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Is a Copenhagen Climate Treaty Still Possible?

Scientific Analysis Provides New Insights for Agreement and a Better Treaty for the Planet

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Main Conclusions of the Scientific Analysis

This paper presents our predictions for the outcomes of the most controversial issues at the 15th Conference of Parties (COP) Meeting in Copenhagen, December 7-15, 2009. For these predictions we used methodology that was developed at the University of Groningen, The Netherlands, in collaboration with consultancy firm Decide (dutch group). Based on these insights, a completely new strategy was developed, which resulted in a stronger treaty and created interests that are better harmonized among all states for a better climate and planet.

Our main conclusions are that the only possible agreement in Copenhagen is the following:

- ***The treaty in Copenhagen will be acknowledged as an extension of the Kyoto Treaty.***
- ***Rich countries will commit to a 20 to 30 percent reduction of their CO_2 emissions relative to their 1990 emissions, provided that the United States contribution is voluntary.***
- ***Rich countries will be allowed to realize a large proportion of this reduction in developing countries.***
- ***China, India and Brazil are prepared to reduce their dependency on fossil resources substantially, particularly in the industrial, transport, and electricity sectors in line with the demand of the United States, provided that their contributions are voluntary.***
- ***Rich countries will commit limited amounts of money for adaptation in developing countries after 2020.***
- ***The adaptation fund will be considered new money and not linked to the aid budgets of rich countries.***
- ***Developing nations will decide themselves on how to allocate money to projects.***

The predicted Copenhagen agreement has several weaknesses. The first weakness is the voluntary basis of the contributions of the United States, China and India, notwithstanding the fact that they are substantially above the ones expressed so far. The second one is the limited size of the adaptation fund and the uncontrolled allocation of its resources by developing countries. The softness of the agreement is due to the fact that the interests of countries are not well aligned, as they are neither shared nor complementary. ***A strong agreement requires an element that harmonizes the interests of rich countries, China, India, and developing countries, which can be achieved by incorporating the deployment of renewable technologies in the Copenhagen agreement.***

The deployment of renewable technologies in developing countries causes mounting conflicting interests between rich countries and developing ones. Rich countries want to prevent surrogates of new technologies being developed quickly in developing countries, nullifying large development costs. On the other hand, developing countries want to prevent renewable technologies from being expensive for years due to patents. If the agreement summarized above can be linked in a very specific way to a fund for the deployment of renewable technologies in developing countries, the soft agreement could easily be converted into a very strong one. To do so we propose the following construction:

The COP should decide to create a separate fund for the deployment of renewable technologies in developing countries. The size of the fund would be determined by two parameters:

- ***The more rich countries fail to realize CO_2 reduction in their own countries, the larger the fund.***
- ***The more China, India and Brazil realize a larger CO_2 free component in their growth, particularly in their industrial, transport, and electricity sectors, the larger the fund.***

In addition, the fund is not allocated in money, but in actual realizations of renewable technologies.

Preferably, the sizes of the contributions of rich countries are based on the 2020 CO_2 reductions, as required by IPCC for a fifty-fifty likelihood to keep the world temperature increase below two degrees Celsius. The G20 formulated the two-degree increase explicitly as a goal, which is likely to be reaffirmed in Copenhagen. In doing so, the COP links fund contributions to scientifically required CO_2 reductions, with this explicit goal. ***Politics can then be associated with real solutions, not with politically driven insufficient ones!***

This strategy brings about the following harmonization of interests:

- Rich countries pay more, the *less successful* they are in realizing their annual and final objectives in CO_2 reduction in their own countries. This gives them an extra incentive for a large CO_2 reduction at home, even when the reduction is voluntary in the United States.
- Developing countries, including China, India and Brazil can deploy less renewable technologies paid by rich countries, the *less they contribute themselves* to CO_2 reductions in their own countries. This gives them an extra incentive for reductions in their own countries.
- Developing countries can deploy and import new renewable technologies without having to pay for them, even if patents protect them. Moreover, they have all the freedom to make their own choices, conditionally to the renewability of the technologies. As payment is based on the deployment itself, the likelihood of corruption is considerably reduced.
- The fund and its dependency on the successful realization of CO_2 reductions in both rich and developing countries create a large market for renewable technologies in industry. In any case, there is a large market and the proposed construction guarantees possibilities to include the research and developing costs in the prices through the patent system.
- The more successful the mitigation, additionally supported by the technology acceleration fund, the lower the adaptation fund can be after 2020. Linking the

size of the technology acceleration fund to the expected adaptation needs after 2020 would require the technology acceleration fund to be a maximum of about $ 100 billion a year. The actual size depends on how well rich countries fulfil their emission reduction obligations and developing countries succeed in realizing a large renewable growth segment. To give an idea of how these are related to the size of the fund, its size can be summarized as follows for extreme cases:

Size of the technology acceleration fund		Developing country obligations	
		Completely fulfilled	No emission free growth realized
Rich country obligations	Completely fulfilled	$ 50 billion	$ 0 billion
	No emission reduction realized	$ 100 billion	$ 50 billion

The proposed solution for the harmonization of interests through the technology acceleration fund aims to increase both the likelihood of a Copenhagen agreement and the later realization of the Copenhagen promises and obligations as well. This is only the case following a number of criteria:

1. Not only new and renewable technologies from rich countries are eligible for the fund, but also ones developed or produced in developing countries. The sole criterion is 100 percent renewable in use, not nullified in the production process.
2. Small-scale solutions should also be eligible, not just large-scale ones. Small-scale solutions are often more efficient and effective in developing countries without proper infrastructure.
3. The fund should not solely be used for deploying renewable technologies, but also to create local infrastructure and expertise for maintenance and replacement.
4. Any combination of renewable technologies should be eligible. Tailor-made solutions often consist of a combination of renewable technologies, using solar, wind, geothermal, water, not-with-food-competing biomass technologies, and maybe even future technologies based on gravitation or the likes.
5. Projects should not be prioritized solely on renewability, but also on them providing solutions to other problems. The major advantage of renewable technologies over fossil-based technologies is that they often solve other problems simultaneously, such as reduced water use, water desalination and waste processing. The more problems are solved simultaneously, the better the ranking in the pool of project proposals.

The research methodology

The methodology is based on special interview techniques to obtain the required data for computer simulation of the dynamics in complex collective decision-making processes. Firstly, a few experts determine the main issues at stake in a complex decision-making process. Then, experts provide a list of stakeholders that have substantial influence on the outcomes of issues. Finally, experts provide the data for each stakeholder on every issue: its position, salience and potential influence. For the present study, two experts of the Stockholm Environment Institute were interviewed on October 27 and 28, 2009. They specified seven controversial main issues which

will be at stake at the Copenhagen COP in December 2009. The issues and the other data they provided are given in Section 2 of the report. Computer simulation, partly based on game theory, is used to investigate the expected outcomes and, depending on the goals of the study, strategies for more optimal outcomes. For each issue, the positions are rated on a scale from 0 to 100. On that scale the expected outcome can also be specified.

