price cap would not be a preferred option for Annex I countries. If it is then applied to Non-Annex I countries, rules would have to be implemented to avoid overselling: the country with the lowest price cap could export those credits to countries where reductions would be more expensive.

**Environmental effectiveness:** A price cap would introduce uncertainty on future emission levels. In the Kyoto system already the Clean Development Mechanism serves essentially the same purpose: Additional allowances can be introduced in the system, but at the advantage that they represent real reductions elsewhere.

**Economic efficiency:** If Annex I countries would not have a price cap and some Non-Annex I countries would have a price cap, the emission trading would be less efficient. If the global market price rises above the price cap, the country with the price cap would give out additional allowances, while the other countries would have to continue to reduce emissions at higher costs.

**Common but differentiated responsibility:** Some Non-Annex I countries with medium development could take on binding emission targets with a price cap as an incentive to take on ambitious targets.

**Conclusion:** Also for Non-Annex I countries, price caps would be introduced to overcome barriers to taking on stringent binding targets such as the uncertainty of economic growth or of abatement costs. But the Clean Development Mechanism already serves essentially the same purpose. Hence, a price cap for Non-Annex I countries would complicate the system and would not add a significantly new element.

### 3.3 Intensity targets (Emissions/GDP)

Intensity targets (a limit on greenhouse gas emissions per GDP) could also be an option for some developing countries. But especially for developing countries the direct relationship between national emissions and GDP is not always apparent thus increasing the uncertainty. For example, Argentina offered a voluntary target indexed to GDP in 1999, where a 1% increase in GDP would allow a ½% increase in emissions. This was due to the fact that agriculture contributes significantly to the total emissions, but less significantly to the national GDP. Only for the few countries that are very advanced in their development and where the emissions are well correlated with GDP, intensity targets could be applied.

**Environmental effectiveness:** With intensity targets, the future emission level is uncertain, it depends on the future level of the GDP. They are also only suitable for slowing the growth or moderate reduction of absolute emissions.

**Economic efficiency:** Emission trading would still be possible with an intensity target. The dynamic nature of the target requires additional rules, as the total amount of allowances will only be known when the GDP in the target year is known. Either trading can only take place at the end of the commitment period or the amount of allowances is adjusted at the end of the commitment period, both options reducing liquidity in the market.

**Common but differentiated responsibility:** Intensity targets for some Non-Annex I countries could be seen as a first moderate step to participate in the system with emission targets. They are perceived as not limiting economic growth.

**Conclusion:** Intensity targets could be applied by Non-Annex I countries as moderate first steps to participate in the system, but they are only applicable to a limited set of very advanced developing countries, where emissions and GDP are well correlated.

### 3.4 Dual targets

A further adjustment to absolute binding emission targets would be to set two targets: one “selling target”, below which emission rights can be sold and one “buying target”, above which emission rights have to be bought. The country has achieved the overall target, if emission should fall in between the two boundaries. The aim of such an approach is to take into account the uncertainty in future emissions.

**Environmental effectiveness:** While this approach does set targets, which have a positive environmental impact, such dual targets reduces certainty on the emission level, which is only guaranteed within a bandwidth.

**Economic efficiency:** Emission trading would still be possible and would provide flexibility and avoid high costs due to unexpected developments.

**Common but differentiated responsibility:** Dual targets could be a possible first step for newly participating countries, with moderate development. This slightly weaker type of target would take into account the different responsibility of these countries.

**Conclusion:** Dual targets could be used for those Non-Annex I countries with moderate development, where uncertainty of economic and emission growth prevents setting an absolute target.

### 3.5 “No lose” targets

A weak version of an absolute target would be a “no lose” target, where emission rights can be sold to other countries with binding absolute emission targets, if the target is exceeded, but no additional rights have to be bought, if the target is not met. Participation with such a type of target is only to the advantage of the country. As a variant, emission rights could be discounted when sold (e.g. 50%) to provide an incentive to take on an absolute target, where they would not be discounted.

**Environmental effectiveness:** The effect on emissions is not guaranteed, but if such a target could provide an incentive for a country to participate that would otherwise not have participated, it would reduce the overall emission level.

**Economic efficiency:** The mechanism allows the direct inclusion of these countries in the emission trading system, making it more efficient.

**Common but differentiated responsibility:** “No lose” targets would be a support mechanism for developing country action.

