EMISSION TRADING AND AVIATION

Thesis submitted in partial fulfilment of the requirements of the Degree of Master of Science at Lund University

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ABSTRACT

Emissions from airlines contribute to the phenomena of global warming. It seems evident that the emissions of so-called greenhouse gases from airlines have to be limited if the ultimate goal of sustainable development is to be reached The paper discusses these issues and especially how these should be incorporated into an emission trading system and the viability of such a system. The discussion is therefore focused on different emission trading mechanisms (emission credit trading, benchmarking as well as cap and trade) and their main methods of allocation. Different means of reducing the emissions through operational changes and technology development are scanned and analysed in brief. A walkthrough of the current status and thinking in the aviation industry on this subject as well as a discussion of the driving forces behind them has also been attempted.

The paper focuses on analysing means of distributing emission permits or credits prior; how to start the market for emission permits; to guide the aviation industry towards sustainability through the use of market based measures. The conclusion is that voluntary commitments from airlines could provide for the basis of an initial cap and trade market, but in the long run other commitments under the control of the state is preferable. To maintain the emission trading market in the long run, it is imperative that major regulations of the market should be avoided. Towards this goal, an emission rights and credit based on the point of departure and arrival is suggested.

ACRONYMS

CO	Carbon Monoxide
CO_2	Carbon Dioxide
Gton	10^9 ton (giga ton)
ICAO	International Civil Aviation Organisation
IATA	International Air Transport Association
IGO	Intergovernmental Organisation
IPCC	Intergovernmental Panel on Climate Change
The Kyoto Protocol	The Kyoto Protocol to the United Nations Framework Convention on Climate Change
ppm	parts per million (10^6)
NGO	Non governmental organisation
NO_X	Nitrogen Oxides
SBSTA	Subsidiary Body for Scientific and Technological Advice (to the United Nations Framework Convention on Climate Change negotiations)

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1. INTRODUCTION

Approximately one third of the oil consumption in the world today goes to transport;[1] it is calculated that aviation stands for 7% of the world's transport related Carbon Dioxide (CO_2) emissions.[2] Five years ago, the world's civil airlines carried more than 1.4 billion passengers and 26 million tonnes freight (if calculated by value, 40% of all manufactured goods) across the world. [3] In order to accomplish this, fuel consumption was as much as 160 billion litres.[4] As air transport continues to grow, the aviation fuel required is likely to increase by 3% per year between 1990 and 2015.[5] Aircraft operations often involve indirect routings, delays and other factors "that may contribute to increased fuel burn and associated emissions".[6] There are ongoing discussions, both at the international level, as well as at the national level in many states, on how emissions from international aviation should be addressed, especially as it together with emission international maritime transport remain unregulated. There are many ways of accomplishing emission reduction, and perhaps this should be seen as a whole, so that the focus is on reducing in all areas where there is a possibility. It would also be possible to combine this with other measures such as standards and taxes. How this would affect a potential emission trading market, thus requiring additional research. Today, the discussions and negotiations are very focused on creating a market for emission trading. Other parts of the transport chain, such as transportation to and from airport are already addressed by states, as well as by national carriers. However, international aviation remain unregulated and there is a consensus that these have to be addressed. Although the true regulation for international aviation is likely to need to occur on the national level, there seems to be a need for co-ordination on the international level at the very least.

In theory, markets are not difficult to create. As long as there is a difference in marginal costs for emission abatements, there will be possibilities for trade (the ones with high abatement costs will pay for the emission cuts to be made somewhere else). What is more complicated is the creation of a fair market; the method of allocating rights may create competitive advantages and disadvantages for different actors. Through allocation, a factual barrier could be created that prevents new companies from entering into an emission trading market simply by granting them no right to emit, or by giving one entity so many emission permits that it does not have to do anything to lower the emissions while its competitors are struggling.

Allocation is not simple, and it is one of the first basic questions that have to be resolved in order for an emission-trading regime to be implemented. This will determine if there are any initial competitive advantages, how easy it will be for new airlines to enter the market, as well as if and how the special needs of developing countries need to be taken into consideration. What is clear is that the emissions from international transportation have to be reduced in an economic efficient manner, and that emission trading offers a method of accomplishing this. There are different options for creating trade; it could be based upon relative standards (such as benchmarking where the emission reductions are based on certain relative emission standards or credit trading where the emission credits are created, certified and then traded with) or based on an absolute emission restriction (cap and trade). All these

[1] ICAO: *Statement from the International Civil Aviation Organization (ICAO) to the Eighteenth Session of the UNFCCC Subsidiary Body for Scientific and Technological Advice (SBSTA)*, Bonn, 4-13 June 2003 as accessed on September 12, 2003 at http://www.icao.int/icao/en/env/sbsta-18.htm - on file with author.
[2] IPCCC, UNEP and WMO: *Aviation and the Global Atmosphere* 1999 Cambridge University press p 284
[3] Léonie Dobbie and Martin Eran-Tasker: *Measures to minimize fuel consumption appear to be of greatest importance to airlines* in ICAO Journal, Volume 56 no 4 (2001) p 32
[4] *Ibid*
[5] IPCC (1999) *op cit* p 4
[6] ICAO (2003) *op cit*.

different systems require the market to be created, thus the commodity that will be traded has to be distributed. How this is to be accomplished (what the market is to be based upon) is yet to be addressed. Within the benchmarking, as well as the emission credit schemes, allocation (distributing emission permits or credits) comes rather naturally. But with emission trading with cap and trade" there are various options for a market creation.

1.1 Aim

If a market for aviation trading is to be established, the question is how to start it, i.e. which allocation method would be the most suitable, seen in the light of equity, environmental benefits, and economic efficiency. Also so-called voluntary commitments could form the basis for an emission-trading scheme. In this paper I will address these trading systems whilst putting the focus on investigating the allocation methods.

Today groups of airlines are voluntarily committing themselves to reduce their greenhouse gas emissions. I will argue that this is not enough. Also it will be argued that the responsibility should be on the national level and that the allocation of emissions permits should be shared between the state of departure and the state of arrival. Using these statements as an hypothesis, how to start the market for international aviation emissions will be investigated, thereby posing the question: How could the emission rights/credits be allocated?

21.2 Method and Scope

There are several ways of creating an emission trading market, credit trading, baselines and cap and trade schemes. This choice will affect the need for a special allocation system for emission permits. will mainly look at them from three different standpoints the environmental perspective, the economic perspective, as well as equity issues, which will form the basis for the discussion. Connections to the emission trading markets under the Kyoto Protocol will also be touched upon. If the reduction of emissions from aviation is to be addressed in a constructive way it is important to understand parts of the system affecting emission trading and allocation. Hence the issues of types of emissions, possibilities for emission reductions, different emission trading systems as well as legal issues have been touched upon. An extensive literature study has been undertaken to allow the reader to understand these issues and connections better.

It seems evident that an emission trading system for aviation has to be fair and equitable. The initial allocation of emission permits plays an important role for companies' abilities to participate on equal terms on the market. Here the initial advantages or disadvantages can be created. This is one of the areas where fairness and special considerations for the developing countries can be given. Hence a long discussion on this topic has been included.

As the market for aviation is becoming increasingly internationalised it is possible for airlines to move from one place to the other, thereby reducing the ties to the national state. Although the ties between the airline and nation state remain strong, internationalisation makes it possible to have headquarters in one country while flying between others. This factor makes it rather important to study how the airlines themselves perceive a potential regime for reducing the emissions. I have therefore tried to apply a rather qualitative method to access this information. However, sampling is generally a problem. As I contacted American Airlines, it turned out that they regarded emission trading and their position on the topic as a trade secret, while Scandinavian Airline Systems could help. It was also difficult to identify the appropriate person to contact in this matter. I therefore resorted to

study the communications found on airlines' websites. It is important to note that they choose to publish very different kinds of information and emphasise very different actors. However, as information on a potential regime for reducing the emissions from the larger "alliances" and organisations for airlines have been studied, the general statements seem to have received the support of most airlines. The information has, in this age of information technology, been published on the internet. Naturally it could be argued that this is only the information aimed at a general public, but it is not certain that interviews would have given a different result. Further, the information gathered could only be viewed as indicating a position and not presenting the internal strategies or plans for how to deal with a possible future emission-trading regime.

While the allocation methods under benchmarking and credit trading has allocation issues as an implicit part of the system, the cap and trade scheme opens up several possibilities of allocation methods, which makes this system interesting to look at in greater detail. Naturally, there are many ways in which emission rights can be distributed under a cap and trade regime; therefore the work that has occurred is limited to the umbrella of the negotiations of the United Nations Framework Convention on Climate Change (UNFCCC) and the subsequent Kyoto Protocol. Several methods had been studied with a few selected for further studies[7];

1. Allocation to airlines based on grand-fathering
2. Allocation to airlines based on auctions
3. Allocation to the country where the fuel is sold
4. Allocation to the country of the nationality of passengers/cargo
5. Allocation to the nationality of airline
6. Allocation to the country of departure and arrival of the aircraft
7. Allocation to airlines through voluntary commitments

These allocation methods[8] have been slightly adjusted to suit this investigation and make them more suitable to be addressed. Allocation methods 1 and 2 have been included as these are the means commonly used in the existing national and regional emission trading regimes. [9] It has to be acknowledged that the UNFCCC included an option for having no allocation scheme at all, and chose it for further investigation. However, as the ICAO is currently advocating so-called voluntary commitments, it is more suitable to address these. [10] Yet another of the adjustments that have been included is method 4. Here, I have chosen to discuss allocation according to the nationality of passengers or cargo instead of according to the final destination of passengers/cargo. The assumption is that nationality is simpler to determine and that the final destination will be the home, as most have the nationality of their home states.

[7] For the list of different allocations see UNFCCC/SBSTA/1996/9/Add. 2 p 20 et seq as accessed at http://unfccc.int/resource/docs/1996/sbsta/09a02.pdf as well as UNFCCC/SBSTA/1999/INF.4 II A para 6 as accessed on June 10, 2004 at http://unfccc.int/resource/docs/1999/sbsta/inf04.pdf on May 15, 2004; both on file with author.

[8] This list is in no way an identical copy of the one contained in the decisions by UNFCCC, instead their names have been slightly shortened and focused around the basis for allocation and not containing any longer description.

[9] EU directive 2003/87/EG art 10 and Helen Groenenberg and Kornelis Blok: *Benchmark-based emission allocation in a cap-and-trade system*, Climate Policy 2, (2002), pp 105-109, p 106

[10] ICAO: Report on Agenda Item 2, CAEP/6 WP/57 chapter 2.5.2.

2 AVIATION, EMISSIONS AND ENVIRONMENT

It is difficult to create an emission trading system for aviation, mainly due to the large amount of different emissions and the complicated processes in the atmosphere. These reactions and potential consequences need to be considered in order to create a system that does not increase the effects on global climate change.

Emissions from aviation can become a rather complex issue and the effect depends on whether emissions occur in the troposphere, where most of the aircraft fly today or in the stratosphere, where the supersonic aircraft tend to fly. It is rather difficult to estimate the effects of some of the emissions from an aircraft, such as particles and the contrails formed, compared with the gaseous emissions.[11] These emissions may also cause the formation of cirrus clouds, although the understanding of this process is very poor. It is therefore important to bear in mind that this science is rather complex, and that the numbers are based on advanced calculations where the results rarely can be verified.

2.1 Emissions

In 1990, 2.4% of the total amount of fossil fuels used world-wide were burned in the aviation sector – and approximately 80% of this was used in civil aviation.[12] It has been estimated that the aviation sector caused 3.5% of the total anthropogenic radiative forcing (or how large "the global, annual mean radiative imbalance to the Earth's climate system caused by human activities" is[13]) in 1992 – and this effect is likely to become greater as the aviation industry is projected to continue growing.

2.1.1 Water

Aircraft also cause water vapour to be let out into the atmosphere, and this also has environmental consequences.

The water system in the global atmosphere is rather complex – especially in the troposphere where there is "continual cycling between water vapour, clouds, precipitation, and ground water".[14] In the higher layers of the atmosphere, the water vapour is removed within one or two weeks; a smaller fraction ends up in the lower layer of the atmosphere where it "can build up to larger concentrations".[15] The scientific understanding of how the water vapour affects the global climate is poor, but in general, this has caused a warmer climate.[16]

2.1.2 Contrails

Aircraft in the sky contribute to the formation of visible line clouds behind the aircraft "that are flying in sufficiently cold air as a result of water vapour emissions"[17]; contrails. Clouds at different levels have different effects on the radiation to and from the earth – if they are at a low level they can both prevent radiation from leaving the earth as well as prevent radiation

[11] Helen Groenenberg *et al op cit* p 188
[12] Joosung J Lee, Stephen P Lukachko, Ian A Waitz and Andreas Schafer: *Historical and Future trends in AircraftPerformance, Cost, and Emissions* in Annual Review of Energy and the Environment 2001, 26, pp 167-200, p 172
[13] IPCC (1999) *op cit* p 187
[14] *Ibid* p 22
[15] *Ibid* p 7.
[16] *Ibid* p 22
[17] *Ibid* p 67

from reaching the earth. If the clouds are situated on a higher level, they make it more difficult for radiation leaving the ground than preventing radiation, thus enhancing the greenhouse effect.[18]

In 1990 – the line-shaped contrails following the aircraft across the sky was estimated to cover approximately 0.1% of the earth's surface.[19] As they are situated on a high level in the atmosphere, they seem to be enhancing climate change – although their full effect is not completely understood.

