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# Voluntary Carbon Offsets in the Airline Industry – A Critical Assessment –

## 1. Intoduction

The market for voluntary carbon offsets, i.e. those outside the strictly regulated Kyoto framework for tradable carbon emission permits, is growing with a vengeance. With only six such organisations in the business in 2000, their number has virtually skyrocketed to more than 40 commercial as well as not-for-profit outfits today – 17 of which entered the trade after 2005 (Gössling/Broderick/Upham/Ceron/Dubois/Peeters/Strasdas 2007, 231). This trend has not eluded the world of commercial aviation. Quite the contrary, carbon-offsetting appears to have become a serious concern for the top management of some of the world leading airlines. Carriers as diverse as Air Canada, British Airways, Ethiopian Airways, Qantas (incl. its subsidiaries QantasLink and Jetstar), Continental, Cathay Pacific, Japan Air Lines, Air France/KLM, the SAS Group, easyJet and Virgin Blue, to name just a few, now actively encourage their passengers to pay for the 'neutralising' services of select carbon offset providers on top of the ticket price whenever they book a flight. Carbon offsetting has even reached the more glamorous segment of executive travel: The European arm of NatJets has vowed to become fully carbon neutral[1] by 2012, while Silverjet, a UK-based all-business class transatlantic airline, whose fares do include a mandatory carbon offset contribution, recently received the 'Environmentally Aware Airline 2007' award by the Birmingham-based Institute of Transport Management (ITM) and advertises itself as the world's first carbon neutral carrier. Finally, some large online travel agencies such as Expedia and Travelocity as well as leading car rental companies (AVIS) invite their customers to purchase carbon offsets.

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1 In 2006, carbon neutral was chosen as "word of the year" by the New Oxford American Dictionary (Trexler Climate + Energy Services 2006).

The objectives of this paper are as follows: First, after a brief overview of the market for voluntary carbon offsets, we will assess the effectiveness of carbon offset schemes with regard to their stated objective of reducing the net greenhouse gas emissions of commercial air travel. Second, we will compare the mechanism of carbon offsetting to two alternative approaches to internalise the climate-relevant externalities of air travel: carbon taxes and the inclusion of commercial aviation in emission trading schemes such as the ETS.

## 2. Man-Made Global Warming: Alleged Causes, Effects, and Costs

In the past two decades, the fear of global climate change has grown into a phenomenon of strong scientific, political and public interest, and controversy. Public awareness – some say hysteria – has reached its peaks in spring 2007, when the Intergovernmental Panel on Climate Change (IPCC) published its latest Assessment Report, and in the fall when Al Gore and the IPCC were jointly awarded the Nobel Peace Prize. The central message of the IPCC report is the broad consensus among the contributing scientists that anthropogenic greenhouse gas emissions have a discernable negative impact on the world's climate. Whereas emissions of methane, nitrous oxide and other greenhouse gases (GHG) are rarely the subject of political or public attention – although the later two are the main emissions in agriculture, which is in turn the source of 1/3 of all man-made GHG emissions (WWF Deutschland 2007) – anthropogenic $CO_2$ emissions are clearly at the center stage of current climate policy. Moreover, the rise of $CO_2$ emissions caused by human activities based on the use of fossile energy is also claimed by the IPCC to be the main reason for the Global Warming (IPCC 2007).

The 2007 IPCC report essentially argues that a rise of global average temperature – as much a statistical artifact as GDP per head figures, by the way – to the order of 2 degrees centigrade compared to pre-industrial levels cannot be avoided anymore. Based upon sophisticated computer models, the most probable range of the future rise of the global average temperature was estimated at between +1.8 and +4 degrees centrigrade. The most unfavourable scenario predicts a rise of the global average temperature by slightly more than 6 degrees. Furthermore, a global warming of two or more degrees is predicted to cause massive disturbances of eco-systems and severe damages due to extreme weather conditions (e.g. storms, fires, droughts). The resulting rise of the sea level is, in turn, projected to submerge many coastal areas, including some of the world's mega-cities such as New York and Shanghai, as well as island nations in the Indian and Pacific Oceans (Maldives, Lakkadives, Tuvalu etc.). Moreover, agricultural production is supposed to be adversely affected by droughts, floods and heavy rain, especially in the developing countries. As a consequence, harvest yields may decline causing famines and social conflicts (Hare 2003).

The so called Stern Report, named after Sir Nicholas Stern, who, as the British government's Chief Economist, directed its elaboration, estimates the costs of global climate change to reach 5-20% of the world's Gross National Product (GNP) in 2050. On the other hand, the costs of a stringent policy against climate change were calculated to account for only 1% of the GNP (Stern 2007). While the methodology of the Stern Report has been heavily criticised by several eminent environmental economists as substantially flawed (or at least extremely biased towards a worst-case scenario),[2] the report is nevertheless widely regarded as irrefutable proof of the vast economic benefits which would arise from the stabilization or, preferably, the large-scale reduction of GHG emissions.

In the EU's, its 27 member-states have agreed to obligatory emission reductions which go far beyond the goals of the Kyoto agreement. The objective is to reduce emissions of $CO_2$ 20% until 2020 compared with baseline year 1990; in case other countries commit to this goal as well, the EU has pledged to pursue the even more demanding objective of a 30% reduction (Umweltbundesamt/European Economic and Social Committee 2007). The primary policy instrument of the EU's climate policy is the European Emission Trading Scheme (ETS).

