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# Aviation and Climate Change

## Search for effective global Market-based options that secure interests of developing countries

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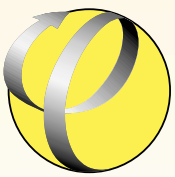

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# Contents

# Executive Summary

ICAO/CAEP is currently involved in the development and evaluation of options for the control of $CO_2$ emissions from international aviation. This is a difficult process, however, a major problem being the question of how to deal with the aviation of developing countries. Although these countries are not subject to binding emissions targets under the Kyoto Protocol, they are members of ICAO. During the most recent meeting of the UN/ICAO environmental committee, CAEP/5, last January this difficulty was again highlighted:

> *"several members expressed concerns about the possible negative effects on economic growth in developing States that could result from the implementation of market-based measures (charges, tradable permits). It was felt that further studies should be conducted on the subject, …" (Article 2.1.6.1, CAEP/5 Report).*
>
> *and:*
>
> *"Concern was also expressed over the effects on competition if only the developed States committed themselves to emissions reduction through an emissions trading regime." (Article 2.1.6.2, CAEP/5 Report)*

These concerns have been the point of departure for the present paper. It outlines six systems for controlling greenhouse gas emissions from international aviation, including the use of revenues, that could meet the concerns of both developed and developing states.

Preliminary analysis shows as most promising a market-based option limited to all traffic within and between developed countries (annex B countries), regardless of the nationality of the carrier. Such an MBO would neither affect developing countries negatively nor would it lead to unequal competition. After all, the MBO affects everyone equally at the specific partial market. Although such an option would not address all greenhouse-gas emissions by aviation, it would address the greater part. Finally, it would avoid difficult negotiations about transfers of funds between developed and developing countries. This option has not been discussed within the working groups of ICAO/CAEP so far.

Prospects for a market-based option, which also covers developing countries, seem less bright. To accept a global market-based option, developing countries will probably demand financial compensation for economic losses and risks. Since the problem of unequal competition can also be solved by a regional MBO restricted to the annex B countries, the only gain for annex B countries by extending the MBO to non-annex B countries are additional $CO_2$-emission reductions. It is therefore questionable whether the annex B countries will be willing to supply the substantial financial compensation to non-annex B countries accepting a global MBO.

# 1 Introduction

International climate policy is formulated amidst strong, often opposing forces. On the one hand, there is a demand for climate policy that is effective, efficient, and leading to a level playing field for international economic competition. This claim usually leads to the advocacy of market-based instruments, which are introduced worldwide and affecting everyone equally.
On the other hand, there is a demand for climate policy, which recognizes the special responsibilities of the industrialized countries to combat climate change, and respects the priority needs of developing countries for the achievement of sustained economic growth and the eradication of poverty.
In principle, both demands could be reconciled by a transfer of funds from the developed to the developing world. Such a solution, however, obviously leads to new advocates and opponents.

So far, these forces have resulted in the Climate Convention (1992) and the Kyoto Protocol (1997). In the Kyoto Protocol, the developed countries committed themselves to quantitative emission reduction targets, while in accordance with the Climate Convention the developing countries are exempted from such commitments. To assist the developed countries in achieving compliance with their emission reduction commitments and to assist the developing countries in achieving sustainable development, e.g. the Clean Development Mechanism (CDM) has been established, a form of emission trading.[1] Developed countries can buy emission reductions achieved in developing countries and subtract them from their national commitments. Also three funds have been established under the Kyoto Protocol, which in particular are for the benefit of the developing countries.[2]

Emissions from international aviation are not included within the national targets agreed under the Kyoto Protocol. Article 2.2 of the Protocol asks the developed countries and countries with economies in transition to pursue limitation or reduction of emissions of greenhouse gases not controlled by the Montreal Protocol from aviation bunker fuels, working through the International Civil Aviation Organization (ICAO). Therefore, the ICAO Committee on Aviation Environmental Protection (CAEP) is currently evaluating the potential role of a range of market-based options for limiting carbon dioxide emissions from the aviation sector. In this task, the ICAO has to operate under the same forces that affect international climate policy.[3] While ICAO spans both the developed and developing world, developing countries do not have emission reduction commitments under the Kyoto Protocol. Perhaps the dilemmas ICAO is facing are even more pronounced:

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1 Apart from the CDM there are two other so-called 'flexible mechanisms' under the Kyoto Protocol: emission trading and Joint Implementation between Annex I countries.

