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Aviation and Emissions Trading

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Preface

Aviation is one of the sectors in the European Community which is undergoing rapid economic expansion. Even though it makes a substantial contribution to trade and industry, a more comprehensive discussion about the drawbacks of aviation has not yet taken place.

The Commission endorsed emissions trading as "the best way forward" to address the environmental impacts of CO_2 emissions caused by air traffic.[i] The Council of Ministers followed the recommendation, as outlined in their press release of December 2005. Also ICAO approved emissions trading as an appropriate measure. The Members of the European Parliament expressed their support by voting for the proposal of rapporteur Caroline Lucas and the Environment Committee regarding emissions trading and aviation on 4 July 2006. However, there was some discrepancy with the Transport Committee concerning certain key points. The most controversial subject was the question of whether aviation should be integrated into the existing European Emissions Trading Scheme (EU-ETS) or if there should be a separate scheme.

Although aviation causes only 3.5 % of human induced climate impacts[ii], the predicted growth in the number of flights departing from EU airports are of concern: e.g. 7.4 % increase in 2004.[iii] The expansion in this rising sector should not be halted, but there is a need to show more environmental responsibility. The need for action is even more serious, since growing emissions in aviation are about to offset emission reduction measures of other sectors.

As a politician with a strong interest in transport, I consider the design elements of emissions trading as pivotal to successfully reducing climate change impacts. I am particularly in favour of a unified EU approach regarding this issue rather than national solo attempts at ticket charges and kerosene taxes. A comprehensive development and harmonization of regulations in European aviation will contribute to this, as well as the implementation of the SESAR program and the "Single European Sky" legislation. A better air traffic management (currently there are 35 different national agencies involved) in Europe has the potential to reduce by 15 % the greenhouse gas emissions produced by aviation. The re-arrangement of air space will help to reduce un-necessary holding pattern.[iv]

Aviation generates many economic benefits by establishing a worldwide transport and logistics network. Only through aviation does unrestricted mobility and the transport of high

value goods become possible. Two billion passengers are handled per year and 25 % of business turnover is directly dependent on aviation. In Europe alone, 228 billion Euro and 4.1 million jobs are created directly or indirectly by the sector. However, these benefits cannot offset the concurrently generated disadvantages of increased emissions. We need a European instrument which is not only political feasible and effective, but that also dampens the negative environmental impacts. An emissions trading scheme seems to be such an instrument and all efforts should be taken for a rapid implementation of the scheme.

This paper aims to initiate a proper discussion of a highly complex issue and to provide all involved stakeholders from politics, economy and society with a guide to decision making.

1. Information on emissions trading and its international application

Emissions trading is an economic instrument aiming at mitigating the greenhouse gas CO_2. It is the most important transnational climate protection measure based on the Kyoto-Protocol of 1997.[v]

1.1. Background

In 1997, 39 developed countries committed themselves to reduce their output of climate changing gases (6 greenhouse gases including CO_2) by 5 % by 2012 compared to 1990 levels. Emissions trading is one instrument amongst a range of climate change measures designed to reach this goal. Based on Directive 2003/87/EC[vi], the EU-ETS was established on 1 January 2005 and covers 12.000 installations. Currently, this is the main system for trading allowances.

1.2. Principle

The European Emissions Trading Scheme (EU-ETS) obliges the operator of a facility (e.g. energy, cement, metal and glass) to surrender a so-called "EUA - European Union Allowance" for each emitted ton of CO_2. The EU-ETS is divided into 3 phases:

Phase 1: 2005 - 2007
Phase 2: 2008 - 2012
Phase 3: 2013 - 2017[vii]

The EU-ETS works according to the "cap-and-trade" approach. The cap sets the limit for CO_2 per trading period. In accordance with the cap, allowances are allocated to facility operators. The value of a ton of CO_2 is defined by the market. All sectors taking part in emissions trading can freely sell and buy allowances. If the actual emissions of a facility are lower than the number of allowances allocated, the surplus can be sold on the market. In case ‘own abatement’ measures are too costly and the allowances allocated are insufficient, a facility operator can buy excess allowances on the market.

1.3. Sanctions

If a facility operator is not able to surrender sufficient allowances according to his actual emissions’ data, sanctions are as follows:

In Phase 1 from 2005-2007, the penalty per ton CO_2 amounts to 40 Euro.
In Phase 2 from 2008-2012 the penalty increases to 100 Euro per ton CO_2.

Furthermore, the missing allowances have to be surrendered additionally in the subsequent year.

1.4. Other measures

Through the so called "linking directive"[viii] other environmentally friendly project activities outside of the country can be incorporated in the mandatory trading of CO_2 allowances. The facility operators participating in emissions trading can also acquire allowances through the following measures:

- "Clean Development Mechanism" (CDM) projects with developing countries: these projects generate "CERs - Certified Emissions Reductions"[ix], which can be used instead of "EUAs - European Union Allowances".