## 3. Aviation and Global Warming

A rational climate policy should attempt to reduce GHG emissions at the lowest possible costs to society. In other words, reduction efforts must cover all, or at least all the major emitting activities (and should be based on the equimarginal principle, i.e. the marginal reduction costs per unit of GHG should be equal for all sectors). It is therefore not surprising that the transport sector has moved into the focus of climate policy and, given its above average growth rates, that there is special attention to the emissions from the air transport industry; as early as 1999, in its special report "Aviation and the Global Atmosphere" (IPCC 1999),

2 For a critical assessment see Nordhaus (2007), Weitzman (2007).

the IPCC investigated the potential effects of air travel on the global climate in general and on atmospheric ozone concentrations in particular.

Today, the contribution of the transport sector to worldwide $CO_2$ emissions reaches around 24%, although it accounts for only 14% of all GHG emissions (WWF Deutschland 2007). The corresponding figure for the European Union is pretty much the same, whereas the contribution of the transport sector to carbon emissions at the OECD level is estimated at about 30% (ECT 2007).

Keeping these figures in mind, it is obvious that cutting $CO_2$ emissions in the transportation sector should have a substantial impact because of the considerable contribution of the sector to overall emissions. Tackling the GHG emissions of transport becomes even more important when we look at sectoral emission trends in the last few years. Worldwide transport-related emissions grew by 31% from 1990 to 2003 (ECMT 2007). Whereas emissions of other sectors (e.g. households, agriculture, industry) in the EU could be reduced since 1990, emissions of the transportation sector were up 26% by 2005. Air transportation was one of the fastest growing modes not only with respect to the passenger numbers and the cargo volume uplifted, but also with respect to $CO_2$ emissions: they rose by 44% during this 15-year period.

On the other hand, the contribution of the aviation sector to the $CO_2$ emissions is only about 3% at the moment, whereas 19% are caused by road transport (EEA 2007). But this might be slightly misleading on two counts: First of all, there is still uncertainty about the true impact of the emissions of air transportation. As the emissions occur at high altitude, their effects on the climate may be worse than the pure figures indicate because of so-called radiative forcing which acts as an amplifier. As a result, though at the moment we do not fully understand the complex physical interrelationships, the real impact of air travel $CO_2$ emissions may be twice or threefold compared with $CO_2$ emissions on the ground (ECMT 2007).

If we take a look at the expected future growth rate of international air transport, carbon emissions will increase faster than can be compensated by means of efficiency improvements due to the introduction of more modern aircraft and improved engine technology. With other sectors stabilizing their GHG emissions, the air transport industry may further increase its contribution to the global man-made $CO_2$ emissions as a result. As the Stern report notes, air transportation will account for 5% of emissions in 2050 on the basis of the most recent growth forecasts (Stern 2007). This is only a small contribution to the problem as a whole, but a rational policy against climate change cannot spare air transportation because of the strong absolute and relative growth of emissions. Therefore, the costs and benefits of alternative ways of limiting air transport related $CO_2$ emissions have to be evaluated and compared.

As stated above, from the perspective of economic efficiency, climate policy should reduce $CO_2$ and all other GHG emissions at the lowest possible social costs. From this point of view, alternative measures against the future growth of carbon emissions may show quite different cost-benefit ratios. Therefore, it is not clear whether carbon offsetting is a particularly useful measure against climate change. Hence we have to discuss the efficiency criteria of a rational climate policy and the costs and benefits of the most important measures of climate policy in the next chapter.

## 4. Policies Against Climate Change In the Air Transport Industry – Some Efficiency Considerations

### 4.1 Efficiency Criteria For Climate Policy

A rational policy against the climate change and its potentially adverse consequences has to follow the same efficiency criteria as environmental policy in general. In this context, economists primarily point to the criteria of static and dynamic efficiency of political measures (Fritsch/Wein/Ewers 2005). Static efficiency means that any politically desired amount of emissions' reduction should be reached at the lowest possible costs to society. The solution for this problem is that marginal costs of reduction should be the same in each sector concerned, i.e. the equimarginal principle is fulfilled (Fees 1997). To apply a uniform target for the reduction of emissions to all sectors concerned, for example, hence does not meet the goal of static efficiency, because the marginal cost of avoidance usually differ significantly between sectors. Static efficiency is also affected by the transaction costs caused by a political measure. Therefore, rational environmental policy requires a rigorous comparative assessment of the transaction costs of different measures before adopting them to get a clear understanding of the likely abatement costs.

An even more important criterion is the dynamic efficiency of a political measure. Environmental policy should give incentives for an effective reduction of emissions and for technological progress (Fritsch/Wein/Ewers 2005). If people have to pay for the volume of emissions caused by their economic activities, there is a strong incentive to reduce GHG emissions either by reducing the volume of the transactions itself or by searching for and adopting technological improvements which help to minimize the emissions in question. A third crucial point is the issue of ecological effectiveness. Ecological effectiveness requires that the instruments used by environmental policy are indeed conducive to reach the ecological target. With respect to the problem of climate change we therefore have to assess, whether the measures chosen actually contribute to reducing the amount of GHG (including $CO_2$) emitted by the economy as desired by climate policy.