2 See also footnote 13.

3 During the meeting of the UN/ICAO environmental committee CAEP/5, January 2001, the difficulties were again highlighted:
"several members expressed concerns about the possible negative effects on economic growth in developing States that could result from the implementation of market-based measures (charges, tradable permits)." (Article 2.1.6.1, CAEP/5 Report).
"Concern was also expressed over the effects on competition if only the developed States committed themselves to emissions reduction through an emissions trading regime." (Article 2.1.6.2, CAEP/5 Report)

1 Aviation is pre-eminently a sector exposed to international competition. The distributional effects of an uneven international allocation of emissions-reduction obligations would therefore be felt sooner and more keenly than in the case of many other sectors and products. Indeed there are developed countries, such as Singapore (Singapore Airlines) and Hong Kong, which are not subject to emission reduction obligations under the Kyoto Protocol, but whose airlines are highly competitive.
2 National governments can protect most economic sectors against the effects of unequal international competition by shifting some of the burden of climate policy from the sectors exposed to international competition to the sheltered sectors. This is no option, however, if climate policy deals with the international aviation sector in isolation and a separate target is set for the aviation sector.
3 If air transport becomes more expensive, the demand for major exports from developing countries may be directly affected, and the prospects for economic development in such countries may suffer as a consequence.

Against this background the aim of the present paper is the following:

> *To explore how measures for controlling greenhouse gas emissions from international aviation should be designed in order to present a system (including use of revenues) that would reconcile both the demands from the developed and developing countries.*[4]

## 2 Objections from developing countries to global MBO's

Developing countries have a strong case against market-based options to be introduced worldwide which could affect their economic development. Not only do developing countries believe they have a 'moral' basis to be exempted from emission reduction obligations, these arguments have also been acknowledged in international agreements, such as the Climate Convention and the Kyoto Protocol.

In the United Nations Framework Convention on Climate Change (UNFCCC), adopted in 1992 and entered into force in 1994, the following considerations are given:

> "Noting that the largest share of historical and current global emissions of greenhouse gases has originated in developed countries, that per capita emissions in developing countries are still relatively low and that the share of global emissions originating in developing countries will grow to meet their social and development needs…"
>
> "Affirming that responses to climate change should be co-ordinated with social and economic development in an integrated manner with a view to avoiding adverse impacts on the latter, taking into full account the legitimate priority needs of developing countries for the achievement of sustained economic growth and the eradication of poverty,"

On the basis of these considerations and others Article 3, Principle 1 of the UNFCCC states that:

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[4] No subject of exploration has been the option to allocate the emissions by aviation to the various countries.

> "The Parties should protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities. Accordingly, the developed country Parties should take the lead in combating climate change and the adverse effects thereof."

The UNFCCC was signed by 177 nations, in both the industrialised and developing world. This includes the United States who in 2001 rejected the Kyoto Protocol.

In line with the UNFCCC developing countries are not subject to binding emissions targets under the Kyoto Protocol.

Finally, the same line is followed in the appeal to the ICAO (Article 2.2) in the Kyoto Protocol, which in particular addresses the developed countries and countries with economies in transition:

> "The Parties included in Annex I shall pursue limitation or reduction of emissions of greenhouse gases not controlled by the Montreal Protocol from aviation and marine bunker fuels, working through the International Civil Aviation Organization and the International Maritime Organization, respectively."

Given these considerations, it may be expected that most developing countries will only accept measures for controlling greenhouse gas emissions from international aviation voluntarily if it is economically neutral or profitable for them.