This methodology has been developed and improved in the last 16 years at the Institute for Social Science and Theory and Methodology (ICS) of the University of Groningen in collaboration with the consultancy firm Decide, currently part of the dutch group. It has been applied in a broad variety of contexts, like collective decision-making in complex negotiations at the local, national and international level (i.e. European Union), negotiations between employees and employers, mergers, and new legislation. The present study aims at contributing to an agreement in Copenhagen that is strong and effective in reducing climate change. It aims to show that applying this methodology can generate fundamentally new insights, also in complex negotiations as the ones in Copenhagen.

The Report

1 Introduction, Aim and Research Questions

The 15th Conference of Parties (COP) Meeting takes place in Copenhagen from December 7 to 15, 2009. Aim of the conference is an agreement on measures to be taken against climate change due to our fossil based economy. The present climate treaty of Kyoto ends in 2012. One of the major controversial questions in Copenhagen is whether the Kyoto treaty has to be extended or whether the decisions in Copenhagen have to result in a new treaty. This is particularly controversial, as the United States has not signed the Kyoto treaty.

Apart from the question of the status of the decisions in Copenhagen, the parties have different positions on a number of other highly controversial issues. Most of them are related to mitigation and adaptation. Mitigation concerns the reduction of greenhouse gas emissions, like CO_2; adaptation concerns measures to circumvent or diminish damage due to climate change. Within both mitigation and adaptation a number of controversial issues for decision making can be distinguished. In the next Section, we present the positions of different countries or country groups on seven of the most controversial issues on the table in Copenhagen.

We will investigate on which controversial issues the country groups are able to reach consensus and predict the outcome. For these predictions we use the extensively tested methodology that has been developed at the University of Groningen, The Netherlands, in collaboration with the consultancy company Decide (dutch group). The methodology uses special interview techniques to obtain the required data for computer simulation of the dynamics in complex collective decision-making processes. In the first step, a few experts determine the main issues at stake in a complex decision making process. Two experts from the Stockholm Environment Institute specified seven issues as the main one at stake in Copenhagen. Subsequently, they specified with countries and country groups have to be distinguished. Finally, they provided the data for each stakeholder on each issue: its position, salience, and potential influence. The two experts were interviewed on October 27 and 28, 2009. Section 2 contains an overview of the obtained data that we used for our analyses. The positions on the issues are given on a scale from 0 to 100. The issues are controversial as the country groups take different positions on the scale, while a collective decision can result in only one outcome.

At the moment of writing of this report, it is already clear that no treaty will be signed in Copenhagen. That requires more time and is foreseen for mid-2010 in Bonn. This makes Copenhagen not less important: Copenhagen should result in an agreement on all issues on the basis of which the treaty can be written for and signed in Bonn.

Our study will give an answer on the following three questions

a. On which issues do we expect a unanimous outcome in Copenhagen?

b. What will be the outcome on these issues?

c. ***Can we develop a strategy to increase the likelihood of unanimity while the outcomes are simultaneously more favorable for the climate and planet?***

2 Party Groups and Issues

The Parties at COP meetings usually coordinate policies with other parties. It is therefore not necessary to estimate positions and saliences of all Parties. If a Group of Parties coordinates policies and reach similar positions and saliences on the issues, we can take them as a group. Table 1 presents the Party Groups the experts identified and the abbreviations we use in the remainder of this report.

Developing countries coordinate their positions within the Group of 77 (G77). At the establishment of this group in the 1960s, 77 developing countries participated. The name of the group remained the same over the years even though many new developing countries emerged and joined the group. Since the G77 countries are very diverse, the experts identified several subgroups within the G77 and provided data for each of the subgroups rather than for the whole G77.

Table 1 also presents estimates of the relative influence of Party Groups during the informal negotiation process preceding the final vote. To reach agreement, the vote should be unanimous, but Party Groups differ in the importance they attach to reach an overall agreement. The more importance they attach to an overall agreement, the more they are willing to compromise. We asked the experts to score this on a scale from 0 (not important) to 100 (the Party Group will try to reach agreement with all means to its disposal). The expert ratings are given in the most right column of Table 1. The United States is estimated to have the greatest influence, however they are also very little inclined to make concessions to come to a unanimous agreement. In contrast, the EU is willing to promote unanimity very strongly.

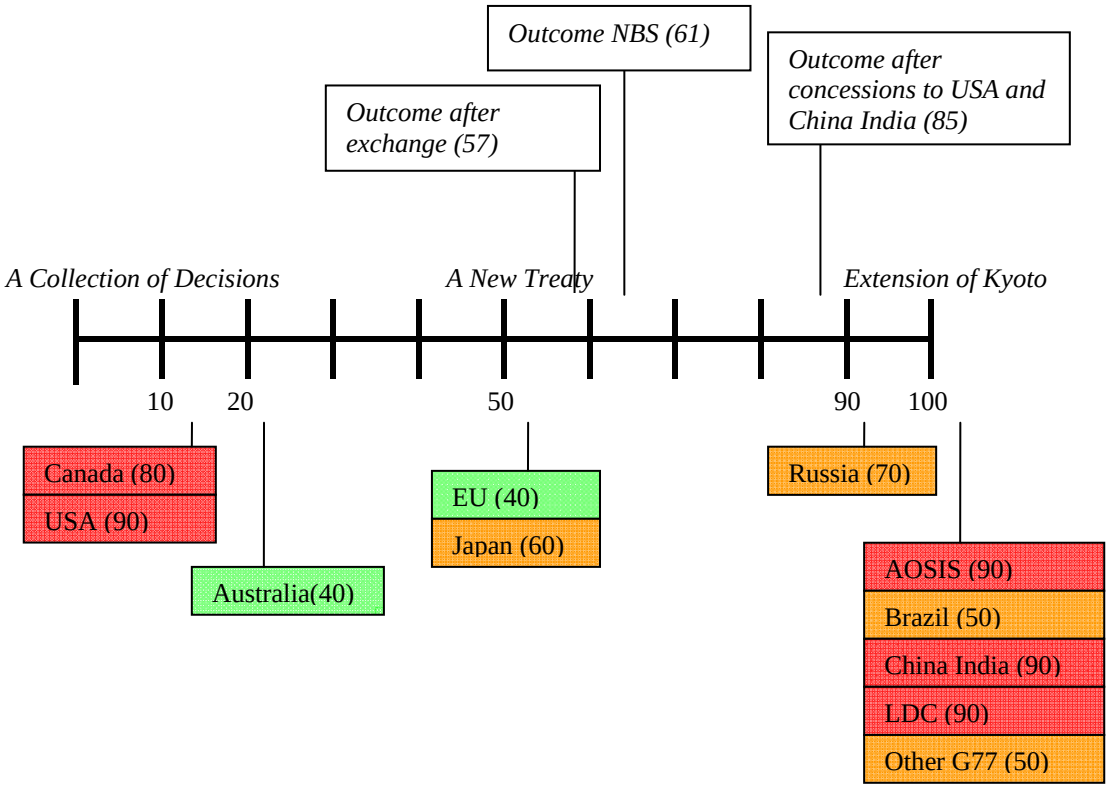
What are according to our experts, the main issues for negotiation and what are the positions of different stakeholders on these issues? In the remainder of the Section, we will give a short description of each issue. In our methodology, issues are represented as one-dimensional scales on which the positions of all Party Groups and the outcome can be represented. For each issue this is given in a figure. Party Groups are placed on the scale according to their position. Party Groups differ also in the importance they attach to reach an outcome close to their position. This is denoted the salience of a Party Group. Saliences of Party Groups are given in parentheses after their acronym, ranging from 0 to 100. The higher the score the more the Party Group will fight for an outcome close to its position. The salience is also represented by a color. Party Groups in red attach a salience between 80 and 100 to the issue; in orange between 50 and 80; and in green below 50. When both ends of a scale are covered with red coloured Party Groups an issue is to be regarded as highly controversial. Above the scale the outcomes are presented we expect under different assumptions. They will be discussed in more detail in Section Three.