2.1.3 Carbon dioxide, Carbon monoxide and Hydrocarbons

By nature, all ignition processes produce at least CO_2. The emissions of CO_2 from aviation are rather simple to calculate, it is dependent of the amount of carbon in the fuel. In 1992, the emissions of CO_2 were as large as 0.14 Gton, which accounts for approximate 2% of the world's global CO_2 emissions. [20] Its behaviour is rather simple and well understood – the effect on our climate "is direct and depends simply on its atmospheric concentrations",[21] it leads to increased climate change. The 1999 IPCC report on the global climate contain two rather interesting conclusions that should be borne in mind - if the emissions of CO_2 were to stabilise at 1990 levels, then the concentration of CO_2 in the atmosphere would continue to rise during the next 200 years. Before the industrial revolution started, the concentration of CO_2 in the atmosphere was as low as 280 ppm. but as the emissions of CO_2 continues the amounts in the atmosphere will continue to increase, if the emissions drop below 1990s levels in 40, 140 or 240 years from now, the concentration of CO_2 in the atmosphere will stabilise at 450, 650 or 1000 ppm.[22]

Today's cleaner and more efficient engines have almost eliminated the emissions of carbon monoxide (CO) and Hydrocarbons. [23]

2.1.4 Nitrogen Oxides and its effects

The common aircraft technology at present offers trade-offs between the emissions of CO_2 and NO_X. Most NO_X comes from the air and not from the fuel, see Figure 1.[24] If engines are to become more efficient, it requires them to work at a higher temperature, which means that more NO_X will be created and thus released into the atmosphere. This will increase if the engine is to operate more efficiently according to the present technological standards.[25]

It is estimated that the amount of ozone at lower levels in the atmosphere has increased as much as 6% compared with an atmosphere without aircraft emissions, this due to the emissions of NO_X. The emissions at higher levels in the atmosphere are capable to produce more ozone than what is possible at the surface. On the other hand, the sulphur emissions and the water vapour "tend to deplete ozone". [26] It is therefore difficult to determine the effects on the global climate. NO_X is also expected to reduce the amounts of methane,

[18] Victoria Williams, Robert B. Noland, Ralf Toumi: *Reducing the climate change impacts of aviation by restricting cruise altitudes* in Transportation Research Part D (2002) pp 451-464, p 452
[19] IPCC (1999) *op cit* p 7
[20] *Ibid* p 6
[21] *Ibid* p 21
[22] *Ibid*
[23] Léonie Dobbie (1999) *op cit* p 16-17.
[24] IPCC (1999) *op cit* p 255
[25] ICAO: *Annex 16 — Environmental Protection, Volume II — Aircraft Engine Emissions* to the Convention on International Civil Aviation as refered to in IPCC (1999) *op cit* chap 7
[26] IPCC (1999) *op cit*, p 6

which is one of the greenhouse gases addressed under the Kyoto Protocol. This reduction is global.[27]

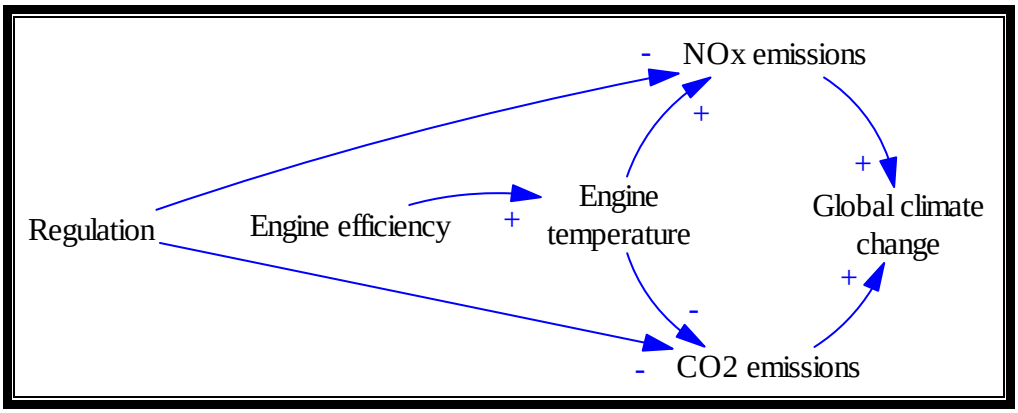

Figure 1: Trade-off between CO2 and NOx emissions in traditional engine. Illustration also shows there are international standards for NOx. International standards for international CO2 emissions are lacking, however the national ones are covered in the Kyoto Protocol.

2.1.5 Sulphate

Depending on the content of the fuel, the emissions may also contain amounts of sulphate, which originates from the fuel itself. There is a fair understanding of the effects of sulphate, and it is likely to reduce the global warming effects.[28]

2.1.6 Soot and particles

As in most ignition processes, soot particles are formed during the combustion of fuel[29] and emitted into the atmosphere. The amount of emissions of soot is considered to be proportional to the "equivalence ratio, to pressure at the combustor inlet (both with exponents to be determined), and to an exponential function controlling the reaction rate."[30] – with an up to 20% deviation rate. Today only the large particles of soot are measured.[31] Soot particles are likely to increase the global warming. The effect of this is small in comparison with the effects of other emissions from aircraft.

2.2 Scientific uncertainty

The emissions from aviation occur at a very high level, and there is still a lot of uncertainty of the effects they have on the global climate change. Figure 2 illustrates the scientific understanding of the emissions from airlines and their effects on the global climate, as well as the insecurity as to the prediction. However, it seems clear that the airlines contribute to the anthropogenic interference with the global climate.

[27] *Ibid*, p 7
[28] *Ibid* p 7-8
[29] *Ibid* p 69
[30] *Ibid* p 251
[31] *Ibid*

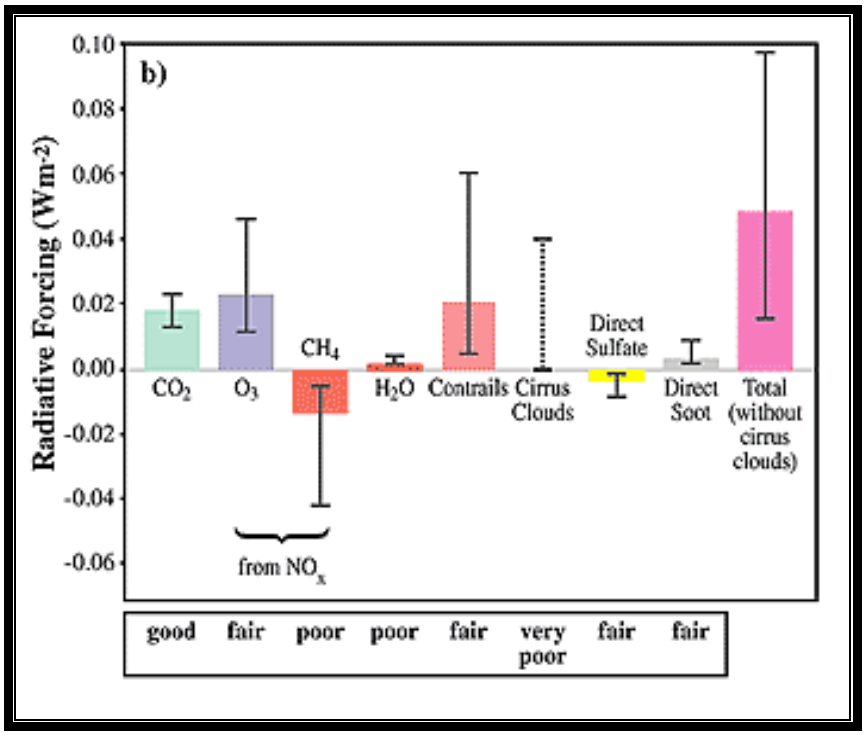

Figure 2: Illustrating the potential effect on the global climate with the uncertainty included (as the black lines). From the IPCC, UNEP and WMO report on Aviation and the Global Atmosphere, p 210.

3 POSSIBILITIES TO REDUCE THE EMISSION FROM AVIATION

The emission reduction scheme for airlines is depending on many factors. One of them is naturally the possibility for airlines to lower their emissions, thus being able to produce emission credits/have excess of emission permits to trade with. At the end of the day, the credibility of an emission trading regime is dependent on the possibility of reducing emissions.

It could be argued that aviation already has an incentive to reduce the emissions of CO_2 and water vapour as these are directly related to fuel consumption. Today, the fuel only costs between 12.5 and 35 % of total aircraft costs.[32] Granted, policy making through control and command measures, such as demands on engines or and the monitoring of certain emissions can be aimed at phasing out specific aircraft types and therefore have a positive effect on the emission trends. Airlines can respond to increases in fuel in a variety of ways as it increases the direct operating costs. In the short run it is likely that these are borne by the passengers, through increases in price;[33] according to basic economic theories this increased price is likely to reduce the number of passengers. Another quick response could be to alter the operational procedures, thus trying to lower costs that way. [34] In the longer term, however, airlines are likely to try to lower their direct operating costs by replacing old aircraft with newer ones based on more efficient technology.[35] The benefit of increasing the fuel price would be that it penalises the non-efficient airlines. There are different aspects that can be targeted in the efforts to reduce the emissions from aviation, to accomplish the most economically efficient solutions.

3.1 Reduce transportation demand and increase optimising the number of passengers in the aircraft

It probably goes without saying that a reduction in the number of passengers would lead to less flying and consequently also less pollution. One could therefore argue that it is important to encourage passengers either to travel less or to choose more environmentally friendly transports, such as railways. Provided that these railways are powered by renewable energy sources, it could quite significantly reduce the emissions of CO_2. However, this is not likely to solve more than one part of the problem.

In general new aircraft are more environmentally friendly than old ones; big aircraft are less polluting than small ones if calculated per passenger and presuming a full plane. But the total emissions from a small aeroplane in general emit less than the big ones. It is possible to reduce the consumption per passenger (or cargo) by 2-6% by optimising the number of passengers and cargo for a given aircraft, optimising the speed, reducing taxing and limiting auxiliary power unit use.[36]

To accomplish these changes, new means of travelling could be found or alternatives to travelling, for example through the development of communication technology.[37] Another way would be to increase the price of travel, and thereby affecting the passengers that are price sensitive to consider other means of travel such as railways.

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[32] Joosung J Lee *et al op cit* (2001), p 187
[33] *Ibid* p 196
[34] *Ibid*
[35] *Ibid* p 196
[36] *Ibid* p 17
[37] Although it could be argued that communication development actually increase travel and transport. Through the use of IT it is possible to purchase goods from any country and customers rarely want to wait long for their good. Internet also provides greater possibilities for interaction and network, and in consequence increasing the need (or want) to travel. (see e.g. Stephen Graham (1997): *Viewpoint – Telecommunications and the future of*

3.2 Operational changes

Today, airlines tend to use a hub and spokes network that allows them to co-ordinate their transports. An airline has several aircraft that go from different points of departure to one destination where the passengers can switch aircraft and continue to their final destination. This allows the airline to cover a larger number of destinations than if they flew from one place to the final destination. However, if airlines would find shorter routes, less fuel would be needed. Further, the starting and landing consume more energy than the actual flying; long range aeroplanes are approximately "5% more fuel efficient than the short-range as they carry more passengers over a flight spent primarily at /…/ cruise conditions".[38] ICAO has also published a circular on Operational Opportunities to Minimise Fuel Use and Reduce Emissions – which contains the best industry practices for reducing fuel consumption. Operational change may also be beneficial for the passengers. It is very well possible that many of today's passengers would not mind paying a slightly higher price for the ticket if the travel would be faster (without delays on the runway and in the air) and without having to transfer to other aircraft).[39] Naturally, this argument presumes that it will be possible to fill the aeroplane with passengers, or the emissions per transported good/passenger will become larger.

Delays on the ground and in the air also prolong the flight, thus causing extra unnecessary emissions. However, Lee *et al* have found that the extra hours spent in the air or on the ground "do not account for more than 0.75-0. 9 [%] of the total operational hours of the aircraft".[40] To change the air traffic management systems (reduce the queues in the air and make the routes more direct) could reduce the fuel consumption by 6-12%.[41]

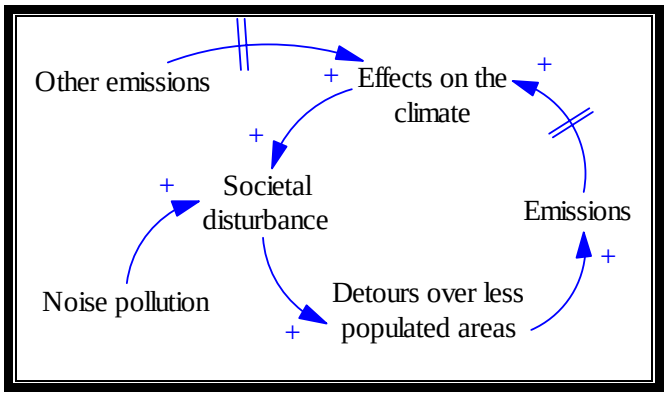

Figure 3: Illustration of the trade-off between noise pollution and emissions; how the noise pollution forces airlines to take detours thus increasing the emissions which together with other emissions change the climate. With time, this in turn will create additional societal disturbance.

Also the altitude at which aircraft fly affect how the environment is capable of dealing with the emissions; as factors such as temperature and humidity affect how the atmosphere react with the emissions. Research has shown that adaptations of altitude can reduce the environmental consequences from aviation.

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cities: Debunking the myths in Cities, Vol. 14 1 pp 21-29 p 25-26 and William R Black (2001) : *An unpopular essay on transportation*, Journal of Transport Geography 9 pp 1-11, p 8)

[38] Joosung J Lee *et al op cit* (2001) p 184.

[39] Victoria Williams *et al (2002) op cit*

[40] *Ibid* p 186.