**Conclusion:** “No lose” targets can be used for countries that have clearly lower development and emission levels compared to Annex I, but are important due to their size for the urgent global emission reduction effort. “No lose” targets could be an incentive mechanism for these countries to reduce emissions.

### 3.6 Sectoral targets

Also for developing countries the notion of sectoral targets is not always clear. Targets for selected sectors could be applied on a global level, so also for Non-Annex I countries. But more relevant seems to be that Non-Annex I countries participate in the emission trading system with the selected sectors only, that are particularly suited for a sectoral approach, such as the industrial or electricity production. For these sectors they would receive dynamic targets as a function of the respective output of the sectors (t of steel, kWh produced, etc.).

**Environmental effectiveness:** If only selected sectors are included, not all emissions are covered. The dynamic nature would make total emissions uncertain.

**Economic efficiency:** The mechanism allows the inclusion of these countries in the emission trading system, making it more efficient.

**Common but differentiated responsibility:** Such targets would make participation of selected sectors of countries easier. The dynamic nature of the targets would allow economic growth and would not cap the development. It could allow developing countries to gain experience in one sector first before having to adopt national approaches.

**Conclusion:** For some developing countries it could be an incentive to participate in an emission trading system, if it were possible to include only a particular sector. If the targets were designed in a dynamic way as function of output, they would be a bit more complicated to define, but could be even more acceptable. Sectoral agreements on a global level with equal rules for all Annex I and all Non-Annex I countries however seem to violate the principle of common but differentiated responsibility. A possible solution could be to use the same sectoral considerations (e.g. a certain improvement in efficiency) for setting *absolute* national targets of Annex I countries and at the same time *dynamic* sectoral targets for some Non-Annex I countries. This approach could be applied to many Non-Annex I countries, varying in comprehensiveness of the sectors covered.

### 3.7 Extended CDM (sector crediting baseline)

Another option for Non-Annex I countries would be to extend the Clean Development Mechanism (CDM) from a project-by-project mechanism to include also sector-wide national emission reduction projects. It would then also include reductions as a result of sector policies. The amount of the reduction credits would be the difference between the sector's baseline level and the actual level. Any transfers would take place only after verification by

an independent entity. Such projects could also be implemented unilaterally without an investor country. As a variant, emission rights could be discounted (e.g. 50%) when sold to provide an incentive to take on an absolute target, where they would not be discounted.

**Environmental effectiveness:** The effect on emissions is not guaranteed, but if such a target could provide an incentive for a country to participate that would otherwise not have participated, it would reduce the overall emission level.

**Economic efficiency:** The mechanism allows the inclusion of these countries more comprehensively in the emission trading system, making it more efficient.

**Common but differentiated responsibility:** Extended CDM would be a support mechanism for developing country action.

**Conclusion:** Such an extended CDM could be seen as a stepping-stone for absolute targets. But it would be very close to a “no lose” target for all or selected sectors. A “no lose” target would cover all advantages but is much simpler to implement, not requiring the approval procedure of the CDM Executive Board.

### 3.8 Sustainable development policies and measures

As alternative to emission targets, Non-Annex I countries could agree to implement a set of policies and measures, that support their sustainable development. Starting from a development plan, a set of climate related policies are designed. Countries could receive support for the implementation of these policies from other countries.

**Environmental effectiveness:** The effect on emissions is not guaranteed, but if such a target could provide an incentive for a country to participate that would otherwise not have participated, it would reduce the overall emission level.

**Economic efficiency:** Countries with such commitments could not participate in emission trading.

**Common but differentiated responsibility:** The approach is based on the concept of common but differentiated responsibility. It is designed specifically for developing countries, starting from a development focus.

**Conclusion:** Sustainable development policies and measures can be seen as only a very first step in participating in the regime. The urgency of required emission limitations would require a fast movement to more stringent targets. Candidate countries for such an approach would be Non-Annex I countries with relatively low development.

## 4 Conclusions

**Annex I:** If Annex I countries are to take the lead in keeping global temperature increase below 2°C, their emissions need to be reduced substantially and action cannot be postponed. This would require an approach that is binding, that is balanced over the countries and that at the same time provides large flexibility in implementing the commitment.

Absolute binding national emission targets for Annex I countries as in the Kyoto Protocol is the only option that fully satisfies these criteria. They have proven viable in the Kyoto system and the EU emission trading system. They safeguard the level of emissions in a target year for all participating countries and can be set in a way that necessary ambitious emission reductions are achieved. Emission reductions are achieved where most cost effective through emission trading. The Clean Development Mechanism ensures that reduction costs are kept as low as possible and cannot rise infinitely.

