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Reducing the Impact of Aviation on Climate Change.

**Economic aspects of inclusion of the aviation sector in
the EU Emissions Trading Scheme**

Briefing Note

(IP/A/ENVI/FWC/2005-35)

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KEY POINTS

1. As a result of the recent and projected future increase in greenhouse gas emissions (GHG) from the aviation sector, action to design a framework incentivizing industry to reduce these emissions should be a political priority.
2. According to recent studies, inclusion of aviation in the EU Emissions Trading Scheme (ETS) by 2012, with an initial allocation based on 2008 emission levels, is unlikely to affect substantially the demand for credits in the ETS, or the carbon price.
3. Design options significantly affect the cost to the aviation industry of the measures, notably grandfathering versus auctioning. Intra-sector competitiveness impacts are likely to be more pronounced than concerns about effects on other sectors.
4. The requirements of the Emissions Trading Directive have required a steep learning curve for current sectors, which will be even more true for aviation, which has less experience with similar regulation. Sufficient thought would have to be given to the technical underpinnings of the system to facilitate integration.
5. If there current moment toward implementing an emissions trading system for aviation in the first Kyoto period 2008-2012 is insufficient to lead to agreement to do so, it could be more realistic to consider a post-2012 system. However, were this to be the case, then much of the work done to date predicting the economic impacts is likely to be irrelevant: far from being a minor addition to the system with little effect on price, aviation could be a major inclusion, given emissions growth rates.
6. If the introduction of a system for aviation happens late in the 2008-12 period, or later, incentives may be created for airlines to put off fleet renewal or efficiency improvements until after the introduction of the system. Interim measures need to be taken to avoid this downward spiral.

POLICY BRIEF FOR THE EP ENVIRONMENT COMMITTEE

IP/A/ENVI/FWC/2005-35

Reducing the Climate Change Impact of Aviation: Economic aspects of inclusion in the EU Emissions Trading Scheme

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1 INTRODUCTION

Aviation's greenhouse gas emissions in Europe are rising at a rate of around four per cent per year, while emissions from most other activities (outside of transport) are falling. Even though aviation's share of overall EU greenhouse gas emissions is still modest between 1990 and 2003 international aviation emissions in the EU-25 rose 73%, while total GHG emissions fell 5.5% (Akermann, 2005; CE, 2005). If growth in international aviation continues as projected, the increase in emissions from EU international aviation could offset more than a quarter of the Community's 8% reduction target under the Kyoto protocol (European Commission, 2005). Predictions say air traffic will double by 2020 when compared to the numbers of 1998 (Eurocontrol, 2006).

It has been difficult to tame aviation emissions for two reasons: first is that it is an international activity whose common measures are coordinated by the International Civil Aviation Authority (ICAO) as a specialised agency of the United Nations.¹ Recognising the authority of ICAO in this area and the difficulty of devising an appropriate international instrument for the sector, the Kyoto Protocol excluded international aviation from its reach. Even though ICAO discussed publicly voluntary mechanisms, emission charges as well as emissions trading, unfortunately it has overall not been proactive in tackling the issue, and greenhouse gas (GHG) reduction policy has been sidelined. The European Union, being made up of many countries with strong ties of commerce and leisure, has a significant amount of international air travel, making the exclusion from Kyoto a major loophole.

The second reason is the rise of low-cost carriers and the growing expectation in society that travel needs, particularly for leisure, can be met by cheap flights. While old 'legacy' carriers have suffered financially of late, particularly following September 11, 2001, upstart no-frills airlines have boomed, and changed the landscape of the industry.

Recognising that an unchecked aviation industry places GHG mitigation efforts at risk, the European Commission and many others have devised plans to limit emissions from the sector. The preferred option for the Commission, as outlined in its Communication (COM (2005) 459), is to include aviation in the EU Emissions Trading Scheme (ETS). It views this as the most economically efficient and politically attractive course of action compared to other options, such as emissions changes or departure taxes.

While much has been written about both emissions trading and the opportunity to include aviation in it, there have been few comprehensive studies analysing the effect of such a course of action for the EU ETS in any economic detail. The main effort was carried out by CE Delft (2005) for the Commission, and is complemented by CE's work previous to (2002) and since that paper (2006).

¹ Article 2 (2) Kyoto Protocol: 'The Parties included in Annex I shall pursue limitation or reduction of emissions of greenhouse gases not controlled by the Montreal Protocol from aviation and marine bunker fuels, working through the International Civil Aviation Organization and the International Maritime Organization, respectively'

A second study analysed CE's results (ICF, 2006) and used a different modelling approach to come to its own conclusions.

This paper reflects the results of those two papers (CE Delft, 2005 and ICF, 2006), adding insights where appropriate from work on specific aspects of emissions trading system design, and the effect on industry, particularly within the aviation sector. It is a very large subject with many possible avenues to explore: the issues covered are those requested by the European Parliament in the terms of reference agreed with IEEP and Ecologic, focusing on economic impacts of specific aspects of system design, ie:

- System design factors that influence the cost of CO₂ allowances;
- Volumes of credits potentially traded between aviation and other industries;
and
- Pros and cons of a stand-alone system for aviation, compared to an integrated system.