Irrelevant from an efficiency point of view – although politically salient – are the distributive effects of alternative reduction measures. It is obvious that the instruments of climate policy will affect consumers, firms and the government in different manner. This is not a topic of static or dynamic efficiency, however, but affects the political appeal of these measures, i.e. the voters' preferred choice of policy. Hence, fairness with respect to sharing the economic burden of GHG reduction efforts between the affected parties (if these are domestic voters) will and must be a key factor in all political considerations, which are additionally influenced by the activities of special interest groups including NGOs. If, for example, consumers are likely to bear the brunt of the use of an efficient and effective measure against global warming, politicians may refuse to adopt it nevertheless for fear to lose voters. They may therefore prefer to use a different measure with less evident economic consequences. On the other hand, industrial lobbies will, sometimes successfully, oppose measures they feel will put most of the burden on their industry. In general politicians will prefer measures that do not clearly disclose the true costs to the affected societal groups, because this increases the chance of implementation.

### 4.2 GHG Reduction Instruments: Survey and Brief Assessment

Using the efficiency criteria derived in the preceding chapter, we can now try to assess to pros and cons of alternative measures of climate policy in order to get an idea of their economic efficiency and ecological effectiveness. This may lead to an sensible assessment of the efficiency and effectiveness of carbon offsetting for air transportation. Looking at the air transport sector as a whole we can say that air transport is not affected by climate policy at the moment. In most countries, there are no special taxes or levies on the use of kerosene. Neither is air transportation subject to the requirements stipulated by the Kyoto Protocol

(Grimme/Schaefer/Scheelhaase 2007); airlines serving the EU, however, will be included in the ETS from 2011 or 2012. On the other hand, $CO_2$ emissions of the air transport sector are growing very fast due to the expansion of traffic volume as argued above. While significant progress was made in the past three decades with respect to reducing specific fuel consumption of commercial aircraft (with three- and four-holers having largely been replaced by twinjets etc.), the massive traffic growth led to a net-rise of the total demand for fuel and hence to an increase of the carbon emissions resulting from air travel.

### 4.2.1. Supply Side Measures

Possible measures to reduce the $CO_2$ emissions of air transportation may be applied on the demand side or the supply side of the industry. Supply side measures are supposed to provide potentially strong incentives for the airlines themselves to reduce the specific fuel consumption of their aircraft. This results simply from market pressure and rising kerosene prices. Fuel consumption per passenger kilometre may be reduced by a variety of measures such as the use of new, technologically improved engines or new types of aircraft, by reducing the weight of the aircraft through different measures and by an improvement of capacity utilization (seat load factors) or by introducing more efficient operational procedures.[3] Because of the market forces working – the oil price is about to hit or even pass the $100 mark per barrel – we do not see any need for additional governmental intervention in this field. For example, any official standards for maximum fuel consumption or similar measures will rather affect than improve static and dynamic efficiency.

However, there are two possible avenues for indirect public intervention on the supply side which merit further exploring. First there is the possibility to promote public or private research and development in this sector. Objects for future research may include the optimization of fuel consumption of aircrafts or the development of alternatives to kerosene (e.g. the use of biofuels or liquid natural gas, which was recently proposed by Qatar Airways). Economists are usually sceptical with respect to public activities of governmental interventions in the field of applied research, however, which should, on efficiency grounds, essentially remain a private-sector affair (Eisenkopf 2007). Therefore, the government

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[3] See for example Lufthansa (2007): Lufthansa reports a reduction of carbon emissions from 15.8 kg/100 pkm to 11.1 kg/100 pkm from 1991 to 2006.

should mainly try to design a suitable institutional framework to promote research and development in the air transport sector but not set precise targets or mandate a politically preferred technology.

Another task for transport policy, especially in Europe, is to finally develop a framework for a harmonized, centralized air traffic control system and to create a truly Single European Sky. As the airlines rightly point out, the harmonization of aerial surveillance would lead to an optimization of aircraft operations that will remarkably reduces fuel consumption and carbon emissions (Lufthansa 2007). Although the scale of possible reductions is considerable, we have to bear in mind, however, that the economic and ecological dividend from such improvements is a one-off effect.

#### 4.2.2. Demand Side Measures

Currently, the public discussion of possible measures to fight global warming is largely focused on the demand side of the market. This is especially true with respect to aviation. The objective is to dampen demand for air transport services to a sustainable level by means of suitable measures which fully internalise the social costs of air transport-related GHG emissions. The common attitude to the air transportation market is that flying is “too cheap” at the moment because the price of the ticket does not reflect the external costs of this activity; unsurprisingly, this view is, in particular, held by intermodal competitors such as most of – heavily subsidized – state-owned railways (Deutsche Bahn 2005) and their scientific and political advisors. Despite of the both methodologically and practically insurmountable problem to measure the external costs of additional GHG emissions in a precise manner, the solution proposed by simple welfare economics is relatively straightforward: internalisation by means of one the instruments available to policy-makers. As it would be beyond the scope and purpose of this paper to discuss their respective advantages and disadvantages,[4] we will confine ourselves to the most relevant instruments in the field of commercial aviation: taxes or levies on kerosene and the inclusion of air transport into a system of tradable emission permits like the EU’s ETS, as these

4 In the following, we will not discuss further instruments like regulatory measures or standards. For a short survey of potential instruments see Umweltbundesamt/European Economic and Social Committee (2007).

alternatives shall serve as the benchmark for the assessment of voluntary carbon offsetting schemes later on.