- "Joint Implementation" (JI) projects (from 2008) with other developed countries: "ERUs - Emission Reduction Units" are generated which can also be used instead of "EUAs - European Union Allowances"

1.5. Allocation of Allowances

The facility operator has to file an application for allocation of allowances.[x] Also, emissions data has to be certified and controlled by an independent expert. Calculation of quantity is made according to the national implementation legislation of allocation plans.[xi] A registry[xii] records who owns how many allowances. Each individual or entity can set up an account at the national registry. The facility operator gets an account to which the yearly amount is transferred (e.g. for 3 years in three commensurate tranches).

The facility operator has to present an emissions report by 1 March, which is the basis of the yearly settlement. In accordance with the actual emissions data, allowances have to be surrendered by 30 April to the national authority.

Important: The date for issuance of allowances (28 February) for the ongoing year and the deadline for surrender (30 April) of allowances for the previous year are overlapping. Therefore, allowances for the current year can be used to fulfil the obligations from the previous year.

Banking: A transfer of allowance between the trading phases (e.g. from Phase 2008 - 2012 to Phase 2013 - 2017) is permitted according emissions trading directive (2003/87/EC).

1.6. Criticism of emissions trading

There are some points that should be taken into account when talking about emissions trading.

Emissions trading is a complex instrument which is difficult to handle and monitor. The efficiency of the instrument for the most part depends on the "caps". Often, these caps are set according to politics and are not in line with their efficiency. The price of allowances is not foreseeable and depends on a volatile market. This marks a significant contrast to other measures like taxes, which are precise and unequivocal.

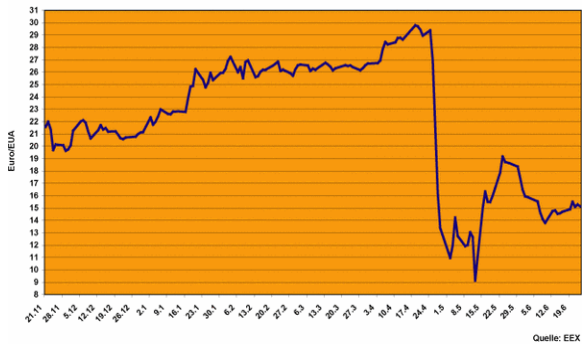
1.7. Practical experiences with the European Emissions Trading Scheme and future implications

The review of Phase 1 of emissions trading, which will end in 2007, has come to the conclusion that facility operators have made substantial profits through emissions trading. The EU Environment Commissioner, Mr Stavros Dimas, called for an increase in emission reduction targets to an average of 6 % in order to keep in line with the obligations under the Kyoto-Protocol.[xiii]

In general, the success of the European Emissions Trading Scheme depends on whether there will be a sequel after 2012 and how long the time span for upcoming trading periods will be set for, along with how much a ton of CO_2 will cost in the future. After a year of emissions trading, you can draw the following conclusions:

- In order to implement Kyoto targets cost effectively, there must be more use of emissions trading
- Registries were brought online in a gradual fashion - this has hampered the spot market
- Allocations have in general been more restrictive for power generators
- It is essential for allowance market development to prohibit ex-post adjustments
- The national allocation plans of the member states should not be complex, but sufficiently transparent and submitted in time.
- Some member states are in considerable arrears with compliance of their Kyoto targets.
- Mistakable definitions regarding scope, new entrants, facility closures and harmonisation of the allocation process have to be clarified.
- A revision of allocation methods for better predictability through stable baseline years and/or allocation periods and/or deduction of future allocation from past allocation.
- The system shall be enlarged to other sectors and gases.

EU-Allowances
(prices in Euro / allowances EAU)



1.8. International application of emissions trading systems

USA This concept was first used in 1995 when the US introduced the "Acid Rain Program" to mitigate sulphur dioxide emissions. Regional initiatives such as the "Regional Clean Air Incentives Market Program (RECLAIM)" started in 1994 to fight sulphur dioxide and nitrogen oxides in Los Angeles, California.

In October 1998 the US EPA called on states to mitigate Ozone ("NOx SIP Call"). Those states that decided to meet their obligations through a "cap-and-trade" approach were provided with a trading program ("NOx Budget Trading Program").[xiv]

Currently, a new initiative is starting up in the USA to fight CO_2 emissions, the so-called "Regional Greenhouse Gas Initiative - RGGI". Seven states from the Northeast have teamed up to cut CO_2 emissions from power plants by a mandatory "cap-and-trade" system. Emissions from the power sector shall be stabilized at current levels from the start of program in 2009 through the beginning of 2015. From 2015 through 2018 emissions will decline, achieving a 10 % reduction by 2019.[xv]

Canada has commissioned a study already in 1998 to examine and assess five potential models for emissions trading.[xvi] At present, there is a focus on reduction of greenhouse gases from so-called "large final emitters - LFE". The federal government has set a target of a reduction in emissions intensities by 15 % of 2010 levels for the Kyoto period of 2008 - 2012. In order to assist large final emitters in meeting their emission reduction targets in a cost effective manner, Canada has initiated the establishment of a domestic emissions trading system. Large final emitters will be allocated permits per unit of output each year equal, on average, to 85 % of their forecast 2010 emissions. A price cap of $15 per ton for the purchase of emissions permits has been set by the federal government.[xvii]