2 SYSTEM DESIGN FACTORS INFLUENCING COST OF CO₂ ALLOWANCES

Many choices would have to be made in the design of an emissions trading system that includes aviation. These options have the potential to affect the price of CO₂ allowances on the market: anything that tends to require more mitigation effort of the sector, or make purchases on the market either more necessary or attractive, will increase allowance prices.

Relevant factors with potential to influence allowance prices include the following:

- *The choice of allocation methodology* – the options vary between giving the sector the allowances without charging for them, to charging for each allowance allocated. Typical methods of allocation free of charge are grandfathering and benchmarking. On the other hand, allowances can be auctioned, so that industry has to pay for their allowances. Further, the aviation sector can either be offered new allowances, or be required to buy allowances already in the system – the latter would clearly cause price rises. This issue is explored in more detail in Section 2.1.
- *The amount allocated* –the overall amount of credits allocated to any sector has obvious implications for allowance prices (see Section 2.3).
- *Choice of base period or benchmark reference* – grandfathered allocations need to have a period to refer to. The chosen years are crucial for the amount of allowances allocated. Thus, basing the allocation on years with higher emissions will create a lighter burden than those based on low emission years (see Section 2.3). When benchmarks are chosen for allocation, the way of establishing benchmarks, the data a benchmark is based upon and the type of benchmark can also have a crucial influence on the stringency of allocation.
- *Accounting for non-CO₂ climate impact* – CO₂ is only part of the climate impact of aviation – contrails, cirrus clouds, NO_x are also damaging factors, though by how much is a difficult calculation. It may well be that allowances covering double or more of the emissions of CO₂ should be required of aviation operators to account for all of the climate relevant factors. This higher burden on the aviation sector (if not reflected by a higher amount of allowances allocated to it) would obviously affect the market price for allowances.
- *Interconnection with the Kyoto allocation* – as international aviation is currently outside of the Kyoto system, it is an open question as to how to ‘create’ allowances. Allowances in the ETS are backed by ‘assigned amount units’ (AAUs) held by the relevant Member State. If a set of non-AAU-backed allowances were created for aviation, then sold into the other sectors, there would essentially be an inflation of the assigned amount, which would not be recognised by Kyoto. The range of options to avoid problems is explored in detail in CE (2005). One option would be to have a closed aviation system with no interaction with the rest of the ETS. Another one would be not to assign ‘new’ allowances but force aviation to buy only AAU-backed allowances: this would obviously increase demand in the market significantly.

- A third option would be to allow the aviation industry to buy allowances from other sectors but not to sell its own allowances (semi-open trading).. Perhaps the easiest solution is to allow free trading between aviation and existing EU ETS sectors but where allowances from the aviation sector are not counted as AAUs (see Section 4).
- *Timing of introduction into the EU ETS* – the basic assumption of all of the work on the issue to date is that aviation would be included in the EU ETS prior to 2012. All of the economic calculations are relevant to the 2008-2012 commitment period. However, given the difficulties of designing, agreeing and implementing any emission trading regime for the aviation sector by then, it seems more likely at the moment that ET will be a post-2012 activity in the aviation sector. The later it is included, the higher emissions will be in aviation and (hopefully) the lower the emissions in other sectors. What this means for the market is explored in more detail in the conclusions.

The first three of these design factors are explored in more detail below.

2.1 Initial allocation methodologies

The CE Delft study lists five main options for allocation:

1. Grandfathering (based on historic emissions).
2. Benchmarking (allocating according to an emissions factor, such as the industry average, the industry leader, best available technique (BAT) etc.)
3. Auctioning (buying all allowances needed).
4. Baseline (establishing an agreed level, for example, the emissions of a particular year, where only emissions beyond this baseline need to be covered by allowances). It should be noted though, that even though the CE Delft study mentions it as a allocation method² this system is not fully compatible with a cap-and-trade system like the EU ETS, as reducing emissions below the baseline level does not create saleable allowances.
5. No allocation (the aviation industry simply has to buy the credit it needs, which would lead to results similar to auctioning but which does not boost the number of allowances in the market).

A ‘sixth option’ is to use a combination of the above: for example, grandfathering a portion of allowances, but auctioning the rest³.

Options 1-3 deal with *how* allowances are distributed between entities, while the total amount of allowances to be allocated has to be determined in a separate step (see Section 2.3). For all of these options the amount allocated could be the same. But again, it has to be kept in mind that with auctioning (and no allocation) additional sector-specific credit volumes are not allocated for free (or, not at all). They therefore have to be purchased during the auction (or on the market).

² CE Delft (2005), p. 3.

³ The Emission Trading Directive allows up to 10% auctioning for the second trading period; if auctioning were used in other sectors as well, full auctioning within the aviation sector might overstep the national limit. However, as aviation is less than 10% of each Member State’s emissions, were no other sectors to use auctioning, aviation could use full auctioning.

In case of grandfathering or benchmarking the amount allocated for free could, but does have to be the same for all of the other methods, depending on the choices made.

2.1.1 *Windfall profits due to allocation methodology*

In the following, discussions of impacts of different allocation methods will be limited to the first three options. This reflects the importance of these three options as “real” allocation methods. There will be a focus on auctioning versus grandfathering, as those are the options mostly used and easiest to apply in the EU (though especially grandfathering poses major challenges given the need for historic data).

