

## **The influence of a “de minimis” clause on the CO<sub>2</sub> emissions of developing countries’ flights to or from the European Union – A Belgian case-study**

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### **Résumé**

*Ce document a pour but d’analyser l’influence d’une possible clause “de minimis” dans le cas où le système d’échange d’émissions européen (EU-ETS) serait étendu à l’aviation (internationale). Une clause “de minimis” a pour effet d’introduire un seuil à l’intégration d’une compagnie aérienne (ou opérateur) ou d’un appareil en particulier dans le système d’échange. Ce seuil peut par exemple être un seuil au niveau du poids de l’appareil ou un seuil au niveau de la fréquence annuelle des vols d’un opérateur donné depuis ou vers l’UE. Le présent travail se focalise principalement sur le paramètre “fréquence”, ainsi que sur son influence sur les activités aériennes entre les aéroports belges et les pays en voie de développement en particulier. Une analyse des vols réguliers permet d’estimer le nombre de vols exemptés, ainsi que la proportion des émissions de CO<sub>2</sub> qui serait exclue du système dans l’hypothèse où la clause serait adoptée, par rapport à la quantité totale des émissions incluse dans le système. Etant donné que l’analyse se limite aux aéroports situés sur le territoire belge, les conclusions formulées ne peuvent être extrapolées à toute l’UE sans analyser la situation pour chaque état-membre de manière plus approfondie. Ceci s’explique par le fait que le seuil limite pour l’intégration des activités d’un opérateur est basé sur le total des activités de cet opérateur précis sur le total des territoires nationaux des 27 états-membres de l’UE.*

**Mots-clefs:** système européen d’échange d’émissions, aviation, clause “de minimis”, émissions de CO<sub>2</sub>.

### **1. Introduction**

Transportation is one of the sectors for which a substantial effort is required if the international community wants to reach the commitments of the Kyoto protocol. Rail and road transport are both included in what currently remains the main worldwide attempt to tackle climate change. However, concerning aviation, the Kyoto protocol objectives only concern emissions from domestic flights and thus don’t include emissions from international flights. The Kyoto protocol requires that Annex I countries: “...pursue limitation or reduction of [Greenhouse gas emissions from aviation], working through the International Civil Aviation Organization (ICAO)...”. In 2001, the ICAO endorsed the development of open emissions trading for international aviation. The possibility of integrating the (international) aviation sector in the climate policy is more and more considered both at the European level and in the context of the United Nations Framework Convention on Climate Change (UNFCCC). More specifically, the extension of the European Union’s Emission Trading Scheme (EU-ETS) is being evaluated and developed right now by the European Union under great international attention.

The intensity of air travel has never been as high as it currently is (Airbus, 2004; IATA, 2007). Providing unseen exchanging possibilities and comfort to travelling people around the world, the current growth in international air traffic also threatens the potential beneficial achievements of the efforts made in other sectors towards reducing their contribution to global warming.

With this in mind, the European Commission proposed to include the aviation sector in the EU-ETS, while capping the emissions to 100% of the aircraft operators' average emissions during the period 2004-2006. The European Parliament went even further, proposing to reduce the authorized emissions to 90% of this total. Recent signals indicate a cap of 97% will be applied in a first phase and a 95% cap would be used promptly in a subsequent second phase. This "cap" sets a limit to the total amount of CO<sub>2</sub> emissions for the participants to the scheme. Part of the permits for this total will be allocated to operators free of charge, while others will be auctioned amongst the participants. Concerning the timing for the different types of flights (intra- vs. extra-EU flights), as opposed to the 2-phase approach which had been proposed by some, it currently seems likely that there will be no distinction between intra-EU and extra-EU flights and that effective extension of the EU-ETS will be performed for both in 2012.