## 3 Indication of impacts of MBO

ICAO is currently evaluating various market-based options (MBO's) for the reduction of $CO_2$ emissions from aviation.[5] The focus is directed to MBO's, since on theoretical grounds it may be expected that with MBO's emission reductions can be achieved with lowest costs. The options include environmental levies, emission trading and voluntary agreements, both regionally and globally applied. Furthermore, analysis is performed for various $CO_2$-emission reduction targets.

Analysis by the Forecast and Economic Support Group (FESG) of CAEP/ICAO shows that if emissions by aviation are reduced with lowest costs, the greater part (about 70%) of the emission reduction will be the result of a reduction in aircraft kilometres and revenue tonne kilometres (RTK's).[6] Technology improvement from a shift towards using more fuel-efficient aircraft accounts for the balance (around 30%).[7]

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[5] MBO Analysis Task Group (MATG), Analysis of Market-Based Options for the reduction of $CO_2$ emissions from aviation with the AERO modelling system, Produced for Forecast and Economic Support Group (FESG) CAEP/5, November 2000.

[6] MBO Analysis Task Group (MATG), Analysis of Market-Based Options for the reduction of $CO_2$ emissions from aviation with the AERO modelling system, Produced for Forecast and Economic Support Group (FESG) CAEP/5, November 2000.

[7] This not to say that MBO's cannot be given shape in such a manner that the share of technology improvement is higher, but this will be against higher costs.

In case the marginal costs of $CO_2$ emissions are $45 per tonne,[8] the amount of aircraft kilometres would decrease by about 5% in annex B countries[9] and about 4% in non-annex B countries with respect to the expected developments in 2010.[10] Obviously, this decrease in transport translates itself in fleet size (-6% and -5% respectively) and airlines related employment (-5% and -4% respectively).

Without going into great detail, it is obvious global MBO's will affect developing countries. Changes in the amount of aircraft kilometres will also have its effects on air transport related economic activities, such as tourism. While on average the effects may be modest, for specific countries and export products the effects may be large. International air transport contributes to employment and foreign exchange income by transporting tourists and cargo. Cargo transport by air allows developing countries to compete in markets that would otherwise not be open to them. Important export markets for developing countries include flowers (e.g. from the Ivory Coast, Kenya and Colombia) and fruit and vegetables (e.g. from Thailand and Zimbabwe). In particular, for those developing countries that are extremely poor and strongly dependent on air transport the introduction of MBO's may have big impacts. These countries mostly export products for which the costs of transport form a large part of the overall price of the product. In that case, an increase in transport prices may have a strong effect on export and foreign exchange income.

The question therefore is how market-based instruments can be given shape in such a manner that they are acceptable for developing countries and do not have significant adverse effects for the competitive position of airlines from Annex B countries. Below we discuss six options.

## 4 Option 1: MBO applied to carriers from annex B countries

A first option is to follow the line of thought in the Climate Convention and the Kyoto Protocol literally. The Kyoto Protocol asks the developed countries and countries with economies in transition to pursue limitation or reduction of emissions of greenhouse gases not controlled by the Montreal Protocol from

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[8] These marginal costs are taken from the FESG-paper. Probably, the marginal costs will be lower, however, in the order of $15 per tonne of $CO_2$. This is the price that will result under the Kyoto Protocol if an international market arises for emission reductions (Dutch National Institute of Public Health and the Environment, 2001, The Bonn Agreement and Marrakesh Accords: an updated analysis, Bilthoven, the Netherlands). Furthermore, it may be expected that ICAO will adopt market-based options that will lead to marginal costs of emissions by aviation comparable to those by other economic sectors. Otherwise, an uneven level playing field will arise between aviation and other (transport) sectors, and climate policy will be more costly than necessary.