#### 4.2.2.1. Kerosene Taxes

If taxes on kerosene increase the fuel price for air transportation, they will have a dampening effect on air travel demand and, as a result reduce the GHG emissions of the airline industry in absolute terms. In this standard textbook scenario, that outcome is contingent upon the assumption of an elastic demand curve, however. But a closer look reveals some serious limitation to the use of kerosene taxes as a tool to substantially reduce GHG emissions:

- Taxes on the kerosene consumption of air transportation have to be introduced by an international agreement; otherwise it would result in severe distortion of competition between airlines registered in and/or operating to and from countries with kerosene taxes and other ones without. While this might be a negligible scenario for short- to medium-range non-stop or direct travel, it might impact strongly on hub competition for long-distance connecting services. Moreover, given some countries' strong resistance to the idea, its universal implementation seems extremely unlikely in the foreseeable future.
- The implementation issue aside, there is also significant doubt about the economic efficiency and the ecological effectiveness of a kerosene tax. Static efficiency requires that the marginal costs of reduction are the same for every emission source of $CO_2$ (or any other GHG). This will not be true of a tax levied on the kerosene consumption of aircrafts, if there is no similar tax imposed on all other modes of transport (or any other activity) which burn carbon fuels, too. In the German context, for example, for historical reasons, road infrastructure has in large part been financed by means of a gasoline tax and rail infrastructure out of general tax revenues (with track access charges as an additional source more recently). By contrast, the infrastructure costs of air transport have generally been covered by all sorts of user fees imposed upon airlines and passed on to passengers (and cargo forwarders). Since Germany only levies a negligible eco tax on gasoline consumption, any kerosene tax which would be comparably higher would inevitably distort inter-modal competition.

- Third, for the reasons given above, the ecological effectiveness of a kerosene tax remains doubtful, because it is very difficult to precisely estimate the reaction of the consumers concerned and, hence, the elasticity of demand.
- Finally, the main argument against the use of kerosene taxes for the internalization of externalities of carbon emissions results from allocative considerations. Due to the high income elasticity of the demand for air travel, even a high kerosene tax might not dampen demand substantially; this seems to be proven by the fact that passenger numbers and pkm continue to rise, the ever higher "kerosene surcharges" levied by most major airlines in reaction to soaring oil prices notwithstanding.

#### 4.2.2.2. Tradable Emission Permits

Current knowledge does not allow any reliable prediction of which sector of the economy will be able to reduce energy consumption at the lowest costs to society. Moreover, if one follows the IPCC's stance, there seems to be a strong case in favour of an upper target for the amount of GHG emissions which may be released into the atmosphere. The economic consequence of all this is that climate policy should be based on a system of tradable permits. This is for two reasons: First, at least in the world of economic textbooks (though not necessarily in the real world), ETS are widely considered to be superior in terms of ecological effectiveness for the very reason that the absolute number of permits, and hence, the volume of GHG emissions, is fixed by policy-makers. Second, ETS are also economically efficient, because emissions will be reduced in the sector with the cheapest abatement cost; in other words, the equimarginal principal applies.

The main problem, however, is put theory to practice. This has several aspects. Obviously, on efficiency grounds, any real-world ETS should cover any meaningful emitter on the globe, regardless of location, industry and activity. At the moment, the largest such scheme which is operational, the EU's ETS, is of regional significance only and so far only covers the energy sector and energy-intensive industries. An important, though politically unlikely, step towards a rational climate policy would therefore be to include all other large-scale producers of GHG, including the transport sector, but also all non-$CO_2$-GHG emitters, such as agriculture in particular, and to implement it globally. The inclusion of air transport into the EU's ETS, which is being very actively pursued by the EU and some member-states alike, would certainly be a first step in the right direction. However, if this were to remain a EU-only effort, it would also lead to a massive competitive disadvantage for EU airlines and airports vis-à-vis competing non-EU carriers and airports (Grimme/Schaefer/Scheelhaase 2007). Moreover, the inclusion of air transport as the only mode of transport, would distort intermodal competition on a similar scale as was already discussed in the context of a selective kerosene tax regime. If, on an even higher level, air transport, but not all of the other large-scale emitters were included, too high a share of adoptions costs would be imposed on the sector while other industries would enjoy a free ride. From an economy-wide perspective, this breach if the equimarginal principle would invariably result in an inefficient overall allocation of resources

## 5. Assessment of Carbon Offset Schemes

Against this background we will now turn our attention to carbon offset schemes. For this purpose, we will begin by analysing the structure of alternative types of carbon offset regimes and the behavioural incentives they create for providers and consumers alike. In a second step, we will compare the mechanism of carbon offsetting with the two alternative internalisation tools which were discussed in the previous chapter.