In the context of the inclusion of aviation in the EU-ETS, the European authorities are evaluating the possibility to include a "de minimis" clause to the newly proposed directive. This clause states that operators performing less than a defined yearly number of flights to or from the European Union would be exempted from participation to the EU-ETS. The current proposal suggests that airlines operating less than 243 flights to/from the EU per 4-month period, during three consecutive periods or emitting less than 10 000 tons of CO<sub>2</sub> per year would be exempted from the scheme. This threshold corresponds to approximately two one-way flights per day.

Next to the discussion about the "de minimis" clause is the issue of the allocation of the revenues of the auctions. Some members of the European parliament suggest earmarking these revenues to use them to finance climate change initiatives in the developing world. Others suggested using the revenues to limit European climate impact by encouraging low-carbon transportation as a whole, for example through additional financing of public transport or through the additional financing of research. However, it seems the legislations of some member states make it impossible to implement such an earmarking on public revenues and therefore it seems likely that the legislative text will remain a mere "recommendation" to use the revenues for climate change prevention and mitigation, rather than a real mandate on how to spend the funds.

## **2. Aviation and Climate**

On a worldwide scale CO<sub>2</sub> is, by far, the emission that impacts climate in the strongest way. This explains the focus of the EU-ETS on the emissions of this gas. However, aviation presents some specific climate-related characteristics resulting from other emissions which are largely emitted in the higher troposphere and in the lower stratosphere.

Nitrogen oxide emissions (NO<sub>x</sub>) of subsonic aircraft tend to decrease the lifetime of the greenhouse gas methane (CH<sub>4</sub>) that is present in the atmosphere. Also, NO<sub>x</sub> emissions tend to increase ozone production in the higher troposphere. This ozone is a very short-lived greenhouse gas.

Besides this, aviation induces condensation trails (contrails) and possibly also the formation of cirrus clouds. The total impact of aviation on climate is believed to be two- to four-fold (Figure 1) that of CO<sub>2</sub> alone (Sausen et al., 2005). However, as the effects of the different gases are differentiated in both time and place from the effects of CO<sub>2</sub>, the use of a multiplier for the calculation of the overall effects of aviation on climate might be an oversimplification.

Based on some results from the TRADEOFF project, Sausen et al. (2005) performed an update on radiative forcing or RF (the difference between incoming radiative energy and outgoing radiative energy of the Earth) from aviation and compared different studies dealing with aviation and radiative forcing (Figure 1). Although the influence of aviation on climate is larger than the impact of its CO<sub>2</sub> emissions only, the focus of this paper will be on CO<sub>2</sub> emissions.

## **3. Objectives**

The main objective is to evaluate the influence of the implementation of a "de minimis" clause to the extension of the EU-ETS. Two main goals are advocated for the implementation of this clause. Firstly, it will reduce the administrative burden for companies with low activities to and from the EU

as well as for the European administration managing the system. Secondly, it is aimed at shielding (often small) companies in developing countries with little resources and limited activities to and from Europe. Moreover, it might help in convincing non-EU countries to participate in the EU-ETS.

The approach used to assess the influence of this clause is an analysis of the flights performed between the Belgian airports and airports located in developing countries. Typically, these countries are located in 5 ICAO code zones (Figure 2): D-G (Western Africa), H (Eastern Africa), F (Central and Southern Africa), M (Central America and the Caribbean area) and S (South America).

Table 1 lists the countries in these zones to or from which flights were operated in 2007. As a consequence, if a country is not listed in the table, it doesn't necessarily mean it is not taken into account in the analysis, but it might rather mean that no flights were operated between that country and Belgium in 2007. As an indication, the countries located south of the red lines in figure 2 are included in the current analysis.

#### **4. Approach for the quantification of the different flight types and their emissions**

The calculation method is based on the approach used in the Belgian Federal Research project "ABC Impacts" or "Aviation and the Belgian Climate Policy: Integration Options and Impacts" (ABCI, 2008). The calculations are based on data provided by the Belgian Air Traffic Management operator (Belgocontrol) and include all instrument flight routes (IFR) activities taking place in the Belgian air space. For flights with a stop-over, only the leg including a landing or take-off on a Belgian airport is included.