[9] Annex B countries are the countries who accepted quantitative reduction targets under the Kyoto Protocol. They are essentially the same as Annex I countries from the Framework Convention on Climate Change. There are some differences; for example, Belarus and Turkey are not included in Annex B. The Annex B Countries are: Australia, Austria, Belgium, Bulgaria, Canada, Croatia, Czech Republic, Denmark, Estonia, Finland, France (including Monaco), Germany, Greece, Hungary, Iceland, Ireland, Italy (including San Marino), Japan, Latvia, Lithuania, Luxembourg, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Russian Federation, Slovakia, Slovenia, Spain, Sweden, Switzerland (including Liechtenstein), Ukraine, United Kingdom, United States of America.

[10] CAEP/6, Forecast and Economic Support Group (FESG), Assessment of impacts of Market-Based Options for Developing States with the AERO-MS, August 2001.

aviation bunker fuels, working through the International Civil Aviation Organization (ICAO). Under the Kyoto Protocol, developing countries are exempted from obligations.

An obvious option would therefore be to apply an MBO to carriers from annex B countries, thereby addressing 73% of emissions, and exempt carriers from non-annex B countries. Since annex B and non-annex B carriers may compete on the same lines, this could lead to unequal competition. It is important to note that such unequal competition is not necessarily *unfair* competition. Under the Climate Convention and the Kyoto Protocol it is acknowledged that countries should protect the climate system in accordance with their common but differentiated responsibilities and respective capabilities. Accordingly, the Climate Convention asks developed countries to take the lead in combating climate change and the adverse effects thereof.

The result is that developing countries have less restriction on economic development than developed countries. Participating in international economic competition, however, is an integral part of economic development. The acknowledgement that developing countries have legitimate priority needs for the achievement of sustained economic growth and the eradication of poverty therefore also includes the acknowledgement that developing countries have a legitimate claim to catch up with global international competition.

However, there is a general tendency within national governments to protect their economic sectors exposed to (unequal) international competition by exempting them to a large extent from obligations. The burden of climate policy is shifted for example from the sectors exposed to international competition to the sheltered sectors. This makes it doubtful whether the international community would accept unequal competition within the aviation sector. In particular, unequal competition could be felt unacceptable between carriers from developed countries, which are subject to emission reduction obligations under the Kyoto Protocol, and carriers from developed countries, which are not, but whose airlines are highly competitive, such as Singapore (Singapore Airlines) and Hong Kong.

Furthermore, in many cases it is difficult to divide internationally operating carriers over the annex B and non-annex B countries.

Finally, restricting aviation by carriers from annex B countries flying on non-annex B countries may also affect developing countries negatively. These carriers also bring tourists to and take back cargo from non-annex B countries.

## 5 Option 2: MBO applied to carriers from extended group annex B countries

One of the major objections to an MBO applied to carriers from annex B countries is that it leads to unequal competition. This unequal competition is foremost problematic between annex B countries and non-annex B countries such as Singapore, whose airlines are highly competitive. A solution that could soften this objection is to extend the group of annex B countries with countries with large airlines. It is unclear, however, what 'carrot' can be offered to these countries to join the annex B countries.

It should be noted that the issue of unequal competition is not restricted to aviation. Therefore, it is to be expected that the distribution of obligations

among countries has to be reconsidered in time according to development criteria. This could result in non-annex B countries joining annex B countries.

## 6 Option 3: MBO for traffic within and between annex B countries

A more realistic possibility than Option 1 and 2 is an MBO for all traffic within and between annex B countries.[11] This traffic is responsible for about 57% of global $CO_2$ emissions by aviation.[12] Such an MBO would neither affect developing countries nor would it lead to unequal competition. After all, the MBO affects everyone equally at the specific partial market. It affects emissions originating from aviation within and between annex B countries, irrespective of the carrier and the country to which it can be attributed. For example, carriers from developing countries operating on lines between annex B countries pay for emissions as well as carriers from annex B countries.

It should be noted that although an MBO for traffic within and between annex B countries addresses the greater part of emissions by annex B carriers (about 80%), it does not address *all* their emissions.