[41] Léonie Dobbie (1999) *op cit* p 17

Making the routes more direct is likely to have drawbacks and trade-offs in the form of noise pollution; at present, ICAO is also trying to prevent noise pollution through operational changes; that airlines are not allowed to fly over certain areas. Here they prevent aircraft to fly over areas that could be negatively affected by noise pollution.[42] If the noise pollution is taken into consideration, then the routes can become longer and therefore causing more emissions.

3.3 Technical improvements

Naturally, development of technology and the creation of new and better engines, as well as new solutions or the use of alternative energy sources can reduce the emissions of greenhouse gases. Even if it is presumed that the current technology will remain, there are still possibilities of reducing the fuel consumption by using lighter materials; and thereby reducing the weight of the aircraft. This in turn reduces the amount of fuel it needs to burn. Replacing current materials with e.g. aluminium or titanium components in non-bearing structures, or smaller changes such as replacing existing wiring with fibre optics that could make the aircraft lighter. Naturally, if the aircraft is filled to the limits and all passengers have the maximum amount of luggage, then the aircraft will become heavier. Another way of reducing the weight would therefore be to reduce the amount of luggage passengers are allowed to bring on board the plane.

3.3.1 Technology development: History and estimations of the future

Technological development has lead to large improvements throughout history, however, future technological development is therefore likely not to be sufficient to counter balance the increase of emissions.[43] Since the start of the jet age (during the 1960s) aircraft have become 70% more fuel efficient,[44] and this development is likely to continue. These efficiency improvements were "largely driven by market forces responding to higher oil prices in the 1970s and 1980s, in combination with continued technological advances in aircraft and propulsion, increasing average aircraft size, and higher seat occupancy rate".[45] Energy efficiency per passenger is calculated to increase 1%-2% per year during the next 25 years, while the future of air-traffic growth is calculated to increase by 4%-6% annually. [46]

3.3.2 Trade-offs and barriers

The development of more fuel-efficient engines that were introduced in the 1970´s and 1980´s reduced CO_2, CO and hydrocarbon emissions, while increasing the NO_X emission. As the technological development continued, the increase in NO_X emissions have been constrained, but it is becoming clear that radical changes are needed if a more substantial emission

[42] Abeyratne, Ruwantissa I.R. *Aircraft Noise – legal and regulatory issues and trends,* in Environmental policy and law, February 2001, pp 51-58
[43] Joosung J Lee *et al op cit* (2001), p 170
[44] IATA: Policy options for addressing aircraft emissions, as accessed on October 15, 2003 at http://www.iata.org/soi/environment/emissionspolicyoptions.htm
and IATA: Aircraft emissions as accessed on October 15, 3003 at http://www.iata.org/soi/environment/aircraftemissions.htm Both on file with author.
[45] David L Greene and Andreas Schafer: Reducing Greenhouse Gas emissions from US Transportation sector, Pew Center, May 2003 as accessed on October 20, 2003 at http://www.pewclimate.org/docUploads/ustransp%2Epdf - on file with author. – p 8
[46] Joosung J Lee *et al op cit* (2001), p 170

reduction will occur.[47] However, higher efficiency means that the engine operates under higher temperatures, and thereby increasing the NO_X emissions (see also above chap 2.4).[48] An efficient and lighter engine would also increase its noise, thereby presenting another trade-off between noise and energy efficiency.[49] Previous research was much focused on reducing the emissions of NO_X. These research programmes showed that a reduction of NO_X emissions could lead to reduced performance in other areas, leading to trade-offs in design.[50]

Replacement of old technology takes time and is a costly process, but the one that is likely to be the most influential in the reduction of emissions. On average, it has taken the US fleet upto15 years to "achieve the same fuel efficiency as that of newly introduced aircraft".[51] It is likely that this slow process also applies to other airlines across the world. But as new aircraft with new technologies are introduced, prices for aviation services increase, but they can become cheaper with time as the technology is gradually getting more obsolete and the competition increase.[52] All companies will suffer from this, and imposing an emission trading regime on only some of them could mean that the liberalisation process of the aviation market is altered.

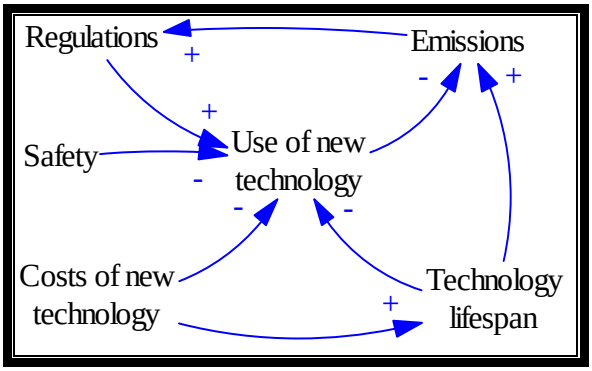

Figure 4: Illustrating the difficulty in replacing old technology (see technology lifespan) with new technology. The main barriers are viewed as safety, cost and the slow replacement rate. The regulation, (together with need to replacements of aircraft that is implicit in the technology lifespan; as well as the possibilities for savings) are viewed as the main driving forces. Naturally safety can, in some cases also act as a driving force for technology replacements.

As the development of new technology for aircraft have to take many factors into account; e.g. operability, reliability, durability, efficiency, and noise, it can be a rather slow process. Aviation is a factor where issues such as safety should not be compromised with, something that may mean that the truly innovative ideas will have to be disregarded. Good and safe engines are imperative to the future of aviation, and it makes airlines less eager to take chances, than in many other transport sectors. Also, the lifespan of the aviation technology is long, and replacement costly. These are two other factors that can have negative effects on the replacement of old technology to more efficient one (see figure on trade-offs and replacement of technology).

[47] IPCC (1999) *op cit* p 243
[48] Joosung J. Lee, *et al op cit (*2001), p 169.
[49] (British) House of Commons Inquiry into Aviation, April 2003 as accessed on October 15, 2003 at http://www.raeng.org.uk/policy/pdfs/Response1.pdf - on file with author p 4
[50] IPCC (1999) *op cit* p 237
[51] Joosung J Lee *et al* (2001), p 184
[52] *Ibid* 188

3.4 Ongoing international policy initiatives to reduce emissions

Naturally, there is ongoing work to encourage the aviation sector to become more aware of its environmental consequences. International organs are also addressing these issues, thus probably contributing to the airline sectors awareness of the challenges involved. The works of different international organs are also very important in potential negotiation on so-called voluntary commitments.

The Kyoto Protocol states that the states that have committed to reducing their emissions of greenhouse gases shall "pursue limitation or reduction of emissions of greenhouse gases /…./ working through the International Civil Aviation Organization and the International Maritime Organization, respectively".[53]

3.4.1 ICAO

ICAO is an intergovernmental organisation, with 188 member states, which was formed in accordance with the 1944 Chicago Convention. The purpose of this organisation is promote co-operation, and to ensure that international civil aviation "may be developed in a safe and orderly manner and the international air transport services may be established on the basis of equality of opportunity and operated soundly and economically".[54] In 1947, ICAO became a specialised organisation under the UN. ICAO is therefore in a position that enables it to define goals, thus indicating a direction for the aviation companies to struggle towards, it can also inspire action and push policy development in the environmental field. This goal setting makes ICAO very important despite the lack of official power to enforce recommendations and standards. In a sense, ICAO is co-ordinating the efforts of improving the environmental and safety standards of aircraft. All the power and possibilities for enforcing standards is something that ICAO derives from the individual states. ICAOs Council Resolution on Environmental Charges and Taxes, adopted on 9 December 1996, addresses the issue of environmental charges and taxes. It is stated that charges or taxes should be enforced in a way that does not distort the free competition. ICAO therefore recommends that "any levies on air transport which States may introduce should be in the form of charges rather than taxes and that the funds collected should be applied in the first instance to mitigate the environmental impact of aircraft engine emissions".[55]

When ICAO first started investigating how to use policy in an attempt to reduce greenhouse gas emissions, they found that the traditional policy responses such as emission standards and operating measures would not be appropriate. Instead ICAO and its environmental committee have agreed that the use of market mechanisms has encouraged fuel efficiency, and that the use of these mechanisms has meant that the aviation industry focused its efforts on different means of reducing emissions.[56] Emission trading is the most appealing option as it could accomplish cost efficient emission reductions and exist in the free market. Voluntary commitments could provide means of creating a first step to accomplish short term actions. ICAOs analysis also indicated that short term voluntary commitments could be a first step towards future actions to reduce emissions.

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[53] The Kyoto Protocol to the United Nations Framework Convention on Climate Change, as accessed at http://unfccc.int/resource/docs/convkp/kpeng.pdf on May 1, 2004 on file with author (Kyoto Protocol art 2 (2))

[54] The 1944 Chicago Convention on Civil Aviation; as accessed on April 18, 2004 at http://www.icao.int/cgi/goto.pl?icao/en/history.htm on file with author.

[55] ICAO Council Resolution on Environmental Charges and Taxes adopted by the Council on 9 December 1996 at the 16th Meeting of its 149th session - as accessed on September 12, 2003 http://www.icao.int/icao/en/env/taxes.htm - on file with author - para 4

[56] Léonie Dobbie (2001) *et al op cit* p 28

3.4.2 European Union

As an international organisation, EU is rather unique. It possesses some characteristics of a state and others of an intergovernmental organisation. Policy making in the European Union (EU) can be rather long, and it does take time before any decisions are reached, different statements from the institution matter. The main task of the EU commission could be seen as driving the development of new policy. Seen in this light, it is interesting to note that the commission has stated that "Community unilateral action should be avoided in order not to distort competition to the benefit of third country aircraft and create socio-economic effects."[57] However, the council also recognises that there may be exceptions for carriers flying for the developing countries – but that the possibilities to fly a "flag of convenience" should be avoided.[58] Three years later, in October 2003, the EU commissioner for the environment, Ms Margot Wallström expressed her "disappointment /../ with the slow progress that has been made within ICAO on climate change".[59] As aviation has been included in the EU 6th environmental framework – it indicates that the EU can move ahead unless ICAO makes a serious attempt to control emissions from aviation. At present, EU is investigating two parallel systems for reducing emissions, one that implements a tax on kerosene and en route charges – here the advantage would be that it can target all climate aspects of aviation and not only the greenhouse gases. It could also apply to all flights that land within the EU and consequently also foreign aircraft. These two instruments could then be combined with cap-and-trade system for the EU countries. This means that all states are granted a certain number of emission rights – thus fixing the amount of emission rights on the market. Margot Wallström states that a part of these emission rights should be allocated free of charge but "Member States may auction a certain percentage of allowances". [60] Although Margot Wallström admits that it is complicated to connect the emission trading regime with the national one – although she does "not want to close the door on this issue." [61]

Although the Commissioner cannot be seen as having the power to decide on such matters for the commission, but these initiatives may be seen as a way of putting additional pressure on airlines as well as on ICAO to find a global regime of reducing the emissions.[62] It could also be viewed as an additional incentive for airlines to investigate possibilities to take action. As the EU is developing an internal emission trading scheme it is possible to include aviation in a regional scheme.

[57] European Commission: Communication from the Commission to the Council - Community objectives for the 33rd Assembly of the International Civil Aviation Organisation (ICAO) and ICAO Council decisions prior to this Assembly in the field of environmental protection – CELEX 52000DC0821 – para 18 (6) as accessed on http://europa.eu.int/smartapi/cgi/sga_doc?smartapi!celexplus!prod!DocNumber&lg=en&type_doc=COMfinal&an_doc=2000&nu_doc=821 - on file with author.
[58] EU op cit para 4
[59] Margot Wallström: Climate Change and Aviation - speech given at BAA Climate Change and Aviation Conference, London 13 October 2003 as accessed on October 30, 2003 at http://www.environmentdaily.com/docs/31014b.doc - on file with author.
[60] *Ibid*
[61] *Ibid*
[62] Sebastian Oberthür: Institutional interactions to address greenhouse gas emissions from international transport: ICAO, IMO and the Kyoto Protocol, in Climate Policy 3 (2003) pp 191-205, p 202

4 EMISSION TRADING

4.1. Emission trading systems today

To control emissions through emission trading system is not a new thought. The United States and Canada have been co-operating in various emission trading schemes to reduce emissions in an economically efficient manner.

Within the emission trading system under the UNFCCC and the subsequent Kyoto Protocol, emission trade is provided for on an international level. Here it is the so-called Annex 1 countries (countries that have taken on the obligation to reduce emissions of greenhouse gases) that are able to participate; provided of course that the states have ratified the convention and the protocol.

Due to the current structure of international law, only states are able to participate in the emission trading regime on the international level. As states are considered the main actors under international law, these are also the ones that will be able to participate in emission trading on account of their nationals. To implement this under an international emission trading regime is naturally rather complicated. Neither the UNFCCC nor the Kyoto Protocol gives a clear indication of how an emission trading system can be structured. The rules in the Kyoto Protocol are rather scattered and takes the perspective of states as the parties engaging in trade. Under the protocol, it is presumed that the emission permits traded are added or subtracted from the party's (country's) total assigned amounts. The Kyoto Protocol applies international rules where only states are regarded as individuals and persons are only regarded as subjects in extreme circumstances. It is therefore difficult to imagine that the companies will be allowed to participate in trading directly under the Kyoto Protocol, without any additional international agreements.

Although the creation of the market remains to be agreed upon, it is inherently connected to the question on how the market will look. It is important that there are so many emission permits as to create a market, but also so that there will be incentives for trading.

4.1.2 Emission trading within the EU

If an emission trading scheme for aviation would be implemented within the European Union, the situation would be quite different from the rest of the international trading systems. Here the supranational character makes EU rather suitable for emission trade in aircraft emissions. It has already developed an emission trading scheme for its member states.[63] In this case, the member states are allowed to determine how to allocate the rights themselves (as long as they are objective and transparent) and a committee will review these rules to ensure that the free competition is not put in jeopardy. But the EU differs from most other international organisation in that it has a very efficient compliance system.