Based on these data, several kinds of flights will be excluded from the analysis to focus exclusively on flights between Belgium and developing countries in Africa and Latin America. The excluded flights are: flights between Belgium and industrialized countries, flights operated by the main operators performing scheduled flights (which easily overpass the threshold value for an exemption to participate in the EU-ETS), and flights to or from Mediterranean countries with a highly developed tourist activity. The remaining activity will be the flight operations to or from developing countries which might be exempted from the scheme (potentially exempted activities).

In the next step, the Corinair methodology (EMEP/Corinair, 2003) will be applied to calculate fuel consumption and CO<sub>2</sub> emissions related to the flights described above. The fuel consumption and its consequent emissions depend on the type of aircraft, the occurring flight phase and the covered distance. The total fuel use was calculated by adding the average fuel uses of the different type aircraft which were obtained through a linear regression of the fuel use/emission data for the climb-cruise-descent data provided in EMEP/Corinair (2003). The distance used to calculate the fuel consumption and emissions was the great circle distance ("as the crow flies") from Brussels to the capital of the concerned country. This might lead to a slight underestimation of the distances, nevertheless it doesn't impede drawing conclusions as the orders of magnitude between the different flights remain very similar. Finally, the emissions will be compared to the emissions (from these same countries) which will certainly be included in the scheme. Also the potential number of exempted flights will be put in perspective with the total aviation activity in Belgium.

#### **5. Results**

The distributions of the number of flights (Figure 3) and of the CO<sub>2</sub> emissions (Figure 4) assessed in this analysis are shown below. Due to the fact that the number of type aircraft included in the EMEP/Corinair methodology is not completely exhaustive, only 98.7% of the flights could be included in this analysis, resulting in a total number of 4197 flights for the year 2007. This ratio has been estimated to be satisfactory to describe the general tendencies and to enable the drawing of conclusions. Five countries represent more than half of the flights included in this analysis, namely: Nigeria (678), Senegal (609), Cameroon (417), Kenya (381) and the Dominican Republic (359).

As the distances between the city-pairs as well as the aircraft types operating between the different city-pairs differ, the distribution of the CO<sub>2</sub> emissions (Figure 4) is slightly different from the distribution of the numbers of flights (Figure 3). Nevertheless, the five same countries contribute for

more than half of the CO<sub>2</sub> emissions: Nigeria (95 485 tons), Senegal (56 011 tons), Kenya (55 322 tons), the Dominican Republic (46 533 tons) and Cameroon (45 273 tons).

When removing the flights operated by companies known to be not complying with the conditions to be exempted from the EU-ETS through the “de minimis” clause (operating more than the maximum number of flights to comply with the clause’s conditions), 8.7 percent of the flights and 10.3 percent of the CO<sub>2</sub> emissions are left as potentially concerned by an exemption through the “de minimis” clause, which doesn’t necessarily mean they effectively will be exempted.

## **6. Discussion**

An overview of the potentially exempted flights and emissions was provided above. When the aviation activities to and from the countries analysed above (4 197 flights) are put into perspective with the total number of flights on Belgian airports during the year 2007 (319 868 flights), one should be conscious they represent only a limited fraction of the total aviation activities (1.3%).

As can be seen in Figure 5, the potentially exempted emissions and flights even only form a minority of the total aviation emissions (10.3%) and flights (8.7%) in the analysed regions of the world. It might therefore be acceptable to exempt part of these activities to improve the efficiency of the system as a whole. Consequently the “de minimis” clause could be valuable. On the other hand, one should realise the situation described above is the worst-case scenario for 2007 (the scenario with the highest possible level of exemptions). This is due to several main reasons:

- 1) The potentially exempted flights might be operated by companies exceeding the threshold of the “de minimis” clause operating these routes less frequently and might therefore possibly not have been detected by the authors.
- 2) The potentially exempted flights might be military or humanitarian flights, which are exempted from the EU-ETS anyway.
- 3) Airlines or operators might remain under the threshold when looking at their activities on the Belgian airports only, but they might be exceeding this threshold if their activities in the entire EU were to be analysed. Consequently they wouldn’t be exempted.