Table 1: Party Groups with Their Relative Influence and the Importance They Attach to Reaching an Overall Agreement.

Party Groups	*Abbreviation*	*Relative Influence*	*Importance Attached to Reaching Agreement*
United States of America	*USA*	100	10
Canada	*Canada*	15	40
Australia	*Australia*	10	50
European Union	*EU*	60	90
Japan	*Japan*	20	60
Russia	*Russia*	5	10
China and India	*China India*	95	70
Brazil	*Brazil*	10	60
Least Developed Countries	*LDC*	30	85
Alliance Of Small Island States	*AOSIS*	30	90
G77 minus LDC, AOSIS, China, India, and Brazil.	*Other G77*	10	65

Issue 1. Will a new treaty come about or will the Kyoto Treaty be extended?

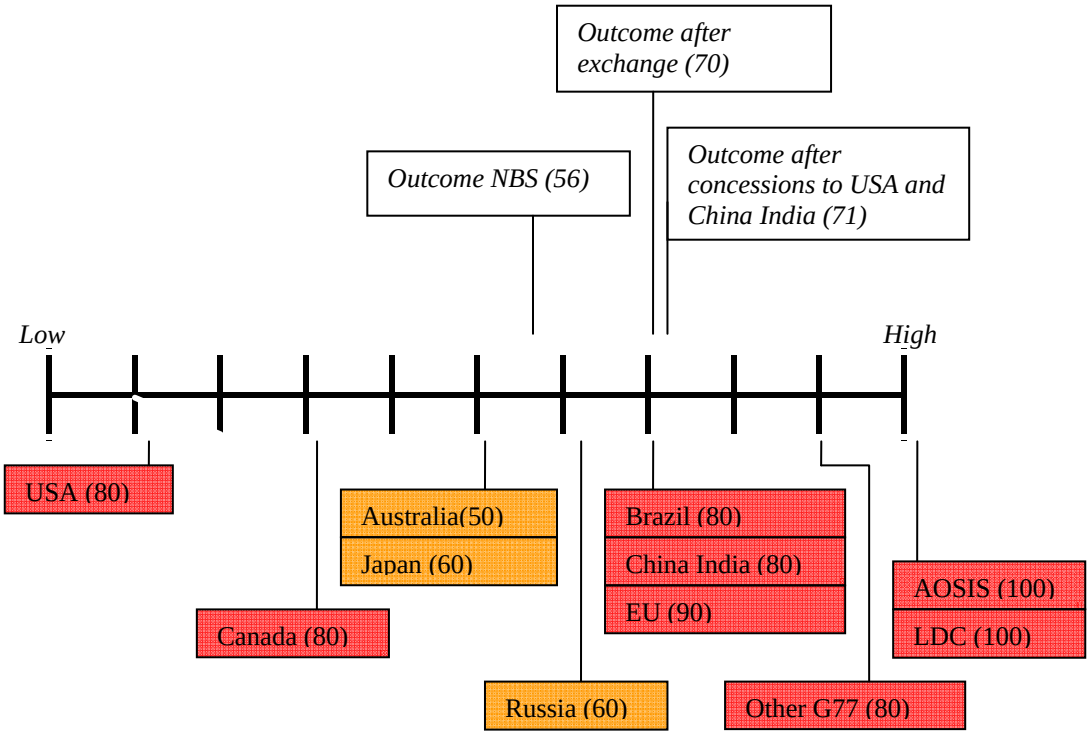
The Kyoto Treaty will end in 2012. The status of the Copenhagen decisions is, according to our experts, a highly controversial issue. Is the outcome of the Copenhagen COP an extension of the Kyoto Treaty (position 100 on the scale), a new treaty (position 50), or just a collection decisions (position 0)? The Kyoto Treaty gives important rights and obligations to different Party Groups. If the Copenhagen COP results in a new treaty or even just in a collection of decisions, the Kyoto rights and obligations are lost, unless they are reaffirmed. The status of the Copenhagen agreement has consequently far ranging consequences for different Party Groups. For this reason, Party Groups do not only take different positions on the scale, but some of them attach also a high salience for an outcome close to their position.
The USA and Canada are on the one end of the scale, aiming at an outcome that is seen as a collection of new decisions, whereas China, India, the LDC and the AOSIS aim at an extension of the Kyoto Treaty. Brazil and the Other G77 nations support the latter. The EU and Japan take intermediate positions and attach less salience to whatever is the outcome. The issue is to be regarded as strongly controversial as the Party groups at the opposite sides of the scale attach a high salience to the issue.



Issue 1: New Decisions vs. Extension of Kyoto

Issue 2. Reduction of CO_2 emissions by rich countries in 2020 relative to 1990

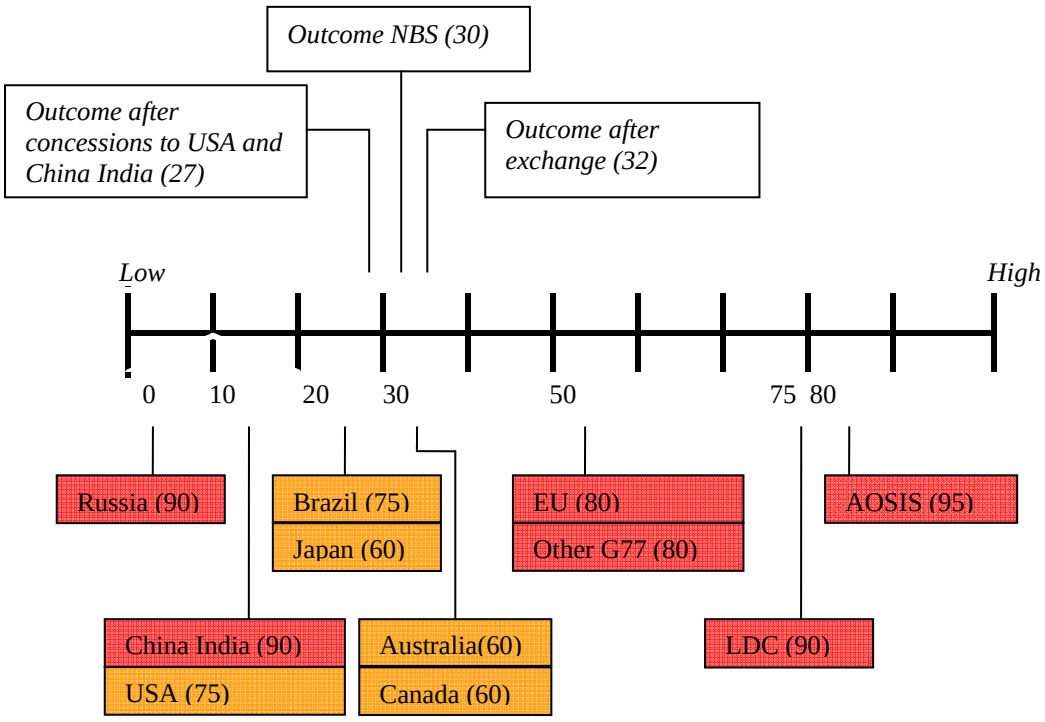
The amount of CO_2 emission rich countries have to reduce in 2020 relative to 1990 is a recurring topic since the Kyoto Treaty. The Kyoto Treaty requires a reduction of 5.2 percent. Since this agreement ends in 2012 renegotiation on this topic is required. Positions of Party Groups vary strongly on this mitigation issues and are strongly related to their possibilities to reduce their CO_2 emissions. Both Canada and the USA prefer a low reduction, whereas the EU, Brazil, China, India, the LDC, the other G77 nations, and Russia prefer a high reduction. Australia and Japan take an intermediate position.



