EFFECTS OF EUROPEAN EMISSIONS TRADING SYSTEM APPLICATION TO NON-EU AIRLINES

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ABSTRACT

The European Union requires the application of an Emission Trading System (ETS) to all the flights arriving to or departing from EU airports beginning on 1st of January 2012, according to the rules published in the Directive 2008/101/EC. Although actual emissions trading will take place in 2012 and on, part of the regulation started to be applicable in January 2010, in order to gather airline data that will be used for distribution of free emissions permits and for establishing the number of permits to be auctioned.

EU carriers will have almost every flight included in the ETS, but non EU airlines participation will be limited to flights touching one EU airport, representing a relatively small part of their route system. However they are subject to the same administrative requirements, being obliged to submit Monitoring, Reporting and Verification (MRV) procedures to the EU Authority corresponding to the country with the most emissions from that carrier.

This paper explores some of the most likely consequences for non EU carriers, coming from the entry into force of the ETS, both during 2010 and after 1st of January 2012, when the system will start to be applicable. These effects may be classified in six categories:

- strategies to obtain the maximum number of free permits in the first distribution, to be made on 2010 traffic basis
- participation in the CO_2 auctioning or other carbon markets elements, as a way to obtain additional permits when needed
- other Kyoto Protocol tools for achieving additional permits (Joint Implementation, Clean Development Mechanisms)
- fuel savings policies to minimise the number of permits needed since 2012
- new schemes for route evaluation, considering the repercussions of ETS
- general planning (fleet and network) including carbon accounting

As a conclusion it is shown that ETS application will have some unavoidable economic penalties and a non desirable administrative burden but, may offer a number of possibilities for minimising the negative effects of those measures and obtaining competitive advantages if airlines take early measures and elaborate the planning tools with enough anticipation.

Key words: *Emissions Trading, European ETS, air transport economics, carbon market*

1. THE LEGAL FRAMEWORK

The European Union (EU) adopted an Emissions Trading Scheme (ETS) in 2003 (ref. [1]) as the most cost efficient market mechanism, intended for optimizing the cost of reducing Greenhouse Gas (GHG) emissions from different industrial sectors (energy generation, oil refining, steel industry, timber, cement and ceramic, paper), all of them coming from fixed sources and representing roughly 50% of European emissions. The EU ETS started on 1st of January, 2005, with the purpose of helping EU Member States to comply with the target established in the Kyoto Protocol for the EU as a whole (a reduction of 8% GHG emissions in 2012 with respect to the 1990 levels). Each country was assigned an individual goal, according with its present emission levels, the aggregation of which, leads to the global 8% reduction target.

Kyoto Protocol defines six substances as GHGs: CO_2, methane, N_2O, HFC, PFC and SF_6. Among them, aviation only emits CO_2 although other emissions like NO_2, water vapour and particles might act as precursors of different elements that contribute to climate warming, like ozone or clouds (ref. [2]). Due to the high level of scientific incertitude still existing with respect to the nature and magnitude of these other effects, all the actions taken up to this moment to limit the impact of aviation on climatic change refer only to the CO_2 emissions, that represent about 2% of world man-made CO_2 and about 12% of world transport CO_2 emissions.

The major difference between industrial and transportation emissions, at the moment of allocating them to the inventory of a specific state, is mobility. The Kyoto Protocol worked on the principle that emissions from fixed sources will be attributed to the country where they were produced, independently of the nationality of the company. Transportation emissions followed the same concept in the trips moving across a single country, but there was no agreement on how to assign emissions of international travel, when the vehicle was going through different states. The so called *bunker fuels* burn by international aviation and shipping companies were left out of the Protocol mandate.

As international civil flight emissions, on the contrary than domestic ones, were not included in the Kyoto Protocol, but left in the hands of the International Civil Aviation Organization (ICAO), this body initiated different analysis to determine the best way to control the emissions produced by those flights on a worldwide basis. In the ICAO 37th General Assembly, held in September-October 2007, some recommendations on market based measures were adopted, outlining Emissions Trading as the most efficient way forward in terms of environmental cost/benefit analysis, after evaluations comparing the potential of this tool versus voluntary agreements, environmental charges and taxes.

