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The impact of renewable fuels on plane tickets

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Contents

1 The impact of using renewable fuels means multiplying fuel cost by a factor 2-6

The aim of this document is to illustrate how large the impact of replacing fossil fuels with renewable ones is in the aviation sector. This comparison, shown in Figure 1, focuses on fuel costs only because a discussion on the total price of the tickets would be more complex[1] and the fuel price gives a good indication of the impact of renewable fuels. As shown in Figure 1, the fuel costs of a round-trip flight of one passenger from Amsterdam to Madrid would go from about €46 if using fossil fuels to about €92-€275 (i.e. multiply them by a factor 2-6) if using renewable fuels. In other words, the fuel costs of flying on renewable fuels would be about €46-€229 higher than the fuel costs of flying with fossil fuels. This premium is considerably higher than what it would cost to purchase ETS rights (about €2.7-€4.1) or offsets from a CO_2 compensation scheme (about €2.1-€14.0).

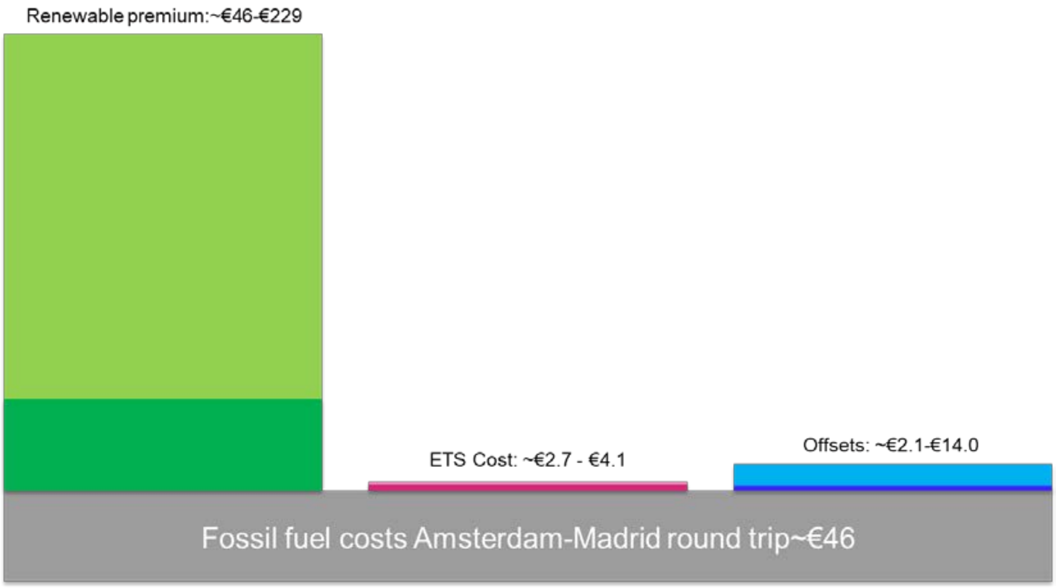

Figure 1: Cost comparisons of renewable premium, ETS, and offsets for Amsterdam-Madrid (round trip)

In the following chapters is explained how these numbers were obtained (sources and computations performed).

[1] As the prices are not very transparent, and as changes in fuel prices do not necessarily simply translate into changes in ticket costs

2 Journey fuel costs

The fuel costs of a journey are simply the product of the amount of fuel used (in litres) and of the price of the fuel (in euro per litre).

2.1 Fuel use

Table 1: Emissions and fuel consumptions for round-trip journeys starting from Amsterdam Schiphol

Destination	Emissions per passenger (kg)	Litres fuel per passenger
London Heathrow	119.00	46.84
London City	149.00	58.65
Berlin- Schönfeld	164.60	64.79
Berlin - Tegel	160.20	63.05
New York JFK	700.80	275.84
Moscow (SVO)	349.00	137.37
Madrid	255.00	100.37
Athens	352.00	138.55

Table 1 shows the emissions and the corresponding amount for fuels for a selection of round trips starting at Amsterdam Schiphol, including the Madrid reference that we use throughout this document.

The emissions per passenger were obtained from the ICAO Carbon Emissions Calculator [1]. This calculator uses publicly available industry data for the various elements that are needed for calculating the emissions (such as route data, aircraft type, or passenger load factor).

