Olympics 2012 Journey Carbon Footprint Calculator:

Summary

BP TargetNeutral has committed to offset the carbon emissions associated with spectator travel to and from London and regional venues during the 2012 Olympics. This paper sets out the approach taken in order to calculate the scale of these emissions, and so inform the total volume of carbon emissions to be offset.

In basic terms, the calculation of carbon emissions to be offset from spectator travel to and from the Games is made by calculating an estimate of the carbon emissions for each individual spectator travelling from a particular country and then multiplying this by the number of spectators from that country who register for a carbon offset when they purchase their tickets. The emissions per spectator depend on their country of origin (and so the distance they will travel) and also their mode of transport (since some modes of transport emit more carbon emissions per passenger km than others).

For spectators living in the UK, a calculation of average travel-related emissions per spectator has been undertaken by the consultancy Best Foot Forward, drawing upon analysis conducted by them for the London Organising Committee for the Olympic Games (LOCOG). The calculation of average emissions per spectator living in the UK takes into account travel by spectators from all parts of the UK to and from Games events both within and outside of London. It applies weighted averages for travel distances and assumptions about the likely mode of travel (e.g. air, rail, car, bus, underground) to calculate the average travel-related emissions per spectator.

For spectators travelling from outside of the UK, ERM has applied a series of simplified, conservative assumptions to calculate an estimate of the carbon emissions per spectator that is accurate and yet errs on the side of over- rather than under-estimating the emissions that need to be offset. For example, the calculations assume that all spectators travelling from outside the UK would travel by air from their country of origin, arriving into London Heathrow.

For the most significant countries of origin in terms of spectator numbers (the top 40, as estimated by LOCOG), individual emission factors were calculated for spectator travel. An estimate of air travel emissions was determined based on the distance from the capital city airport within each county of origin to London Heathrow. For a small number of countries of origin (where the country is large and the capital is closer to London than the majority of the population), a weighted average distance from the four most populated cities in each country was used. An estimate of emissions from ground travel was determined based on the assumption that spectators would drive to the airport in their country of origin, and that the majority of travellers live within 1-2 hours, or 150km, ground transport of their departure airport. Emissions related to transport within the UK to attend the Games events were also included.

To capture the emissions associated with travel from those countries not in the ‘top 40’ described above, a series of regional emission factors were developed. These regional emission factors were determined either by using an average from the relevant countries within the ‘top 40’ or, where a region was not represented within the top 40, by referring to the distance from the capital city of the furthest mainland country within the region. All remaining countries of origin were then assigned to one of these regions, based on UN categorisations.
Olympics 2012 Journey Carbon Footprint Calculator: Method Statement

The following sets out the method used to calculate the emissions associated with spectator travel to/from London and all Olympic sites during the 2012 Olympics. Key aspects of the method are outlined in the following sections:

1.1 – Geographical Scope;
1.2 – Emissions from UK Spectator Travel;
1.3 – Spectators from Outside of the UK: Ground Travel Distance;
1.4 – Spectators from Outside of the UK: Air Travel Distance;
1.5 – Countries not Represented in the Geographical Scope; and
1.6 – Emission Factors.

In order to deliver a practical solution to the challenge of assessing global travel patterns, a simplified approach was taken to generating a realistic estimate of emissions. The underlying principle behind the methodological choices made was one of conservatism, as a way to avoid underestimating the emissions. Following this principle, a core assumption applied was that all spectators travelling from outside the UK would travel by air from their country of origin, arriving into London Heathrow. They would then use the underground to travel to central London.

1.1 GEOGRAPHICAL SCOPE

For UK spectator emissions, a separate calculation was undertaken by Best Foot Forward, as part of the London 2012 Carbon Management Strategy. This is reported in a White Paper on Spectator Transport, appended in Annex A. An overview of the approach taken is provided in Section 1.2.

For the following 40 countries, individual emission factors were calculated for spectator travel. These are the most significant countries in terms of spectator numbers, as estimated by LOCOG.