Japan The Ministry of Environment in Japan has chosen 32 companies which will take part in a voluntary emissions trading scheme to reduce their greenhouse emissions by 21 % until 31 March 2007, compared to average levels of the baseline years from 2002 to 2004. Under this scheme, the installation of technical equipment to reduce CO_2 emissions is subsidised by the Ministry. In return, companies have to commit to a certain amount of CO_2 reductions. It is also possible to fulfil one's obligations through trading of allowances with other companies. The federal government has allocated a budget of 2.6 billion Yen or 17.7 million Euro for this measurement. If a company cannot meet its promised reduction target, the subsidy has to be paid back.[xviii]

2. Reasons for the inclusion of aviation in emissions trading

2.1. Growth rates

While the transport sector is one of the biggest producers of CO_2 worldwide (accounting for 25 %[xix]), alongside the energy and household sector, the overall proportion accounted for by aviation is rather small at 2 %[xx]. Within the transport sector, aviation accounts for 12 %[xxi] of CO_2 emissions.

According to estimates of the "Intergovernmental Panel on Climate Change - IPCC", air traffic is estimated to contribute to about 3.5% of the total share of human activities held responsible for climate change. This share is expected to grow to 5% by 2050 and threatens to undermine global warming mitigation efforts made in other industrial sectors.[xxii] The EU is an important actor in global aviation and accounts for about half of the CO_2 emissions in international aviation of developed nations.

Worldwide CO_2 emissions from EU aircraft have risen between 1990 and 2003 by 73 %. This corresponds to a yearly growth rate of 4.3 % on average.[xxiii] According to a study of the European Environment Agency (EEA), in 2004 emissions were up by 85 % compared to 1990 levels. 2004 was an exceptional year with an increase of 7.4 %.[xxiv]

The forecast of EUROCONTROL indicates that air traffic will more than double by 2020 compared to 2003. For EU airports alone passenger traffic has risen by 10.3 % between April 2005 and April 2006 (Freight traffic has grown by 1 % during the same period).

2.2. EUROCONTROL study on fuel burn and carbon dioxide emissions evolution in EU25 member states

EUROCONTROL carried out a study[xxv] to assess the yearly evolution from 2002 to 2005 of the air traffic departing from airports located in the EU25 member states (irrespective of the destination), and of the related estimated fuel burn and CO_2 emissions. Since actual fuel burn and CO_2 emissions are not reported by the airlines, air traffic movement data[xxvi] for the years 2002 to 2005 was analyzed. All flights departing from airports located in the EU25 member states were extracted and used to estimate fuel burn and CO_2 emissions over the period in question. Additional data was used to calculate flight efficiency based on a notion of fuel burn per revenue passenger kilometre.

The database used comprises global civil traffic data for **six representative weeks each year and covers the years from 2002 to 2005**. Each traffic sample is chosen to obtain representative days throughout each year. The data collection methodology accounts for the seasonal, weekly and diurnal variation in air traffic. The traffic sample was then scaled up to yearly figures, based on 'Back Aviation's schedule traffic' for each whole year.

Estimations of fuel burn and CO_2 were conducted using the AEM (Advanced Emission Model)[xxvii] tool, which was developed by the EUROCONTROL Experimental Centre in order to estimate aviation emissions and fuel burn based on flight profile descriptions. As output, AEM delivers detailed fuel burn and emissions data all along flight profiles.

The amount of CO_2 emissions per kilogram of fuel burned is constant if complete combustion of the fuel is assumed. However, the exact amount depends on the chemical composition of the fuel, in particular on its carbon mass content.

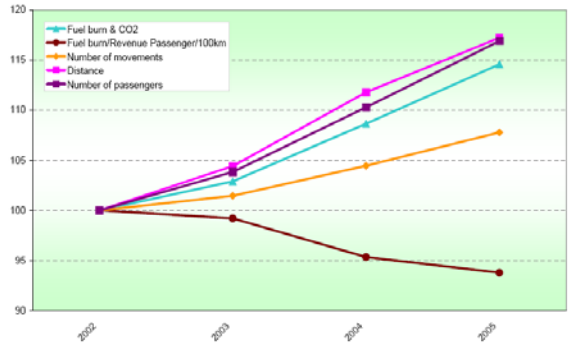
There are various types of fuel used in the aviation sector, with different chemical compositions. The actual composition of fuel used for each individual flight is most of the time not recorded. As a consequence, **an average fuel composition** has been applied in this report, with an emission index of 3.149 kg of CO_2 emitted per kg of fuel burned. Composition of fuel over the four years studied (2002 to 2005) did not significantly change, hence the possible differences would be in fact negligible. CO_2 is thus proportional to fuel burn in the results of this study.