It is important to distinguish between the effect each of these options would have on costs *to the aviation industry* (allocation free of charge via benchmarking or grandfathering, as opposed to auctioning) compared to costs of CO₂ allowances *in the EU ETS*, were aviation to be integrated with other sectors.

The CE study found that under scenarios where allowances are allocated for free compared to one where these allowances were auctioned, the amount of credits subsequently purchased in the market during the trading period was roughly similar, and hence the price effect on the carbon market is the same. However, with auctioning, the sector had to pay between approximately €1 billion and €3 billion to buy the initial allowances. The impact of this expenditure on the industry depends on two factors: whether this revenue is recycled back to the operators in some way; and whether operators are able to pass costs through to customers.

Conversely, free allocation creates the opportunity for windfall profits: Operators might increase their prices to cover the increased marginal cost due to the cost of allowances purchased beyond their initial allocation. But because initial allowances are allocated free of charge, operators are earning increased revenue across their entire sales rather than simply the proportion of credits that had to be purchased in the market. This problem of windfall profits has happened in the European energy sector where the value of allowances has been considered as opportunity cost in the price calculation – even though the allocation was free of charge. This phenomenon has vexed heavy electricity users faced with prices increased by the marginal cost of credits across all sales.

When comparing an auctioning versus grandfathering approach, EFTEC (2004) determined that while emission reductions, passenger demand and technology improvements were the same under auctioning or grandfathering (with retention of windfall profits), the industry would lose €200 million in the first case, but earn €10.8 billion in the second. Should the airlines not pass on marginal costs but rather average costs of permits and thus not earn full windfall profits, the ironic result is that not only do they earn less money (€200 million), but there is less reduction in emissions in the sector, because passengers do not face as high a rise in ticket prices, and thus demand is cut by much less.

2.1.2 *Distribution effect of Emissions Trading*

Differences among airlines mean there is very likely to be a *distribution effect* of the ETS – while recent reports primarily reflect net changes, a look in depth shows that some airlines will be more affected than others. The relevant issues are:

- Low-cost carriers have far more leisure travellers who are more price sensitive, and tend to have only one class of service. ‘Legacy’ carriers (BA, Air France, etc.) have more business and first class travellers, who are not only less price sensitive, but to whom more of the price burden can be shifted, to avoid losing leisure travellers (Trucost, 2004). Studies show, however, that the effect on ticket price will be minimal, and hence the elasticity effect should not be overestimated (CE 2005 shows a range of increase between €0.40 and €0, with most estimates on the order of one Euro).
- Airlines with older fleets will have the opportunity to make big efficiency improvements with new aircraft, which those with younger fleets will not be able to do⁴. Low-cost carriers tend to have newer fleets. Under grandfathering, there is then the possibility for a big reduction from historical emission levels; this phenomenon is not as relevant in case of benchmarking or auctioning.
- Legacy carriers have in some cases seen a drop in passenger traffic since 2001 and could therefore stand to earn ‘free’ allowances under a grandfathering approach if the base period includes years prior to the drop in business. Low-cost carriers, on the other hand, are growing very rapidly and are likely to continue to do so in future – they will face both allocation deficits and problems of handling growth if the allocation scheme does not account for growth.

On balance it seems low cost carriers are more likely losers in emissions trading; of course it is their growth that is largely responsible for the sharp rise in airline emissions.

2.1.3 *Intermediate result*

The decision of allocation option thus would seem to have little effect on the overall system in terms of allowance prices and volumes to be bought on the market, though some options are more favourable to some carriers than others. The characteristics of the three main options are:

- *Grandfathering* will give the opportunity for windfall profits to the industry (which may or may not be realised, as noted above), and complicates the issuance of allowances for new entrants, who do not have historical emissions to serve as a base period (in this case, carriers with historic emissions could receive allowances via grandfathering, whereas new entrants could face benchmarks. Furthermore, grandfathering is based on historical data.

⁴ Aircraft can have a useful operational life of 30 years.

This leads not only to a considerable administrative burden of collecting and validating the data which have not yet been collected, but leads also to the problem of justifying the chosen base-period, that is: which, and what number of, years should be chosen and how will untypical emission amounts in these years for certain companies be considered. Furthermore, without an adequate early-action-rule grandfathering tends to reward 'late-movers'.

- *Auctioning* is held to be the most economically efficient method with the least transaction costs but will yield significant costs to industry as the allowances are not allocated free of charge; these could be offset by passing costs on to consumers, which will, depending on the elasticity, reduce demand ; the industry views this option much less favourably than grandfathering, where they *may* stand to earn rather than lose revenue.
- *Benchmarking* would reward early action and can provide an equitable basis for allocation; the effect would of course depend on the level set. But to agree on the kind of benchmark (e.g. best available technique or average), set the level and collect the necessary data for it still poses a major challenge in the sectors currently using this approach in the EU ETS. Benchmarking is similarly likely to pose a challenge in the aviation sector. For new entrants, the benchmarking approach is already being used in the existing EU ETS in most Member States. As new installations/aircraft are usually based on the most efficient technology a benchmark system could be appropriate allocation method for them.