An additional option is to extend the group of annex B countries as proposed in option 2. This would strongly increase the percentage of global emissions addressed. If a country joins the group of annex B countries, not only a large share of its emissions are addressed, but also all of the emissions which result from flights from other annex B countries to this new country.

## 7 Option 4: global MBO, revenues to national treasuries on per capita basis

A third option would be to introduce market-based instruments *globally*, and use the revenues to compensate economic losses of the non-annex B countries. However, how to distribute the revenues of taxation or auctioned permits to national treasuries is still a controversial question and strongly related to how to allocate emissions by aviation to the various countries. Various possibilities exist: distribution of revenues proportional to the economic 'inconvenience' due to the MBO (reduction of fuel sales, aviation, transport of passengers and cargo), to present national emissions, to the nationality of the carriers, *et cetera*. In all of these cases, however, the revenues for governments of non-annex B countries do not offset the negative economic effects.

One option that could offset the negative effects is a distribution of revenues to national treasuries in proportion to the national population size. Such an option would correspond to the idea that basically the global atmosphere is a global commons to which no one can justify a bigger claim than any other: each inhabitant of this globe should have equal access to the absorption capacity of the atmosphere for carbon dioxide. The idea of equal per capita entitlements to the global atmosphere also seems to lie at the basis of the exemption of developing countries from obligations in the Climate Convention (see section 2: "Noting … that per capita emissions in developing countries are still relatively low"). It should be noted, however, that contrary to the

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[11] In this paper, the question is left unanswered how to distribute the revenues of fuel taxes or auctioned permits amongst the annex B countries.

[12] Traffic within and between non-annex B countries is responsible for about 17% of emissions, while traffic between annex B and non-annex B countries accounts for the remaining 26%.

concept of equal per capita emission rights also other principles are proposed such as principles which are based on historical rights.

This option of equal per capita emission rights implies financial transfers from annex B to non-annex B countries. The question is whether annex B countries are offered enough in return by an extension of the MBO to non-annex B countries. After all, the problem of unequal competition can also be solved by a regional MBO restricted to the annex B countries. Therefore, the only thing annex B countries gain by extending the MBO to non-annex B countries are additional $CO_2$-emission reductions. These emission reductions are, however, not a cheap option such as the Clean Development Mechanism. In the case of aviation, most emission reductions will be the result of decreases in transport activities.
It is therefore questionable whether the annex B countries will be willing to supply the substantial financial compensation to non-annex B countries accepting a global MBO.

## 8 Option 5: global MBO, revenues to dedicated funds

Objections could exist against the recycling of revenues without earmarking, as proposed in the previous option. For example, the ICAO Council Resolution on Environmental Charges and Taxes – adopted in December 1996, and endorsed by the 32nd ICAO Assembly – strongly recommends "that the funds collected should be applied in the first instance to mitigating the environmental impact of aircraft engine emissions".

An option, which could meet such a demand, is to transfer revenues to a dedicated fund from which activities can be financed relating to climate change e.g. in the areas of adaptation or mitigation.[13]

The operational Multilateral Fund for the Implementation of the Montreal Protocol may serve here as an example. The Montreal Protocol on Substances that Deplete the Ozone Layer is an international agreement designed to protect the stratospheric ozone layer. The treaty was originally signed in 1987. The Multilateral Fund was established to assist developing country parties to the Montreal Protocol to comply with the control measures

[13] The three funds established under the Kyoto Protocol (the Special Climate Change Fund, the Least Developed Countries Fund, and the Kyoto Protocol Adaptation Fund) may serve as examples, although it is also a possibility to transfer revenues to these Kyoto funds directly.
The Special Climate Change Fund is to finance activities relating to climate change in the areas of adaptation, technology transfer, energy, transport, industry, agriculture, forestry and waste management; as well as activities to assist developing countries whose economies are highly dependent on income generated from fossil fuels in diversifying their economies.
The Least Developed Countries Fund will support, among other things, the preparation of national adaptation programs of actions for these countries.
The Kyoto Protocol Adaptation Fund is to be established under the Protocol to finance concrete adaptation projects and programmes, such as training scientists to measure emissions, in developing countries that ratify the Protocol.
The first two funds will be operated by the Global Environment Facility (GEF), a joint partnership between UNEP, the United Nations Development Programme (UNDP) and the World Bank to forge international co-operation and finance actions to address biodiversity loss, climate change, international waters, and ozone depletion within the framework of sustainable development.

of the Protocol. As at 20 July 2001 the contributions made to the Multilateral Fund by some 32 industrialised countries amounted to US $1.3 billion.