However, it was not possible to reach an agreement on a worldwide system for emissions trading in the international aviation sector and the European Union decided to take the initiative of including the civil flights making a stop at its airports in the already working European Emissions Trading Scheme. An evaluation of possible European strategies to fight

aviation GHG, reinforcing the findings of ICAO that point out Emission Trading as the one having the minimum cost/benefits results, is included as ref. [3].

On legal grounds, the European action creates some doubts to the international aviation law experts. A number of non EU countries are complaining against the inclusion of non EU operators in the system, pointing out that the ICAO recommendation on emissions trading systems requires State level agreement for its application. In December 2009, three US airlines (American, Continental and United) launched a legal challenge to the rule in a British Court that, if successful, might modify the reach of the rule.

On November 18, 2008 Directive 2008/101/EC, in ref. [4], was approved, amending the existing ETS Directive (2003/87/EC), with the purpose of adding civil aviation to the sectors allowed to trade CO_2 emission permits. The amended Directive considers EU civil aviation as a whole sector where operators (commercial airlines or other aircraft users) are the subject of emission limits and, therefore, the entities allowed to trade permits, starting on January 1, 2012. The maximum level of emissions (the cap of the trading system) is established at 97% of the historical emissions, to be understood as the average of the annual CO_2 emissions in the calendar years 2004, 2005 and 2006 from aircraft performing an aviation activity included in the amended Directive. After reserving a 3% of the permits for protecting new entrants or operators with a high level of growth, the rest of the emissions cap will originate an equivalent amount of permits, to be distributed for free among the operators, proportionally to their Revenue Ton-kilometers (RTK) performed in the year 2010. The 97% cap will pass to be 95% in 2013. The long term objective is a continuous reduction of the cap until reaching a situation with no free permit at all, always as a single sector, independent of national goals.

This system will have important economic repercussions for the affected operators. Those emitting more than their free permit quotas in 2012 and beyond, will be forced to buy additional permits in the open market to compensate the exceeded amount. On the contrary, if an operator emits less than its quota, the operator is allowed to sell the unused permits and make a profit. Then, the calculation of historical emissions plays a key role in the efficiency of the system. If the number is too small, the amount of distributed emission allowances would be insufficient and there would be a high demand for purchasing permits, which price would increase with heavy financial effects on the operators' economy. However, an over-estimate of the historical emissions might put in danger the environmental impact of the regulation, demanding very minor actions for compliance by the individual carriers.

The high volatility level of emission permit prices, caused by inaccurate calculation of the needs of the different economic sectors at the initial phase of ETS application, and by the speculative movements of investing banks in the world stock markets, has made very difficult calculate a global cost for the airline industry. A forecast placed in the middle between the most extreme pessimistic and optimistic predictions would be in the order of 30,000 million euro in the 2012 – 2021 period, with a continuous increase from a low figure of 1,000 M€ in 2012 up to almost 6,000 M€ in 2021, with a large majority of those amounts paid by the EU airlines.

2. STRATEGIES TO OBTAIN FREE PERMITS

The mechanism for the distribution of the free permits is based in two groups of data:

- the historical emissions calculation, which has been tasked to the European Traffic Control Organisation (EUROCONTROL), and it is expected to be published soon
- the amount of RTK performed and reported by the individual airlines during the year 2010, according to the Monitoring, Reporting and Verification (MRV) plans submitted to the competent Authorities

Competent Authority means the national administration body designated by each EU State to control the process. Although the permit distribution is a competence of the European Commission, individual States must take care of MRV plans approval and execution, including the auditing of the data and operational procedures and the possible penalties on the non complying airlines included in its inventory. The airlines to be controlled by an EU state are included in a list, approved and published by the European Commission. A draft version of the list appeared on March 2009, having suffered several amendments before its first official publication in August 2009. The most recent and definitive, at least until this moment, was issued in January 2010 (ref. [5]).

