How much carbon dioxide is *your* airport generating?

Climate change is now constantly in the media, with public awareness and scientific understanding (as well as the urgency of the situation) growing daily. But although climate change will have a damaging effect on the whole planet and is a compelling reason *not* to expand airports, the greenhouse gas emissions from an airport (unlike the noise and air pollution) have no immediate impact on the local community.

For this reason, it can be hard for residents and campaigners to visualise or feel threatened by greenhouse gases from their local airport, and they may tend to underplay it in their campaigns. To try to overcome this, a number of groups have estimated the emissions of carbon dioxide (CO2), the most important greenhouse gas, associated with their local airport.

There are no statistics, official or otherwise, on the emissions from each UK airport, so groups have had to devise their own methods of calculation. They have used national statistics which refer to the total of UK airports as well as information on their local airport, such as number of passengers, number of flights, aircraft types and routes flown.

A figure of 9.8 million tonnes of carbon emissions emitted by aircraft from all UK airports in 2005 was given in answer to a Parliamentary Question (Hansard, 8 December 2005). Half the emissions of aircraft flying from UK airport to foreign airports have been included in this figure – the other half, reasonably enough, are apportioned to return flights from the far end.

One tonne of carbon is equivalent to 3.67 tonnes of CO2, so 9.8 tonnes of carbon is equivalent to 36 mt of CO2.

Estimates have now been made for 4 UK airports:

- Bristol 0.7 mt pa
- Gatwick 5.0
- Stansted 2.2
- Heathrow 13.9

Such figures have more impact if they can be related to other things. Bristol, for example, has compared the airport emissions with those from all Bristol's road traffic and the amount of forest one would need to store the CO2. All local groups can play this game and, by doing so, give a local context and perspective to airport emissions.

In the rest of this pullout we present the calculations done for Gatwick and Stansted.

Calculations for Gatwick

(with thanks to Brendon Sewill)

One simple way to get an approximate estimate is to start from the figures given by the Department for Transport that all aircraft from UK airports emitted 9.8 million tonnes (Mt) of carbon in 2005. That is equivalent to 36 Mt of CO_2.

Gatwick handled 32 million passengers compared to a UK total of 217 million. The distance flown by planes from Gatwick is probably about equal to the national average – less than from Heathrow but more than from other airports. That suggests that aircraft from Gatwick on their outward journeys emitted about 5 Mt of CO_2.

A second method of calculation is to start from the amount of aviation fuel taken on board aircraft at Gatwick. In 2004 this was 2.4 billion litres which would weigh roughly 2 million tonnes. Every tonne of aviation fuel produces 3.15 tonnes of CO_2. Thus the fuel taken on board at Gatwick produces 6.3 million tonnes of CO_2.

That figure needs adjusting to allow for the fact that some aircraft fill up at Gatwick for both the outward and for the return journeys. On the other hand aircraft belonging to foreign airlines may fill up abroad for both journeys. (This calculation is unduly kind to BAA. They charge a commission on all aircraft fuel loaded at Gatwick, and therefore in theory ought to take some responsibility for ALL the CO_2 produced when that fuel is burnt, whether on an outward or inward flight.)

According to an aviation expert, for most of the Mediterranean and tourist destinations Gatwick fuel is fairly close in price to the destination price - particularly for a Gatwick-based airline which will achieve a volume discount. Most of the leisure flights to these points are operated on aircraft that can comfortably carry round trip fuel without the economic disadvantage of having to burn off too much to carry it. For flights to say the Middle East, Egypt and North Africa it may be advantageous to uplift fuel at destination - and for long haul flights to USA etc the fuel required will eliminate the capability of carrying much, if any, of the return fuel load. ‘At a rough guess, I would say that 60% of departures from Gatwick, accounting for about 40% of the fuel uplift, are carrying fuel for the return journey’.

This suggests that the CO_2 emissions caused by the outward flights are around 4.5 Mt, broadly confirming the figure obtained by the first method.

A third, but more complicated, method is to add up the mileage of all the routes flown, and assess the emissions caused by each type of aircraft both on take-off and when cruising. This method has been used by the Stop Stansted Expansion campaign, and their results are consistent with our results above.

Calculations for Stansted

(with thanks to Brian Ross)

Step 1) Fuel consumption: We arrived at a fuel burn figure of 3.1 tonnes per hour as the weighted average for passenger aircraft operating in and out of Stansted. This average is mostly derived from Ryanair's fleet of (mostly) Boeing 737-800 aircraft and Easyjet's fleet of (mostly) Airbus A319s. Ryanair accounts for 60% of all Stansted scheduled passenger traffic and Easyjet for 27%. Both fleets will very soon be standardised on these modern and fuel efficient aircraft types and we have assumed that they already are, which makes our baseline slightly conservative.