Nevertheless, this potentially exempted number of flights and emissions constitute a non-negligible fraction of the total emissions and therefore the “de minimis” clause should be implemented only after some more thorough analysis on an EU-wide scale. On the risk side, the European authorities should pay some special attention to avoid carbon leakage through potential foundation of new companies, created by existing operators with the aim to remain below the threshold of the clause and of the EU-ETS.

## **Acknowledgments**

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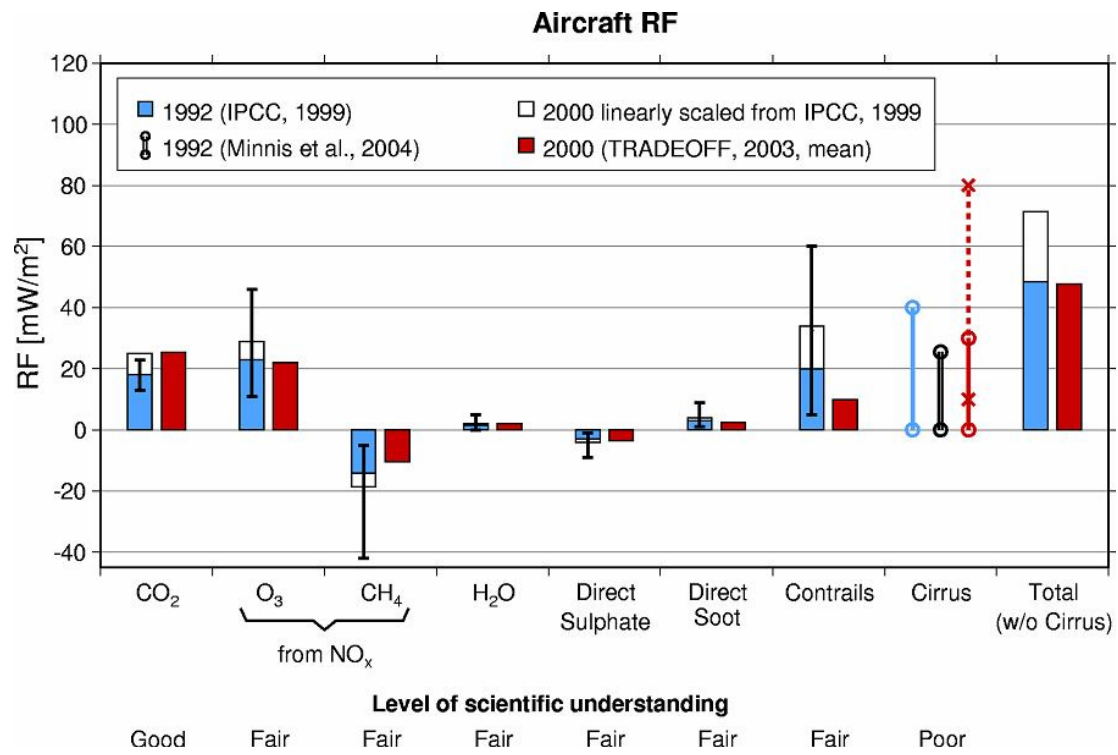


Figure 1: Climate effects of aviation, including the level of scientific understanding of the different impacts (Sausen et al., 2005). RF stands for Radiative Forcing and reflects climate impact.