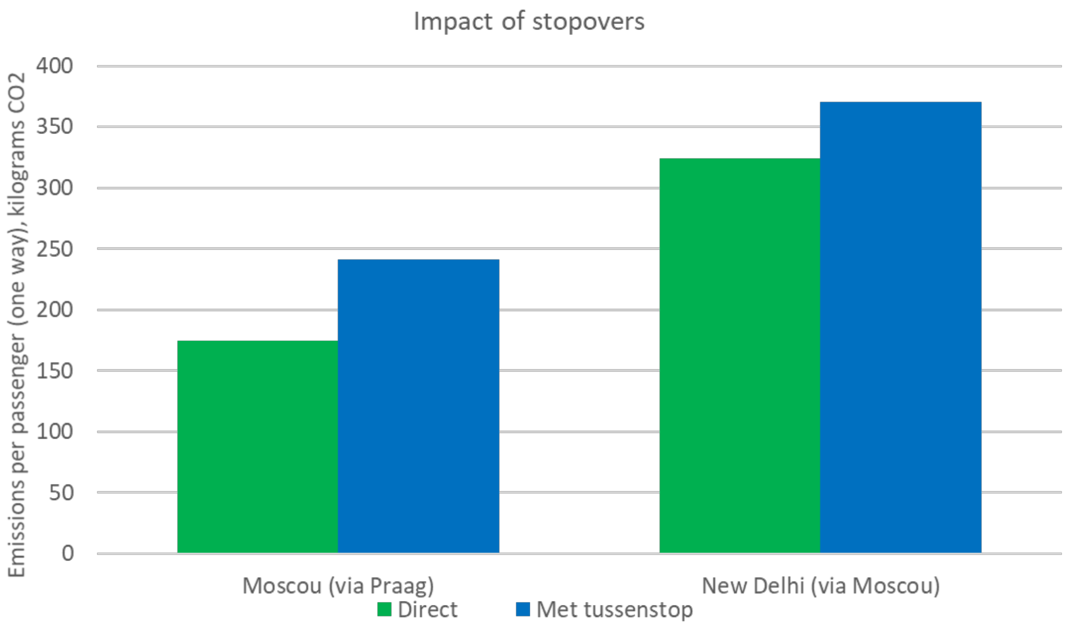

Figure 2: Impact of stopovers

An interesting side note from the data provided by the ICAO calculator is the impact of stopovers, which can be quite large, as shown in Figure 2. Using a stopover in Prague adds about 38% to an Amsterdam to Moscow flight (one way), and a stop in Moscow adds about 14% to a flight from Amsterdam to New Delhi (one way).

To get the corresponding fuel consumption, we need to reconstruct what was done by the calculator and divide the emissions by the product of the emissions per kg fuel (3.16 kg CO_2/kg fuel, from [2]) and of the fuel density of Jet A-1 (0.804 kg/litre from [3]).

2.2 Fuel prices (per liter)

2.2.1 Fossil fuels

For the price of fossil fuels (per litre), we looked at the IATA fuel monitor [4], to get a value of €0.46/ litre (USD 1.92/ gallon, and 0.90 USD in an euro [5], and 3.785 litres in a gallon).

2.2.2 Renewable fuels

For the renewable fuel premium, we assumed that this would at least be twice the price of fossil and go up to six times the price of fossil, based on a variety of external sources ([6],[7],[8],[9]).

2.2.3 Potential taxes

There are two types of taxes that could apply to aviation fuels (but aren't currently applied):

1) A levy, which was applied in the Netherlands until 2011for certain types of flights, with a tariff of €0.22/litre [10].
2) A VAT (currently 21% [11]).

All these costs are put together in Figure 3, which shows the costs for fossil fuels without taxes (the current situations), as well as the minimal and maximal values for a journey with renewable fuels, with and without taxes. This is done for a selection of destinations, staring from Amsterdam Schiphol.