According to directive 2003/87/EC on establishing a scheme for greenhouse gas emission allowance trading within the Community an emission trading system will be implemented to start in 2005.[64] It will be based on the trading of emission rights by natural or legal persons and the different member states are obliged to ensure that the rules necessary are ın force.[65] The directive also opens up the possibility for their nationals to purchase emission

[63] EU Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC. as accessed on April 18, 2004, http://europa.eu.int/eur-lex/pri/en/oj/dat/2003/l_275/l_27520031025en00320046.pdf - on fıle wıth author.

[64] EU directive 2003/87/EC

[65] Artıcle 12

permits from outside of the EU, provided that there is an agreement between the EU and the state from which the emission permits originate. This agreement is there to ensure that the emission reduction permits are real, and that the emission reductions are in accordance with the Kyoto Protocol.[66] Allocation of emissions occurs at the national level (mainly through grandfathering), according to a national plan that has to be approved by the commission. According to article 24, the possibility for including additional activities into the emission trading market is provided for; provided that these are included in the national allocation plans as well as that these are approved in advance by the commission.

According to Appendix 2 of the directive, the distribution of emission permits within the EU should be consistent with the technical possibilities, and could for example be calculated per product in each area taken together with what progress is possible.[67] It shall be consistent with EU legislation and other national rules, while preserving free competition,[68] and also address how newcomers into the market should be treated. During the first period of emission trading (between 2005 and 2007), only a few sectors are to be covered; carbon dioxide emissions from energy production as well as a few industrial emissions.

There is a possibility for states to include aviation into the EU emission trading regime, and this could be done through the procedure described in article 24 of the directive. However, as aviation today is not included in the Kyoto Protocol, it is not either included in the EU scheme.

4.2 Responsibility

In any kind of an agreement, there has to be an element of trust and responsibility for what is agreed to. It is important to note that these rules look different at the international as well as on the national level and that this has consequences for how an emission trading system may be structured.

International aviation operates on a very special market that is not only characterised by the possibility of operating globally but also one where the national airlines are receiving a varying amount of support from their national states (see above). Also, it is possible for e.g. a French airline to fly between Bermuda and Britain; thus decreasing the importance of ties to one single nation that most other companies have. Due to the possibility to operate between other countries than the national state, it is very possible to fly the flag of convenience, that is being the national of one country (with low standards) while operating between others, thereby circumventing more stringent rules that otherwise would have been applied.

4.2.1 Is ICAO up to the challenge?

In general, on the international level, states are perceived as main actors and are also the ones that are entering into agreements and thereby also the ones responsible for implementing them. Here the state is responsible for implementing legislation in a satisfactory manner, but cannot be held responsible if their nationals violate the legislation. [69] International

[66] Artıcle 25
[67] Appendix II, para 3.
[68] Appendix II, para 5.
[69] A question of State responsibility for its nationals is in no way simple. In the Caire Claim the president of the Franco Mexican Claims Commission stated that ”the doctrine of objective responsibility of the State, that is so to say, a responsibility for those acts committed by its officials or its organs, and which they are bound to perform, despite the absence of fault on their part... The State also bears responsibility for all acts committed by its officials or its organs which are delictual according to international law, regardless whether the official organ has acted within limits of his competency or has exceeded those limits... However, in order to justify the admission

organisations or companies (such as airline companies) are not regarded as persons *per se* under international rule, and can therefore neither take on binding commitments, nor be held responsible. Instead it is the states themselves that take on the responsibility of implementing the decisions. As states are regarded as actors under international rule, and natural persons only possess rights and obligations according to principles of Human Rights.

This also has consequences for an emission trading system, and some factors have to be taken into account. This in particular applies to a possible compliance system for emission rights. From this point of view, an emission trading system for international aviation becomes more reliable if it is based on states trading emissions with each other; and that these then are transferred to the airline by the state.

In general, the role of international organisations has become more and more strong, and their possibility for meaningful participation on the international arena has increased. Despite this trend, according to traditional international law, international organisations are not fully acknowledged as real actors on the international arena. Here the international organisation possesses power in accordance to what power states have delegated to it.

If ICAO would be chosen as the co-ordinating organ for an emission trading regime, it is likely that the states would have to delegate some of their sovereignty to the organisation in order for it to be able to enforce rules and standards on the national territories. Naturally there would be other ways of enforcing emission standards, such as by limiting the market to actors in compliance etc. It could also be argued that the emission trading system should function similar to a stock trade, where the companies can participate. However, as these stocks exist in different countries, the ones trading on it also have agreed to comply with certain national legislation. In case of airlines, it is difficult to imagine that this could happen. Firstly as airlines are not likely to want to trade with their own emissions and secondly as this would require them to subject themselves to the standards of one country (if the market was to contain as many actors as possible and thereby also become the most efficient).

Putting the responsibility for aviation emissions in the hands of ICAO may ensure that all airlines are treated equally and that the risk of flag of convenience will be avoided. However, this is likely to be hard to accomplish on the international political arena today.

4.2.2 State responsibility for aviation emissions

In the national context, who can be held responsible for a breach of act is restricted to those who possess a "legal personality"; in general either persons or companies. These are the ones that can hold both obligations and rights, and therefore are regarded as responsible for what their actions as well as the consequences thereof.

Another more traditional solution could be that the state takes responsibility for the airlines flying its flag. Today, the state is responsible to implement the rules it has agreed to; and is therefore obliged to ensure that airlines obey by e.g. rules on safety and technical standards, and naturally some states are enforcing this while others are taking it slightly easier. Hereby, it is possible for airlines to fly the flag that puts the least demand on them, perhaps in states that have not ratified any of the international standards that are applied in other parts of the world and therefore are not obliged to implement them. This system could

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of this objective responsibility of the State for acts committed by its officials or organs outside of their competence, it is necessary that they should have acted, at least apparently, as authorised officials or organs, or that, in acting, they should have used powers or measures appropriate to their official character…." (Verzijl, President of the France-Mexican Claims Commission in the Caire claim(1929) RIAA v p 516 at pp 529-31 as quoted by Brownlie: System of the law of nations State Responsibility Part 1 Claredon Press, Oxford 1983 p 39

thereby create incentives for airlines to choose a "flag of convenience" in this case flying a flag of a state that has not agreed to comply with any emission trading rules.

If states would take on commitments to reduce the emissions of greenhouse gases, they would be obliged to implement them. The states will be responsible for implementing the emission reductions for airlines and for the implementation of standards and regulations necessary to ensure that the commitments are honoured.

4.3 Emission trading methods for airlines

The design of an emission trading system has been debated rather well. Simplified, it could be stated that there are three main means of creating an emission trading regime with different kinds of approaches. The challenge in regards to aviation is to ensure that not only emission reductions are accomplished, but that this is done in an equitable manner and addresses all possible areas where these reductions can be accomplished.

The basic idea of trade is applied, namely that the ones with the highest marginal abatement costs will chose to purchase rights, and the ones with the lowest will make the most reductions. This in turn could be seen as ensuring that the cheapest possible emission reductions are achieved.

4.3.1 Credits and credit trading

The credit programs can be explained as companies creating emission credits through well defined measures for emission reductions. These credits are created "through administrative process in which the credits must be pre-certified before they can be traded",[70] i.e. once a company has achieved an emission reduction, it has to be verified before it is sold to a company that would like to have more emission credits. The emission credits only measure the absolute amount of the emission reductions made.

From a company perspective this could sound like a rather attractive alternative; here airlines have the possibility to struggle towards an environmental goal; while knowing that the credits available on the market originate from real and actual emission reductions. This kind of system, where no cap is set, would not limit the number of actors on the market and allow the companies to participate on equal terms. Through the use of a market mechanism, trading, it can be ensured that the emission reductions are achieved where they are cheaper than the cost of accomplishing them.

From the environmental perspective, the drawback is that it is hard to estimate how large the emission reductions will be under a credit trading scheme. But here the emission reductions will originate from real emission cuts.

4.3.2 *Benchmarking*

Benchmarking means that certain "predetermined emission *rate* to covered activities to ensure that the average emission rate achieved does not exceed this benchmark level".[71] This rate can consist of different factors, such as fuel consumed per passenger mile which should not exceed a benchmarked value of fuel per passenger mile. Thus, it is a relative standard which

[70] David Harrison , Jr, Daniel Radov and James Patchett (2003): *Evaluation of the feasibility of market–based instruments to promote low–emission shipping in European Union sea areas, preliminary discussion document for September 5 , 2003 workshop – a report for the European Commission, Directorat–General Environment* as accessed on January 1, 2004 at http://www.europa.eu.int/comm/environment/air/pdf/day1_nera_findings.pdf on file with author, p 5

[71] David Harrison (2003), *et al op cit* p 6

requires the emissions to be reduced in comparison with a business as usual scenario. Where there is an excess or deficit of emission permits, the different entities are allowed to trade with each other to meet limits imposed by the legislator. As in the case of credit trading, there is no absolute limit in regards to what emission reductions have to be accomplished, but there is a demand on how much emission that will be allowed in comparison with that benchmark. For the aviation sector – the benchmarking could be based on different factors, such as cargo or passenger miles. Naturally these benchmarking schemes could be based on legislative standards that prescribe the maximum amount of emissions allowed calculated per unit (as also shown in the figure below); thus in reality targeting the technological development and standards.

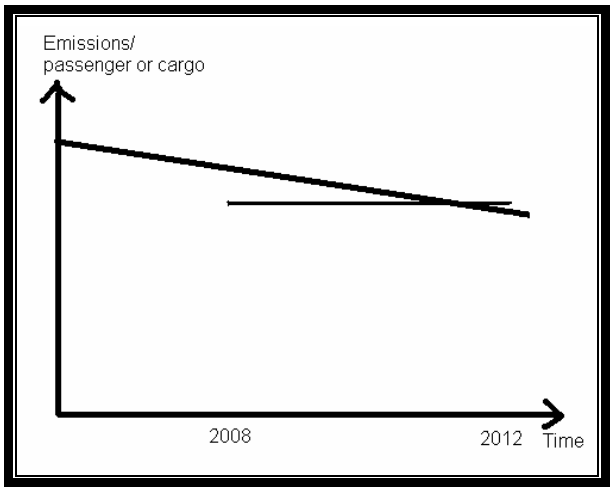

Figure 5: illustrating how the demand of a e.g. fifteen percent benchmark in comparison with a base year. Here this benchmark is applied throughout the period 2008 –2012 (in order to take advantage of the commitment period as agreed upon in the Kyoto Protocol).
NB! These emission reductions are calculated *per unit transported* and does therefore not give an indication of the total amount.

This would provide a rather flexible system, and like the credit trading scheme, benchmarking would allow the aviation companies to expand their businesses and grow; thus increasing the total amount of emissions; and this kind of scheme would allow new companies to enter into the market, which means that the total amount of emissions could be allowed to grow.

As benchmarking is a rather flexible system, the environmental consequences are less predictable than e.g. in a cap-and-trade regime. But its main advantage is that the flexible character would not prevent new companies to enter the market as long as they are capable of meeting that relative standard.

4.3.3 Cap-and-trade

A cap and trade programme works, from a company perspective, rather differently from the credit trading scheme. Here, the legislator determines an overall limit (a cap) for the total emissions allowed. This cap then determines how many emission permits that will be issued. Here the airline is provided with a certain amount of allowances – each of which grants the entity to emit a certain amount and has to make absolute and not relative emission reductions. The airline is then required to hold enough emission permits for the amount of emissions they generate during a certain period. If the company finds that it has an excess or deficiency of emission permits then there is a possibility for them to trade.

This kind of regulation could however work as means of preventing new companies from entering the market, as there is a limited amount of emission permits that are available.

Here it is predetermined how much the emissions will be reduced, and consequently it will be easier to predict the environmental consequences. Within the cap-and-trade scheme, emissions are not allowed to exceed a certain limit.

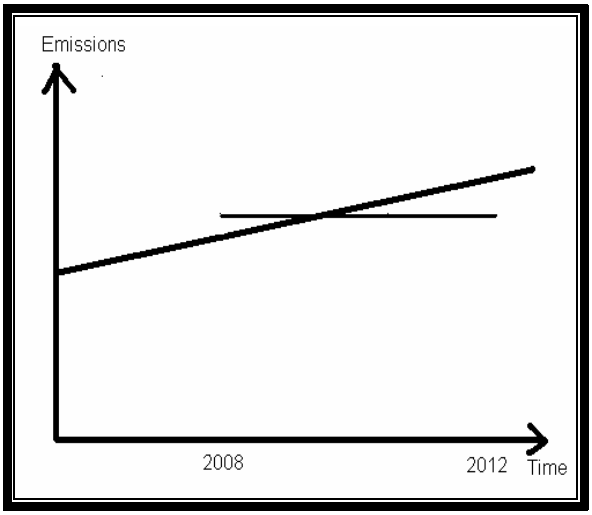

Figure 6: Illustrating that the total emissions from aviation are increasing. The horizontal line showing the total amount that the airlines have to be under in a cap and trade regime (many times this has to be accomplished as an average of the commitment period; here 2008 until 2012, as this is the commitment period for the Kyoto Protocol.

4.4 Compliance

Although there are many different regimes, there still has to be means of ensuring that the commitments are honoured, although most of them are based on responsible actors, there are also means of basing them upon access to the trading regime. Today, the most common way of constructing an emission trading regime is buyer liability; that the purchaser is responsible to ensure that the emission permits originate from real emission reductions.[72]

It is important to bear in mind that compliance with actors that possess a legal personality (hence capable of possessing both rights and obligations, and thereby capable of entering into agreements) is not simple. However, as there in general are sanctions contained in the agreement, and, if these agreements then are breached, there is a general acknowledgement that there can be consequences.