### 5.1. Excursus: Key Terms[5]

The carbon footprint is the estimated amount of carbon dioxide emissions resulting from a particular activity. Due to the fact, that more often than not it is not only $CO_2$ which is emitted, but other GHG as well, it appears more appropriate to measure the total climate effect of any activity, or human being, in $CO_2$ equivalent units. The climate effects of the emission of one unit of methane, for example, are equivalent to the emission of 21 units of $CO_2$.

A carbon sink is a condition, or a reservoir, such as trees or the oceans, which store more $CO_2$ than they release, resulting in a net reduction of $CO_2$. The process of uptaking and storing carbon is called carbon sequestration.

[5] This subsection and subsection 5.2. draw heavily on Kollmuss/Bowell (2006), Taiyab (2006), Trexel Climate + Energy Services (2006), House of Commons. Environmental Audit Committee (2007), and World Bank (2007).

An offset is a counterbalancing equivalent. With regard to GHG emissions, it refers to the “act of reducing or avoiding GHG emissions in one place in order to “offset” GHG emissions occurring somewhere else” (Trexler Climate + Energy Services 2006). The ecological background is that contrary to local pollutants, which should be addressed at their very source, in the case of GHG emissions it does not matter where on the globe they are mitigated. Moreover, carbon offset offers the opportunity to take advantage of the “radically different costs and practicalities of achieving GHG emission reductions by sector and geography” (ibd.). The term carbon neutrality describes a situation when all $CO_2$, though not necessarily all GHG emissions resulting from whatever activity have successfully been offset.

The Kyoto Protocol, signed in 1997, is an international agreement under the umbrella United Nations Framework Convention on Climate Change (UNFCCC) which legally binds its signatories to reduce the emissions of some GHG by 5.2% in the 2008-1012 period compared to the base year 1990. The protocol covers a total of six GHG: carbon dioxide – $CO_2$ –, methane – $CH_4$ –, nitrous oxide – $N_2O$ –, sulphur hexafluoride – $SF_6$ –, hydrofluorocarbons – HFC –, and perfluorocarbons – PFC –, but not water vapour, which accidentally is the most important GHG in absolute terms, though not with respect to its global warming potential.

## 5.2. An Overview of the Carbon Market

### 5.2,1. The Regulated Carbon Market Under the Kyoto Protocol

The Kyoto Protocol has created a market for GHG emission permits and credits. It is based on a cap-and-trade system which imposes national emission quotas – caps – upon its Annex I signatory states, all of which are developed countries. It was not ratified by the USA, in terms of absolute GHG emissions the largest emitter, nor by Australia. Moreover, most developing countries, commonly referred to as Annex II countries, are not subject to any binding reduction goal under the protocol. This includes China, the world’s second largest GHG emitter and likely to surpass the USA in the very near future. Most importantly from an economic perspective, the Kyoto Protocol gave rise to the emergence of carbon markets, by allowing signatories to meet their reduction obligation by means of any of three Flexible Mechanisms established by the protocol: the Clean Development Mechanism (CDM), Joint Implementation (JI) and emissions trading (like under the EU’s ETS scheme).

CDM allows signatories to meet their own reduction obligations by implementing projects in developing countries which reduce or even avoid GHG emissions; if done successfully, this will earn them a corresponding number of tradable emission credits called Certified Emissions Reduction (CER), with one tonne of carbon reduction equalling one CER. Credits will only be generated if the project in question meets strict quality standards; in particular, it must be proven that the emission reductions generated are purely additional, i.e. they would not have happened anyway, but represent an extra gain. Applying additionality tests, certain authorised bodies are in charge of verifying and certifying any project before it will be permitted to participate in the CDM. JI follows the same rationale and procedures, the only difference being that emission reduction projects will be implemented in other developed countries. The tradable emission credits created under the JI framework are called Emission Reduction Units (ERU). Finally, under emission trading schemes such as the ETS, emission allowances – the so-called Assigned Amount Units (AAU) or, in the ETS context, EU Allowances (EUA) – are defined and allocated to the signatory states which, in turn, will reallocate them to national emitters. In the aggregate, their supply reflects the agreed upon $CO_2$ emission reduction target.

### 5.2.2. The Voluntary Carbon Market

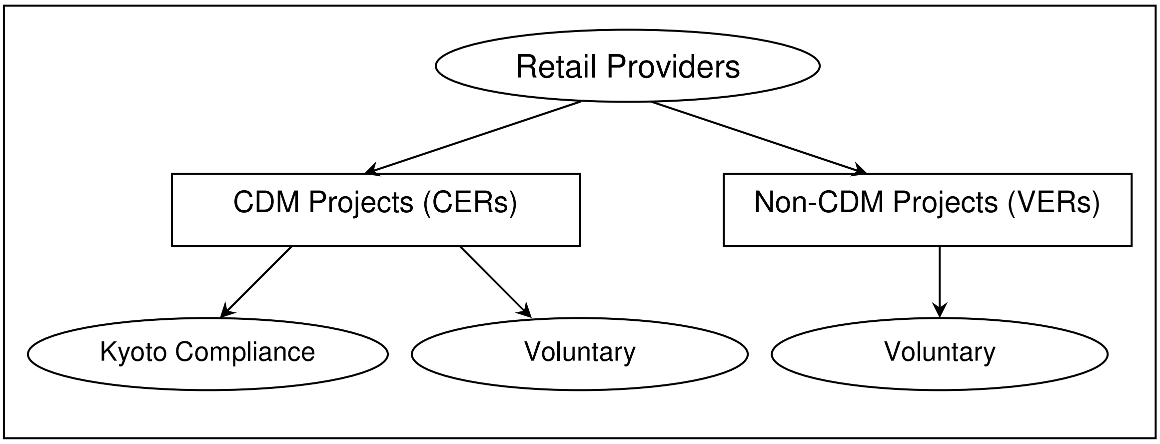
In contrast to the regulated carbon market described above, its voluntary counterpart has come into being without government action and "is a place where anybody, from businesses, to NGOs, to individuals can participate in the business of offsetting" (House of Commons. Environmental Audit Committee 2007, 8).