2.2 Aims and Special Challenges for the Aviation Sector

The main aim of introducing any ETS is to reach an overall reduction of GHG emissions in an efficient way. Beside this guiding goal, aims that need to be balanced with the choice of allocation methodologies are:

- Acceptance, and hence political feasibility, of agreeing the scheme;
- Burden on the industry (or windfall profits on the other hand);
- Burden on passengers;
- Decreasing the demand for flights;
- Rewarding early action;
- The incentive for technology innovation; and
- An impartial and equitable approach across operators and for new entrants

The current ETS covers installations/facilities, not entire companies (though all installations of one company might be covered). If aviation operators (airlines) were the entities relevant for the allocation in the ETS, there would be a paradigm shift in the meaning of a 'facility'. The implication is more noticeable when examining how to handle new entrants. If an existing power plant produces (and thus emits) more than in the base-period, it will nevertheless not receive further credits. It must buy them on the market. A new power plant, though, is dealt with through new entrant reserves, generally granted for free on a benchmarked basis. But while we are unlikely to see many new airlines, some airlines will be growing more strongly, adding planes and routes. If the allowances were allocated not to planes as "facilities" but to the aviation companies, the growth of the airline might be seen like a production increase of an installation.

No extra credits would be allocated. If this kind of growth were considered like a new entrant, though, the company might be entitled to receive additional allowances. In this case again, it has to be decided if the allocation should be free of charge. Free allocation to such growth seems contrary to the general incentives the ETS is designed to put in place. An auctioning approach would be even-handed, while setting incentives to reduce GHG emissions.

Another important factor is whether a centralised allocation is undertaken, coordinated at EU level, or whether Member States perform the allocation themselves and can make a independent (though maybe guided) choices regarding the allocation method, as they did establishing their National Allocation Plans for the existing EU ETS. In the second case, it is possible that if all Member States use benchmarking, for example, they simply apply different benchmarks. The inequity and conflict this would lead to have led to frequent calls for not just harmonised methodologies, but for a centralised allocation system; however, it remains to be seen whether this is politically feasible. The same argumentation with similar logic did not carry far in the original design of the EU ETS for other sectors, with widespread dissimilarities and distortions as a result. Given greater homogeneity than other sectors, the distortions would likely be more pronounced in aviation.

2.3 Amount of initial allocation and choice of reference period for calculations

The prerequisite for a functioning emissions trading system is the ‘cap’ on emissions – a quantitative target for the total amount of carbon emitted overall or, as in this case, by an individual sector. This cap is reflected in the total amount of allowances issued at the beginning of the trading period.

2.3.1 Impact on the aviation sector as a whole and on the EU ETS market

Both the CE and ICF studies take 2008 emission levels as the reference for their quantitative impact analysis. This means that in the respective scenarios,

- either the amount of allowances initially grandfathered or auctioned to aircraft operators is equivalent to the total 2008 emissions of the aviation sector, or
- the aviation sector has to buy allowances for all emissions that exceed this historical baseline.

If the quantitative emissions target for the aviation sector were derived from an earlier reference year, e.g. if stabilisation of emissions at 1990 levels or even a Kyoto-type reduction of 5% compared to 1990 emissions were envisioned, the aviation industry would have to buy a much greater amount of allowances, so that the effects both on costs incurred by the sector and on carbon prices might be considerably higher than those found by CE Delft (2005) and ICF (2006)⁵. However, no quantitative data are available at present as to the effects on allowance prices of different reference years or reduction targets for the aviation sector. Further research would be needed to assess the consequences of different initial allocation amounts in detail.

⁵ The Öko-Institut (2004) points out that given the enormous growth in aviation, caps based on 1990 or even 2000 levels could only be implemented using an open trading system, since in a closed system this would be equivalent to a drastic restriction of international air transport.

2.3.2 Impact on intra-sector competition

The choice of base year for allocation is particularly relevant when grandfathering or when baselines are chosen as the allocation methodology. There are two main factors at issue: variability; and trends, including early action.

Emissions are variable year to year, so choosing a single base year may yield a number that is exceptional, and hence a bad basis for allocation. A better approach would be to take the average of a period of perhaps three to five years. In the UK ETS, the four years with the highest emissions are chosen over a five-year period.

The second factor is how recent a base year period to choose. The older the base year, the more reward there is for companies that took action in the interim, or which have seen a downward trend in demand – choosing a more recent base year simply provides those who have done nothing, or which have been on a growth trend, with more credits.

In the benchmarking case, while not a ‘base year’ issue as such, the quality and reliability of data used to calculate the benchmark is relevant. The CE report notes that data on Revenue Tonne Kilometres (RTK), which is the standard metric used to help calculate the benchmark, has not been independently verified in the past. More recent data may have a greater chance of being more reliable.

An example of the effect of base year is shown in Table 1. The emissions from three major airlines are shown over a recent five-year period. Three options are shown for allocation: choosing the most recent year, in which case there is no gap between current allowances and current emissions; choosing a base year of 1998, in which case BA has over half a million tonnes of excess allowance, given the drop in its emissions, whereas SAS has a rise of over 300,000 tonnes; and an approach taken in the UK emissions trading system, which takes an average of the top four years’ emissions in the previous five year period – in that case the extremes are somewhat reduced.

Table 1: The effect of the choice of base year on allocation: an example of three carriers and three options for allocation (adapted from Trucost, 2004)

Airline	Emissions (KT) in year					Difference between 2002 emissions and ...		
	1998	1999	2000	2001	2002	Most recent year	Five years ago	Average of top four
BA	3,558	3,481	3,426	3,156	3,030	0	-528	-375
KLM	935	955	945	948	918	0	-17	-28
SAS	875	874	903	1,039	1,209	0	+334	+202

The implications for the airlines are clear: an allocation of half a million tonnes above its emissions gives BA assets on hand of €15 million, at current carbon prices – clearly preferable to other options, from their perspective. Growing airlines, on the other hand, face a shortfall, as SAS does in this case.