The procedure for determining the allocation of an operator to a state is developed and executed by EUROCONTROL, having into account the calculation of CO_2 emissions of each airline flights to and from the European territory as is indicated in ref. [6]. Each state takes controls its own airlines plus non EU airlines emitting the highest quantity of CO_2 in the flights to that country. Logically large countries receive higher number of operators, mostly grouped by historical affinities: the majority of US airlines are allocated to the United Kingdom, most former Soviet Union members to Germany and almost all Latin American companies to Spain.

The Monitoring, Reporting and Verification (MRV) process is an adaptation of the regulatory framework adopted for other industrial sectors included in the European ETS. It was enforced by a Commission regulation as in ref. [7]. Operators not included in the low emitter exemptions must establish a documented and audited procedure to account and report the amount of kerosene consumed and the RTK performed by city pair of the routes to the EU airports. The regulation indicates different ways of compliance with this requisite, with the purpose of reducing the interferences with the carrier statistics, avoiding an excessive administrative burden and minimising the compliance cost.

In April 2011, the European Commission will grant to each participating airline a number of permits, equivalent to the number of CO_2 ton that airline will be allowed to emit at no charge in its 2012 flights to the EU territory. The permit attribution will follow the formula:

$$Na_{2012} = 0.82\ HE \times (RTKa_{2010} / \sum RTKi_{2010}) \quad (1)$$

where: Na_{2012} is the number of free permits for airline a in the year 2012

HE is the average number of CO_2 ton calculated by EUROCONTROL
$RTKa_{2010}$ the number of Revenue Ton-Kilometre performed by airline a flights touching EU territory in 2010
$\sum RTKi_{2010}$ the total number of Revenue Ton-Kilometre performed by all the operators included in EU ETS in 2010

The CO_2 emissions of a flight are directly proportional to its fuel consumption. An overwhelming majority of the aircraft affected by the EU ETS is consuming kerosene type fuel, specifications Jet A and Jet A1 and the Directive establishes an emission factor of 3.15 kg of CO_2 per kilogram of kerosene. As the ETS will start in the year 2012, by April 2013 each airline must deliver a number of permits equal to its fuel consumption in tons, multiplied by 3.15, corresponding to its 2012 flights in and out the EU.

It is interesting to notice that, for this first distribution, fuel efficiency plays no role and the only important variable is the market share of individual airlines in terms of RTK. Notwithstanding, the compensation of the actual emissions in 2012 of the permits granted on 2010 RTK bases favors the most fuel efficient airlines in 2012, with the lowest fuel consumption per RTK ratio. This benchmarking distribution tries to incentivize fuel efficiency in aggregate figures but does not recognize the differences between particular features of each specific network, like average stage length, infrastructure conditions or meteorology, which have a relevant influence on the amount of fuel burn.

From a service planning point of view, the strategy to get the most of free permits goes through increasing the total 2010 RTKs, either adding capacity to certain routes, playing with pricing policies to stimulate demand or increasing the number of direct flights, reducing intermediate stops. For the ETS, fuel consumption and RTKs are accounted only for the last segment before landing or the first one after takeoff. For example, a Delhi - Rome flight gets its total fuel consumption and RTKs accounted, while a Delhi – Istanbul – Rome only includes the Istanbul – Rome figures.

A second possibility to increase the number of performed RTKs depends on the way of calculating that magnitude. MRV regulation indicates a single way to calculate flight distances, consistent in taking the WGS84 system (ICAO model to compute orthodromic distances between two airports) and adding 95 kilometre per flight to compensate the difference between the optimum flight path and the actual one, assuming that, in percentage of distance, short flights deviates more than long ones.