Issue 2: CO_2 Reduction by rich countries in 2020

Issue 3. Domestic Rich Country CO_2 Emission Reduction

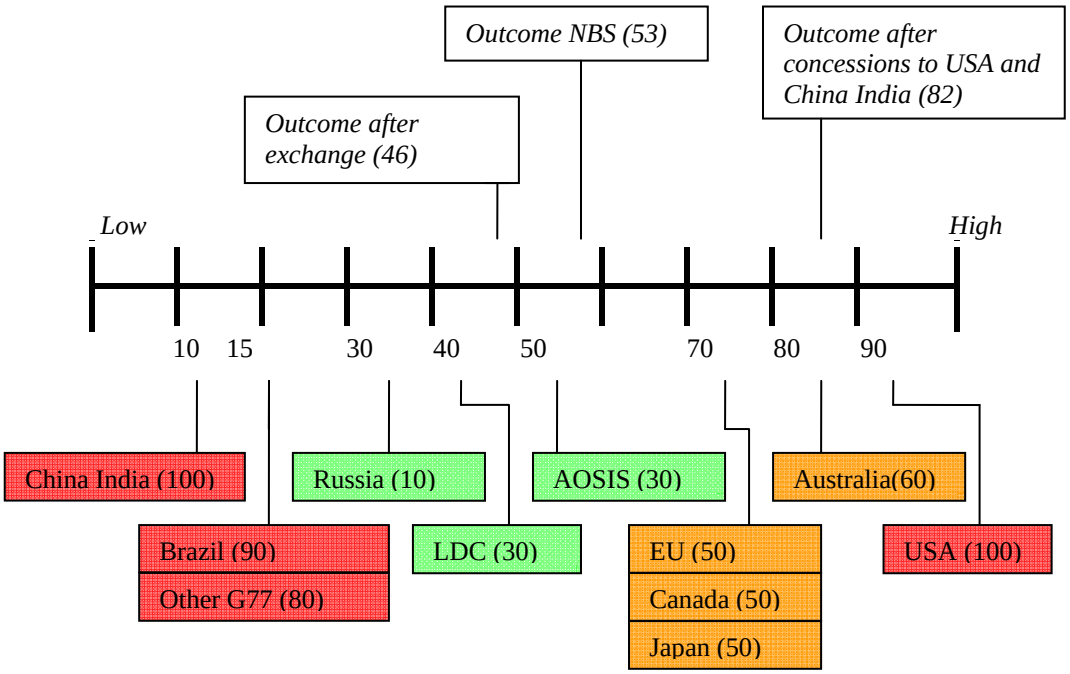
Domestic reduction of CO_2 emission is related to the Kyoto *cap and trade* system that defines nation specific maximum emission levels for rich countries. The emission targets are not necessarily to be realized domestically but can also be achieved by transferring industries to developing countries. Russia, China, India, the USA, Brazil, Japan, Australia, and Canada all prefer low domestic reductions. The LDC and AOSIS prefer a high domestic reduction of CO_2 emissions by rich countries. They do not consider transferring industries as a contribution to solving climate problems. The EU and the other G77 nations take an intermediate position.



Issue 3: Domestic CO_2 Emission Reduction

Issue 4. MRV CO_2 Emission Reduction in Developing Countries.

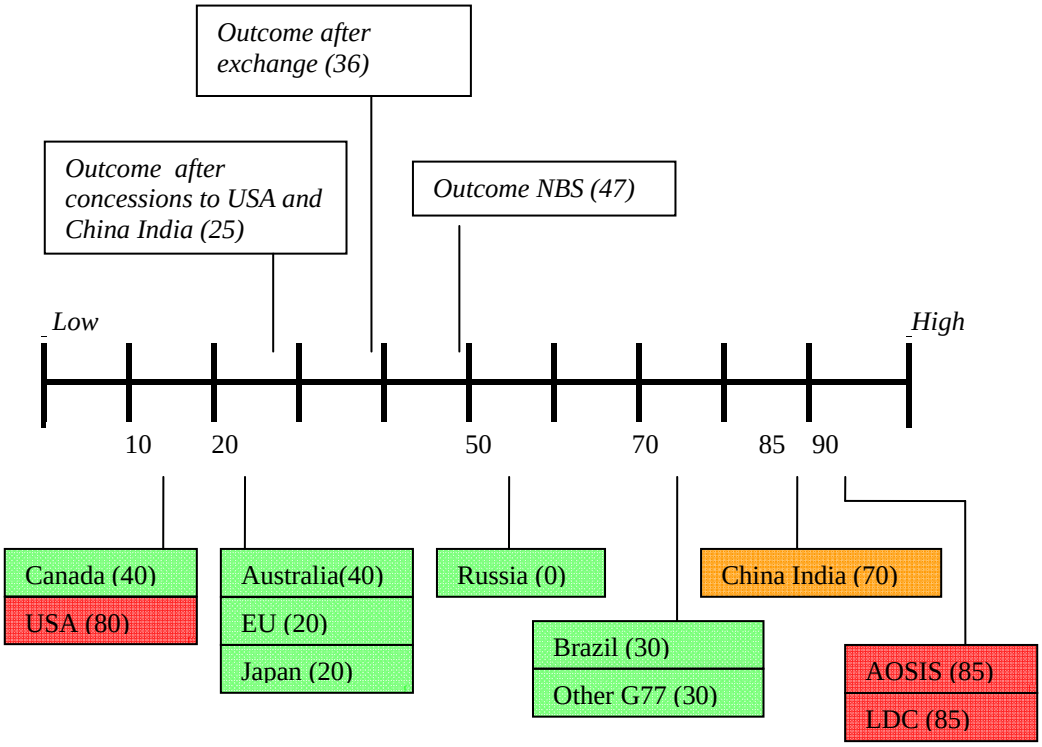
MRV CO_2 emission reduction refers to reductions that are *"Measurable, reportable, and Verifiable"* (MRV). These criteria's are applied to ensure measurable CO_2 emission reductions. Whereas in rich countries MRV's concern reductions in the total amount of emissions in 2020, developing countries are still allowed the increase their total emissions for obtaining a higher welfare. MRV CO_2 emission reduction in developing countries aim to increase CO_2 emission free proportion in their growth, especially in sectors involving high emissions such as heavy industries, electricity, and transport. The MRV issue concerns, therefore, the commitments of developing countries to create a more sustainable economy. Most developing economies are in favor of a low reduction of CO_2 emissions compared to their growth rates, while rich countries demand a high reduction by developing countries. China, India, Brazil, the other G77 nations, Russia, and to a lesser extent, the LDC and AOSIS prefer a low reduction and find it of high importance. The EU, Canada, and Japan and to a greater extent, Australia and the USA demand a high reduction. With the issue about the status of the decisions as an extension of the Kyoto Treaty or not, the MRV issue belongs to the most controversial issues.