There are two main differences between the two: First, instead of government regulations, non-binding voluntary standards and methodologies for creating credits are applied. Second, while credits created under the Kyoto Protocol's rules, are perfectly fungible, i.e. may be used in any scheme, credits created on the voluntary market are not. This has resulted in a substantial lack of transparency with respect to the credibility of offset providers and real environmental benefits of the schemes they have on offer.

In reaction to this obvious shortcoming, however, several self-developed and hence non-binding standards – such as the Voluntary Gold Standard (VGS) and the Voluntary Carbon Standard (VSC) –, which were in part conceived by reputable NGOs, are emerging to fill this vacuum and to provide guidance to potential buyers of offsets (House of Commons. Environmental Audit Committee 2007, 9). Moreover, Tufts University's Tufts Climate Initiative provides a regular rating of offset providers. Essentially, these private-sector standards and initiatives draw heavily on the CDM's regulations and methodologies and aim to ensure "real, quantifiable, additional, and permanent project-based emission reductions".[6]

Overall, on all counts, the voluntary carbon market is still small, but expanding rapidly. According to estimates for 2006, demand was for 20 million tonnes of $CO_2$ equivalent, a figure set to grow to 400 million by 2010 (the corresponding CRM figure is 125 million annually with a total of 2 billion tonnes traded so far). Turnover of the 40+ providers was estimated at $125 million in 2006, but is predicted to reach $260 million by 2009 (House of Commons. Environmental Audit Committee 2007, 15f). However, one should not overlook the fact that the volume of voluntary emissions reductions has to increase by a factor of 400 for the voluntary market to cover 10% of the aviation-related GHG emissions (Gössling et. al. 2007).

**Table 1: The Carbon Market**




Source: Taiyab (2006, 8)

6 http://www.v-c-s.org/uploads/VCS_V2_consultation_letter_final.pdf

### 5.3. Voluntary Carbon Offset Schemes in Practice

#### 5.3.1. Main Providers

In 1989, the first carbon offset project was organised in the USA. At that time, Applied Energy Services committed to plant 50 million trees in the Western Highlands of Guatemala in return for the permission to build a coal-fired power station (Carbon Trade Watch 2007, 14). In 1990, the Solar Electric Light Fund, the first carbon offset provider started operations in the USA, followed, in 1992, by Prima Klima Weltweit, a German outfit. Today more than 40 competitors are active on the market, most of them based in the USA, the UK, Germany, Australia and other rich OECD countries. Currently, there is not a single offset provider originating from a developing country. Among the leading carbon offsetters in the segment of aviation-related offsets, both non-profit and for-profit organisations coexist. Eminent examples include atmosfair (Germany, non-profit), myclimate (Switzerland, non-profit), Climate Care (UK, for-profit), and The Carbon Neutral Company (UK, for-profit) (Kollmuss/Boswell 2007, 39ff).

#### 5.3.2. Functioning

The idea behind voluntary offsets is to “neutralize that part of a carbon footprint not addressed through direct emissions reductions, the purchase of emissions-free electricity, or other means” (Trexler Climate + Energy Services 2006, 1). Achieving carbon neutrality therefore requires a multi-stage approach. Ideally, in stage one, the exact size of the carbon footprint will be assessed. Stage two sees the implementation of reduction measures at the source. In stage three, the remaining unaccounted-for carbon emissions have to be calculated, before in stage four, a sufficient number of GHG offsets must be purchased to cover this difference (ibd, 1).

The choice of offset projects differs substantially among offset providers. Most, however, prefer to finance the extension of land-based sinks, i.e. they focus on forestry-/plantation-based sequestration. Others, by contrast, opt to invest their funds in renewable energy projects, energy saving schemes etc.