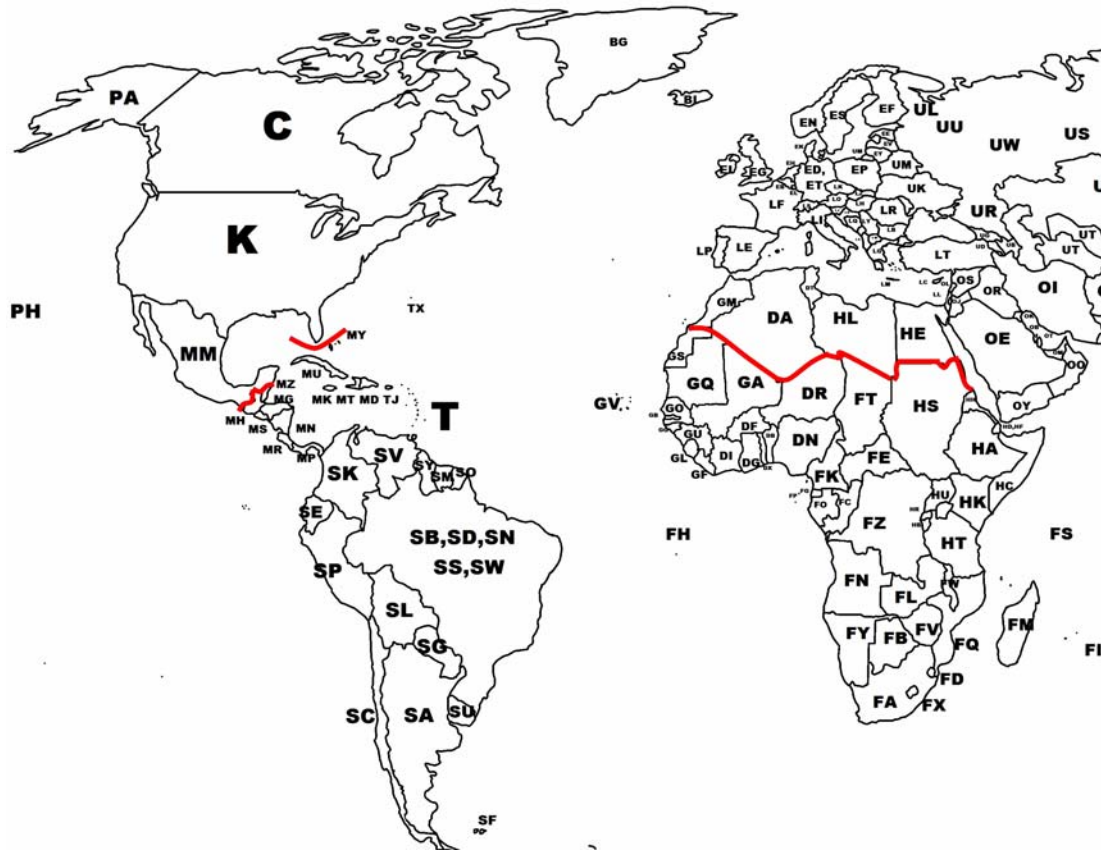


Figure 2: ICAO codes for several airport zones, with Western Africa, Eastern Africa, Central Africa + Southern Africa, Central America + Caribbean and South America respectively indicated through the letters D-G, H, F, M and S.

Table 1: List of the countries included in the analysis of the flights to and from Belgium with their respective ICAO codes.

	Country		Country		Country
DB	Benin	FT	Chad	HB	Burundi
DF	Burkina Faso	FW	Malawi	HH	Eritrea
DG	Ghana	FY	Namibia	HK	Kenya
DI	Ivory Coast	FZ	Democratic Rep Congo	HR	Rwanda
DN	Nigeria	GA	Mali	HS	Sudan
DR	Niger	GB	Gambia	HT	Tanzania
DX	Togo	GF	Liberia	HU	Uganda
FA	South Africa	GG	Guinea-Bissau	MD	Dominican Republic
FB	Botswana	GL	Sierra Leone	MK	Jamaica
FC	Congo (Brazzaville)	GO	Senegal	MP	Panama
FE	Central African Republic	GQ	Mauritania	MU	Cuba
FG	Equatorial Guinea	GU	Guinea	SB	Brazil
FK	Cameroon	GV	Cape Verde	SP	Peru
FN	Angola	HA	Ethiopia	SV	Venezuela
FO	Gabon				