All other options could theoretically score equally well, but based on experience thus far, they would be an unlikely outcome of the negotiations. Intensity targets could be set as stringently as absolute targets, but the so far proposed reductions are much too small to reach the stabilization goal. Combined with the environmental uncertainty and lower trading levels, it

therefore seems that intensity targets for Annex I countries would not be a viable option that could ensure staying below the 2°C threshold.

A price cap at a low level would compromise the environmental integrity and would not be sufficient to stay below the 2°C threshold. A high price cap is an unlikely result of the negotiations. In addition, the Clean Development Mechanism already serves essentially the same function. Hence, a price cap would complicate the system and would not add a significantly new element.

Sectoral approaches intend to decrease competitiveness concerns within one sector, but create new complications in return. With sectoral technology standards, emission trading could not be applied and coverage of all sectors would be difficult. Dynamic sectoral emission targets would require a lot of negotiation time. Applying sectoral targets to all countries violates the concept of common but differentiated responsibility. Although sectoral approaches are en vogue in the current discussion, they all have their downsides when looking at them more closely and do not seem appropriate for Annex I countries.

Technology cooperation agreements alone would not be able to ensure that the 2°C threshold is not breached. Such agreements would also not provide the flexibility of emission targets. Technology development is essential to be able to reduce emissions drastically in the long term, but can only be a part of a strategy that needs to be supplemented with measures to reduce emissions in the short-term, e.g. absolute emission targets.

From this follows that a menu approach for Annex I countries, where a country could choose any of the above types of commitments, would not be sufficient to stay below the 2°C threshold nor would it be economically efficient or fulfil the principle of common but differentiated responsibilities. It seems very unlikely that a sufficiently stringent overall system would be the result of such negotiations.

**Non-Annex I:** Various options are available to facilitate the gradual participation of Non-Annex I countries according to the principle of common but differentiated responsibility. The group of Non-Annex I countries is very diverse, not all countries would necessarily take on the same type of target at the same time.

Also for Non-Annex I countries, absolute binding national emission targets would be the final stage when gradually phasing in commitments. Due to the principle of common but differentiated responsibility this would only apply for countries level of development, economic power and historical responsibility similar to those of Annex I countries.

Several less stringent options would be available for Non-Annex I to start participating in the system, of which only the dual targets seem to have the best chances. They could be used for those Non-Annex I countries with moderate development, where uncertainty of economic and emission growth prevents setting an absolute target. Price caps would not be necessary as the Clean Development Mechanism already serves essentially the same purpose. Intensity targets could only be applied to a limited set of countries, where emissions and GDP are well correlated.

For some countries it could be an incentive to participate in an emission trading system, if it were possible to include only a particular sector. If the targets were designed in a dynamic way as function of output, they would be a bit more complicated to define, but they could be even more acceptable. Sectoral agreements on a global level with equal rules for all Annex I and all Non-Annex I countries however seem to violate the principle of common but differentiated responsibility. A possible solution could be to use the same sectoral considerations (e.g. a certain improvement in efficiency) for setting *absolute* national targets of Annex I countries and at the same time *dynamic* sectors targets for some Non-Annex I countries.

Finally, several support mechanisms are available that allow that the participation is to the advantage of the Non-Annex I country but also would potentially supply Annex I countries

with additional units to meet their targets. They could be applied to those countries that have clearly lower development and emission levels compared to Annex I, but are important due to their size for the urgent global emission reduction effort. “No lose” targets could be such an incentive mechanism for these countries to reduce emissions. “No lose” targets would also be preferred over an extended CDM, as they would cover all advantages of an extended CDM but would be much simpler to implement, not requiring the approval procedure of the CDM Executive Board.

Moving completely away from quantitative emission limits to e.g. sustainable development policies and measures can be seen as only a very first step in participating in the regime. The urgency of required emission limitations would require a fast movement to more stringent targets.

**Next steps:** Given the urgency, it seems important that the official negotiations are started as soon as possible to allow for a formal discussion and assessment of the options. Non-Annex I countries should evaluate the options presented above and assess which of the options would best fit their national circumstances. Many of these targets can be seen as opportunity to support the financing of sustainable development.

Annex I countries can clearly state through the types of commitment that they support, whether they are serious in staying below the 2 °C threshold. Only absolute binding emission targets seem to be the tool at hand.

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