Issue 4. MRV CO_2 Reduction in Developing Countries.

Issue 5. Should the rich countries commit to binding agreements about financial aid to developing countries for climate adaptation after 2020?

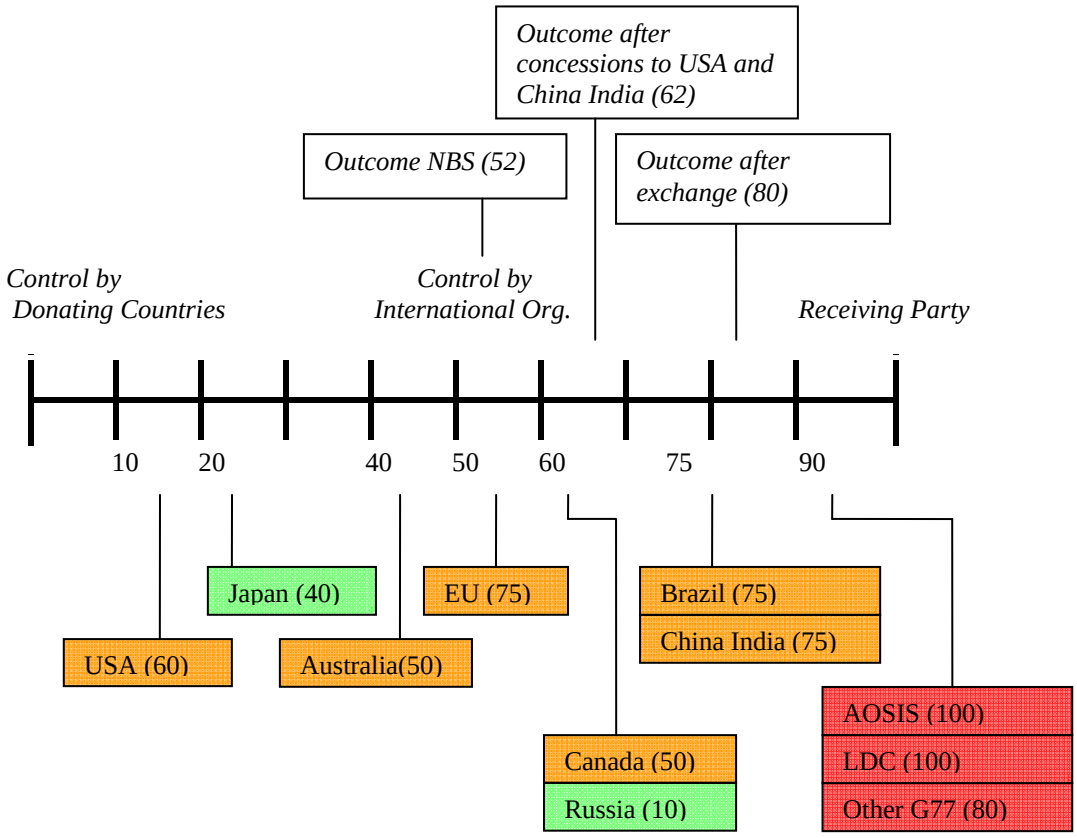
Climate change will require large and costly adaptation measures in developing countries, particularly after 2020. Rich countries are, therefore, asked to commit already now large financial resources for their realization in an adaptation fund. Again, this is a highly controversial issue in Copenhagen. Developing countries are, as to be expected, highly in favor of a large adaptation fund and binding commitments of rich countries to finance that. Most rich countries are reluctant and not prepared to make large commitments now. Especially the USA, Canada, and to a lesser extent, Australia, the EU, and Japan are against these types of commitments. Russia takes an intermediate position on this issue.



Issue 5 Binding commitments for adaptation fund

Issue 6. Adaptation Fund Discretion Power of Developing Countries

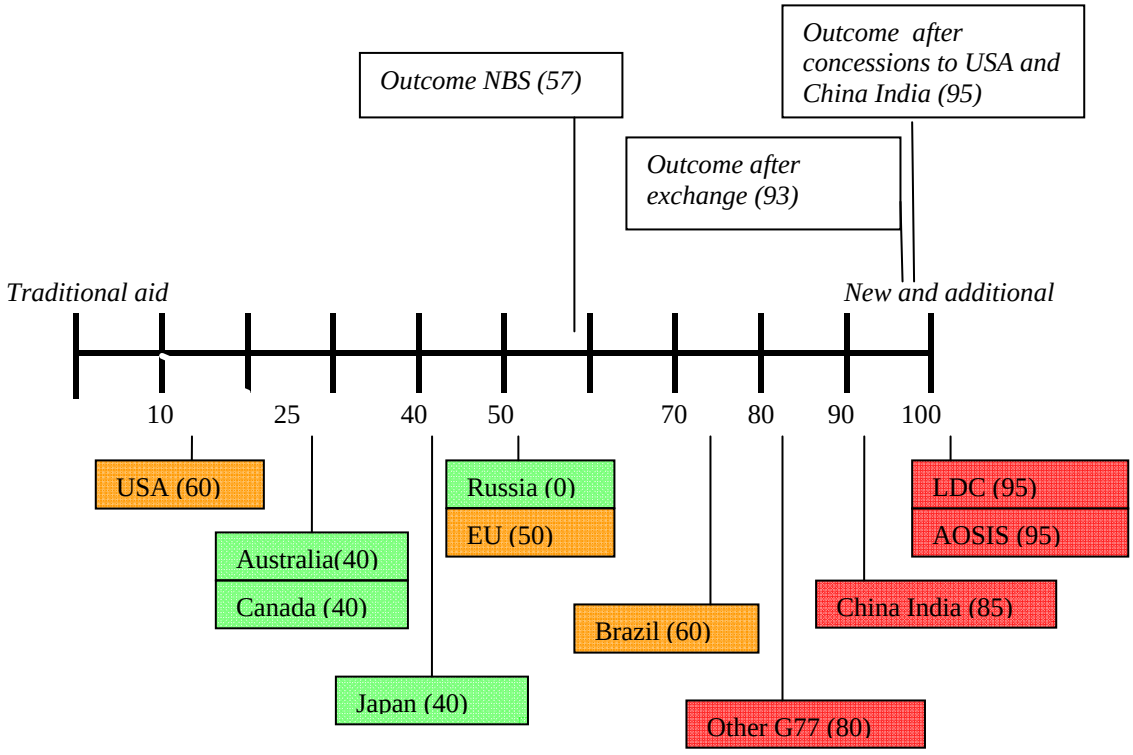
There are not only different views regarding the size of the adaptation fund, but also about the discretion power of the developing countries to finance projects with the fund resources. There is major disagreement on the extent to which developing countries are free to spend its resources according to their own judgment or that control is exercised by the donating countries or by international organizations. Especially developing countries prefer a large discretion power. The USA and Japan prefer control by supplying countries, while the other rich countries prefer control by an international organization.