Of course the effect is static, not accounting for future growth – SAS could stagnate while BA grows tremendously, for example. However, having assets in the form of excess carbon allowances gives real financial benefits and potentially more flexibility for carbon management – conceivably providing a fund for efficiency investment, for example. The second factor not considered here is whether, for example, despite having a tougher allocation SAS has an old fleet ready to be replaced by new, efficient planes, such that it has an easier time limiting emissions during the commitment period⁶.

In terms of the total amount of allocation in the above example, which affects the sector's likely demand for credits on the market, and hence market price, there is no clear trend, as winners and losers tend to balance each other out. The total allocation to these three airlines based on a base year of 2002 is 5,157 Kilotonnes (KT), based on 1998 it is 5,368 KT, and using the averaging method it is 5,167 KT. As noted at several points in this report, the choice of allocation method is relevant more to intra-aviation competitiveness effects than to the impact on the market.

⁶ The example is purely illustrative, as in 2002 BA and SAS had exactly the same fleet age – 7.5 years (Trucost, 2005). At the time, however, Ryanair's fleet was 17.8 years old, and on the point of replacement, making it an interesting case.

3 VOLUMES OF CREDITS AVIATION MAY BUY AND THE IMPACT ON OTHER INDUSTRIES

How much credit aviation will have to buy on the ETS depends on design, external factors, and market conditions. The design factors, noted in section two above, are:

1. The initial allocation methodology;
2. The amount allocated and the choice of base year;
3. Whether non-CO₂ effects are taken into account; and
4. How interconnection to account for AAUs in the Kyoto system is done.

In addition to these system design issues, there are of course factors outside the system that will have a large effect on the reduction effort needed and the price of allowances. These include such things as:

1. If the Clean Development Mechanism (CDM) and Joint Implementation (JI) begin to pick up the pace of credit delivery, or if they remain mired in start-up difficulties;
2. Higher gas prices will affect the relative use of gas and coal power, with the latter requiring more carbon allowances; current gas prices are high, so a fall in future could relieve some of the carbon price pressure;
3. Timing of nuclear phase out in Germany – if delayed, there could be reduced demand for carbon credit; and
4. Suppression of air transport demand through fears of terrorism or other external factors – this is not out of the question, though seemingly unlikely to divert the current trend over long time spans.

These factors are discussed in several recent reports, as follows.

3.1 Recent studies indicate little effect on market price

Current allocation in covered ETS sectors is around 2,200 MT CO₂. This compares to between 52 MT (for intra-EU flights only) and 162 MT of CO₂ emitted by flights originating in the EU or flying through its airspace (i.e. the maximum possible accounting of aviation emissions in the EU) (CE, 2005). Hence, aviation will add between 2% and 7% of the total emissions of the ETS (accounting only for CO₂), with the likely level of coverage (perhaps EU departures only or EU airspace only) somewhere in between. Thus while aviation is an important and growing sector, at current levels, and given the choice for a coverage approach accounting of less than 100% of the possible amount, and not accounting for anything other than CO₂, it is not a massive addition to the ETS.

In their analyses of likely environmental impacts of the inclusion of aviation into the EU ETS, CE (2005) and ICF (2006) come to the conclusion that under a range of possible scenarios, emissions would be reduced by between 20 and 26 Mt CO₂. Under all scenarios of the CE Delft study, the larger part of these emissions reductions is delivered by non-aviation sectors, allowances being purchased by aviation entities, while only between 1.5% and 25% of reductions are achieved within the aviation sector. The ICF study, by contrast, calculates that approximately 50% of reductions would be achieved by the aviation industry (Table 2).

Table 2: Reduction needed by 2012 in the aviation sector and additional demand in the EU ETS (MT CO₂) under a range of ET systems designs and future carbon prices, in CE (2005) and ICF (2006)

<i>coverage</i>	CE (€10)		CE (€30)		ICF	ICF (€ €1 and €21)
	Reduction in 2012	Bought in ETS	Reduction in 2012	Bought in ETS	Reduction in 2012	Bought in ETS
Intra-EU	20.3	19.9	20.0	19.3	20.6	10.12
EU departure	25.9	24.8	25.9	22.7	25.9	12.72
EU airspace	22.7	20.7	22.7	17.1	22.7	11.14

The basic design options considered relate to the coverage of the system; both studies consider the same three options: covering only flights from one EU country to another (intra-EU); covering flights that depart from the EU even if they then go outside the EU (EU departure); and flights that cross EU airspace (which for obvious reasons will overlap heavily with the previous one).

Although not reflected in this table, there are other design options chosen along with each of these: the CE study, for example envisages three different allocation methodologies, and a multiplier in the first case for non-CO₂ impacts. The ICF study produces potential future credit price scenarios that depend on analyses of a range of external factors, including gas prices, the amount of CDM and JI credit available to the system and the timing of German nuclear energy plant closures.