Note however, that whilst Ryanair and Easyjet account for 87% of scheduled Stansted traffic, the remaining 13% generally operate older, less fuel efficient aircraft. Also, Stansted now has some longer haul scheduled services, for example to New York and Washington where larger aircraft are used, burning far more fuel per trip. And there are also charter flights to consider. These only account for 4.2% of total passenger flights at Stansted but they push up the average slightly because they generally operate larger, less modern, aircraft types consuming more fuel per hour. Thus the 3.1 tonne figure is slightly higher than the average for Ryanair and Easyjet alone.

Step 2) Trip duration: An analysis based on the BAA Stansted flight timetable (scheduled and charter flights) enabled us to calculate the average duration for a passenger flight at Stansted of 96 minutes (1.6 hours). Here again, short haul services by Ryanair and Easyjet dominate this schedule but charter and long haul flights push up the average.

Step 3) Fuel burn per trip: From the above, this works out to 4.96 tonnes of fuel used per trip (3.1 x 1.6). As a reality check, this is only slightly higher (as we would expect) than the fuel usage figure which can be derived from information published by Ryanair on total annual trips and total annual tonnes of fuel purchased.

Step 4) Conversion to CO2: When one tonne of kerosene is burnt, it produces 3.11 tonnes of CO2. This is an internationally accepted conversion factor. Hence an average Stansted flight generates 15.4 tonnes of CO2 (4.96 x 3.11).

Step 5) Commercial passenger flights: Stansted handled a total of 178,414 commercial flights in 2005 of which 166,767 were commercial passenger flights (scheduled and charter) and the remainder were freight (see below). At 15.4 tonnes per flight, this equates to 2.6m tonnes of CO2 for the passenger flights.

Step 6) Freight flights Stansted handled 11,647 freight flights in 2005. Freight aircraft operate much larger (and generally older) aircraft and mostly operate on long haul routes - bringing in fruit, flowers, veg and all manner of high value goods from all corners of the world and a Boeing 747 freighter will use about 120 tonnes of fuel on a trip from Hong Kong. We do not have precise data for average trip length/duration but we estimate an average 8 hour trip and an average fuel burn of 8 tonnes per hour. Overall, for freight flights, we have estimated an average fuel burn

of 64 tonnes per flight which equates to 199 tonnes (64 x 3.11) of CO2 per flight = 2.3m tonnes of CO2 for 11,647 flights.

Step 7) Non Commerical Flights: Stansted handles a further 15,097 flights in 2005 - i.e. on top of the 178,414. Non-commercial flights consist of aircraft carrying less than 10 passengers, business jets, aircraft repositioning, training and testing flights, diplomatic, military, Queens Flight, and rotary wing flights. An aircraft's fuel usage is dramatically higher (up to 10 times) during the first 20 minutes of a flight, whilst climbing to its cruising altitude, but even so, we have assumed that the contribution of non-commericial flights to CO2 emissions to be relatively small. We have estimated this nominally at 2 tonnes of fuel per flight = 6.22 tonnes of CO2 = 0.1m tonnes.

Step 8) Sub-total: Adding (5), (6) and (7) together we arrive at a figure of 5.0m tonnes of CO2 emissions. However, there are some further calculations to be done:

Step 9) Radiative Force Index (RFI): This is defined in the HMT/DfT paper, "Aviation and the Environment; Using Economic Instruments" (see reference (iv) above) as the ratio of total radiative forcing to that from CO2 emissions alone. Total radiative forcing induced by aircraft is the sum of all forcings, including direct emissions (e.g. CO2, soot) and indirect atmospheric responses (e.g. CH4,O3, sulphate, contrails). RFI is a measure of the importance of aircraft-induced climate change caused by all emissions, not just the contribution from the release of fossil carbon alone. According to the 1999 IPCC report "Aviation and the Global Atmosphere" (see reference (i) above) the RFI for aircraft is 2.7. Thus the 5.0m tonnes of CO2 shown at Step (8) becomes 13.5m tonnes when expressed as 'CO2 equivalent'.

Step 10) Divide by 2: The Government's approach is to divide aircraft emissions on international flights by 2, based on the argument that emissions should be split 50:50 between the country of origin and the country of destination. Despite the fact that it seems a bit unreasonable to hold the Maldives responsible for 50% of the carbon emissions created by all the Jumbo jets delivering and collecting hoardes of British holidaymakers, we apply the 50:50 rule to our calculations. In fact, we apply this for dometic flights also, so that a trip between Stansted and Edinburgh results in the emissions being allocated 50:50 to each airport. This reduces the Stansted's CO2 emissions in 2005 to the equivalent of 6.75m tonnes.

Step 11) Surface Access Transport: This relates to the carbon emissions arising from passengers and employees travelling to and from the airport by car, bus, train etc. We estimate all this to be about 2% of the Stansted total for aircraft emissions based on wider Department for Transport analysis - i.e. 135,000 tonnes. There is also a small quantity of on-site airport emissions.

In total therefore we estimate that operations at Stansted Airport in 2005 produced the equivalent of 6.9m tonnes of CO2