Issue 6: Adaptation Fund Discretion Power

Issue 7. Adaptation Fund: Traditional Aid or New and Additional?

Like on the former two issues, rich and developing countries have different positions on the question whether the adaptation fund should be classified as traditional aid or as new and additional. In the latter case, they fear double counting. The USA, Canada, and to a lesser extent, Japan prefer to consider adaptation fund resources as traditional development aid. The EU – due to internal agreement, and Russia take an intermediate position. Brazil, the other G77 nations, and particularly China, India, the LDC, and AOSIS aim to classify the adaptation fund as new and additional.



Issue 7: Adaptation Fund: Aid or New and Additional

3 Predicting outcomes

The question whether consensus will be reached in Copenhagen depends on two perceptions of the Party groups. The first perception concerns the severity of the expected climate changes as a consequence of greenhouse gas emissions owing to currently unsustainable industrial production. The second is evaluating the importance of a worldwide agreement between the Parties in order to realize the transition to a more sustainable production. If both perceptions are strong and can be shared by all Party Groups, failing to reach a unanimous agreement will be seen as highly undesirable, even less desirable than a weak compromise. If this is the case, unanimity will be reached in the end, even when the Party Groups fundamentally disagree on a number of issues. For each issue, the expected outcome will be close to the mean of the Party positions on the scale, weighted by their influence and salience. This is an approximation of a well-known game theoretical solution called the 'Nash Bargaining Solution' (NBS)[1].

Although this solution takes into account all positions, those of influential Parties like the USA, China, India and EU, and the Parties with a high salience for an issue are given more consideration. Table 2 contains an overview of the expected outcomes based on NBS. To get a feeling for what it actually means Table 2 lists the Party Groups that have positions at or close to the expected outcomes. Table 2 shows the expected outcomes *if the desire for an overall agreement is strong for all Party Groups.*

Table 2. Expected outcomes based on NBS and Agreement Indicator

Issues	Expected outcomes based on *NBS*	Agreement Indicator
New Decisions vs. Extension of Kyoto (*0 = New Decisions, 100 = Extension Kyoto*)	61 (EU, Japan position)	59
CO_2 Reduction by Rich Countries in 2020 (0 = *Low, 100 = High*)	56 (Russia position)	68
Domestic CO_2 Emission Reduction (*0 = Low, 100 = High*)	30 (Australia, Canada position)	74
MRV CO_2 Reduction in Developing Countries (*0 = Low, 100 = High*)	53 (OASIS position)	65
Binding Commitments for Adaptation Fund (*0 = Low, 100 = High*)	47 (Russia position)	63
Adaptation Fund Discretion Power (*0 = No, 100 = Yes*)	52 (EU position)	70
Adaptation Fund: Aid or New and Additional (*0 = Aid, 100 = New/Additional*)	57 (EU, Russia position)	64

[1] See Achen, 2006.

Importance Attached to Reaching an Agreement

Table 1 shows that certain Party Groups do not attach much importance to reaching an agreement. The EU, the least developing countries and AOSIS want to reach an agreement, but others like the United States and Russia do not. The likelihood of an agreement will be very low in case Party Group positions are widely dispersed over the scale, particularly if this is the case for influential Party Groups. An indicator for agreement is then defined that will reach its maximum value of 100 if all Party Groups have the same position. In this case, there is an overall agreement on the outcome. The likelihood of agreement diminishes to the degree that the positions vary more over the scale. We therefore computed the standard deviation of the positions weighted by the influence of the Party Groups and subtracted this value from 100 for every issue. In case the importance for overall agreement is low for a number of Parties, we expect that a value below 80 is already a strong indication that unanimity will not be achieved. The last column of Table 2 shows that the agreement indicator is much lower than 80 for all issues. *In combination with the low importance attached to reaching an agreement by a number of influential parties, the conclusion is that the expected outcomes in Table 2 are not a basis for an overall agreement among all Party Groups.*

Expected outcomes and expectation of overall agreement after bilateral exchanges between Party Groups

As stated above, the original positions vary too much to expect an overall agreement, particularly because a number of Party Groups are not willing to make large concessions for an overall agreement. The expected outcomes, but also the variation of the positions can change fundamentally if Party Groups exchange voting positions by linking the issues with each other. If an issue that is related to another one is of less importance for one Party Group than for another Party Group, it is willing to compromise on that issue in exchange for support for the relatively more important issue. Party Groups will realize such exchanges of positions with other Parties, only if both can profit from it[2]. The more complementary the interests of the Parties (the more Parties differ in their saliences over the issues) the more they can gain from such bilateral exchanges. This is the next step in our analysis.

Table 3 contains the expected outcomes and the degree of agreement *after the exchange process.* Important shifts in expected outcomes can be seen for several issues, although for others the expected outcomes barely differ. On the one hand, rich countries are expected to commit themselves to higher levels of CO_2 reduction about to the level the EU offered by the end of October. On the other hand, China and India are less ready to take MRV CO_2 reduction measures. Rich countries are expected to be more reluctant to make binding commitments for the adaptation fund than in the former analysis, but developing countries will get more discretionary power over the fund. Resources in the fund will be now seen as new and additional, which are important and substantial shifts in expected outcomes. Probably more important is the fundamental increase in overall agreement on five of the seven controversial issues, of which two remain highly controversial: the state of the decisions in Copenhagen as new or as an extension of Kyoto (Issue 1) and the size of MRV CO_2 reduction in advanced developing countries, like China, India and Brazil (Issue 4). The basis for

[2] For a more detailed explanation on the model used, see Stokman and Van Oosten 1994, Stokman et al., 2000 and Arregui et al., 2006.

agreement then improves fundamentally, but two issues will continue to cause problems.

Another reason why it is not expected that this exchange process will result in an overall agreement is that every exchange between any two Parties can result in positive or negative effects for other Parties, depending on whether the expected outcomes shift in the direction of their positions on salient issues or not. We call this effect of exchanges on other Parties externalities[3]. Table 4 and Figure 1 show that, over all simulated exchanges between Party Groups, the positive externalities are greater than the negative ones only for the EU, Russia and some developing country groups. All other Party Groups perceive higher negative externalities than positive ones, which is the second reason for the main conclusion that *the interests of the Party Groups are not sufficiently aligned to arrive at an overall agreement by simply exchanging positions*. *Two issues remain controversial and require another solution. There are simply not enough complementarities between interests to reach an overall agreement.* The next question is then whether there are instruments to increase the complementarities of interests of the Party Groups in Copenhagen in such a way that an overall agreement can be achieved, preferably for a set of decisions or a treaty that is even more favourable for the climate and planet than the ones above. A strategy for such an outcome will be elaborated in the next section.

[3] For a more detailed explanation see, Dijkstra et al. 2008, Van Assen et al. 2003.