As can be concluded from Table 2, little demand from aviation is to be expected on the market – aviation would buy allowances for between 10.2 and 24.8 MT CO₂. This amounts to in the order of 0.5% to 1% of the current total supply of allowances under the EU ETS. The conclusion drawn is that there will be little impact on the system. Despite all of the system design differences, after all of the analysis that has been done, the bottom line is that none of the scenarios yields differences in outcomes on a scale that is likely to have an impact on the market. Interestingly that means that even considering potentially major factors, such as future fuel prices, whether the scheme covers EU or international flights, whether or not there are many CERs available for purchase, and a range of carbon market prices from €5 to €30 in the two studies – the net effect is very small.

3.2 Reduction in aviation versus purchases on the market

The demand for credits aviation would create in the market depends fundamentally on whether reduction commitments are met by action within the sector (whether through higher prices suppressing demand, or technology and practice shifts), and how much is purchased on the market. More autonomous effort means less demand in the market.

ICF criticised the approach taken in the CE study as not going into sufficient depth to examine abatement options within the sector. While conclusions about the amount of abatement needed to meet obligations are the same (as in Table 2, above) ICF finds that under a range of possible credit prices and system design options, the amount of credits to be purchased on the market varies between 10.12 and 12.72 MT. This is about half that foreseen by CE, meaning that much more is being reduced in the sector.

A recent report by the Science and Technology Sub-Group of the UK Royal Aeronautical Society (RAS, 2005), on opportunities for greening air travel, concurs with these results. It concluded that there are 'some operational measures [that] may be capable of providing benefits across the whole fleet in a matter of years rather than decades.' For example, the report quotes an International Civil Aviation Organisation (ICAO) circular of 2001 that identified changes to CNS/ATM⁷ systems that have the potential to deliver fuel savings of up to 5% by 2015 in the US and Europe and even greater savings in the longer-term. Hence, the industry appears to recognise that there are measures that can be taken in the relatively short-term to reduce aviation's emissions. It is not clear from this what the cost implications of such measures might be, but this suggests that the marginal cost of taking action in the aviation sector might be rather lower than the 'received wisdom' might lead one to suppose.

That there are near-term reduction opportunities in aviation is a very important conclusion to bear in mind when considering the timing of the sector's inclusion in the ETS. While most analysis considers options prior to 2012, it may be unrealistic to achieve by that time. Any later inclusion might then miss the short term opportunities just noted. The implications are explored further in the concluding section.

⁷ Defined by ICAO as 'Communication, Navigation and Surveillance systems... including satellite systems ... applied in support of a seamless global Air Traffic Management system.'

4 PROS AND CONS OF A STAND-ALONE VERSUS INTEGRATED SYSTEM

The principal difference between a stand-alone (or closed) system and an integrated (or open) trading system is whether allowances or permits generated within the aviation sector can be traded with those generated by other sectors: a closed system allows no such trading, while an open system does.

4.1 A closed system is likely to be less economically efficient, but guarantees change in the aviation sector

The principal report undertaken for the European Commission on aviation and emissions trading does not explore the option of a closed system compared to an open system, as its objective was explicitly to explore how aviation might be included in the EU emissions trading Directive (CE Delft, 2005) – i.e. it assumed an open system. In a more recent report, the same authors did briefly discuss the possibility of introducing alternative versions, either a ‘cap and trade’ or a ‘baseline and credit’, of a closed international emissions trading scheme for the aviation sector (CE Delft, 2006). They argued here that a closed system would leave little flexibility to reduce emissions, as mitigation measures in the aviation sector are relatively expensive, hence, ‘an open system may be more cost effective’.

Arthur Andersen (2001), in a report for the aviation industry, also argued that an open system had broad political support and was better than a closed system for a number of reasons, including:

- An open system is *‘far more economically effective’* than a closed system. The report argues that, in terms of economic efficiency, a trading system should ensure that most emission reductions occur outside of the aviation sector – aviation would be expected to be a net buyer of credits, as ‘its internal abatement costs are likely to be higher than the expected market price’.
- The *cost of credits* may be between 10 to 20 times higher under a closed system than in an open system, particularly if the cap is set to reduce emissions relative to 1990 levels.
- *Price volatility* in a closed system is likely to be higher than in an open system.

Consequently, the report argues that a closed system would increase the cost of air travel and curtail the growth in demand in the sector. Deloitte (2005) came to a similar conclusion, i.e. that a closed system would be less economically efficient than an open system. In addition, they estimated that the trading price in a closed system would need to be several times higher than in an open system to achieve the same level of reductions.

The Öko-Institut (2004) on the other hand argue that a closed system is able to ensure – depending on the choice of cap – that efforts are made to reduce emissions from aviation, whereas an open system is not able to ensure this, as emission rights can be bought from other sectors. Further, they argue that the administration of a closed system would be comparatively simple, as compatibility with the requirements of other trading systems, such as those of the EU ETS, would not have to be ensured. In addition, the fact that international aviation is not covered by the Kyoto Protocol would not have to be addressed within a closed system (as noted in Section 2). On the other hand, they agree with other authors that an open system would be more economically efficient than a closed system, as the ‘marginal avoidance costs of emission reduction measures in aviation ... are high compared to other sectors’. In other words, it is expensive to reduce aviation’s emissions, and hence, in a closed system, it is likely that the main way of reducing emissions would be to reduce the number of flights. They note that the cap for aviation in an open system can be set at a more ambitious level, as the sector could buy allowances from other sectors, thus improving market liquidity.