### 5.3.3. Critical Assessment

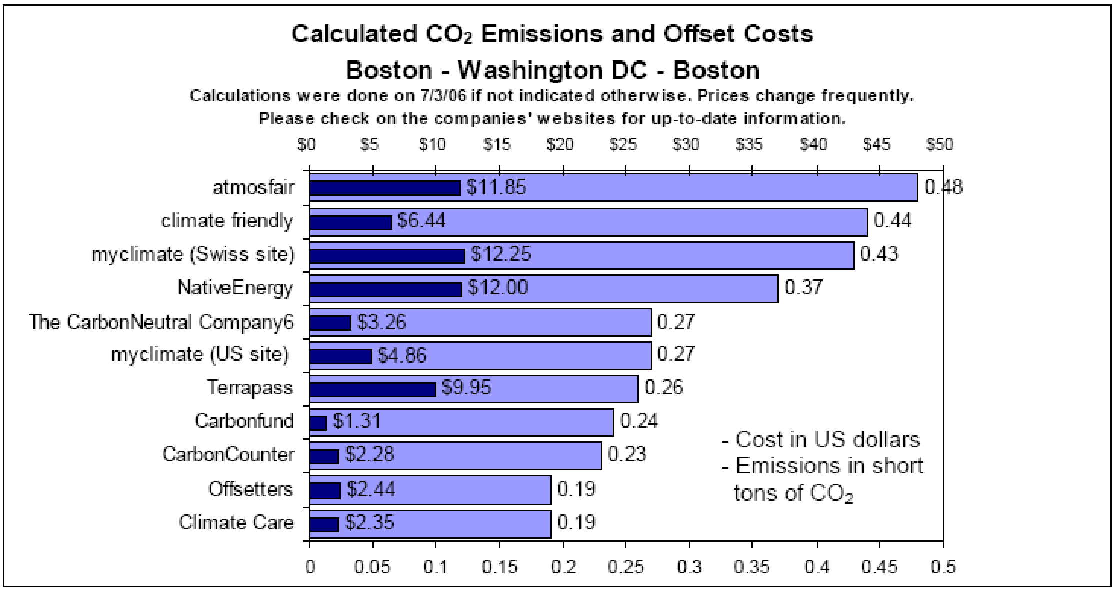
#### 5.3.3.1. Unsolved Issues with Respect to Offset Schemes

Aside from the fact that forestry-based offset projects, which still are the most popular ones, are likely to run into severe spatial constraints in the foreseeable future,[7] a number of specific problems exist.

##### 5.3.3.1.1. Inaccurate Calculation of the Carbon Footprint

To help customers calculate the required amount of offsets, almost all providers offer their own more or less sophisticated carbon calculators on their websites. However, even for identical itineraries, the results typically differ substantially. What is more, purchase prices for the offsets vary substantially, too – often by a factor of 6, i.e. from \$5-\$31 per tonne of $CO_2$ equivalent –, while at the same time many offsetters do not provide their (potential) customers detailed information about the nature of their projects (see below Table 2).

**Table 2a: Differences in Calculated $CO_2$ Emissions and Offsets Costs**




<u>Source</u>: Kollmuss/Bowell (2007, 30)

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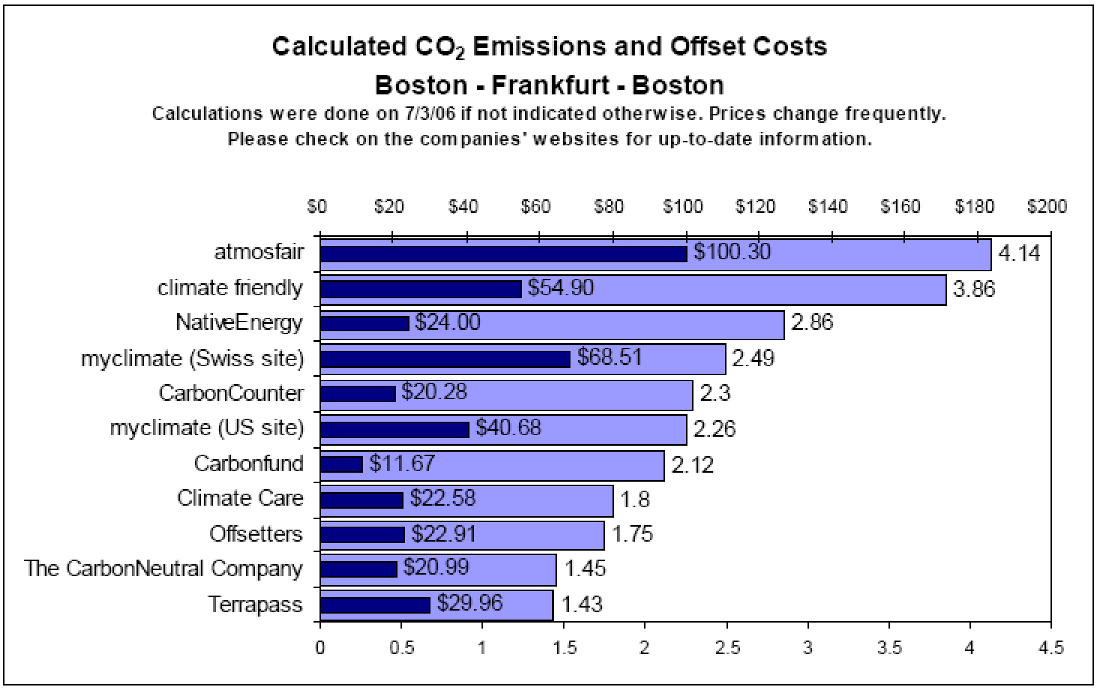
7 According to calculations by Boon/Schroten/Kampman (2006), the area available globally for afforestation will be filled by 2050 by aviation alone, should all its climate effects be offset in this way.