So as to compare with other transportation modes, **fuel efficiency** has been expressed as 'fuel burn per revenue passenger per 100 kilometres'. As CO_2 is proportional to fuel burn, this parameter also reflects 'CO_2 efficiency'. Although fuel burn and distance flown are deduced from GAES-Move input data through AEM, the *actual load* factor, i.e. the percentage of total capacity available for passengers, freight and mail which is actually sold and utilised for each flight, is not available. Therefore, load factors for 2002, 2003 and 2004 are **overall load factors** (weighted averages) derived from AEA statistics. Information for 2005 was not yet

available, so the load factor for that year was extrapolated based on the averaged evolution over the 30 past years.

Fuel efficiency is determined flight by flight, based on actual traffic and detailed flight profiles. Therefore values obtained reflect the fuel efficiency improvements. Also, fleet renewal is captured in this study, i.e. the tendency to replace “old” aircraft with more fuel efficient aircraft.
The figure below shows that whilst air traffic movements, passenger numbers and flown distances have continued to increase during the period under consideration, the amount of fuel burned per passenger kilometre flown has actually fallen.

Percentage of evolution of different parameters for air traffic departing from airports located in the EU25 Member States



The number of passengers and the distance flown has increased most significantly during these four years by 16.9 % and 17.2 % respectively. Subsequently, fuel burn and CO_2 emissions rose by 14.6 %. However, there was an improvement in fuel efficiency since the parameter ‘fuel burn per revenue passenger per 100 kilometres’ has improved by 6.2 % during the same time period. As CO_2 is proportional to fuel burn, this means that also ‘CO_2 efficiency’ has developed positively. This improvement is predominantly due to a higher load factor and fleet renewal, which has brought more fuel efficient aircraft into the sky. As the distance flown has increased, more efficient cruise phases have been created compared to the fuel intensive phases of take-off and landing.

In contrast to other modes of transport, international aviation is neither subject to the Kyoto-Protocol nor subject to kerosene or value added taxes. Although operational/technological improvements promise to counter-balance traffic growth (about 1 - 2 % increase in efficiency per year) the dampening effect will not be sufficient to offset increases.

If the trend of growth in aviation continues, a quarter of reduction efforts by other industry sectors will be offset in terms of the Kyoto targets of 2012. Furthermore, climate change impacts of aviation accounts for two to four times of CO_2 impact alone.[xxviii] CO_2 accounts for only one third (37 %) of the total radiative forcing from climate relevant emissions of aviation. [xxix] In addition to CO_2, NOx, water vapour and constrails also contribute to the greenhouse effect.

2.3. Opinions of the Commission, Council, Parliament and ICAO

The **Commission**[xxx] has endorsed emissions trading as the most cost effective and environmentally friendly measure to address climate impacts of aviation. However, it also stresses the need to pursue already existing concepts further, such as:

- Research projects regarding climate impacts of aviation under the Seventh Framework Programme of the EU.
- Changes in air traffic management with programmes such as SESAME or the 'Single European Sky' initiative can instigate efficiency improvements of about 8 % to 18 %.
- Approaches for a broad taxation of aircraft fuel will be further examined in the context of the ongoing renegotiations of bilateral air service agreements.[xxxi]

The **Council**[xxxii] announced on 2 December 2005 in its press release that the inclusion of the aviation sector in the European Emissions Trading Scheme seems to be "the best way forward." This has to be interpreted against the background of the already existing trading scheme and has the greatest potential of being applied internationally. The Kyoto-Protocol also envisages the establishment of an international emissions trading scheme.

Since no agreement has been reached regarding the provision for allowances in international aviation, the signatory countries have decided to undertake emission reduction measures under the supervision of ICAO. Until now, the 188 member countries of ICAO could not come to a conclusion regarding regulatory standards or emissions charges applicable to CO_2 emissions. However, ICAO has endorsed the concept of international open emissions trading to be implemented through voluntary emissions trading or the inclusion of international aviation into existing national schemes.

In the **Sixth Community Environment Action Programme** the European Parliament and the Council decided to identify and undertake specific actions to reduce greenhouse gas emissions from aviation if no such action was agreed within ICAO by 2002.

The **position of the European Parliament** regarding this matter seems to be strongly coined by the Environment Committee. But on the topic of creating a separate trading scheme for aviation and the introduction of a multiplier to include non-CO_2-emissions in the trading scheme, the Transport Committee had another opinion.

Currently, European institutions are working on several legislative acts to secure a more efficient use of common air space. The already existing dossiers and future projects like the "Single European Sky" initiative or a unified system for air traffic management such as the SESARE program should be implemented as soon as possible. This would not only contribute to simplifying European air traffic but also helps to curb emissions from aviation for a cleaner environment.

2.4. Other instruments like kerosene tax, ticket charge and emissions tax

On 4 July 2006, the members of the European Parliament voted on the report in response to the communication of the Commission regarding the reduction of climate change impact of aviation and emphatically supported the intention to pursue the introduction of kerosene taxes. They also asked for a charge on Intra-EU flights. Here is a short overview of possible measures:

Kerosene tax
In a report from 1996, the Commission proposed to charge excise taxes on aircraft fuel as soon as the international legal situation allows for it. Such a provision shall be applied to all carriers, including those from Non-EU member states.