In addition to discussing the pros and cons of open and closed systems, Öko-Institut proposes a third option – a half-open system. In this alternative, emission rights from trading schemes within the Kyoto system, such as the EU ETS, would be recognised in the aviation sector, but emission rights from the aviation system would not be able to be used in Kyoto schemes, such as the EU ETS. The advantage to this scheme would be that, as a likely net buyer, aviation would still be able to buy emission rights from other sectors, thus minimising both costs and losses in efficiency, without the need to ensure complete compatibility with the administrative requirements of a Kyoto scheme. The authors refer to a half-open system as a ‘safety valve’, which would enable participants in aviation trading to purchase emission rights from participants in the EU ETS if this proved to be more cost-effective than reducing aviation’s emissions.

4.2 The cost of mitigation within aviation may be overestimated

Most commentators agree that an open system is economically more efficient than a closed one, because it increases the opportunity to make reductions where it is cheapest to do so. This is certainly true provided that the market is working effectively; but the discussion elsewhere in this document raises some difficulties that might arise in integrating aviation into the ETS at an early stage, and hence it could be argued that flanking measures or a closed system in the initial phase might be preferable.

In most cases the existing literature also takes it for granted that mitigation measures in aviation are more expensive than taking measures in other sectors, and hence that a closed system for aviation would be significantly more expensive than an open one. Clearly some of the technological design of aircraft is likely to be only a long-term proposition, which is likely to be expensive. However, there may well be other short term and operational savings available that might be significantly cheaper than this (as noted in Section 3.2).

Furthermore, given that by 2013, were aviation only by then included in the EU ETS, other sectors covered by the EU ETS will have had eight years of regulatory pressure to reduce their carbon dioxide emissions, it is likely that the cheapest options in these industries will have been exhausted by then. Hence, it is by no means certain what the situation in 2013 might be and there appears to have been little comprehensive analysis to show that it will be likely that by then measures to reduce aviation's emissions will still be more expensive than those of other sectors.

5 CONCLUSIONS

It is important to underline that, as a result of the recent and projected future increase in the emission of greenhouse gases, mitigation efforts have to be a political priority. The preferred policy instrument currently being discussed at the European level is emissions trading, which has been the focus of this briefing.

Recent studies have analysed a range of design options for including aviation in the ETS, as well as considering the effect of both trends in other sectors already covered by the ETS, and energy market conditions. The net result indicates that for inclusion of aviation by 2012, with an initial allocation based on 2008 levels, under the tested design assumptions there is likely to be little impact on the demand for credits in the ETS, and aviation is unlikely to affect the carbon price significantly.

Design options significantly affect the cost to the aviation industry of the measure (e.g. grandfathering versus auctioning), and there is the possibility for large difference in competitive advantage within the industry (e.g. depending on the choice of base year and whether different Member States apply different allocation rules). Further, examination of reduction options within the aviation sector leads to different conclusions about how much abatement would take place within the aviation sector itself versus the purchase of carbon allowances.

These results indicate that options exist to include aviation that may not significantly perturb the system, leading to a politically acceptable course of action. Nevertheless, it is important to note that there are significant concerns with the approach taken by all of the work to date: two of the most important are the practical feasibility of introducing the system, particularly an integrated one, and the implications for the timing of the introduction of aviation into the scheme.

It should be underlined that Phase I of the EU ETS, which runs from 2005 to 2007, is effectively a trial run for Phase II, which is to run coincident with the Kyoto Protocol commitment period. This was considered to be important so that the operators and regulatory authorities could gain experience with the practical aspects of the scheme to ensure that it ran smoothly in Phase II. In spite of the considerable existing experience of the regulatory authorities in regulating the installations included in Phase I of the scheme (e.g. through legislation, such as the IPPC Directive⁸), the different requirements of the emissions trading Directive have led to a steep learning curve⁹.

This knowledge can be passed on and shared with the relevant players in the aviation sector. Nevertheless, given that there is little existing experience of regulating the emissions of airlines, it is likely that the learning curve for the competent authorities responsible for overseeing the participation of airlines in an emissions trading scheme is likely to be a challenge to everybody involved.

⁸ Directive 96/61/EC concerning integrated pollution prevention and control

⁹ See, for example, IMPEL (2005) *Identifying Good Regulatory Practice In The EU Emissions Trading Scheme*

Full integration of the aviation sector in the EU ETS could be interesting as it enlarges the market and gives opportunities to find the most efficient reduction options. Mitigation with the least costs is one of the main aims of the ETS. But due to some legal as well as economic and technical problems (e.g. aviation being outside assigned amounts under the Kyoto Protocol), the immediate and fully open integration with other sectors could pose implementation difficulties. Hence, from this perspective, there is a certain logic in keeping aviation trading at least partly separate from a developed scheme, such as the EU emissions trading system, potentially using a half-open system such as that suggested by Öko-Institut (2004).