Table 2: Type aircraft with CO<sub>2</sub> emission factors per km (left column) and per landing and take-off cycle LTO (kg/LTO) (EMEP/Corinair, 2003).

Type aircraft	CO <sub>2</sub> (kg/km)	CO <sub>2</sub> (kg/LTO)
A310	15.28	4 853
A320	8.63	2 527
A330	20.41	7 029
A340	22.18	6 363
BAC1-11	7.97	2 147
BAe146	8.69	1 794
B727	14.02	4 450
B737 100	8.95	2 897
B737 400	9.54	2 600
B747 100-300	37.58	10 754
B747 400	34.27	10 717
B757	12.10	3 947
B767 300 ER	16.60	5 094
B777	24.07	8 073
DC9	9.67	2 760
DC10	28.35	7 501
F28	7.59	2 098
F100	8.03	2 345
MD82	10.90	3 160

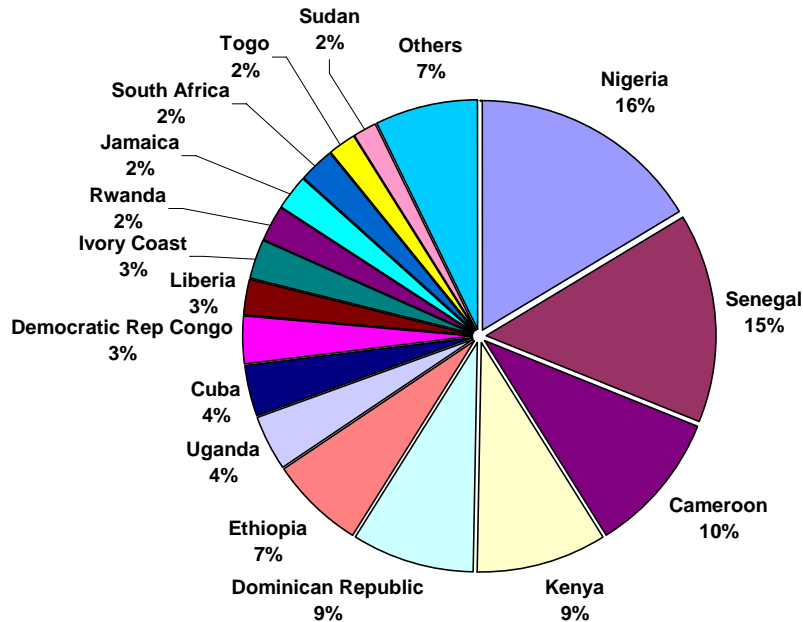


Figure 3: Distribution of the number of flights (4 197 in total) related to the assessed aviation activity by country of origin or destination.