Legally, aircraft fuel is differentiated into two categories:

- Fuel, which was already “on board” is subject to the Chicago Convention from 1944 (Paragraph 24)
- Fuel, which is "loaded" in the destination country. In this case, fiscal treatment is subject to the legally binding bilateral air service agreements.

Through the Council Directive on restructuring the Community framework for the taxation of energy products and electricity,[xxxiii] member states can now abolish tax exemptions for national flights as well as for bilateral agreements between member states. Until now, only the Netherlands has decided to introduce a tax of 20.6 cents per litre fuel on domestic flights since 1 January 2005.

A problem occurs with the taxation of kerosene between member states if non-EU carriers have so called "5th freedom rights" because of bilateral air service agreements and thus enjoy tax exemption, whereas EU carriers are already subject to taxation. Also, with "code-sharing" on Intra-EU routes it is difficult to distinguish an EU-operator from a non-EU operator of a flight regarding taxation.

A renegotiation of bilateral air service agreements between member states and third countries is therefore necessary. Until now, about 200 air service agreements have been renegotiated by the EU and thus have established the possibility for the taxation of fuel.

The "effectiveness" of a tax depends on its level and scope. The positive impact on the environment results predominantly from a slowdown in demand and the stimulation of research into low emissions power trains. Reduction in demand depends on the possibility to roll over cost to the customer. Low fair airlines will particularly feel the pressure since their customers are quite price sensitive and fuel costs make up a considerable part of their calculation.

Avoidance measures like "tankering" and a shift of tourism destinations would partly offset a positive environmental effect and, in the worst case, could lead to longer travel routes and hence to an increase in emissions. Since non-EU-airlines on Intra-EU routes account for only 5 % of the market (mainly freight carriers) this does not seem to be a serious distortion of competition.

A really positive environmental effect can only be reached by high tax rates. With a tax rate of 245 Euro/1000 litre on all routes you would get a reduction in CO_2-emissions in the transport sector of 1.4 % and 0.34 % of overall CO_2-emissions in the EU.[xxxiv]
The "Wissenschaftliche Beirat der Bundesregierung - Globale Umweltveränderung" in Germany reckons that if kerosene were to be taxed at 20 cent per litre there could be a decrease of emissions of 25 - 35 % by 2025 within the EU. This would be an incentive to invent low emissions technologies.[xxxv]

At least, the decision whether or not to tax rests with the non-member states. For "economic" reasons it is currently not sensible to tax Intra-EU flights of EU carriers. Examples from Australia, Norway, Brazil, Canada, Japan and the USA show that national taxation of aircraft fuel does not result in the expected ecological steering effect and yields only minimal revenues. The tax rates have been set too low because of feared evasion and distortions in competition.

An international implementation of energy taxation in the aviation sector will remain the sole sensible way forward, but this can only be reached in the long or medium term' it is not suitable for achieving emissions reductions in a shorter time span.

Ticket charge
Since 1 July 2006, France has introduced a charge of 1 Euro on tickets for intra-EU flights and 4 Euro for long haul flights in economy class. The money will be spent on abatement measures against epidemics. In total, France is expecting revenues of 200 million Euro which will fund the international aid project „UNITAID" to buy urgently needed pharmaceuticals. Sweden also initiated a ticket charge starting on 1 August 2006 (10 Euro intra-EU flights, 20 Euro long haul flights). Other states which have decided to introduce a similar charge on flights in the future are: Brazil, Chile, Ivory Coast, Jordan, Congo, Luxemburg, Madagascar, Mauritius, Nicaragua, Norway, United Kingdom and Cyprus.

Compared to kerosene tax, a ticket charge has only a limited ecological steering effect since there is no incentive to develop low emissions technologies. Also, the intention of this

measure is somewhat different from curbing greenhouse gas emissions. However, this approach can be seen as a first step towards a "greener" taxation.

Emissions tax
A tax on carbon dioxide, nitrogen oxide, other greenhouse gases or constrails could also be considered. This would be a reasonably effective measure as long as all emissions are covered. Ecologically, a substantial steering effect would be given. However, an emissions trading scheme seems to be more effective.

The approach of the Environment Committee to regulate the aviation sector concurrently with measures such as kerosene tax and other charges is not favored by traffic experts. Europe should use one unified instrument, namely emissions trading, to reduce climate change impacts of aviation.

2.4. International application of voluntary self-obligation

Canada In June 2005 the Canadian government and the Canadian air transport association concluded an agreement to voluntarily reduce greenhouse gas emissions. The contract expects the members of the air transport association to improve their energy efficiency by 1.1 % per year. This will lead to a reduction of overall emissions of 24 % until 2012, compared to 1990 levels.[xxxvi]

Japan In 1998 the Japanese aviation industry association has presented a plan for voluntary reductions of greenhouse gases. Starting in baseline year 1990, there should be a reduction of 10% of industry-related CO_2 emissions by 2010, based on fuel consumption per available seat kilometer. By 2003, there was a reduction of 11.6 % compared to 1990 levels.