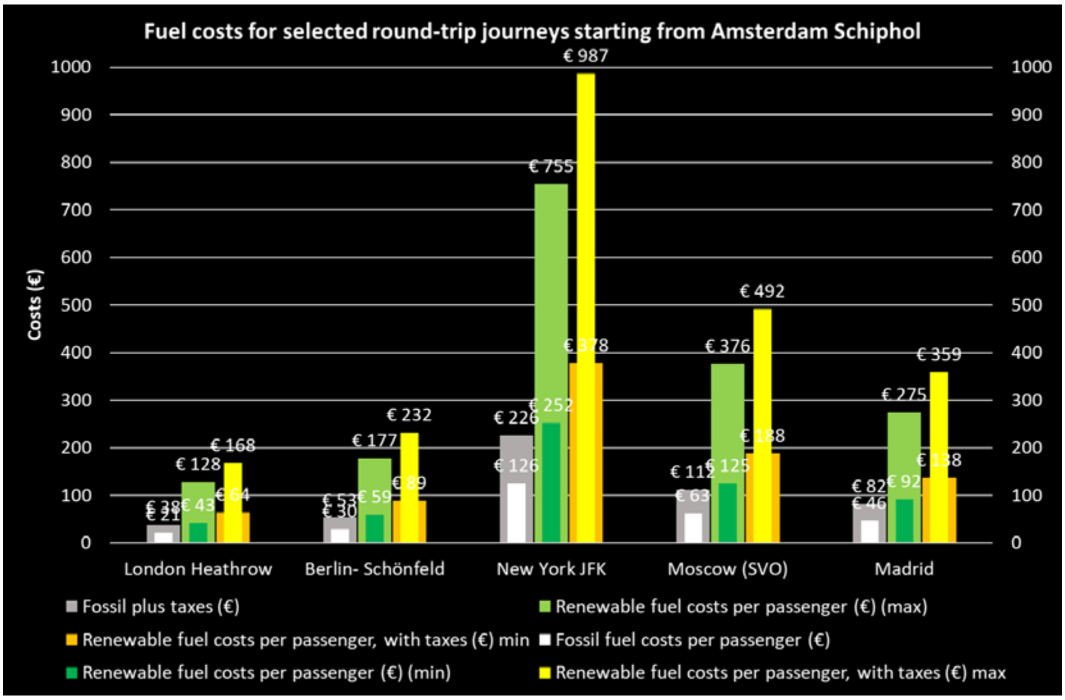

Figure 3: Fuel costs for selected round-trip journeys starting from Amsterdam Schiphol

2.3 Offset prices

2.3.1 ETS

Table 2: ETS price for various destinations, starting for Amsterdam Schiphol (one way)

Destination	ETS price min (€)	ETS price max (€)
London Heathrow	1.26	1.89
London City	1.58	2.37
Berlin- Schönfeld	1.74	2.62
Berlin - Tegel	1.70	2.55
New York JFK	7.43	11.14
Moscow (SVO)	3.70	5.55
Athens	2.70	4.05

To compute the costs of compensating the emissions by purchasing ETS emissions rights, we need to multiply the journey's emissions by the costs of ETS emissions rights (between €20 and €30 per tonne [12]. We then need to multiply this by 1 minus the percentage of free allowances (47% [13]). The results are shown in Table 2.

2.3.2 Offset schemes

The costs for offset schemes are a little bit more complex to compute, because there are two things that vary from scheme to scheme: the price per tonne of CO_2 (which depends on the type of project that is used for compensation, as well as other costs such as administrative fees, which make these costs not entirely transparent), and the amount of CO_2 that the offset scheme assumes for a given journey. The latter can vary quite a bit (sometimes by more than a factor 2). This means that we can either multiply the emissions from our reference calculator by prices of the schemes to have consistency between the prices, or we can use the actual prices the schemes charge for a journey. In the comparison made in Figure 1, we used the latter option, to better match the question “What would happen if we tried to choose this way to make our flight more sustainable?”. The lower value of €2.12 for Amsterdam to Madrid (round trip) comes from the KLM scheme [14], which assumes 250 kg of CO_2 (compared to 255 kg from the ICAO calculator, as shown in Table 1. The higher value of €14.00 for that same journey comes from the MyClimate scheme [15] (which is a provider for Lufthansa, but can also be used independently). This higher price is both due to the higher costs per tonne of the scheme and due to estimated emissions of 549 kg, which is more than twice the KLM estimate (and the ICAO calculator we use as a reference).

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