1. The Netherlands 15. China 29. Cyprus
3. USA 17. Serbia 31. Luxembourg
4. Germany 18. Poland 32. Armenia
5. Brazil 19. Switzerland 33. Slovakia
6. Japan 20. New Zealand 34. Austria

For all remaining countries not included here, the calculator assumes a conservative emission factor (see Section 1.5).
1.2 EMISSIONS FROM UK SPECTATOR TRAVEL

The emissions associated with UK spectator travel were assessed by LOCOG’s carbon footprinting consultancy, Best Foot Forward. These emissions include both transport to London and non-London events, and transport within London, where relevant. Weighted average emissions were calculated based on the estimated number of tickets sold in different UK regions and the distance to London and non-London sites from these regions. Distances from UK regions to non-London sites were aggregated into a single weighted distance based on ticket numbers for each venue.

For spectators travelling to London, the number of spectators stopping at ‘Park and Ride’ sites outside of London was also taken into account. It was estimated that 5% of UK spectators will stop at a ‘Park and Ride’ site, as car travellers would not be able to drive direct to London venues and instead would be diverted to the ‘Park and Ride’ system. In such instances, the return car distances were reduced by the coach distance and the corresponding travel by coach was added to these journeys.

Further details on the data and assumptions supporting the calculation of travel emissions for UK spectators are set out in the Best Foot Forward White Paper on Spectator Transport, appended in Annex A. Note that two scenarios for UK transport emissions are provided in this paper. The more conservative, Reference Case, was used.

1.3 SPECTATORS FROM OUTSIDE OF THE UK: GROUND TRAVEL DISTANCE

No literature reference, applicable to the range of geographies considered, could be found to support an ‘average journey distance’ travelled to an airport. As a result, the following assumptions were made with regard to spectator travel from their home to an airport:

- spectators would drive to the airport, as opposed to taking any form of public transport;
- the majority of travellers will live within 1-2 hours ground transport of a major airport; and
- on this basis, a distance of 150 km travel by car to an airport was included in the emissions estimate for all countries. We consider that this is likely to be a conservative estimate since a significant proportion of ground travel will be by alternative modes (e.g. coach or rail).

Emissions related to public transport to and from Heathrow were calculated based on the distance from Heathrow to central London, and the corresponding emission factor from the Defra/DECC GHG Conversion Factors for Company Reporting (July 2011).

Emissions related to transport within London to attend the Games were taken from the Best Foot Forward White Paper on Spectator Transport, appended in Annex A. The figure provided in this paper (‘return journey in London’) represents a return trip from central London to the Olympic park. One such return journey has been assumed for all spectators travelling from outside of the UK. There is potential that spectators from overseas will make repeat journeys within London, or will travel to Olympic venues outside of London. However, the simplified approach was taken as transport within London, or to other to other venues, contributes only a very small proportion of the emissions associated with the total journey (<1%).
1.4 Spectators from Outside of the UK: Air Travel Distance

There are two key challenges in determining a representative estimate of the flight distance for spectators originating from different countries: 1) there are multiple airports within each country; and 2) flight paths are not always, and often are not, direct.

In order to simplify the calculations, yet retain a realistic estimate overall, the following approach was taken:

- the air travel distance was calculated from the capital city airport within each county of origin to London Heathrow;
- the distance between airports was assessed using the coordinates of each airport, and using the Great Circle Flight methodology, which account for the curvature of the earth; and
- a 9% ‘uplift factor’ was subsequently applied, to account for sub-optimal routing and stacking at airports during periods of heavy congestion. This the factor recommended in the 2011 Guidelines to Defra/DECC’s GHG Conversion Factors for Company Reporting.

In reality, the 'capital city' approach will lead to the under-estimation of travel emissions from some countries, where the capital is relatively close to London (e.g. Paris in France), and an over-estimation for others where the opposite is true (e.g. Berlin in Germany; Rome in Italy where the capital is further from London than the majority of the population).

In the majority of instances, particularly across mainland Europe, it is reasonable to assume that these under-/over-estimations will, on balance, yield a net estimate that is realistic. There are some countries for which the capital city approach is unlikely to be representative, however. A screening step was therefore undertaken to identify countries with a surface area > 1 million km² – considered to be those at greatest risk for potential under-estimation of flight distance.

The countries emerging from this screening step were: the USA; Canada; Australia; Argentina; Russia; China; and Brazil. For these countries further consideration was given to the positioning of the capital city, to determine whether the capital city approach was justified to calculate a reasonable emissions estimate. This was found to be the case for Russia, Brazil, Argentina and China, where either:

- the position of the capital city results in a likely conservative emission factor (eg Beijing, being positioned in the far east part of China); or
- a large proportion of the population lives in a relatively small area, in relatively close proximity to the capital (eg Brazil, Argentina, Russia).