Payload calculation is more complicated because passengers are not actually weighted and each airline uses its own estimations for evaluate the weight of a passenger and his baggage. On this issue the airlines have two options:

- using the standard weight and balance sheet for aircraft dispatching, with its specific values of passenger weights or,
- by default, using a single figure of 100 kg per passenger and his baggage

The experience shows that long range passengers use to travel with heavier baggage than medium range ones and airlines recognise it by applying higher weights in their transcontinental flights, but here there is an opportunity to increase RTK in the year 2010 adopting the most advantageous option (the heavier one), with the purpose of achieving more market share and receiving more permits for the year 2012. It is not allowed to use both procedures during the same calculation period, then it is convenient to make a global evaluation for checking which one gives the best result.

3. POLICIES FOR THE YEAR 2012

Once the airline has received its initial permit allocation by April 2011, the emissions of the flights to the EU in the 2012 program should be compared with the permits on hand in order to know whether there is sufficient coverage or the airline will be forced to buy additional permits.

In the first case, when no more permits are needed, the airline has to explore the conditions for selling the excess of permits of its property or, if it is forecasted an increase in traffic for 2013, evaluate the convenience of keeping them up to the next year. One interesting aspect of the system is the immediate financial liquidity of the permits, the value of which fluctuates in the stock markets, and allows airlines buy and sell with no practical limit. At the moment an airline receive a permit allocation, it may sell those permits in the market to improve its cash position. In the extreme case of a non EU airline receiving permits and deciding not to flight to the EU in 2012, those permits can be sold and the airline will account an extraordinary profit in its books.

In spite of this advantage, airline CO_2 permits can`t be sold to anybody. Carbon market is basically covering allowances of emitters included in the Kyoto Protocol. International aviation emissions are not integrated in the Protocol and are not *Kyoto permits*. The ETS regime allow airlines to buy *Kyoto permits* from other industries and using them to offset their emissions but *aviation permits* can`t be used by other industries and are only valid to offset aviation emissions. It is assumed that airlines will be needing more permits than the total of *aviation permits* created and there will not be problems to trade them among the different carriers. At the end, the market will develop the right interchange equation between Kyoto and non Kyoto permits.

This feature has a great relevancy for network planning and route evaluation. Reducing flights to the EU avoids the cost of permits or creates a profit by selling them, always dependent on the carbon market price. Up to now, that price has been extremely unstable, as it is shown in the figure 1, representing the evolution of the price of the CO_2 ton at the initial phase of the European ETS.

The first ETS year in Europe was 2005 and prices went up from an initial 8€ per ton in December 2004 up to 30€ per ton. In April 2006, the participating companies deliver their permits for compensating their emissions and the market discovered that permit allocation had been very generous and there was an excess of permits in the market. As a

consequence, the price fell down to 10€. The unbalance on free permits was partially corrected in the subsequent years, but prices never came back to the high values. In recent years, the price moves around 12-15€ per ton.

Figure 1.- Fluctuation of the CO_2 ton in the world stock market.

The effect of airline participation in the ETS should increase prices because the airline industry is supposed to be a net buyer of emission allowances, as the traffic growth overpasses the improvement of efficiency and the proportion of free permits is reduced in favor of more auctioning.

A surprising fact is the scarcity of trustable statistics on aviation fuel efficiency, being normal the use of fuel burn figures without the adequate correspondence with Revenue Ton-Kilometre data. To solve this problem, in the year 2000, the International Air Transport Association (IATA) started to monitor the actual evolution of that variable, asking for data directly to its associated companies, and compared them with the theoretical ICAO and IEA (International Energy Agency). The results of the six year comparison is shown in the figure 2. IATA members move over 90% of international air traffic and around 80% of total traffic and the results can be considered representative.

The data indicate that the industry can achieve an impressive improvement of efficiency close to 2% per year, but the traffic growth during that period averaged 5% per year, leaving the airlines in the need of buying permits to compensate the extra traffic.