The market also offers possibilities of ensuring compliance. If companies do not comply they will find themselves excluded from the market on emission rights. No matter if the addressee of the emission trading regime has a legal personality or not, preventing access to the international market provides a means of limiting the possibility for profit through emission trading.

It may be argued that states are not always interested in enforcing emission standards for their national airlines. It is therefore important for the credibility of an emission trading regime that compliance can be ensured from actors within the state. Publishing that an airline or a state is not in compliance with its commitments may act as an effective sanction.

[72] Cathrine Boemare, Philippe Quirion: *Implementing greenhouse gas trading in Europe: lessons from economic literature and international experiences* in Ecological Economics 43 (2002) 213- 230, p 216-217

5 CREATING A TRADE: ALLOCATION

If there is to be trading of emission permits, it is important that a sufficient number is distributed, so that a demand and supply can be created. The price of emission permits have to be such that it also is an incentive of reducing emissions from aviation. This would also mean that the environmental integrity of the emission trading regime is protected. Also, trading has to occur in such environment that can provide for as fair of a competition between the different airlines as possible. Against this need for free competition; there is also a need to pay special consideration to the developing countries.[73] Here, issues of equity and justice become important.

A trading regime presumes that there is a good that can be traded. In the case of emission trade for aviation, the good (emission permits or credits) have to be created by an authority or another type of organisational body and then distributed. Although the principles of trading are not altered by the distribution of emission permits, it is still possible that these may have far reaching consequences for the market (in terms of distorting the market by inequitable distribution of emission rights). Both the market as well as the allocation should encourage a holistic view to target all possibilities for emission reduction.

5.1 Allocation under credit trading

In a credit trading scheme, allocation of energy credits will be an integral part of the emission reduction scheme, as the energy reductions are accomplished. There is therefore not a need for an independent allocation scheme. However, some companies will have a greater possibility for making the emission reductions and therefore be able to have a greater number. Credit trading as such, do not contain many questions on allocation, but rather on how to create a demand for emission permits, and thereby a market.

5.2 Allocation under benchmarking

As stated above, the idea of benchmarking is based on relative standards, that the emissions are reduced in comparison with a business as usual scenario. In contrast to credit trading, the emission rights are not created as the emission reductions occur, but rather, all companies need to be able to show a certain number of emission permits for the emissions exceeding the benchmark. As stated above, it could be claimed that the benchmark is placing the standard for emissions, although a relative one. If a company has emission levels that are lower than the benchmark, emission permits are created.

5.3 Allocation under cap and trade regimes

Allocation under a cap and trade scheme may become a problem. Today, many of the emission trading regimes apply grandfathering (giving away the emission permits to industries, most often based upon their historical emissions) perhaps also in a combination with auctioning (that the emission permits are sold at an open market, where the one that offers the highest price also is allowed to purchase the emission permits).[74] However, other methods of allocation are also debated on the international level; in the EU emission trading scheme, all states have to submit a description of their allocation method.[75] This method is then evaluated to ensure that no company is given too big of a competitive advantage.

[73] This has been acknowledged through the UNFCCC and is manifested e.g. in the preamble.
[74] Helen Groenenberg *et al*, *op cit* p 106
[75] EU directive 2003/87/EG art 9 (1).

The construction of cap and trade regimes enables them to work both with states as well as airlines as main actors. The choice between these two levels will not only depend on the political will but also on the possibilities to create a reliable trading system, especially in respect to responsibility.

Both auctioning and grandfathering can be done from a national level as well as by an international organ, such as ICAO. Grandfathering is described as occurring on both the national and international level but in the national contexts; however, the term grandfathered only addresses the allocation of emission permits to airlines, not to states.

5.4 Introducing allocation methods in a cap and trade market

Cap and trade offers a very traditional solution for controlling the emissions, basically it offers the possibility of implementing a ceiling for the total amount of emissions. It is a method that already exists in the international context as contained in the obligation for industrialised states in the Kyoto Protocol. In contrast to the emission trading regimes discussed above, these do not contain any method of allocation. It is therefore necessary to determine what allocation method would offer the best solution for the aviation sector.

5.4.1 Allocation directly to the airlines

In principle, it is possible that the emission permits are allocated to a state that then distributes it to its airlines or airport. However, it is also possible that a supranational organ could handle the distribution and surveillance of emission permits.

5.4.1.1 Grandfathering to airlines

Grandfathering implies that emission permits are allocated for free to the different actors; the basis for how many emission permits are distributed may vary. As stated above, the national allocation within the EU is based on the historical emissions. According to article 10 in the directive, 95% of these are to be distributed for free. If the emission trading systems are connected, it remains important to ensure that there are actual emission reductions accomplished (not too many emission permits out on the market), that the market is reasonably transparent as well as that the compliance mechanisms are in place.

In regards to airlines, it is possible that the emissions are allocated by an international organ to the aviation companies, most likely be based on the historical emissions. By differentiating the standards for the airlines from developing countries and industrialised countries, it is possible to give developing countries special consideration in such regime. If a trading regime is to be sustainable in a longer term it has to be based on equity and the creation of what could be a fair market.

If grandfathering is based upon historic emissions, then the company that has been relatively clean in the past is greatly affected as they will be awarded few emission permits in comparison with the dirtier ones. This would penalise airlines that have taken early action. The emission rights are distributed without a charge, which naturally makes grandfathering, from the (established) company perspective more appealing, and "turns out a more viable option in practice"[76] as this is something that the existing companies could agree upon.

[76] Helen Groenenberg *et al* (2002), *et al*, *op cit*, p 106

5.4.1.2 Allocation through auctions

Like the grandfathering method mentioned above, this allocation system is commonly used to distribute emission permits in existing regimes, mainly as a compliment to grandfathering. Part of the emission permits that are to be distributed can be allocated through auctions, as is done in some of the existing emission allocation schemes today. Here, the emission permits are simply sold through to the highest bidder through an auction. In this scheme the company is capable of calculating at what price it would be beneficial for them to accomplish emission reductions "at home" or to purchase emission permits, thereby making the price an important indicator for airlines as how to accomplish the most economic and efficient emission cuts. Once the emissions have been allocated, it is possible for airlines to start trading; provided that there is a demand and a supply.

Auctions directly to airlines would also ensure that they are treated equally, although this may not be equitable at all times. Especially as many airlines are state owned and thereby receiving support from the state. Naturally, it is conceivable that auctions could be directed at the state as well, that the states can participate as buyers and then sell or give the rights to their airlines. This would strengthen the ties between the state and its airline. Depending on their relationship, it may also affect the use of price as a signal to companies to purchase emission permits or make emission reductions, and thereby decreasing the economic efficiency of possible emission reductions. Here, the subsequent trading of emission permits could also occur at state level and not only between airlines.

To many, auctioning is economically preferable. Helen Groenenberg *et al* claim that it can be seen as promoting technological development and innovation, while creating revenues that can be used for monitoring and administration of the trading regime. For companies on the other hand, auctioning may become as expensive as or even more expensive than a taxation scheme.[77] Also, another big advantage of auctioning is that it requires no data for the historical emissions, which makes the administration less costly.

5.4.2 Allocation to the states

Instead of choosing airlines as the recipient of emission permits it could be allocated to the state. This would imply that the emission trading system would be more based upon state participation and not on airlines (entities that do not possess an official international personality, and thereby pose new challenges in regards to responsibility and compliance). To base the emission trading (and also the allocation) on state participation, could facilitate potential compliance mechanisms. Another benefit is that states, unlike companies, in general are there a long time. Here states have to distribute the emission permits to airlines, or the state has to ensure that it keeps its emissions below its assigned level.

5.4.2.1 Allocation to the state where the bunker fuel is sold

A country could be viewed as having control over the goods sold within its territory. Also, it is simple to keep track of the amount of e.g. bunker fuel sold, and not having to differentiate between what is sold to international and national aviation. Accessing the data should not be difficult, as the seller naturally keeps track of how much is being sold. Here a state may choose if it is to participate or not.

From the perspective of compliance, this idea would be the most appealing. It is rather simple to keep track of how much bunker fuels actually are sold to aviation or shipping. Also, there will be no need to separate the nationally and internationally used bunker fuels.

[77] *Ibid*

Here it is very natural for the states to take responsibility. This kind of scheme would also be rather simple to connect to the UNFCCC and the Kyoto Protocol. However, this would put a lot of faith in the so-called climate regime, and what happens here will then affect the control of greenhouse gas emissions from airlines.

However, as long as not all countries are obliged to implement emission standards, airlines can choose to purchase their bunker fuels in a country that has no commitments. If airlines choose to do so, this could mean that they are carrying an even heavier load (more weight due to the large amount of fuel), perhaps taking a longer route to fill up there tanks etc. and thereby cause more emissions. It may also create opportunities for Northern airlines to circumvent the scheme, thus potentially also creating a rather uneven aviation market.

According to an investigation by the Danish Environment Protection Agency, this method would mean that a larger share of the emissions will be allocated to the airlines from countries that already have taken on commitments to reduce their greenhouse gas emissions; this is as the lions share of the fuel sold in developing countries (that have no emission standards) are for Northern airlines. The Danish Environment Protection Agency therefore argues that this option can be viewed as the most equitable for developing countries.[78]

5.4.2.2 Allocation to the nationality of airline

It is natural that there is a close connection between a state and its nationals, and the state has jurisdiction over its nationals. The state has therefore unique possibilities of imposing standards and rules on its airlines, even if this operates between different states. To force states to take responsibility for its national airlines may therefore seem like a natural choice. States and airlines are inevitably connected.

One of the main obstacles to this approach is that airlines are becoming increasingly internationalised today and the nationality may not always be clear. The headquarter could be in one country, it may employ staff from several countries, as is the case with e.g. Scandinavian Airlines, and it may be owned by foreign investors, thus having ties to a large number of countries. A system like this could naturally enable airlines to change nationality and "fly the flag of convenience", thus choosing the country that put the least regulation on airlines and their possibilities of reducing the emissions. As the market for international travels is becoming less and less regulated, it is easier for airlines to detach themselves from their national connections and to become more separate from the nation state, and thereby decreasing what control the nation state can exercise over the airline company

5.4.2.3 Allocation to the nationality of cargo/passenger

According to the polluter pays principle, the ones that pollute should pay for it. In the case of aviation, it could be argued that the ones that are actually the cause of the pollution, should be the ones who should pay. The determination of who should pay for the international transports should naturally also be based on equity. In this kind of scheme the state with the responsibility for the nationals causing the emissions are also the bases for an emission trading regime for airlines. Although the emission permits are distributed to the state, and not to the individual, this may be a method of trying to implement something similar to per capita emission standards.

[78] Stefan Kruger Nielsen: *Greenhouse gas emissions from international aviation and allocation options*, ECOtransport Consulting, Danish Environmental Protection Agency, Environmental Project No 769 (2003) p 98

Naturally, allocating emission rights according to this principle could however become rather expensive and complicated; it would request airlines to keep track of who travels with them and how much cargo from different countries are transported as well as how much emissions are generated. This would require airlines to actively participate in the implementation of the regime; and this in turn would have to be reported partly to the state responsible for the emissions and likely also to some kind of international surveillance organ (perhaps ICAO).

This view would naturally remove the challenge of determining the nationality of an airline and remove the potential possibility for "flag of convenience". Here it would be possible to ensure that developing countries under which the goods and passengers belong to, is responsible for the emissions, even though they are excluded from any standards and also from the emission trading regime. Also, states are in a unique position to affect the possibilities for transport to and from its state, as well as investing in transport systems based e.g. on trains. The state also has unique possibilities of affecting its nationals by information and educational programs**.**

This method of allocating the emission rights on a global level has been advocated mainly by the Danish Environment Protection Agency.[79]

5.4.2.4 Allocation to the country of departure/arrival

Tourism is a big industry for many countries today, and provides a good source of income for many states. Countries such as Australia are already raising the issue of tourism in negotiations on the future of aviation.[80] Seen from this perspective, the states that benefit from the air transport should be taking part of the responsibility.

In this case, all airlines arriving to or leaving a territory should thereby be regulated by the state that controls the territory. The burden could also be shared between the arrival and the departure states (see table 1 below). The advantages is that this kind of scheme targets all airlines to and from a certain area, while still allowing certain states to wait before entering into commitments to reduce emissions.

Table 1: How the emission allocation scheme could look according to state of departure/arrival

Flight between states with standards	*State A*	*State B*
Share of emissions	50%	50%
Flight between one state with standard and one without	*State A*	*State C*
Share of emissions	50%	-

This option would require states to be able to divide the emission permits among themselves, and then to allocate them to different companies. One of the main disadvantages is that air travel today is rarely straight; there can be many transfers and stops on the way.

States are by nature the most suitable for taking responsibility for their nationals, including potential information and educational campaigns. By investing in alternative means of transport the state is capable to provide alternatives to airlines. Also, by imposing fees, taxes etc the state is capable of affecting the price on travels for consumers, and thereby affecting consumer behaviour. This means that the states in some respects bear part of the responsibility for bad travelling habits (such as choosing the airline over the train for short distance travels), and have to affect their nationals accordingly. This would also make it

[79] *Ibid* p 100

[80] Peter Forsyth : *Promoting trade in airline services* in Journal of Air Transport Management 7 (2001) 43 – 50, p 47

possible for some states to move further and limit there emissions while leaving other states behind without distorting competition.

Placing the responsibility upon the state of arrival and departure also has its disadvantages. At present the airlines operate in a hub and spoke network. A scheme like this would thereby present the states with large hubs with a challenge. Naturally, this would also mean that they the states with large hubs will be responsible for the emissions that even the transit passengers are causing.

