Sochi 2014 Screening Assessment Carbon Footprint

Prepared for UNDP/GEF project "Greening 2014 Sochi Olympics: A Strategy and Action Plan for the Greening Legacy" and the Ministry of Natural Resources and Environment of Russia.

BESTFOOTFORWARD
The Sustainability Consultants

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Prepared for:
UNDP/GEF project *"Greening 2014 Sochi Olympics: A Strategy and Action Plan for the Greening Legacy"* and the Ministry of Natural Resources and Environment of Russia.

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October 2012 (v4)

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Report:
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Client comments incorporated:
26th October 2012 (v3); 30th October 2012 (v4)

Report approved by:

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BEST FOOT FORWARD

Best Foot Forward (BFF) is an award-winning sustainability consultancy which specialises in carbon and ecological footprinting. The company offers advice on sustainability metrics, software solutions, strategy and communications. It helps organisations to cost-effectively reduce their environmental impact in a world of limited resources.

Best Foot Forward has been leading international developments in footprinting methodologies and tools since 1997. The core textbook on ecological footprinting, 'Sharing Nature's Interest', was co-written by the company's founders and its team advised on the development of PAS2050, as well as several protocols from the World Resources Institute and the World Business Council for Sustainable Development.

Best Foot Forward has unrivalled experience, having helped hundreds of clients spanning government bodies, multinational corporations, SMEs and the third sector. It has calculated thousands of footprints for products, organisations, regions and events, from carrots to county councils, from wine bottles to Wimbledon.

The company's mission is to help organisations, regions and communities to reduce their footprint. In 2012, it was awarded the Environment Product/Service Award at the Environment and Energy Awards for its Product Portfolio Footprinting service, which helps multinational corporations to tackle their supply chain footprint.

Key findings

This report presents the results of a Screening Assessment Carbon Footprint (SACF). A screening assessment is an early, rough estimate of the predicted carbon footprint based on the best available data.

The estimated SACF was 5.1 million tonnes of CO_2e. Of this, 56% is attributable to new infrastructure construction, 28% to spectators, 10% to venues construction and the remaining 5% to operational impacts.

In the case of Sochi 2014, very little primary data was available resulting in the use of many assumptions and estimates. Most of these were based on the experience of past winter and summer Olympic Games; notably London 2012 and Vancouver 2010.

A screening assessment helps establish boundaries, emission sources and emission factors. All of this simplifies later updates to the footprint.

Although only an estimate, a SACF can assist in the early identification of emission 'hotspots' (significant emission sources) and therefore help in the development of carbon reduction and compensation strategies.

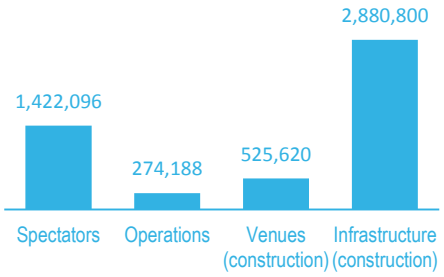
Carbon footprint

Estimate of total Sochi 2014 footprint

Breakdown by main categories shown in tCO_2e.

5.1

Million tonnes CO2e



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1 Introduction

1.1 Purpose of study

This report presents the results of a Screening Assessment Carbon Footprint (SACF). A screening assessment is an early, rough estimate of the predicted carbon footprint based on the best available data.

A screening assessment helps establish boundaries, emission sources and emission factors. All of this simplifies later updates to the footprint.

Although only an estimate, a SACF can assist in the early identification of emission 'hotspots' (significant emission sources) and therefore help in the development of carbon reduction and compensation strategies.

1.2 Data availability

Data was assessed as 'High', 'Medium' or 'Low' depending on the quality.

- High: reliable, physical quantities data based on an in-depth assessment of predicted demand or real, actual data. Examples of high quality data would include an estimated or actual materials inventory from a construction project or an energy demand survey.
- Medium: Verified, estimated physical data based on similar events. For example, data on spectator numbers from a previous Winter Olympics where these estimates are confirmed by Sochi as reliable, working predictions.
- Low: Estimated data which is unverified and/or derived from financial sources. That is, it is not physical data. For example, estimating the carbon impact of a construction project based on its construction cost.

In the case of Sochi 2014, very little verified data was available resulting in the use of many assumptions and estimates. Most of these were based on the experience of past winter and summer Olympic Games; notably London 2012 and Vancouver 2010.