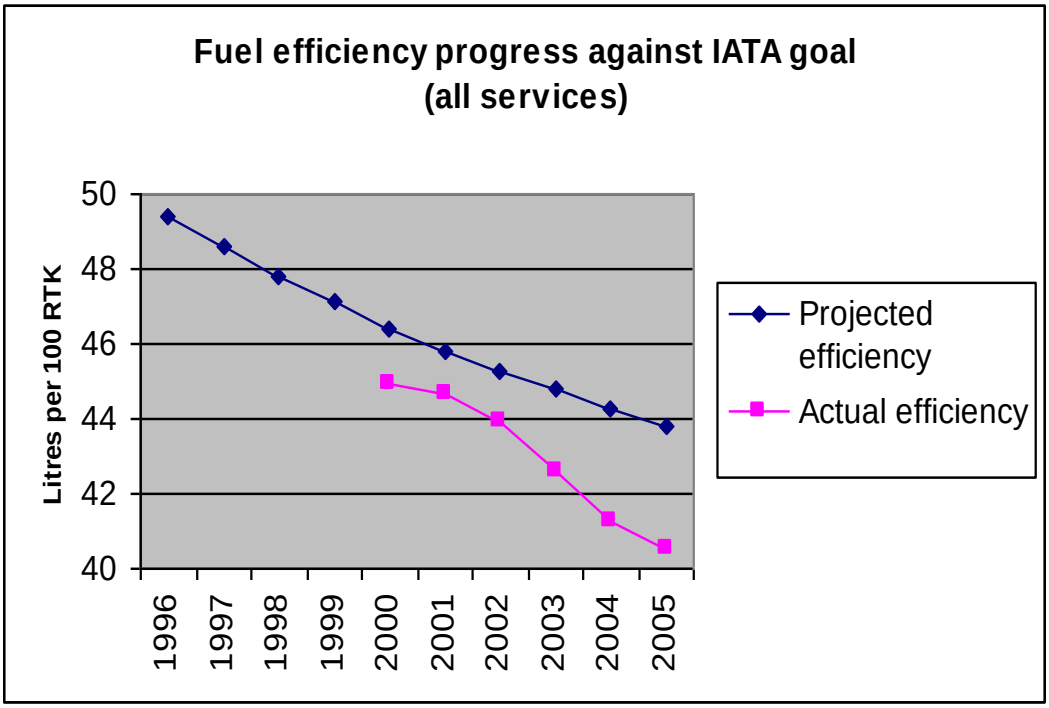

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Figure 2.- Projected and actual fuel use efficiency by IATA airlines

It is obvious that improving the efficiency parameter is key for mitigating the ETS cost. One important element for this purpose would be increasing the load factor of the flights, producing more RTKs with a minor additional amount of fuel burn. The other would be changing the composition of the fleet, introducing more modern and fuel efficient models.

For the non EU airlines, changing the composition of the fleet does not necessarily mean buying or leasing new models, but, in some cases, modify the existing aircraft rotation, assigning the better fuel economy ones to the EU routes. The advantages may be technological or simply by scale factor. All the other things the same, larger aircraft offer higher fuel efficiency.

An alternative method for reducing the amount of emissions included in the ETS consist in reshaping the flight network to shorten those flights touching EU points in 2012, doing exactly the opposite than in 2010. In this year, the target was increase RTKs by doing longer flights without intermediate stops. In 2012, the goal is achieving low CO_2 figures by reducing the length of the flights.

The geographical position of the non EU airline applying this method may be very influential. Airports close to the EU territory, like Istanbul for flights from the East or Casablanca for flights from the South may be excellent intermediate points to stop and limit the fuel burn in the last part of the total itinerary. Even places like the Middle East qualify as good scales for very long flights, like those coming from Australia or South East Asia. This policy has some limitations on commercial fields, as the passengers prefer nonstop flights, and on economy terms, because the selected stopover needs to be at a reasonable distance of the direct route for avoiding excessive detours and cost penalties.