5.5 Voluntary commitments as a basis for an emission trading regime

Naturally an emission trading regime does not have to be based on a legislative framework *per se*. A trading regime could also be voluntary in character and be based on what challenges the airline companies themselves feel that they can take on. Any of the trading regimes mentioned in chapter 4 could be based on voluntary participation from airlines. Here they could, like is the situation today, have a chance of taking on commitments, and thereby also help to build an understanding of the issue.

There are many different ways that the emission reductions can be accomplished. Naturally, voluntary commitments from the aviation industry may include other issues than emission reductions. However, voluntary commitment differs quite a lot in character. In the national context the commitments has also been described as negotiated agreements and takes on different forms and different origins, depending on the context. They can vary from a "gentleman's agreement "to a legally binding contract that can be enforced with the help of courts. Due to the ambiguity of the term, voluntary commitments depend on their cultural and societal context. It is therefore important to clearly define the term, if this is to be applicable to emission reductions in a field like international transport.

5.6.1 What are voluntary commitments?

Voluntary agreements generally find their basis in a giving and a taking. To some extent this is also valid as far as the development of legislation is concerned; legislation also exists in a societal context. As voluntary commitments are based on negotiations, they are often accused of being soft and not containing stringent rules. On the international level however, the threat of new legislation may be viewed as less effective, as the co-ordination of an effective regime is notoriously difficult. The effectiveness of voluntary agreements also depends on the context in which they are to exist. This context can be understood as "the societal environment of an agreement as well as the competitive situation of the relevant firms in and outside of an agreement".[81]

According to Alec Simpson, voluntary commitments can be less expensive than standards or other forms of regulations as industry chooses to work with the legislator.[82] Naturally, this is likely to depend upon the legislative culture and social contexts where the voluntary agreements are to apply. It is likely that many people in legislative cultures with referral systems feel that the companies already have a chance to react to the legislative suggestion before it is decided upon. A big advantage of voluntary agreements is that the different companies can take on as large responsibility as they feel that they can cope with. This would allow for no or very small commitments for the airlines originating in developing countries. It is likely that the substitution of legislation for voluntary commitments in this

[81] Kilian Bizer and Ralf Jülich: Voluntary agreements -trick or treat? In European Environment 9 (1999) pp 59-66 p 61.

[82] Alec Simpson: Voluntary agreements enable operators to provide self-made solutions to an environmental problem in ICAO Journal, Volume 54, No 7, (1999), p 30

case would mean that there will be no international legislation for the airlines and that enforcement may prove to be difficult. How efficient commitments based on voluntary commitments will become depends on a large variety of factors.

5.6.2 Negotiating voluntary agreements

Research shows that negotiation process for voluntary commitments is very important. It should be characterised by the involvement of all stakeholders throughout the negotiation and implementation process, as well as encompassing "clear and democratically accepted pre-set, target driven policy".[83] Bizer *et al* notes that it seems as if the "formulation of clear targets and distinct responsibilities of the parties as well as detailed reporting and monitoring and adequate incentives and sanctions" are important factors to determine the success of the agreement.[84]

One of the main drawbacks of voluntary agreements is the discounting of future; companies seem to feel that the further in the future the benefits or the losses occur, the less appealing they look.[85] Preventing the emissions of greenhouse gases from aircraft may have visible effects far in the future, and it is still rather unclear exactly how they will manifest themselves and how large the total effect actually will be. It may therefore be rather difficult to ensure that the airlines are agreeing to anything that will cause an actual change in travelling. Reaching an agreement on how much the emission should be lowered could, in this light, be viewed as difficult. Although discounting the future is common, it is important to bear in mind during the negotiation of voluntary commitments.

As negotiated agreements are based upon an interaction between companies and the state and contain what has been agreed upon; the views of the actors will play a more important role than in ordinary legislation.

5.6.3 Voluntary commitments as a basis.

As stated above, ICAO has decided to investigate voluntary commitments as a basis for emission trading.[86] Here the allocation would depend on the results of the negotiations, and could take the need for differentiated commitments into account.

As the name implies, voluntary commitments, the possibilities of implementing a real compliance system is rather limited and depends on what can be agreed upon. If the voluntary commitments are truly implemented by the individual airlines, it could improve the emission reduction possibilities and lead to better understanding of the mechanisms behind emission from aviation sector. This is perhaps why ICAO feels that short term voluntary commitments could serve as the initial step towards a control of emission permits.[87]

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[83] Kilian Bizer *et al* (1999) *op cit* p 62
[84] *Ibid* p 61-62
[85] Gerardo A Okhuysen, Adam D Galinsky and Tamara A Uptigrove: *Saving the worst for last: The effect of time horizon on the efficiency of negotiating benefits and burdens* in Organizational behavior and human decision processes 91(2003) pp 269 279, p 271.
[86] ICAO (CAEP/6 WP/57) *op cit*
[87] ICAO, http://www.icao.int/cgi/goto_atb.pl?icao/en/env/overview.htm;env as accessed on February 18, 2004, on file with author.

6 AVIATION MARKET AND VIEWS ON THE ROLE OF AVIATION

In order to be able to implement an emission trading regime for airlines, it is important to see the conditions that they are to exist under. International standards or environmental trading schemes never exist in void. Today, the airlines seems to have become increasingly involved, and they are an important stakeholder as they are the ones that at the end of the day will have to accomplish emission reductions, e.g. through replacement of old technology.

In theory it is simpler to create an open and liberalised market for aviation, where the airlines can compete within a uniform framework. In reality however, it remains a rather protected market where the states are giving their own airlines economic and other support. At all regional and sub regional levels, states are entering into agreements aimed at "unrestricted market access and operational rights".[88] Within the EU, the market is practically liberalised, while it could be claimed that "trade in airline services are still relatively restricted" in other parts of the world; either by regulations or by competitive advantages through e.g. airport slot allocation.[89]

Different airlines are seeking each others co-operation, and are forming alliances. By forming alliances, airlines can access "closed" markets. These partnerships enable airlines to offer their customers more destinations in a simple way. These alliances may be a way for airlines to protect themselves in this rather complicated market.

6.1 States interest in aviation

States are interested in having reliable transport systems. Kenneth O. Rattey argues that participation in the aviation market is not only of theoretical importance. "Regular and reliable air transport services are essential to the economic, social and cultural needs of all countries."[90] He argues further that it is important for all countries to be able to participate in the globalisation process. If the developing countries are not capable of participating in this process, this could lead to an increased marginalisation.[91] Nielsen et al argue that "[t]he new capabilities of information processing and transmissions, as well as the enhanced mobility of people and the movement of freight, are profoundly altering features upon which the competitiveness of firms and the competitive advantages of regions depend".[92] A national airline is important to the states as it could be viewed as a part of the national security and defence system (for urgent transports), trade, tourism, employment, safety (as national aviation authority has the authority of controlling the safety of the national airline, there is less certainty that a foreign owner would abide by these national standards), traffic rights and bilateral agreements (market access is determined by the nationality of the airline), independence (having a national airline could be considered a "symbol of independence – a popular, strategic or national asset that should not be tampered with").[93]

This trend of liberalisation, in combination with the interest for nations to protect their airlines, makes it rather difficult for policy makers to find appropriate legally

[88] ICAO Secretariat: *ICAO conference to address challenges and opportunities of new regulatory framework*, in ICAO Journal, Volume 57, Number 9 (2002), p 5
[89] Peter Forsyth, (2001) *op cit* p 50
[90] Kenneth O. Rattray: *Air carriers of developing countries must have safeguards in a liberalized environment*, in ICAO Journal Volume 57, no 9 (2002), p 13
[91] *Ibid*
[92] Lise Drewes Nielsen, Per Homann Jespersen, Tina Petersen, and Leif Giesing Hansen: Freight transport growth – a theoretical and methodological framework in European Journal of Operational Research 144 (2003) 295 – 305 p 295
[93] Peter van Fenema: *National ownership and control provisions remain major obstacles to airline mergers* in ICAO Journal Volume 57, no 9 (2002), p 8 (quote from this page also)

binding approaches and means of addressing challenges without reducing the competition; even through an emission trading scheme. There are clear attempts from international organisations to limit the environmental consequences of aircraft. The Convention on International Civil Aviation states that every contracting state should have a fair opportunity to operate their national airlines.[94] It is within this liberalised airline market that the emission reduction (and the emission trading regime) has to exist, or it will not be sustainable in a longer perspective.

6.2 Driving forces for aviation; what and why

Clearly, there is at least a perceived need to travel, and that this need manifests itself through e.g. the growing airline industry. It is likely that the business travellers are not bothered by what airline they are travelling with and choose mainly according to routes and schedule; although many airlines are applying different bonus systems to keep their travellers more loyal. This group of travellers is mainly concerned with maximising their productivity while travelling.[95] The airlines seem to be struggling against this trend by implementing various bonus systems. The leisure travellers on the other hand seem to be more sensitive towards the price of tickets.[96] It is important to note that travelling also is connected with our lifestyles, as we become more affluent what we perceive as our need to travel also increases.[97] In the case of aviation, as we become more aware of how much the world has to offer; we are likely to travel far, as long as we can afford it, to get to the places. However, as tourists we become more sensitive to changes in price.

Not only the passenger sector of the aviation industry is growing, the one dealing with cargo is also developing. One of the reasons that goods transport through aviation is increasing seems to be much due to its reliability. Ida J Koppen notes that such development requires that the means of transports are reliable. – "The most important thing for many businesses is to know when a consignment will arrive, not necessarily how long it has taken".[98] She refers to an article by Markham to support the argument that if railroads would invest more in improving services and guaranteeing fast delivery, they could easily gain back part of the market share they have lost since 1970.The argument made by Ida J Koppen may be contradicted as a speedy delivery to the consumers is important; e.g. of flowers from Africa, and the delivery of fresh goods to e.g. stores. Here aviation has big competitive advantages due to its fast deliveries.

6.3 Actor perspective: Airlines on emission trading and allocation

If an emission trading regime is to be successful, it will require the participation of all important stakeholders. As this is to exist within the international system, the views of airlines become increasingly important.

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[94] Art 44 of the Convention on International Civil Aviation (Chicago Convention) as referred to by Kenneth O. Kenneth O. Rattray (2002): *Air carriers of developing countries must have safeguards in a liberalized environment*, in ICAO Journal Volume 57, no 9 p 13

[95] See e.g. Martijn Brons, Eric Pels, Peter Nijkamp, Piet Rietveld: *Price elasticities of demand for passenger air travel: a metaanalysis* in Journal of Air Transport Management 8 (2002) 165 175.

[96] *Ibid*

[97] Amanda Root: *Placebo or panacia? Rural transport corridors: some social and environmental issues* in World Transport Policy & Practice 2/4 (1996) 20-27, p 20

[98] Ida J. Koppen: *Dispelling the myths of transport growth: A critical appraisal and some introductory remarks* in World transport policy practices, Volume 1, Number 2, 1995, p 4 – 6 p 4

6.3.1 What airlines are doing

Airlines like British aviation have funded research[99] on emissions from aviation and are advocating voluntary commitments on their homepage. British Airways has stated that their goal is to reduce their emissions of greenhouse gases by 30% in the period 1990-2010.[100] Lufthansa has published their commitment on reducing emissions from aviation on the internet. Japan Airlines have also committed themselves (voluntarily) to reduce their emissions of CO_2 by 10% between 1990 and 2010.[101]

Airline companies have also united forces in their attempts to reduce their environmental impact, both within the different alliances and through larger organisations. For example, the star alliance[102] has signed a statement where they lay down their environmental principles; but no real targets and limits are mentioned.[103] The 274 members of International Air Transport Association[104] (IATA) have agreed on the goal to reduce the emissions of CO_2 (and NO_X) substantially; in 2000 IATA adopted the goal of decreasing its total emissions by 10% between 2000 and 2010.[105] An additional goal for research is to accomplish an additional 20% reduction of CO_2 emissions as well as a 60% reduction of NO_X emissions for new aircraft engines by the year 2008.[106] As stated under chapter 4.4.1 ICAO has also been active in the attempts to reduce emissions of greenhouse gases.

6.3.2 How airlines would like it

Naturally, it is good if there is a great support for all measures taken to reduce the emissions from aviation. But as airlines remain the main actor in any emission trading regime focused on aviation, their circumstances also have to be considered in a sustainable international framework.

Although all of the airlines are not individually indicating what commitment they are willing to take on, it seems as if many are showing it openly, and targeting more than the greenhouse gases. Many airlines[107] are already trying to save fuel through e g operational

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[99] Chris Hewett and Julie Foley: *Plane Trading*, 2000, Institute for Public Policy Research printed by Central Books. A summary can be accessed at http://www.ippr.org.uk/publications/covers/planetrading_sum.PDF

[100] British Airways social and environmental report 2000 as accessed on October 16, 2003 at http://www.britishairways.com/responsibility/docs/performing/report_2000.pdf - on file with author. – p 36

[101] Japan Airlines: Environmental Report chap VI. (April 1, 2001 March 31, 2002) as accessed on October 16, 2003 at http://www.jal.co.jp/en/environment/6_1.html#1 - on file with author.

[102] Consisting of airlines co-operating with each other; Lufthansa, Scandinavian Airlines, Nippon Air, Air Canada, Air New Zealand, Ansett Australia United Airlines and VARIG Brazilian Airlines.

[103] Star Alliance: Environmental commitments of the star alliance, as accessed on March 6, 2004 at http://konzern.lufthansa.com/en/html/ueber_uns/balance/commitment/umweltstandards/index.html on file with author.

[104] IATA: 274 members – November 19, 2003 - http://www.iata.org/membership/airlines/allairlinemembership.htm?area=all - on file with author.