**Table 2b: Differences in Calculated $CO_2$ Emissions and Offsets Costs**




Source: Kollmuss/Bowell (2007, 31)

As these surprising differences cannot be attributed to the nature of the offset provider's business models – non-profit vs. for-profit –, calculator (in)accuracy as well as the lack of relevant data might be the main culprits. Indeed, the carbon footprint of a flight is not nearly as simple to calculate as it may appear, as a large number of data and effects must be considered. Crucial factors include, but are not limited to flight distance, cruising speed and altitude, type of aircraft (size, age etc.), load factor, economy vs. business vs. first class travel, and weather conditions (which might affect contrail formation and radiative forcing etc.) (Kollmuss/Boswell 2007, 26ff).

### 5.3.3.1.2. Dubious Quality of Some Offset Projects

There are four dimensions which define – and possibly undermine – the overall quality of offset projects:

- Additionality (which must be guaranteed)
- Double counting (which must be avoided)
- The provider's integrity

Obviously, ecological effectiveness can only be achieved if the providers of carbon offset schemes can ensure that consumer's investments actually result in an offset. In other words, additionality must be assured. While one indicator of additionality might be the fact that the project would not have been realised without the provider's financial support, this is not a simple task in practice, even if the available additionality tests are properly applied, for several reasons.

- First of all, since most offset projects are forestry-based, providers must ensure that the carbon will remain sequestered permanently, or at least for a very long period of time (at least 50 years); otherwise, a carbon sink will be transformed in a carbon source due to natural processes (rotting) or as a result of human action (slash and burn etc.).
- Second, double counting of offsets must be discouraged to prevent multiple stakeholders from claiming credits from the same offset activity. The most appropriate solutions to this problem would be to retire offset once they have been sold (to prevent them for getting sold several times to different buyers).
- Third, more information should be made available to potential customers of offset providers about the types of projects pursued and their success rate, and, last not least, the percentage of funds which is actually invested (as opposed to being used to cover administration costs and profit targets) – a figure which shows a startling range (see below Table 3)

**Table 3: Percentage of Funds Invested in Offset Projects**

| Company | For or non-profit | % of money to projects |
|---|---|---|
| Carbonfund.org | Non | 93% |
| CarbonCounter.org | Non | 90% |
| Atmosfair | Non | 80% |
| Myclimate | Non | 80% |
| Climate friendly | For | 66% |
| Offsetters | Non | 65% |
| Climate Care | For | 60% |
| Cleanairpass | For | 25% |
| The CarbonNeutral Company | For | See footnote[25] |
| Better World Club | For | N/A |
| NativeEnergy | For | N/A |
| Solar Electric Light Fund | Non | N/A |
| TerraPass | For | N/A |

Source: Kollmuss/Bowell (2007, 25)

To summarize, in order to continue to grow and to maintain its eco-friendly image in the future, the industry will have to accept a mix of more transparency and some form of self-regulation or governmental standards to overcome the existing informational asymmetry. But the design of standards and the evaluation of offset programmes will also result in non-trivial transaction costs (Parliamentary Office of Science and Technology 2007).

### 5.3.3.2. The Broader Context

It is fair to assume that carbon offsetting, for being a voluntary contribution, is unlikely to reduce the demand for air travel significantly. Anecdotal evidence was recently provided by British Airlines which admitted in a parliamentary hearing that passengers chose to offset only 3,000 tonnes out of a total of 27 million tonnes emitted since the introduction of carbon offsetting in September 2005 – less than 0.01% of the total (Davies 2007). Therefore, in comparison to alternative internalisation strategies, economic pressure to reduce fuel consumption and, as a result, GHG emissions, will be less strong in comparison. In other words: While carbon taxes or the participation in an Emission Trading Scheme would, ceteris paribus, provide provides incentives for technological and operational improvements, carbon offsetting translates in to substantially less dynamic efficiency (Gössling et. al. 2007).

Nevertheless, from a lobbying perspective, the attraction of carbon offsetting for airlines is obvious. Offset schemes may be pushed by industries like aviation for the benefits they create by delaying the necessary transition to a lower-carbon economy for as long as possible. They provide them with ample PR opportunities to "greenwash" their products and services without incurring any adaption costs (Transnational Institute 2007)

Last not least, carbon offsetting might give rise to a tricky conflict of policy goals with climate policy objectives thwarting other, and equally important, environmental policy and sustainable development objectives. For example, a large-scale plantation might indeed offset some GHG emissions but might at the same time contribute to a loss of biodiversity (the monoculture problem).

## 6. Conclusion

Given the global nature of GHG emissions, as well as the validity of the equi-marginal principle, the idea to offset them in some other sector of the economy, or even in a different country, is not dubious per se. On efficiency grounds, however, carbon offsetting cannot replace a well-run – i.e. comprehensive and truly global – system of tradable emission permits. The economic and ecological case for including only air transport, but not the other modes of transport into the EU's ETS, remains weak. While the ensuing costs would certainly increase the price of air travel, which, in turn, might have a dampening effect on demand, most people would not abstain from a trip, but switch to a different mode of transport. However, these substitutes will also generate emissions and in some cases, may be more even carbon-intensive than aviation. For example, a shift from air to road will not result in fewer emissions especially if one takes into account infrastructure provision (Umweltbundesamt/European Economic and Social Committee 2007).

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