The European system works with the amount of fuel burn per flight, independently of the place in which the kerosene has been uploaded. With this philosophy, *tankering* practices are useless. In the case of the US proposed system, in which the permit price is included in the delivered, taking more fuel than needed in a place not covered by the ETS might be considered, depending on the length of the flights and the price of the permits (see ref. [8])

4. BUYING ADDITIONAL PERMITS

If the number of assigned permits is insufficient and the airline decides to go on with its 2012 flight program, there will be a need of obtaining more emission allowances. That can be done in three different ways:

- participating in the auction of 15% of historical emissions, distributed in this way
- buying *aviation permits* to other airlines or *Kyoto permits* in the market
- Using other mechanisms offered by the Kyoto Protocol to compensate the emissions excess, like Joint Implementation or Clean Development Mechanisms

The first option is still to be defined by the EU Commission. The key point is to decide whether there will be an auction, including all the quota, or it will be fragmented in 27 auctions, one per EU member State. The price of these permits should be lower than the market price of *Kyoto permits* for being competitive. Otherwise, it would be more advantageous going to the general market.

This second option, buying in the general market, might have some positive aspects because the permit is easier to resale and the quotation is more transparent. The trading uses to be done by specialised agents who develop negotiation platforms for CO_2 emission allowances, in order to provide large, medium and small companies with an internet based system for the negotiation of emission allowances in a way that is safe, efficient, transparent and egalitarian.

In Europe there are several active markets like the European Market ECX, the Austrian Market EXAA, the French Market Powernext Carbon, the German Market EEX, the Norway Nord Pool and the Mediterranean Market SendeCO_2. Other international markets are USA CCX, the Montreal Climate Exchange and the Japanese markets.

The third possibility is offsetting emissions by entering in Joint Implementation programs or Clean Development Mechanisms. The emissions saved in these programs must compensate the airline emissions. Joint Implementation (JI) are transnational programs in which the partners share the obtained permits, Clean Development Mechanism (CDM) is gathering permits through projects performed in other countries. JI is reserved for EU countries cooperation while JDM is fully open to non EU participants.

The big trouble JI and CDM is the certification of the emissions savings. For example, financing the replacement of an old technology coal energy generator by a modern technology gas powered one. The project needs to be revised by an independent audit company with the purpose of certify the investment amount and the resultant emissions

decrease. The process is complicate, time consuming and expensive and only very big projects, develop by huge companies, reach a scale large enough to compensate the audit cost.

The way of making work CDM projects for medium or small companies is based on creating a company to launch the large project and sell participations to groups of enterprises in the same activity, like airlines groups. IATA has started a program for financing a large reforestation project and offers to its member airlines the possibility of purchasing permits.

The viability of JDM depends heavily on the evolution of carbon markets. As project evaluation, investment finance and operational planning require a certain level of anticipation, the cost of each saved CO_2 is predetermined and the whole project may be a total failure if market prices are lower.

A big part of the price development incertitude comes from the doubts on the pace of demand recovering after the fast traffic level fall down after the financial crash happened in the summer of 2008. The expansion of the crisis ran through the whole 2009, producing the deepest demand reduction since the Second World War.

Among the impressive quantity of negative news on airline business, there was a good one: the aviation emissions included in the future European ETS decreased by an estimated 7% in 2009 with respect to the previous year. Table 1 shows calculated CO_2 figures of the top 30 emitters in 2009 and their respective 2008 figures.

Emissions are reduced 6.8% average, with airlines like Alitalia, Delta, SAS or Singapore airlines decreasing more than 20%. Some of the growing figures in the table are misleading. For example, the 25% growth of Vueling is the consequence of the merger between that company and the other Spanish low cost carrier, Clickair. Other airlines in this category, like Air Berlin or easyJet offer modest increases and the fastest growing low cost carrier in Europe, the Irish company Ryanair keeps practically stable.

Traffic figures of the last three months (December 2009, January and February 2010) seem to indicate a progressive recovery of the demand, stronger in Asia, Middle East and Latin America than in North America and Europe. If this trend continues, non EU carriers will be in a very advantageous position to increase 2010 TRKs and gaining more permits than their slower recovery North American and European counterparts.