For the USA, Canada and Australia it was determined that a more detailed approach was needed, in light of the fact that major population hubs are spread around the country. For these countries, the weighted average distance from the four most populated cities in each country was used. The cities selected for each country are shown in Table 1.
Table 1 Countries and major population hubs

<table>
<thead>
<tr>
<th>Country</th>
<th>Top 4 Cities by Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>New York, Los Angeles, Chicago, Houston</td>
</tr>
<tr>
<td>Australia</td>
<td>Sydney, Melbourne, Brisbane, Perth</td>
</tr>
<tr>
<td>Canada</td>
<td>Toronto, Montreal, Vancouver, Ottawa</td>
</tr>
</tbody>
</table>

1.5 COUNTRIES NOT REPRESENTED IN THE GEOGRAPHICAL SCOPE

The 40 countries included within the scope of the assessment are those from which the greatest number of visitors are expected, but are by no means an exhaustive list of countries from which spectators will travel. To capture the emissions associated with travel from other countries, a series of regional emission factors were developed, using the following approach.

- Where the region was already represented by a country/countries within the geographical scope outlined in Section 1.1, the average emissions for this country/these countries was taken (ie average emissions across the top spectator countries within Western Europe, Northern Europe, Southern Europe, Eastern Europe, Eastern Asia, Central Asia, Western Asia, Oceania, Western Africa, South America). In the case of South America, it was decided to include an emission factor for travelling from Chile, as well as Brazil and Argentina, in this average. This addition was made to allow us to generate an emission factor that more representative for the continent.

- Where the region was not represented within the ‘top 40’ geographical scope, the furthest mainland country in each region was taken and the capital city approach was used to determine an air travel distance. A list of these regions and country representations is shown in Table 2.

Table 2 Regions and country representation

<table>
<thead>
<tr>
<th>Region</th>
<th>Corresponding country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eastern Africa</td>
<td>Mozambique</td>
</tr>
<tr>
<td>Middle Africa</td>
<td>Angola</td>
</tr>
<tr>
<td>Northern Africa</td>
<td>Sudan</td>
</tr>
<tr>
<td>Southern Africa</td>
<td>Lesotho</td>
</tr>
<tr>
<td>Caribbean</td>
<td>Jamaica</td>
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<tr>
<td>Central America</td>
<td>Panama</td>
</tr>
<tr>
<td>Southern Asia</td>
<td>Bangladesh</td>
</tr>
<tr>
<td>South Eastern Asia</td>
<td>Indonesia</td>
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<tr>
<td>Melanesia</td>
<td>New Caledonia</td>
</tr>
<tr>
<td>Micronesia</td>
<td>Guam</td>
</tr>
<tr>
<td>Polynesia</td>
<td>Samoa</td>
</tr>
</tbody>
</table>

1. Please note that world sub-regions categories and country listings were directly extracted from United Nations documentation (link: http://unstats.un.org/unsd/methods/m49/m49regin.htm)
1.6 EMISSION FACTORS

Having defined km travelled by car and by aircraft for each country and region, emission factors ‘per km’ were sourced from the 2011 Guidelines to Defra/DECC GHG Conversion Factors for Company Reporting (July 2011) in order to translate distances into CO₂e emissions.

⇒ For car transport, the emission factor for ‘average passenger car’ was used. This reports emissions per vehicle km and so an average figure for car occupancy (1.57 [1]) was sourced from the European Environment Agency in order to convert to emissions per passenger km.

⇒ For air transport:

  - the emission factors within the Defra/DECC guidelines are categorised by short haul/long haul, and split according to economy/business/first classes of travel. Long haul flights are classed as those greater than 3700 km, and so this cut-off was also applied in the calculations. The estimated proportion of economy, business and first class travel within short haul/long haul flights was subsequently sourced from the Best Foot Forward/LOCOG White Paper on Spectator Transport; and

  - the emission factors within the Defra/DECC guidelines refer to aviation’s direct carbon dioxide, methane and nitrous oxide emissions only. There is currently uncertainty over the other non-CO₂ climate change effects of aviation, for example those associated with vapour trails or NOx emissions. These can be accounted for by applying a multiplier – with the current best scientific evidence suggesting a factor of 1.9 (further detail is available in http://elib.dlr.de/19906/1/s13.pdf). Following the conservative approach, all air transport emission factors were multiplied by this factor.