2.5. Special characteristics of aviation and emissions trading

Emissions from international aviation have not been included in the targets set by the Kyoto-Protocol and are not part of the Council Decision of 25 April 2002 concerning the approval, on behalf of the European Community, of the Kyoto Protocol to the United Nations Framework Convention on Climate Change and the joint fulfilment of commitments there under[xxxvii]. Therefore, aviation is missing a central element of political pressure which could lead countries to undertake emissions abatement measures in other sectors.

Fuels which are used in the international aviation and maritime sector (so called "bunker fuels") are exempt from the reduction and stabilizing obligations for the first commitment period (2008 – 2012), given that there was no agreement on the question of allocation of emissions. Since there are always two countries affected in international aviation, no allocation could be done according to the territorial principle, because there was no agreement on how to share the burden. At the same time, the Kyoto-Protocol obligates Annex I countries in article 2.2 to stabilize or to reduce emissions from bunker fuels in cooperation with the International Maritime Organization (IMO) and the International Civil Aviation Organization (ICAO).

For the planned inclusion of aviation in the European Emissions Trading Scheme, there seem to arise some difficulties with bookkeeping since no AAUs – Assigned Amount Units[xxxviii] –

have been allocated to international flights. Only an extension of the Kyoto-Protocol can resolve this problem after 2012.

Environmental effects
Civil aviation aircraft are travel at cruising altitudes, ranging from 8 to 13 km, where they cause emissions that alter the composition of the atmosphere and contribute to climate change.

Carbon dioxide is the most important greenhouse gas because of the large quantities emitted into the atmosphere and the long retention period.

Nitrogen oxide forms ozone when exposed to sunlight and also decreases the concentration of methane in the atmosphere. These contradictory mechanisms result in a positive net effect for global warming.

Water vapor, e.g. from contrails, enhance the formation of cirrus clouds, which in return have a presumptive warming effect.

Sulfate- and soot particle have relatively small effects. Soot is absorbing heat and hence influences warming. Sulfates reflect radiation and accelerate the formation of clouds and influence their composition.

3. Key points

The following questions remain to be resolved for a smooth integration of the aviation sector into the European Emissions Trading Scheme:

3.1. Operator

It is still unclear who will be responsible for surrendering allowances (airline, aircraft route, operator, airport, etc.) – compared to “installations”, as defined in the current ETS. An "operator" can be defined as the company who earns the revenue from a flight. Subsequently this company should be obliged to surrender the necessary allowances.

3.2. Multiplier for non-CO_2 impacts

Other aviation emissions have an indirect effect on global warming, since the total radiative forcing is 2.7 times that of CO_2 only. The Commission regards a multiplier in the current system as a means to take into account non-CO_2 impacts (NOx, water vapor and the formation

of cirrus clouds) and of respecting the "polluter pays principle". Currently it is very difficult to estimate an applicable factor. The disadvantage of a multiplier is the resulting trade-off when optimizing aircraft engines in respect to CO_2 and NOx.

Flanking measures: An alternative to a multiplier could be additional instruments, such as NOx related take off and landing charges for airports in order to mitigate NOx emissions. The regulation of take off and landing NOx emissions will also have a positive effect on cruise NOx emissions. In addition, local air quality will be improved. Also, a "NOx-en-route" charge is an applicable and effective means to curb total emissions of aviation.

To address non-CO_2 aviation emissions through a multiplier is not an appropriate measure since this causes a trade off when optimizing CO_2 and subsequently increases in noise and NOx. For non-CO_2 related climate impacts, such as NOx emissions, (local) flanking measures like NOx related landing and take off charges - which are revenue neutral (as applied in Switzerland, Sweden, UK) - are probably more effective.

3.3. Integration into the existing or separate system

Since no reduction targets had been fixed for international aviation, the inclusion into the current emissions trading scheme could accrue some difficulties. Some opt for a separate scheme for international aviation that seems to be easier from an accounting point of view. Substantial reductions in emissions in the aviation industry can only be realized in the long term. In the beginning, the sector will be a net buyer. The rapid growth of air traffic triggers an additional surge in demand. In a separate system, where only aviation companies trade with each other, there would not be sufficient allowances available to satisfy demand. Besides the shortage of allowances, a separate system would require additional bureaucracy. Creating another body of administration in parallel to the existing structure would be counterproductive with regard to the "better regulation" argument.

If other branches of the transport sector were integrated in emissions trading, such as shipping, subsequent separate systems would have to be established. According to a statement of Öko-Institut e. V., the inclusion of aviation in the existing emissions trading scheme is "only a technical question."

A possible positive side effect of the inclusion of aviation in the existing emissions trading system is a contribution towards achieving "critical mass", and hence stabilizing price levels.

Aviation industry is a growth market. In a separate system with no or only limited possibilities to buy from other sectors growth could be cut off. This is a bold venture with regard to the Lisbon strategy. For example, the A380 project induces 40 000 jobs directly and indirectly according to the German Federal Association of Air and Space Industry.