[105] IATA: Aviation, Fuel Use and CO2 – a message from the world's airlines, may 2000 as accessed at http://www1.iata.org/WHIP/_Files/WgId_0140/Fuel%20Efficiency.pdf as accessed on October 15, 2003 – on file with author.

[106] IATA: Fast Facts: the air transport industry in Europe has united to present its key facts and figures, Published February 2003 as accessed on October 15, 2003 at http://www.iata.org/soi/environment/emissionspolicyoptions.htm – on file with author.

[107] Air France: *Seventh environmental report* for 0203 as accessed on April 3, 2004 at http://www.airfrance.us/cgi-bin/AF/US/en/local/toutsurairfrance/lacompagnie/environnement_rapport.htm?BV_SessionID=@@@@171413 1107.1081165099@@@@&BV_EngineID=ccccadcldlflfkfcefecekedfljdghl.0, on file with author, p 18

changes, while others[108] feel that there is little room for improvement left there. Naturally the pricing of so-called bunker fuels matter for this development.

When it comes to developing a scheme for controlling the emission from aviation, airlines like Air France emphasise the importance of not distorting competition, environmental efficiency and the need to meet the collective travel needs of all citizens. [109] Scandinavian Airlines are also advocating an emission trading regime, where the emission reductions can occur at the lowest costs.[110] British Airways is advocating emission trading as means of allocating emission rights; and they also feel that the emission market should be open for airlines to participate in.[111] IATA also supports that emission reductions from aviation should occur on a voluntary basis, and that this may be combined with a potential emission trading regime.[112]

[108] British airways: 2002/2003 Social and environmental report as accessed on March 6, 2004 at http://www.britishairways.com/cms/masterEN/content/company_information/community_and_environmental/social_and_environ_report_03.pdf on file with author, p 10

[109] Air France: Seventh environmental report (02 03), *op cit* p 24

[110] Scandinavian Airlines: SAS Koncernens Arsredovisning 2003 as accessed on March 5, 2004 at http://www.scandinavian.net/12208/sas2002swe.pdf on file with author, p 109 and 110

[111] British airways: 2002/2003 Social and environmental *op cit* p 12.

[112] IATA: Policy Options for addressing aircraft emissions as accessed on April 3, 2004 at http://www.iata.org/soi/environment/emissionspolicyoptions.htm on file with author.

7 DISCUSSION

Today transport plays an important role in our society, and it seems as if it will continue doing so for yet some time, and it is also, as research has shown, likely that the aviation industry will continue to grow. Onno Kuik argues that emission trading would not be the best option in the national system; instead taxes would be a more beneficial approach.[113] This may be true, but it seems as if the support from airlines would be greater if an emission reduction scheme based on trading would be chosen. There is also a greater support for this kind of scheme from ICAO.

However, as stated in chapter 4, emission trading offers the possibilities of economic and efficient emission reductions. Depending on what trading scheme is chosen, the possibility for actually preventing the emissions varies; if the benchmarking scheme is chosen and set too low and the emissions from airlines are continuously increasing, then it is possible that the total amount of emissions will not be addressed through a potential emission trading regime. As seen in the previous chapter, airlines are (mainly through their organisations) taking on commitments to reduce their emissions. British airways have clearly stated that emission trading is perceived as the road forward. ICAO has also made similar statements.[114] The alliances formed among different airline companies could be viewed as a means of strengthening trust between different entities, and thereby also creating a better environment for emission trade.

What trading system and allocation system are chosen will affect the rest of a potential emission trading regime. Depending on how long the allocation of emission permits will last, and how they are produced within an emission trading system, the effects will be different. If too many emission permits are distributed, the demand will be reduced, thus leaving little need for airlines to purchase additional emission permits. Hence, there will be very few emission reductions achieved, and the possibilities to take full advantage of the economic efficiency that emission trade offers is lost.

If the allocation occurs on a long term basis then there will be a problem for new companies to access the market as their lack of emission permits will be a competitive disadvantage, especially if there is an adequate price of emission permits. If too many emission permits are distributed, this will however not be a problem.

7.1 Brief discussion on potential trading schemes

The different trading systems have different impacts on how much emission reductions will be achieved. Whereas a cap and trade system offers the possibility of limiting the total amount of emissions. Benchmarking and credit trading do not offer the same possibilities for setting a cap on the total emissions. When it comes to preventing climate change, the total amount of emissions has to be reduced. This makes an emission trading regime based on cap and trade an appealing option, when compared with benchmarking and credit trading. Naturally the environmental efficiency of all regimes will depend upon how the limits are set. Benchmarking would have to take the future development of operational measures and technological research and development into account. In addition, neither benchmarking nor credit trading puts an absolute limit on the total amount of emissions. Naturally the total emission reduction depend upon how the relative standards are set.

[113] Onno Kuik and Machiel Mulder: *Emission trading and competitiveness: pros and cons of relative and absolute schemes* in Energy Policy 32 (2004) 737- 745 737- 745 p 744

[114] ICAO: *Aircraft Engine Emissions: Definition of the problem* as accessed at http://www.icao.org/cgi/goto_atb.pl?icao/en/env/aee.htm;env as accessed on May 11, 2004, on file with author.

Naturally it could be argued that a cap and trade may result in a reduced aviation growth and that there would be simpler and more transparent means. However, it has to be borne in mind that the emission trading regime is designed to reduce the emissions from aviation and that this may very well be a way of crippling the market (provided that the development of technology does not pick up speed). What is clear is that the standards to lower the emissions have to be designed in a way that it does not prevent competition, and that there are environmental benefits.

How the economic side of the different emission trading regimes look depend very much on how they are set up to function. Benchmarking totally have relatively high transaction costs, but they are still lower than in a mixed regime, where the different emission trading systems are integrated. The regime with the lowest transaction cost is a simple cap-and-trade model. [115] If the emission market for aviation is connected with the emission market under the Kyoto Protocol, transaction costs are likely to be affected. One study claims that the transaction cost of the bigger market – where the industry has absolute cap-and-trade standards and aviation bases its emission rights on benchmarking, then aviation will have 8% more expensive transaction costs than in a cap and trade regime (in terms of total permit turnover), mainly due to the actors being treated differently. [116] This could be the result of creating a market where the players work under very different circumstances, and where the different methods of creating the emission permits are rather difficult to compare. Also, as the emission trading market could be less efficient, it is also likely that less emission will be prevented; fewer emission reductions will be perceived as economically beneficial to accomplish. It seems that the cap-and-trade regime has overall the best economic efficiency, environmental benefits, naturally also depending on how the cap is set (and it has the advantage that the result will not fluctuate) and what in literature seems to be viewed as the simplest and consequently the cheapest monitoring requirements.

However, if the emission trading system for airlines is to be based on states bearing the responsibility for the system, then it has the advantage of being incorporated under the Kyoto Protocol and not only under the national or regional trading systems without having to impose special regulation or agreements in order for the airlines to be able to participate in an international emission trading regime. On the regional level it is simpler for the states (politically) to enter into agreements where they acknowledge the national airlines, and the states give up part of their sovereignty to allow a regional body to implement regulations that give the basis for emission trading from airlines.

Thus, if emission trading for airlines is to be connected to an emission trading regime as provided for under the Kyoto Protocol, then cap and trade appears to be the most beneficial option.

7.2 Equity: The role of developing countries and their airlines

The developing countries are in no way a homogenous mass of countries but very different countries with many different interests and point of departures. However, their interests have to be taking into account in the emission trading regime for aviation as well as in the allocation of emission permits.

[115] Onno Kuik *et al* (2004) *op cit* p 742 included in the transaction costs are e.g. research of the market, contacting buyer/seller, negotiating, compliance, monitoring and maintaining.
[116] *Ibid* p 742

7.2.1 Common but differentiated responsibility; connections to the UNFCCC

The developing countries agreed to participate in the negotiation process with the aim of preventing the anthropocentric impacts on the global climate on the condition that their right to development was recognised, and that they were to receive guarantees of financial and technological aid.[117] The emissions of greenhouse gases cannot be avoided in the course of economic and social development of all developing countries. It is therefore clear that issues of development have to be taken into consideration when determining suitable international measures to combat climate change. The principle of common but differentiated responsibility therefore became an important guide for the parties to the UNFCCC.

As the problem of climate change and the emissions of greenhouse gases are so connected to development and energy production and consumption, it is clear that the industrialised countries cannot deprive the developing ones from their right to develop.[118] Abating anthropogenic interference with the climate system require a new approach to the developing countries, where their right to development, as well as the different contributions to the environmental degradation is recognised. The right to development is also recognised in the UNFCCC.[119]

The parties to the convention notes that the largest share of historical and current global emissions of greenhouse gases has originated in the industrialised countries, as well as the need for the developing countries to meet the immediate needs for development.[120] The UNFCCC preamble acknowledges that all states have to co-operate in combating climate change in "accordance with their common but differentiated responsibilities and respective capabilities and their social and economic conditions".[121] This idea of giving special consideration to developing countries is also incorporated in article 3 of the convention, entitled principles: "The Parties should protect the climate system for the benefit of present and future generations of humankind 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 obligation to protect the atmosphere in accordance with the principle of common but differentiated responsibility is not absolute; by using the word "should" this article allows a certain balance of interests. The importance of this article is also watered down by a footnote[122] that states that the titles of the different articles are solely included to assist the reader. It remains therefore unclear if the principles are to be regarded as principles of international law, or merely as ideas that the parties are to be guided by. In addition, as the parties are only to be guided by the principles, they are not obliged to fully implement them in measures to prevent anthropogenic interference with the global climate (although this obligation can be considered as implicit under the UNFCCC and the Kyoto Protocol).[123]

The principle of common but differentiated responsibility creates a moral and legal obligation for the industrial states to take action to protect the global climate. This principle, taken together with the duty to protect the atmosphere for the benefit of current and

[117] Borione and Ripert *Exercising Common but Differentiated Responsibility* in Mintzer and Leonard: Negotiating Climate Change: The inside story of the Rio Convention Cambridge University Press, Cambridge, 1994 p 83

[118] The right to development has been recognised in various international instruments such as the Declaration of the United Nations Conference on the Human Environment (1972 Stockholm Declaration) and African [Banjul] Charter on Human and Peoples' Rights, adopted June 27, 1981, as reprinted in 21 I.L.M. 58 (1982).

[119] UNFCCC preamble para 21

[120] UNFCCC Preamble para 3

[121] Ibid para 6

[122] Footnote attached to the title of article 1, UNFCCC

[123] UNFCCC art 3 para 1

future generations can however not create any obligation for a state (or several states) to pay damage for the anthropogenic influence on the climate system.[124] This statement, taken together, only means that the international community has recognised that the industrialised countries should take the lead in combating climate change.[125]

As stated above, under chapter 6, aviation is of importance to their national states. The idea of justice between states in regards to anything but war and peace is a rather new thought.[126] As the international community started to address questions on global climate change and the emissions of greenhouse gases, it was clear that the industrialised countries bore the lions share of responsibility and that these also had the best opportunity to do something about it. As the negotiations of the Kyoto Protocol started, it was decided that the developing countries would not have to take on any commitments to reduce their emissions. If this idea is made applicable on aviation, it would mean that the developing countries are in need of extra support and that only the industrialised countries and countries in transition should be bound by emission standards.[127] Seen in the light of international policy development, it cannot either be ignored that the industrialised countries bear the historical responsibility for climate change, [128] or that most emissions occur in industrialised countries. It is hard to imagine that these factors can be ignored when discussing the allocation of emission permits to the aviation industry either. At the negotiations in preparation for the Kyoto Protocol, it was agreed that the developing countries should be allowed to reach some level of industrialism before emission standards are imposed upon them.[129]

7.2.2 Equity and aviation?

The aviation industry has been described as of importance to the development of the national states. Today, it seems to be acknowledged that the poorest party should have the least stringent commitment. An investigation on the political reality for imposing emission standards for airlines by Delft suggests that "[p]reliminary analysis shows that the most promising is a market based option /…/ limited to all traffic within and between developed countries /…./ regardless of the nationality of the carrier".[130] This would suggest a possibility of excluding developing countries, from an equity point of view. However, it could also be argued that "[f]ew ethical theories have much direct practical application. Their value resides in the manner in which they stimulate our imaginations and suggest the sort of questions that arise in specific instances".[131]

7.3 Allocation methods.

As stated above, an emission trading regime based on cap and trade (absolute emission reductions) seems to have the best environmental impact. It also seems to be the method that is the most suitable of connecting as a trading mechanism to the Kyoto Protocol from an economic point of view. It has to be acknowledged that it would be possible to address emissions from aviation through the use of the so-called Kyoto Mechanisms in the

[124] Pulvenis: *The Framework Convention on Climate Change*, in Campiglio, Pineschi, Siniscalo and Treves (editors) The Environment after Rio, Graham &Trotman/Martinus Nijhoff, London , 1994 p 93
[125] UNFCCC preamble para 6 and Pulvenis supra note 124, p 93
[126] Wilfred Beckerman and Joanna Pasek: The equitable international allocation of tradable carbon in Global Environmental Change, Vol. 5, No 5, pp 405-413, p 406
[127] Decision 1/CP.1 as accessed on http://unfccc.int/resource/docs/cop1/07a01.pdf
[128] As acknowledged by the UNFCCC preample, para 3.
[129] As acknowledged by the UNFCCC preamble para 22.
[130] DELFT 2002 p 1
[131] Wilfred Beckerman *et al op cit* p 413

protocol.[132] These mechanisms allow two or more states to co-operate in reducing the emissions of greenhouse gases from particular sources in comparison with a baseline. This method could be viewed as very similar to credit trading, but where the states take responsibility for accounting for the emission reductions and these credits then can be allowed into regional or global emission markets that are provided for under the Kyoto Protocol.