Table 3. Expected outcomes after realization of bilateral exchanges between Party Groups, and Agreement Indicator

Issues	Expected outcomes after bilateral exchanges	Agreement Indicator
New Decisions vs. Extension of Kyoto (*0 = New Decisions, 100 = Extension Kyoto*)	57 (EU, Japan position)	61
CO_2 Reduction by Rich Countries in 2020 (0 = *Low, 100 = High*)	70 (EU and Brazil position)	84
Domestic CO_2 Emission Reduction (*0 = Low, 100 = High*)	32 (Australia, Canada position)	89
MRV CO_2 Reduction in Developing Countries (*0 = Low, 100 = High*)	42 (LDC position)	64
Binding Commitments for adaptation fund (*0 = Low, 100 = High*)	36 (Russia position)	80
Adaptation Fund Discretionary Power (*0 = No, 100 = Yes*)	80 (China, Brazil position)	84
Adaptation Fund: Aid or New and Additional (*0 = Aid, 100 = New/Additional*)	93 (China India position)	93

Table 4. Total positive and negative externalities

Name	Total positive externalities	Total negative externalities
USA	*0.11*	*-0.14*
Canada	*0.13*	*-0.29*
Australia	*0.02*	*-0.15*
EU	0.28	-0.04
Japan	*0.05*	*-0.19*
Russia	0.22	-0.09
China India	*0.24*	*-0.29*
Brazil	*0.24*	*-0.35*
LDC	*0.05*	*-0.19*
AOSIS	0.22	-0.11
Other G77	0.22	-0.09
Total	1.79	-1.94

* The Party Groups with higher negative than positive externalities are in italics.

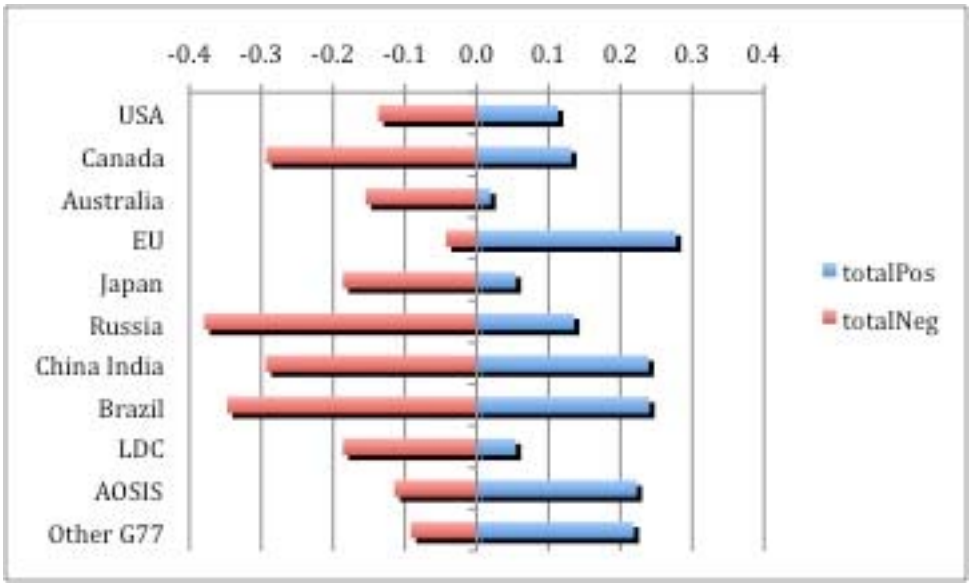


Figure 1. Positive and Negative Externalities of Party Groups.

4 Strategy to increase the likelihood of an agreement and obtain better outcomes for climate and planet

All analyses so far were based on the data obtained on October 27 and 28, 2009 in the interviews with the two experts of the Stockholm Environment Institute. The analyses show that the interests of the Party Groups cannot be harmonized in such a way that an agreement can be reached on all issues. Two issues remain unresolved: the state of the decisions in Copenhagen (Issue 1) and the obligations China and India in particular have to meet to reduce emissions in their growth (Issue 4). We therefore wondered whether a strategy could be formulated that fulfills the following three criteria:

1. An agreement is reached on all seven issues.
2. The agreement is favorable for climate and planet.
3. The interests of the different Party Groups are more aligned so that they all contribute to solving the serious climate problems we will face in the future.

Table 5. Expected outcomes, based on adapted saliences of USA on Issue 1 and China India on Issue 4, after realization of bilateral exchanges between Party Groups, and Agreement Indicator

Issues	Expected outcomes after concessions to USA and China (with exchanges)	Agreement Indicator
New Decisions vs. Extension of Kyoto (*0 = New decisions, 100 = Extension Kyoto*)	85 (Russia position)	83
CO_2 Reduction by rich countries in 2020 (0 = *Low, 100 = High*)	71 (EU, Brazil position)	82
Domestic CO_2 Emission Reduction (*0 = Low, 100 =High*)	27 (Australia, Canada position)	83
MRV CO_2 Reduction in Developing Countries (*0 = Low, 100 = High*)	86 (USA position)	89
Binding Commitments for Adaptation Fund (*0 = Low, 100 = High*)	25 (EU, Australia Japan position)	81
Adaptation Fund Discretion Power (*0 = No, 100 =Yes*)	62 (Canada, Russia position)	84
Adaptation Fund: Aid or New and Additional (*0 = Aid, 100 = New/Additional*)	95 (China India position)	93

Strategy deployed

By making two small changes in the data on the basis of solid reasoning, a new strategy can be deployed that meets the three criteria. Issue 1 is mainly a problem for the United States that never ratified the Kyoto Treaty. If the new decisions are classified as an extension of the Kyoto Treaty, the US House and Senate ratification of the Copenhagen agreement implies a ratification of the Kyoto Treaty. Moreover, after eight years of Bush administration, the US cannot easily catch up. Consequently, the US will not likely sign a treaty that implies ratification of the Kyoto Treaty.

On the other hand, China and India have high stakes in having a Copenhagen agreement as an extension of the Kyoto Treaty, as rich countries can realize their emission reduction obligations with projects in their countries. The MRV CO_2 free reduction in the growth (Issue 4) is especially important to China and India as they are willing to realize such a component in their growth, but are not willing to make binding agreements to do so.
A possible solution could be to accept non-obligatory intentions in both cases, but to put the realizations of CO_2 reduction of these countries in the Copenhagen Treaty. Such a double arrangement considerably reduces the salience of the US in Issue 1 and the salience of China and India in Issue 4, which can be investigated by a considerable reduction of the two saliences in the data. The salience of the US on Issue 1 is reduced from 90 to an arbitrarily chosen value of 70 or lower, such as 50. Simultaneously, the salience of 100 of China and India on Issue 4 is also reduced to 50.
The results of this simulation are shown in Table 5. The results are stable as long as the salience of the US is reduced to 70 or lower for Issue 1 and that of China and India to a value of 90 or lower on Issue 4. In doing so, this provides us with very stable results. The results of Table 5 on the basis of the fifty-fifty saliences are just an example of a more general equilibrium. ***Now, after bilateral exchanges, sufficient agreement is realized on all issues to arrive at a complete agreement.[4]. Moreover, it is more favorable for climate and planet in many ways. The agreement can be summarized as follows:***

- ***The treaty in Copenhagen will be acknowledged as an extension of the Kyoto Treaty.***
- ***Rich countries will commit to a 20 to 30 percent reduction of their CO_2 emissions relative to their 1990 emissions, provided that the United States contribution is voluntary.***
- ***Rich countries will be allowed to realize a large proportion of this reduction in developing countries.***
- ***China, India and Brazil are prepared to reduce their dependency on fossil resources substantially, particularly in the industrial, transport, and electricity sectors in line with the demand of the United States, provided that their contributions are voluntary.***
- ***Rich countries will commit limited amounts of money for adaptation in developing countries after 2020.***
- ***The adaptation fund will be considered new money and not linked to the aid budgets of rich countries.***
- ***Developing nations will decide themselves on how to allocate money to projects.***

[4] A more detailed analysis shows that problems may arise to get the support of Canada and developing countries, as they prefer the outcomes of Table 3 to those of Table 5. However, the outcomes of Table 3 cannot be carried out. The doubts of Canada and certainly those of developing countries can be eliminated by linking the agreement with the technology acceleration fund as proposed below.