Aviation will be a net buyer on the allowance market due to the long term nature of technical investment, since there are no short run possibilities to reduce emissions. Therefore it needs to have access to allowances sold by other industry sectors. In a closed system without the option of buying from other sectors, there is the risk of introducing a price ceiling for allowances or reduction targets having to be weakened. Both options thwart the idea of an emissions trading system.

3.4. Geographical scope

The greater the scope of the emissions trading system, the more substantial is the environmental effect of this policy measure. Global trading under a worldwide emissions trading scheme is the ultimate goal - although it seems to be out of reach at the moment. In order to achieve some effect, the **Commission has proposed in its communication to include all flights departing from a European airport**. EU Environment Commissioner Stavros Dimas reckons that with this scope "a fair share of European emissions are covered and a possible extension of the system to other countries is facilitated."[xxxix]

The European Parliament's own initiative report aims at an even more ambitious scope. It requires **all flights departing from and arriving at European airports to be covered.** If possible, even intercontinental flights over EU airspace should be included. Since these flights only cause a very small fraction of the total emissions the benefit would be less than the efforts to capture those flights.

The **time frame for implementation** of a trading system has to be taken into account since it can have a significant influence on the geographical scope. An emissions trading system which will **only focus on intra-EU flights as a first step** would be much easier and faster to implement than a system that also covers third countries. One can expect harsh resistance with political and legal means from third countries in case they are obliged to obey the European system.

If only intra-EU flights were covered by a European emissions trading scheme, only 40 % of the total emissions of all departing flights from European airports would be captured. Despite competition distortions between EU and non-EU carriers, destinations outside the EU would be preferred, which would hit the sensitive tourism industry. As a result, tourism destinations might shift to countries in Northern Africa and therefore emissions would increase due to longer routes.

Aviation should be included in the current emissions trading system as soon as possible in order to realize the necessary steering effects in a timely manner. All flights departing from a European airport independent of their origin should be covered by an emissions trading system. This is crucial if emissions from aviation are to be mitigated as comprehensively as possible whilst avoiding competition distortions between EU and non-EU carriers. Conflicts with third countries affected should be circumvented by incorporating non-EU countries from the EEA in the European Emissions Trading Scheme.

3.5. Allocation method of allowances

The allocation mechanism for aviation industry is not yet decided. Industry sectors already included in the EU-ETS have received their allowances through **"grandfathering"** – a process where allocation is made according to historic emissions data. The disadvantage of this method is that it discriminates against those who have already taken abatement measures ("early action").
Another possibility is the allocation of allowances through **benchmarks**, but this would require some efforts in determining the adequate factors for the industry.

Auctioning seems to be the most promising method, since "early action" will be rewarded and later market entrants will not be disadvantaged. However, since aviation would be the

first sector where allowances are auctioned this would mean a great inequality in relation to already existing industry sectors in the trading system.

Concerning the allocation of allowances, equality between the aviation and other industry sectors already in the EU-ETS must be insured. Since already integrated sectors have received their allowances almost free of charge, aviation should have the same preconditions. The risk of “windfall profits” is not considered to be a serious problem because of strong competition, even if “marginal cost pricing” is applied.
For new market entrants there should be a reserve from which an allowance will be allocated. Abatement measures already taken - the so-called "early action" - have to be considered e.g. through exemption from the fulfilment factor.

3.6. Exemptions from the emissions trading scheme

There could be the following exemptions from the Emissions Trading Scheme:

- Military aircraft
- Aircraft operating under Visual Flight Rules (VFR)
- Weight threshold
- Activity threshold
- Helicopters
- Other limits: total emissions, weight threshold combined with the number of passengers

Identification of military aircraft can present some difficulties because military flights do not always fly under military flight rules and may not always use aircraft registered as military aircraft. One option to identify a military aircraft would be the code used in the flight plan, but there might be some differences in practice between states.

In any case **aircraft operating under Visual Flight Rules (VFR)** would be excluded from the European Emissions Trading Scheme, if a weight threshold is applied. **Weight thresholds** currently used in the context of ICAO aircraft noise standards could be a helpful orientation. On some routes there is competition between large and small aircraft and if some aircraft are excluded by a weight limit, this would result in a distortion of the market. This is particularly true for those routes where smaller regional jets are flown to feed larger long distance flights.

An **activity limit** could encourage operators to split their operations in order to avoid emissions trading. This is considered to be a risk in the business sector.

Helicopters shall generally not be covered by the scheme. A **combination of weight threshold and a threshold on the number of passengers** as used in regulation 89/629/EEC could, with a passenger limit of 5 persons, include the majority of business jets. A passenger threshold would need to be related to the maximum certificated passenger capacity of the aircraft and not to the actual number of seats in an individual aircraft. This approach would also work for cargo aircraft.

3.7 Factors to be considered

Influence on ultra periphery regions (UPRs):
Islands and less densely populated areas are especially dependent on aviation, such as the northern regions of Finland and Sweden. Economic development of this area could be hampered by the emissions trading scheme. Any potential adverse effects can be mitigated through "Public Service Obligations – PSOs", although this is politically difficult to enforce.