Figure 1 below illustrates this point. Only 1% of the footprint is derived from 'Medium' quality data. The remainder is 'Low' quality.

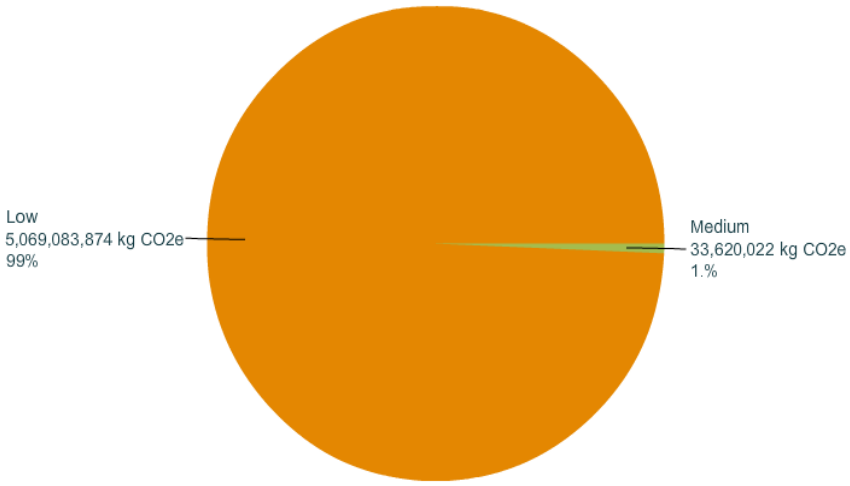

Figure 1: Data quality assessment

1.3 Carbon 'Hotspots'

Of the total 5.1MtCO2e footprint, the majority (56%) is attributable to new infrastructure construction. The second biggest categories of impacts related to spectators (28%). 10% are related to venues construction and the remaining 5% to operational impacts.

Further breaking down these high level categories (see Figure 2) shows the following carbon 'hotspots':

- Infrastructure (construction), transport (48%)
- Spectator travel (14%)
- Spectators, accommodation (13%)
- Infrastructure (construction), support venues (8%)
- Venues construction – coastal cluster (7%)
- Venues (construction), mountain cluster (4%)

The construction of the transport infrastructure predominates making up nearly half (48%) of the entire footprint. This footprint can be further broken down to show the split between bridges and tunnels, roads and rail:

- Bridges/Tunnels: 18.2%
- Road: 19.4%
- Rail: 8.6%

The assumptions used to derive the carbon figures are presented later in this report.