CO2 output by Airline (tonnes)	Total 2008	Total 2009	%+/-
Lufthansa	19,702,395	19,045,017	-3.34%
British Airways	20,016,000	18,921,244	-5.47%
Air France	16,471,318	15,623,617	-5.15%
KLM	12,027,656	11,016,567	-8.41%
Ryanair	9,643,648	9,617,105	-0.28%
Iberia	9,514,220	8,994,872	-5.46%
easyJet	7,423,088	7,565,568	1.92%
United Airlines	6,409,534	5,854,564	-8.66%
Delta Airlines	7,086,837	5,564,615	-21.48%
airberlin	4,539,723	4,877,073	7.43%
Virgin Atlantic Airways	4,833,403	4,533,006	-6.22%
Alitalia	5,106,950	4,013,846	-21.40%
TAP-Portugal	4,011,697	3,592,512	-10.45%
SAS	4,504,916	3,575,975	-20.62%
Qantas Airways	4,110,851	3,464,762	-15.72%
American Airlines	3,713,575	3,317,744	-10.66%
Continental Airlines	3,680,563	3,305,588	-10.19%
Emirates	2,849,866	2,941,452	3.21%
Aer Lingus	2,741,887	2,581,825	-5.84%
US Airways	2,611,897	2,570,936	-1.57%
Austrian	2,703,466	2,480,110	-8.26%
Finnair	2,872,640	2,458,971	-14.40%
Thai Airways International	2,426,169	2,296,063	-5.36%
Condor Flugdienst	2,308,212	2,090,105	-9.45%
Cathay Pacific Airways	1,940,892	2,008,373	3.48%
Singapore Airlines	2,629,768	2,001,378	-23.90%
Air Canada	1,844,171	1,883,218	2.12%
Air Europa Lineas Aereas	1,676,425	1,547,634	-7.68%
Air China	1,783,519	1,489,296	-16.50%
Vueling Airlines	977,431	1,222,530	25.08%
Total - All Airlines	252,706,305	235,391,304	-6.85%

Table 1.- Variation of CO2 emissions 2009-2008 for the top 30 airline emitters in the European ETS

4. CONCLUSIONS

Non EU airlines may opt for applying the above explained procedures only for those flights included in the ETS, segregating them from the rest of the network. Without disregarding

those cases in which the number of selected flights is very small, like a daily flight, ETS offers a great opportunity to increase the efficiency of both the operating and the administrative procedures, building up an accurate and audited control of payloads and fuel loads that may help a great deal into the decision making process of airline management.

To most of the non EU airlines the economic penalty of the ETS will be very modest at the beginning. The 2008-2009 financial crisis has drastically reduced air traffic growth and the figure for historical emissions is very likely to be similar to the corresponding 2010 figure. This is a key issue, because a majority of forecasts signals towards a fast growth recovery after that year, leading to a situation where granted permits cover most of 2012 airline needs but creates a huge deficit in the following years, when the number of free permits is progressively reduced. This makes very important early action to ensure a good starting position since 2010.

In comparative terms, non EU airlines flying long range wide bodies enjoy some advantages with respect to EU airlines mixing narrow and wide bodies and medium and long range flights. Aircraft efficiency of wide bodies flying long range is higher, in the fuel consumed by RTK terms, and depending on the load factor and the range of the flights may grant up to 20% more permits than same traffic volume with a medium range fleet.

The last element but not the least of the ETS strategy is the participation in the carbon market. There is no clear picture of the future situation of the CO_2 price. The historical experience offers an up and downs trajectory, moved by initial unbalances of the system and speculative movements by hedging funds. Even the auctioning procedure for the initial 15% of historical emissions is still to be defined. A prudent airline should keep an eye on future developments, acquire the knowledge needed and consider participation in collective systems of size enough to take leadership on carbon funds or Clean Development mechanisms specifically applicable to aviation.

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