The impact of an aviation ETS is still contested. Regarding the carbon price impact of aviation, for example, where it assumed the industry would be a price taker at €13.80/tonne, Trucost (2004) note that this may be an unrealistically low assumption for anything but the current period. Aviation amounts to 13% of UK carbon emissions if one accounts also for non-CO₂ effects. But this is predicted to rise to 31% by 2030. Furthermore, by 2030 other sectors should also have worked through many of the low-cost mitigation measures; it is also very likely that with some good progress on the international front, developing countries will be more demanding about their carbon mitigation strategies, and some may even take on commitments; the effect could be to increase the price of CDM and JI credits. Trends, in other words, point to a bigger challenge in future, with a greater impact of aviation on an integrated ETS.

Indications are that, whether integrated or not, there may not be the political momentum and practical experience to consider an emissions trading system for aviation within the next couple of years¹⁰. It could be more realistic to consider inclusion later in the 2008-2012 period, or even post-2012. However, were this to be the case, then we risk letting aviation emissions getting out of hand, so that their later integration is a far more difficult challenge.

The irony of the current discussion on emissions trading is that concerns over including aviation, causing delay, means emissions are not tackled – but the prospect of eventual inclusion freezes out effort on current reduction opportunities, which will simply make it harder to include in the system when it does eventually happen. It is a downward spiral. If the introduction of a system for aviation does not happen by 2008, incentives may be created for airlines to put off fleet renewal or efficiency improvements until after the introduction of the system, as well as to increase emissions to achieve a high baseline in the reference period. Between now and 2012 more people will become used to flying and become locked in to lifestyles that rely, for example, on cheap air travel between northern and southern Europe, e.g. through northern Europeans purchasing second homes in Spain. Expectations of constant access to flights will increase, thus increasing public resistance to measures that might increase the cost of air travel.

Given the acknowledged significant, and growing, contribution of aviation to climate change, it is a priority to take action **before** 2012 to reduce the sector's greenhouse gas emissions.

¹⁰ E.g. ENDS Daily, 17 February 2005, 'No change to EU climate trading before 2008,' indicating that there are 'question marks over the prospect of the aviation sector's emissions being incorporated into the trading scheme from 2008'

As outlined in this briefing, there are arguments for and against the early inclusion of aviation in the EU emissions trading scheme. At this stage, it is not clear to see what other measures could be introduced at the EU-level. Member States would have to be relied upon to introduce other policy instruments, e.g. landing charges and kerosene taxes.

A suitable interim measure seems to be a **half-open system**, as noted above, in order that the benefits of an early inclusion could be capitalised upon, while the potential pitfalls be avoided. This would help prepare the industry, and the public that uses it, for aviation's inclusion in fully-fledged emissions trading from 2013.

6 RECOMMENDATIONS TO THE EUROPEAN PARLIAMENT

A number of system design decisions need to be made if the aviation sector is included in the EU ETS. On the basis of the discussions above, the European Parliament is recommended to consider the following points:

Allocation methodology: auctioning has the advantage of greater economic efficiency, while making it easier to deal with business growth and new entrants – a more difficult problem for aviation than for industrial facilities. A second-best option is a benchmark that sets a high standard reflecting recent technology. Allocation can and should be set in line with technical feasibility, and with a view to affecting technological change and limiting demand in the sector; too easy an allocation now will simply make it harder in future to gain a foothold.

Choice of base period or benchmark reference: is not an issue under auctioning; more recent grandfathering may fail to give credit to early action, but older levels are less relevant to current activity levels and may yield what seems likely arbitrary allocations. Benchmark choices can be based on reference levels that reflect high standards.

Amount of initial allocation: recent studies assume allocation equal to 2008 emissions – this is equivalent to a rather generous allocation; the conclusions drawn that economic effects will be minimal is therefore nearly a truism.

Impact of inclusion of aviation on other ETS sectors: is unlikely to be a major issue according to recent studies, but as just noted, this is largely an automatic result of the easy allocations. Still, there are greater influences on future carbon price than the addition of one or two percent of new demand – hence the addition of aviation is unlikely to have as important an effect as future fuel prices or credit availability from CDM and JI.

Intra-industry competitive position: depending on the allocation methodology and amounts, there could be fairly important competitive effects within the aviation industry. Auctioning is also helpful to level the playing field.

Stand-alone vs. integrated system: currently covered facilities in the EU ETS have experience with the ETS, as well as similar types of emissions-control regulation. The aviation sector faces a steep learning curve to integrate easily into the EU ETS, arguing for something akin to a trial period or a semi-integrated system. However, a stand-alone system is likely to be far more stringent, as mitigation costs are generally higher in aviation than in other sectors, diminishing the likely attractiveness of the approach. From an economic point of view, an open trading system with a clearinghouse mechanism would be the favourable option as it uses the mechanism of the trading market in its most efficient way. Considerable thought would then need to be put into the mechanics of such things as data sources, monitoring, reporting and verification to ensure smooth operation of ET in the aviation sector.

Interim measures: recent studies are all predicated on the idea that aviation will join the ETS in the 2008-2012 period. If there is insufficient political momentum to arrange such an early addition to the system, then emissions, expectations of cheap air travel, and the challenge of dealing with these will have risen in the meanwhile. Hence it would be important to consider which flanking measures could be put in place in the meanwhile to divert the upward trend in GHG emissions from aviation.

It is also noted that although they are beyond the scope of this report, important decisions will need to be made on, among other things, whether or not to include non-CO₂ effects of aviation, and if so whether to do so as part of the ETS or in other flanking measures; and whether to have EU centralised, Member State harmonised, or completely decentralised allocation.

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