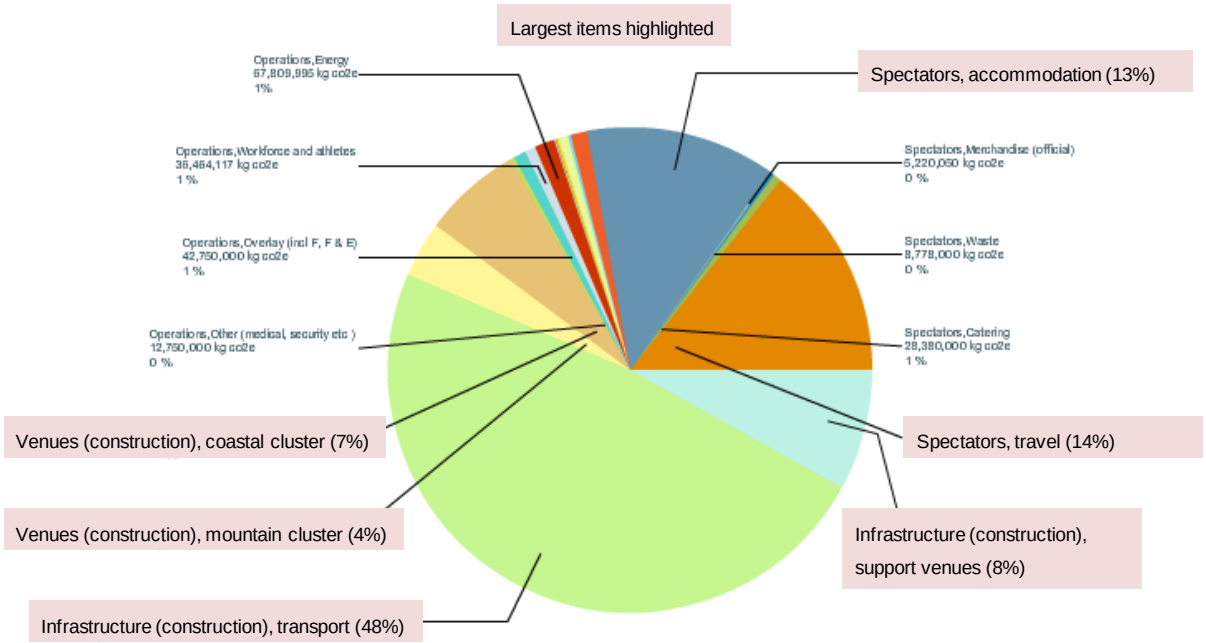

Figure 2: Carbon Hotspots

1.4 Responsibility for the footprint

Several organisations are involved in delivering Sochi 2014; SOCOG, Olympstroy as well as a number of third party Government and private organisations.

The footprint has been split out to show responsibility in Figure 3.

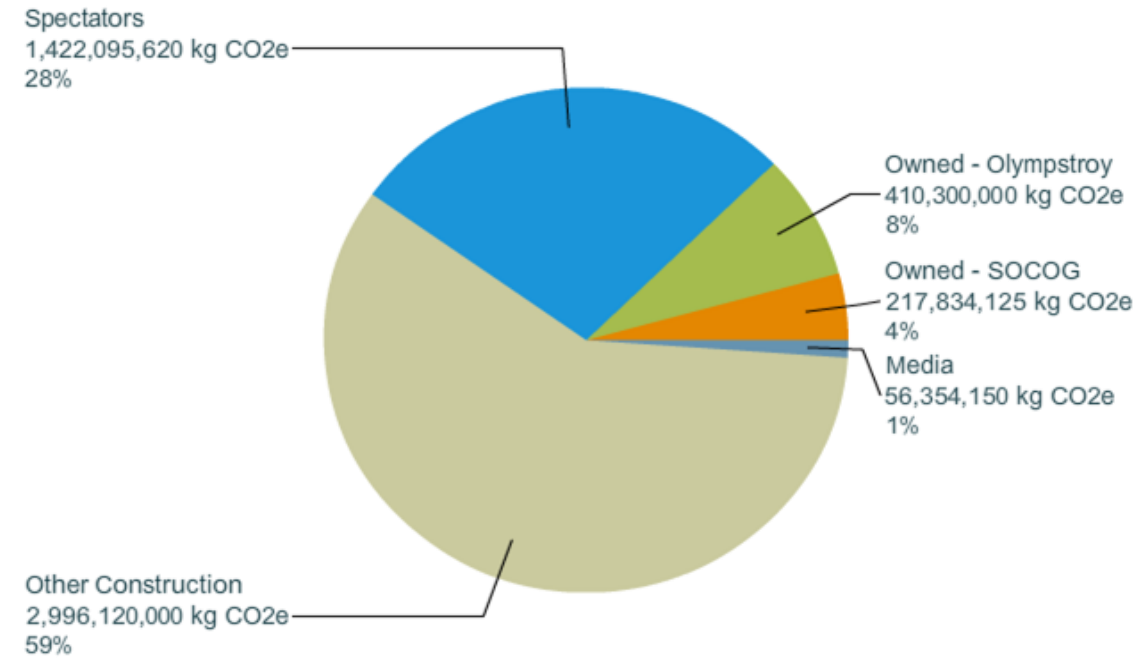

Figure 3 Total footprint by responsible body

A more detailed breakdown of ownership is given in Table 1 below.

		Owned - SOCOG	Owned - Olympstroy	Spectators	Other Construction	Media	Grand Total
Infrastructure (construction)	Support venues				410,200,000		**410,200,000**
	Transport infrastructure		111,000,000		2,359,600,000		**2,470,600,000**
Operations	Energy	67,809,995					**67,809,995**
	Ground transport	32,649,126					**32,649,126**
	Media					56,354,150	**56,354,150**
	Other (medical, security etc.)	12,750,000					**12,750,000**
	Other ceremonies and culture	1,125,000					**1,125,000**
	Overlay (incl F, F & E)	42,750,000					**42,750,000**
	Staff travel and office	8,615,367					**8,615,367**
	Technology	9,750,000					**9,750,000**
	Torch relay and cauldron	970,896					**970,896**
	Travel grants	4,949,625					**4,949,625**
	Workforce and athletes	36,464,117					**36,464,117**
Spectators	Accommodation			649,000,000			**649,000,000**
	Catering			28,380,000			**28,380,000**
	Merchandise (official)			5,220,050			**5,220,050**
	Travel			730,717,570			**730,717,570**
	Waste			8,778,000			**8,778,000**
Venues (construction)	Coastal Cluster		262,400,000		73,800,000		**336,200,000**
	Mountain Cluster		36,900,000		152,520,000		**189,420,000**
Grand Total		**217,834,125**	**410,300,000**	**1,422,095,620**	**2,996,120,000**	**56,354,150**	**5,102,703,895**