An important point of negotiation between annex B and non-annex B countries will be the percentage of revenues to be transferred to a comparable dedicated fund.

## 9 Option 6: global MBO, re-channelling of revenues for scrapping of old aircraft

Often, carriers in developing countries have older, less fuel-efficient aircraft than carriers in industrialised countries. If revenues of fuel taxation or auctioned permits would be used to stimulate premature retirement of these older aircraft, such a measure would therefore especially benefit developing countries. This is an option, which for example is mentioned by the FESG.

However, using revenues to stimulate premature retirement of older aircraft is a subsidy, which may distort competition.

Furthermore, the economic efficiency of this option is relatively low because it provides an incentive on one emission-reduction option only. Other measures such as operational measures or other technical measures might be more cost-effective.

## 10 Evaluation

In the Climate Convention it is recognised that the developed and developing countries have common but differentiated responsibilities. In the Kyoto Protocol, the developed countries committed themselves to quantitative emission reduction targets, while in accordance with the Climate Convention the developing countries are exempted from such commitments.

Against this background, realistic market-based options to limit emissions from aviation either have to be limited to the developed countries, or have to compensate for economic losses and risks of developing countries.

In Table 1 a simple evaluation is given of the various options. The last column needs some more explanation. The various options differ in the resulting flows of funds from the annex B countries to the non-annex B countries. As such, there may be good reasons for these flows of funds. In practice, however, substantial flows of funds have shown a stumbling block in negotiations. Since it has been the purpose of this paper to look for options that would reconcile both the demands from the developed and developing countries, substantial transfer of funds have been given a negative sign.

Table 1 Evaluation of market-based options

| | Percentage of global emissions addressed | Global level Playing field | Differentiated Responsibilities | Transfers of funds between annex B and non-annex B |
|---|---|---|---|---|
| Option 1: MBO applied to carriers from annex B countries | 73% | -- | + | + |
| Option 2: MBO applied to carriers from extended group of annex B countries | > 73% | - | + | + |
| Option 3: MBO for traffic within and between annex B countries | 57% | + | + | + |
| Option 4: global MBO, revenues to national treasuries on per capita basis | 100% | + | + | -- |
| Option 5: global MBO, revenues to dedicated funds | 100% | + | +/- | - |
| Option 6: re-channelling of revenues for scrapping of old aircraft | 100% | +/- | +/- | - |

Most promising seems a market-based option limited to all traffic within and between developed countries (annex B countries), regardless of the nationality of the carrier. Such an option would address the greater part of the aviation emissions by the developed countries, but would not lead to unequal competition.

Prospects for a market-based option, which is introduced globally, seem less bright. To accept a global market-based option, developing countries will probably demand a substantial share of the revenues of market-based options to compensate for economic losses and risks. Presumably, developed countries do not have sufficient interests in global market-based options to agree to such a fund transfer.

## 11 Next steps

The present paper has outlined six systems for controlling greenhouse gas emissions from international aviation, including the use of revenues, that could meet the concerns of both developed and developing states. These six systems are intended as a kickoff for further discussion.

The next step could be a consultation round with the parties involved (developing countries, ICAO bureau, UNFCCC secretariat). Its first purpose would be to probe and enhance recognition of the dilemma and the urgency to solve it. The second purpose would be to test support for specific options and to obtain suggestions for improvements and additions.

The following step would be to work out in detail the most promising option within the framework of a system of global open emission trading.