Analysis

The predicted Copenhagen agreement has several weaknesses. The first weakness is the voluntary basis of the contributions of the United States, China and India, notwithstanding the fact that they are substantially above the ones expressed so far. The second one is the limited size of the adaptation fund and the uncontrolled allocation of its resources by developing countries. The softness of the agreement is due to the fact that the interests of countries are not well aligned, as they are neither shared nor complementary. ***A strong agreement requires an element that harmonizes the interests of rich countries, China, India, and developing countries, which can be achieved by incorporating the deployment of renewable technologies in the Copenhagen agreement.***

Harmonization of interests by way of renewable technologies

The deployment of renewable technologies in developing countries causes mounting conflicting interests between rich countries and developing ones. Rich countries want to prevent surrogates of new technologies being developed quickly in developing countries, nullifying large development costs. On the other hand, developing countries want to prevent renewable technologies from being expensive for years due to patents. If the agreement summarized above can be linked in a very specific way to a fund for the deployment of renewable technologies in developing countries, the soft agreement could easily be converted into a very strong one. To do so we propose the following construction:

The COP should decide to create a separate fund for the deployment of renewable technologies in developing countries. The size of the fund would be determined by two parameters:

- ***The more rich countries fail to realize CO_2 reduction in their own countries, the larger the fund.***
- ***The more China, India and Brazil realize a larger CO_2 free component in their growth, particularly in their industrial, transport and electricity sectors, the larger the fund.***

In addition, the fund is not allocated in money, but in actual realizations of renewable technologies. [5]

Preferably, the sizes of the contributions of rich countries are based on the 2020 CO_2 reductions, as required by IPCC for a fifty-fifty likelihood to keep the world temperature increase below two degrees Celsius. The G20 formulated the two-degree increase explicitly as a goal, which is likely to be reaffirmed in Copenhagen. In doing so, the COP links fund contributions to scientifically required CO_2 reductions, with this explicit goal. ***Politics can then be associated with real solutions, not with politically driven insufficient ones!***

[5] The fund can be seen as what is known in game theory as a commitment or hostage. See Schelling 1960; Snijders and Buskens 2001, among others.
De Coninck (2009) shows in her impressive study that development and transfer of renewable technologies can indeed be used for the harmonization of interests. She gives several suggestions on how this can be incorporated into the Copenhagen Treaty. The proposed technology acceleration fund is a simple instrument to do this efficiently and effectively.

This strategy brings about the following harmonization of interests:

- Rich countries pay more, the *less successful* they are in realizing their annual and final objectives in CO_2 reduction in their own countries. This gives them an extra incentive for a large CO_2 reduction at home, even when the reduction is voluntary in the United States.
- Developing countries, including China, India and Brazil can deploy less renewable technologies paid by rich countries, the *less they contribute themselves* to CO_2 reductions in their own countries. This gives them an extra incentive for reductions in their own countries.
- Developing countries can deploy and import new renewable technologies without having to pay for them, even if patents protect them. Moreover, they have all the freedom to make their own choices, conditionally to the renewability of the technologies. As payment is based on the deployment itself, the likelihood of corruption is considerably reduced.
- The fund and its dependency on the successful realization of CO_2 reductions in both rich and developing countries create a large market for renewable technologies in industry. In any case, there is a large market and the proposed construction guarantees possibilities to include the research and developing costs in the prices through the patent system.
- The more successful the mitigation, additionally supported by the technology acceleration fund, the lower the adaptation fund can be after 2020. Linking the size of the technology acceleration fund to the expected adaptation needs after 2020 would require the technology acceleration fund to be a maximum of about $ 100 billion a year. The actual size depends on how well rich countries fulfil their emission reduction obligations and developing countries succeed in realizing a large renewable growth segment. To give an idea of how these are related to the size of the fund, its size can be summarized as follows for extreme cases:

Size of the technology acceleration fund		Developing country obligations	
		Completely fulfilled	No emission free growth realized
Rich country obligations	Completely fulfilled	$ 50 billion	$ 0 billion
	No emission reduction realized	$ 100 billion	$ 50 billion

5 Conclusions and recommendations

The above scientific analysis of the main controversial issues in the Copenhagen negotiations resulted in the conclusion that an overall agreement is only possible by transforming the future contributions of the US, China and India from obligations into promises and import their realizations into the treaty. At least on paper, these concessions resulted in higher commitments of CO_2 reduction.

The voluntary and non-obligatory nature of the contributions of the US, China and India fundamentally weakens the Copenhagen agreement. However, we have provided a solution to anchor the promised contributions, whether they are binding or voluntary, by creating a technology acceleration fund. The contributions of rich countries in the fund are proposed to be linked to two elements: they are higher, the more they fail to realize their obligations and promises, and are higher the more developing countries (in particularly China and India) succeed in increasing emission-free growth. In this way coordination of interests is created efficiently and effectively.

The proposed solution for the harmonization of interests through the technology acceleration fund aims to increase both the likelihood of a Copenhagen agreement and the later realization of the Copenhagen promises and obligations as well. This is only the case following a number of criteria:

1. Not only new and renewable technologies from rich countries are eligible for the fund, but also ones developed or produced in developing countries. The sole criterion is 100 percent renewable in use, not nullified in the production process. Otherwise, the fund would disturb the market considerably.
2. Small-scale solutions should also be eligible, not just large-scale ones. Small-scale solutions are often more efficient and effective in developing countries without proper infrastructure. Globally, at least 50 percent of the fund should be spent on small-scale solutions.
3. The fund should not solely be used for deploying renewable technologies, but also to create local infrastructure and expertise for maintenance and replacement. This will create autonomous growth and welfare in developing countries, with positive effects on a reduced population growth.
4. Any combination of renewable technologies should be eligible. Tailor-made solutions often consist of a combination of renewable technologies, using solar, wind, geothermal, water, not-with-food-competing biomass technologies, and maybe even future technologies based on gravitation or the likes.
5. Projects should not be prioritized solely on renewability, but also on them providing solutions to other problems. The major advantage of renewable technologies over fossil-based technologies is that they often solve other problems simultaneously, such as reduced water use, water desalination and waste processing. This way the technology acceleration fund can also be linked to the adaptation fund and, if that is established, the fund to prevent deforestation (REDD). The more problems are solved simultaneously, the better the ranking in the pool of project proposals.

All the people and institutions who have contributed to this study wish all participants in the decision-making processes in Copenhagen much wisdom. We hope to have contributed to an even better agreement for the climate and planet with this study.

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