Although the allocation method matters very little for the accomplishment of cost effective emission reductions, it can distort the market by giving some airlines a competitive advantage, especially allocation for a cap and trade scheme. In order to accomplish a trade, a difference in the marginal cost of abatement is required (as well as the administrative costs be kept reasonably low) for a trade to be created. Through the allocation of emission rights, the competitiveness of companies can be affected; for example, if an airline is receiving a lot of emission permits that it does not need, it is possible to sell the excess permits with a profit thus creating funds for expansion or technical development while not having to address their own emissions. In benchmarking and credit trading schemes a regulation of market is more difficult to achieve as all the entities that will comply are subjected to the same rules.

7.3.1 Relative allocation methods

The relative allocation methods offer many advantages, as they can be based on a variety of sources and do not prevent new actors from entering into the market. As far as benchmarking is concerned, identifying the benchmark may be perceived as the main challenges in the regime. What demands can be placed on the technology? This requires the legislator to predict the future speed of technological development and how it could be encouraged through standards. As long as the benchmark is connected to technological solution, the balance between encouraging research and not demanding the impossible has to be found. If the benchmark is set according to passenger- or cargo kilometre then it is likely that we would see even larger aircraft and airlines that are flying long distances, especially in the light of trend that more and more people choose to travel by airlines. This could mean that the total amount of greenhouse gas emissions could continue to grow more than necessary. The benchmarking scheme also requires more data, which means that it will be more costly in regards to compliance and administration.

Credit trading, although very appealing, does not ensure that an emission trade is created; trade will only occur if a deficit of emission permits is created for one of the parties. It could therefore be difficult to implement emission trading based upon this if there are no demands upon reducing the emissions.

A disadvantage with the relative regime is that they only target the emissions occurring during the flight itself, and not the possibilities with measures such as operational changes and simply reducing the number of aeroplanes offered. This would not be a natural way of addressing e.g. operational improvements nor reducing the numbers of aeroplanes. It is important to bear in mind that relative emission encourages development of technology, and is therefore likely to put a focus on this, and not on all the areas where emission reductions could occur.

7.3.2 Absolute allocation methods

A variety of different means of allocating emission permits have been discussed. The different options offer a variety of benefits and obstacles. As a cap and trade regime offers the

[132] Through the use of joint implementation and the clean development mechanisms, as described in the Kyoto Protocol art 6 and 12.

possibility of placing the cap so that there will be a need for companies to trade (i.e. that some companies will see the financial benefits of accomplishing emission reductions, whereas others will be more inclined to purchase emission permits). However, the allocation of emission permits should be accomplished in an equitable way and in a way that does not distort the market more than necessary. Two requirements that at times can contradict each other as the special considerations needed for developing countries also could grant them a competitive advantage. Also, as an international emission trading regime should be based on state and their responsibility, it has to be possible for some states to take their time in ratifying the agreement/not ratifying at all.

In general, the cap and trade system has the advantage of reducing emissions from airlines by technological development, reduction of emissions from operational changes, and reducing the size as well as number of airlines. As this can be combined with a trading regime, the economic efficiency of the emission reductions will be ensured. On what basis the emissions will be allocated (and thereby also on what the emission trading system is to be based) is also a question of equity and fairness. As concluded above, it is necessary that this occurs in a fair and just environment, where the special needs of developing countries are taken into consideration.

7.3.2.1 Allocation based on nationality and bunker fuels

Basing the emission trading regime on nationality of the airline or on where the bunker fuel is sold also has its challenges. If these two allocation methods are directed towards the state, opening a possibility for developing countries to stay outside of the regime will be rather difficult, as they do not provide a reasonable way of providing some states with the possibility of standing outside of the regime. With grandfathering, it would encourage airline companies to be based either in countries with no obligations of limiting emissions or in states where very loose standards apply. Although many airlines are noting the necessity of reducing their emissions, there is likely a few that would like to avoid such measures, and perhaps also the airlines based in developing countries will be affected by this view. Allocating emission rights to where the bunker fuel is sold may also cause problems. In this case states would be forced to limit their selling of bunker fuels, e.g. by raising the price, or rationing the amounts sold. This could very well mean that the amount of emission would not be reduced as it is possible for an airline to choose its own routes, and that the airlines would choose to purchase fuels from places where there are cheaper options. Naturally, if all states would participate together on a level playing field, this challenge would not arise. However, there seems to be a need today to take the special needs of the developing countries into consideration, and to ensure that it is possible to exclude them from an emission trading regime.

7.3.2.2 Allocation based on nationality of cargo/passenger or arrival/departure

Granting states emission permits based upon how much their property or nationals are taking advantage of aviation; something that would make the states responsible for what its citizens does. This would naturally take into account the need for travel. As it is likely that the population in industrial states have access to more money for leisure travel, it is also likely that the industrialised states would take on the lion share of responsibility. This could also be seen compatible with the idea of per capita emission standards.[133] However, as tourism is an important source of income from many states, it has also been advocated that the state of

[133] There are discussions on basing the commitments on the number of inhabitants in a state. To ensure that the population would not increase beyond proportions, the number of inhabitants can be "frozen at a base year", preferably the same base year as is used to calculate emissions.

arrival or the state of departure should take responsibility for the emissions that originates from aeroplanes leaving or coming to their territory.

These options give the possibility for a more flexible regime, which also is less simple to circumvent. Also, airlines will have to take less responsibility for compliance as the basis is on other issues. This kind of structure would also address concerns about the different developing countries and their special needs while allowing other states, such as the EU, to move further without distorting the competition.

EU, as an international organisation with both international and supranational characteristics, have great possibilities for enforcing an emission trading regime, as it is capable of stronger enforcement mechanisms as the member states have delegated part of their sovereignty to the entity. The discussions on implementing an emission trading regime for the EU may enable the region to take what the Commissioner for the Environment, Mrs Margot Wallström, has described as the road forward. Here it would be possible to do so without jeopardising the possibilities for a relatively free competition. As is done with slot location at airports, the emission permits can be allocated the same way. Today the allocation of airport slots in EU is grandfathered based partly on historical allocations and no more than "50% of the slots used or newly created had to be reserved for the newcomers on the market".[134] However, the EU is currently investigating the possibilities to change the system into a market based one.[135] It could perhaps be possible for states to connect the allocation of emission permits to this structure.

If the two schemes is connected, it may be possible for airlines to trade spots with each other, sell the excess of emission permits that they have been allocated (provided that each slot is allocated together with a set amount of emission permits). Another method, which gives airlines less responsibility of the emission reductions, is to allocate only as much of the emissions that each aeroplane needs. Naturally, this may mean that the airports will prioritise the aeroplanes with very low emissions.

Taking these factors into account make allocation based upon the state of departure and arrival an appealing method for allocation. It also seems much more simple and transparent than allocation according to the nationality of the good or passenger.

7.3.2.3 Grandfathering and auctions

Grandfathering based upon historical emissions has both advantages and disadvantages. Here the airlines that have taken early actions will not be receiving any special consideration, and thereby not encouraging airlines to continue struggling towards reducing their emissions. However, the reductions will be set from a cap (thereby creating a set number of emission permits). Grandfathering would provide a rather simple way of distributing the emission permits. From an economic point of view, grandfathering would pose a challenge for companies that will enter the market as they have to purchase the emission permits prior to the emissions. Depending on their price this way of allocating permits may hamper the development of new companies. It may also challenge the possibilities for future growth in the industry as this too would require more emission permits. There are therefore few chances for new airlines to access the market unless they can purchase the emission permits needed at a reasonable price. This would naturally create a competitive advantage for the established companies. Yet, the main advantage is that it is simple (although it is not fair in the sense that it does not take the ideas of common but differentiated responsibility into consideration) and that it forms the basis of the largest regional emission trading scheme; the

[134] EU: Air Transports; as accessed on May 20, 2004 at http://europa.eu.int/comm/transport/air/rules/competition2/slots_en.htm; on file with author.
[135] *Ibid*

one that will take place in the EU. As this kind of structure is likely to provide new airlines with an option, it is likely to appeal to the established airlines if it was to be applied globally.

At times, the set amount of emission permits can be grandfathered in combination with auctions in order to take advantage of price mechanisms as means of communicating to companies when it is time to reduce their emissions. This gives companies an additional incentive of addressing their emission reductions.

Here the challenge will be to find the appropriate mechanisms to ensure compliance and that there are instruments of reporting. However, this kind of cap and trade regime could also, in theory, be based upon voluntary commitments; where the airlines themselves determine how much emission reductions they can achieve. Here it would be possible for differentiated emission reductions.

7.4 Voluntary commitments

Voluntary commitments are a hybrid based upon an agreement between a company and a state, which takes on many different forms. They have mainly been used in the national context, and there their success has been different, and the agreements have varied in form. The success of these commitments has also depended on many factors as discussed above. As is shown in chapter 6, there are groups and coalitions of airlines that have decided to reduce their emissions of greenhouse gases collectively. This could enable voluntary commitments to become the first step towards a binding international regime to address the emissions of greenhouse gases. This could make so-called voluntary commitments sound like an appealing option.

A voluntary emission trading scheme is also advocated by ICAO, where it is suggested that the allocation could be based upon short term voluntary commitments. If these were implemented it would mean that if the airlines are not in compliance, enforcement may be simplified, e.g. by limiting access to the emission market. One may however object to this scheme as it is not sure how companies would dare making long term investments bearing the length of the commitment in mind, as it is likely that they would avoid investing in new technology when it is not considered necessary.

As the goal is clear (reduction of greenhouse gases), and some of the larger stakeholders (such as organisations of airlines and groups of states) have indicated that they are ready to move forward. If the voluntary standards could be connected to a market mechanism, it is possible that this could act as an additional incentive for airlines to take on commitments. There is already an interest on the part of airlines to take on voluntary commitments. This provides the possibility for more flexible regime, where they still will be able to fulfil their commitments by purchasing emission rights or credits. Today, airlines may be trying to identify the measures that would suit them the best to avoid the implementation of taxes and charges.[136] States may also be a part of the driving forces of this development. For example, both the United Kingdom and Japan has been very active in the abatement of global climate change.[137] Here the actions taken by e.g. the British airlines and the group of Nippon airlines may be an indication of how important an active state is for private initiatives.

[136] As described by Klaus Conrad: *Voluntary Emission Agreements vs. Emission taxes* in Strategic Trade Models in Environmental and Resource Economics, 2001, vol 19 no 4 pp 361-381

[137] See e.g. The UK Department of transports white paper *on the future of air transport* as accessed on April 3, 2004 at http://www.dft.gov.uk/aviation/whitepaper/ on file with author and the Japanese National Communication (to the UNFCCC secretariat) as accessed on April 3, 2004 at http://unfccc.int/resource/docs/natc/japnc3.pdf on file with author which shows that the Japanese Government is implementing a lot of policies to combat global climate change; e.g. the development of new technology for aircraft(see p 122).

As airlines are capable of determining if they are capable of taking on commitments or not, it becomes simpler to give special consideration to developing countries. However, it is possible that airlines are pressured into commitments, without being capable of honouring these.

Voluntary commitments may be a means of preparing airlines for a binding emission trading regime, where they can build their understanding and capacity to accomplish emission reductions in this kind of environment. However, it requires the participation of stakeholders as well as a good and thorough negotiation process. Due to the nature of voluntary commitments, they have to be clearly defined for airlines. The compliance regime has to be designed in a way that there is a credible regime that can force real emission reductions.

8 CONCLUSION

Today, the discussions of reducing the emissions originating from international aviation are very focused on creating a market for emission trading; and different international organisations dealing with climate change seem to agree that emission trading would be a suitable method for emission reduction, as it accomplishes the emission reductions in an economically efficient manner. By nature, allocation can create initial competitive advantages, depending on what they are based upon. If the states would distribute the emission permits to the airlines, it would be appropriate that the decision on what the allocation should be based upon should be decided at the international level in order to prevent any regulation of the market. It will also be hard to determine how much emission permits each state should be allocated.

Nine different allocation methods were examined, and these have shown to have both advantages and disadvantages. Benchmarking is based on relative emission standards, and is therefore also addressing the challenge of how to allocate emission permits. Credit trading would require the emission reductions to occur and become certified before any trading can occur. However, relative emission trading schemes normally do not seem to go beyond technological solutions

In order to move towards a more sustainable development in the field of aviation, it is import to target all means possible of accomplishing emission reductions. An emission trading system of cap and trade offer many possibilities for allocation methods. The more common ways of allocation today is through grandfathering and auctions (or a combination hereof). Grandfathering based on historical emissions could make it more difficult for new airlines to access the aviation market. Grandfathering could also be based upon the nationality of the airline, but this could mean that there is an incentive for airlines to fly the flag of convenience. Allocation based upon where the fuel is sold could in turn mean that the aeroplanes choose to purchase their bunker fuels in the state where it is cheapest and where no standards apply and thereby may take a longer route. There is also the possibility of implementing a cap and trade system based upon the nationality of passengers and cargo, or based upon the state of arrival/departure, which may promote equity to a greater extent than the other discussed above.

It is important to bear in mind that the emission trading regime for international aviation has to exist in an international environment, which in itself poses challenges in regards to implementation and compliance. As airlines today are collectively taking on different kinds of commitments, it would seem as if voluntary commitments would be the simplest way of moving forward (although the benefits of this could be doubted). A voluntary system could provide with means for airlines to build their capacity in regards to emission trading. This kind of regime would also grant airlines originating in developing countries the possibility of standing outside of the regime.

However, a cap and trade system based on the participation of states would most likely grant the most efficient and equitable system if the allocation of emission permits would be based upon the state of departure and the state of arrival sharing the responsibility for the emissions. This would also allow regions, such as the EU, to move ahead without jeopardising the possibility for airlines to compete on the regional market.

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