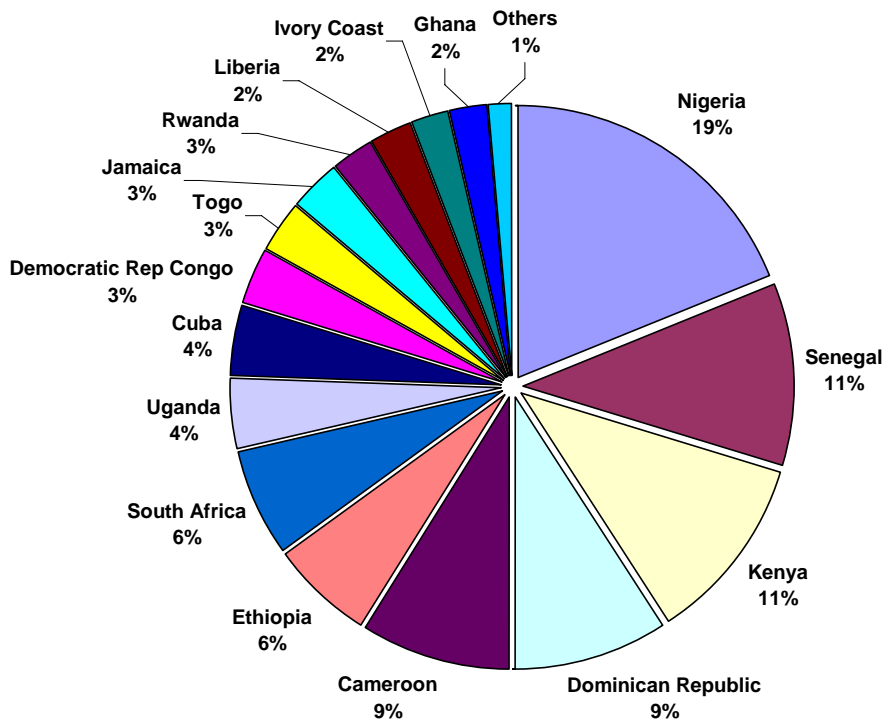


Figure 4: Distribution of the CO<sub>2</sub> emissions (539 370 tons in total) related to the assessed aviation activity by country of origin or destination.

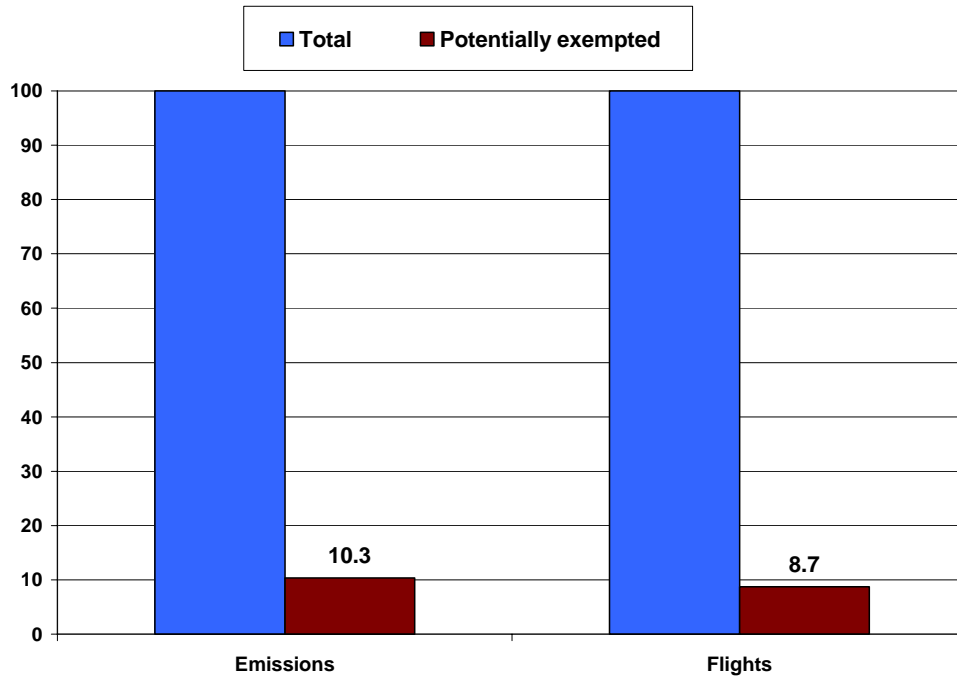


Figure 5: Comparison of the relative quantity of emissions (left) and relative numbers of flights (right) included in this analysis as compared to the potentially exempted quantity of emissions and flights by the “de minimis” clause.