Shifting effects:
Some representatives of the aviation industry expressed their concern regarding the possibility of evasion in order to circumvent the EU ETS. This would lead to a shift of airport hubs to destinations outside the EU area. Since such a detour would be more time intensive for the passenger, this is not a force to be reckoned with. However this effect could be more severe for the freight transport business since freight is easier to handle and for bulk goods, the reloading point does not matter.

Tourism:
If emissions trading is only limited to Intra-EU flights, tourism destinations in the EU would become more expensive. The shift of tourism destinations to regions such as North Africa (Morocco and Tunisia) and Turkey would become cheaper alternatives. Furthermore, land transport could become an attractive option once again. One way to avoid these problems is to cover countries such as Switzerland and others from the EEA, as well as third countries, in the emissions trading scheme.

4. Future Developments:

4.1. Potential impacts of the inclusion of aviation in the EU-ETS

The results of the impact assessment regarding the inclusion of aviation in the EU-ETS will be published together with the legislative proposal of the Commission in the beginning of 2007. According to previous analysis it can be assumed that based on a price of 10 to 30 Euro per ton of CO_2, **demand will only suffer a slight decrease of 0.1 to 2.1 % during 2008 - 2012.**[xl] If EU and non-EU carriers are treated exactly the same in the EU-ETS, there should be no competition distortions. However, the Commission needs to take a close look at the legal aspects of such an equal treatment. There is the risk that if no consensus is found with third countries' carriers regarding their status, it might result in a considerable delay of implementation of the scheme. The industry sectors already participating in emissions trading fear substantial negative impacts on allowance prices - depending on the number of additional allowances issued to the aviation sector.

Generally, we can expect a slight increase in demand of allowances, but it is unlikely that there will be a significant influence on price. In the long run though, especially for the post-2012 phase, there might be stronger market effects due to continued growth of aviation, a tighter cap and diminishing cheap abatement measures.

The price of allowances is determined by the number of allowances:

- those issued in Phase II of the EU-ETS and
- those created by project-related activities, such as "clean development mechanism - CDM" and "joint implementation - JI" projects.[xli]

Price elasticity of demand in the aviation sector plays also a crucial role in the development of the allowance market.

In contrast to the EU-ETS, a broader application of energy taxes in the aviation sector cannot be the central pillar of a strategy to combat aviation's climate change impacts. The implementation process of necessary measures and agreements would take too much time to be effective.

4.2 Possible extension of the EU-ETS to other parts of the transport sector

Shipping
Commercial shipping has the potential to become the greatest source of air pollution in the EU. Unless action is taken to avoid emissions, shipping will emit more than all land sources combined by 2020. In 2000, EU-flagged ships emitted almost 200 million tonnes of carbon dioxide, which is significantly more than emissions from EU aviation.[xlii]
Currently, air pollutant emissions from ships are regulated by Annex VI of the "Marine Pollution Convention" of the International Maritime Organization (IMO). The document contains provisions on Sulphur Oxide Emission Control Areas (Baltic Sea, North Sea & English Channel) and nitrogen emissions standards for ships' engines. The EU strategy seeks to decrease the sulphur content of marine fuel through the application of Directive 2005/33.

In order to address greenhouse gas emissions from ships, the Commission has launched a call for tender for future EU policy options:[xliii]

- Implementation of the so called "IMO CO_2-Index" on reporting CO_2 emissions and the requirement for EU-based ship operators and/or EU-flagged ships and/or EU-based shippers to meet a unitary CO_2 index limit or target
- Inclusion of a mandatory CO_2 element in the proposed EU-wide regime for port infrastructure charging
- Inclusion of CO_2 emissions in the EU emissions trading scheme, for journeys to and from EU ports

Private transport
The Commission is working together with leading car manufacturers worldwide in order to develop voluntary standards of emissions reductions for new cars and the labelling of especially low emission models. A study commissioned by "Umweltbundesamt"[xliv] on the possible introduction of an emissions trading scheme for individual transport following the so called "up-stream-approach" has shown promise. In this approach, the provider of fuel is obliged to surrender the necessary allowances. Effectiveness is ensured by low transaction costs through an already installed collection system.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Remarks:

Opinions expressed in this contribution are those of the authors.

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[v] Entry into force: 16 February 2005

[vi] Entry into force: 25. October 2003

[vii] Directive (2003/87/EG), Trading periods in 5-year-blocks

[viii] "Linking Directive" 2004/101/EC of 27 October 2004

[ix] CERs will inflate the cap for member states since they are generated in countries which are not subject to the targets under the Kyoto Protocol. If allowances based on these projects get into the trading system, countries can increase their emissions relative to their individual emissions target. CERs can be seen as an additional source of tradable CO2 allowances.

[x] In Germany, the "Deutsche Emissionshandelsstelle - DEHSt" in the "Umweltbundesamt" is in charge of allowances requests.

[xi] Relevant law in Germany: "Zuteilungsgesetz 2007" (ZuG 2007)

[xii] In Germany, they use the French software called "Seringas" for the registry

[xiii] Financial Times. "Legal threat to EU countries over emissions trading plans." 29.07.2006. p. 3

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