Table 1: Breakdown by responsibility

2 Assumptions

This section sets out the assumptions used by main category; spectators, operations, infrastructure (construction) and venues (construction). Note that all these assumptions require further and continuous testing with stakeholders to ensure that they reflect the best available data.

2.1 Spectators

Data assumptions used to derive the footprint of spectators are given in Table 2 below.

Description	Quantity	Units	Notes
General data			
Number of spectators	1,100,000	persons	Based on Vancouver
Stay per spectator	3 to 10	days	Estimate
Travel to Sochi			
Percent of spectators flying to Sochi	100	%	Estimate
Average distance flown (one way)	2500	passenger km	Estimate
Travel in Sochi			
Percentage of spectators using car/taxi	25	%	Estimate
Average distance travelled by car/taxi	100	km	Based on round trip to mountain cluster
Occupancy rate – car/taxi	2	persons	Estimate
Percentage of spectators using rail	25	%	Estimate
Average distance travelled by rail	100	passenger km	Based on single round trip to mountain cluster
Catering & Waste			
Food	3	meals/day	Estimate
Drink	5	drinks/day	Estimate
Packaging	8	items/day	Based on London 2012. Linked to number of meals and drinks.
Merchandise			
Programme (paper)	1,100,000	Items	Assume each spectator buys a programme
Programme (paper)	0.25	kg/item	Based on London 2012
Souvenir (clothing item)	1,100,000	Items	Assume each spectator buys a clothing item

Souvenir (clothing item)	0.6	kg/item	Based on London 2012
Souvenir (plastic item)	1,100,000	Items	Assume each spectator buys a plastic souvenir
Souvenir (plastic item)	0.5	kg/item	Based on London 2012
Accommodation			
Bednights	11,000,000	total bednights	Note that this is 'worst' case assumption and assumes 10 nights per spectator.

Table 2: Spectator Assumptions

2.2 Operations

Data assumptions used to derive the footprint of operations are given in Table 3 below.

Description	Quantity	Units	Notes
Media			
Number of broadcasters	17,000	persons	Based on Vancouver
Stay per broadcaster	45	days	Based on Vancouver
Percentage travel by air	100	%	Estimate
Average distance travelled (one way)	2500	Pass-km	Estimate
Accommodation (per person)	45	Bed-nights	Estimate
Technology	9,750	tCO_2e	Based on 25% of London 2012
Ground Transport			
Car (petrol)	3572393	Litres	Data from SOCOG
Car (diesel)	542590	Litres	Data from SOCOG
Bus	6674617	Litres	Data from SOCOG
Staff travel and offices			
Number of staff employed by Sochi 2014	15,000	Staff-years	Data from SOCOG
Average electricity use per staff member per year	500	kWh	Estimate
Average air travel per staff member per year	1,500	pass-km	Estimate
Average fuel use (for road vehicles)	64	Litres	Estimate
Torch Relay			
Number of cars	20	vehicles	Data from SOCOG
Distance per vehicle	65,000	veh-km	Data from SOCOG
Distance flown	23,000	veh-km	Data from SOCOG

Travel by rail	1,250,000	pass-km	Data from SOCOG
Other Ceremonies and Culture	1,125	tCO2e	Based on 25% of London 2012
Travel Grants			
Number in receipt of grants	7,500	people	Data from SOCOG
Average air travel per recipient	5,000	pass-km	Estimate
Energy Use			
Natural gas	65,000	kWh	Based on Vancouver
Electricity	161,279	kWh	Based on Vancouver
Cauldron	1,000	tCO2e	Based on Vancouver
Backup power	1,500	tCO2e	Based on Vancouver
Workforce and athletes			
Number of workforce, officials, athletes	97,500	persons	Data from SOCOG
Uniforms (number of items per person)	5	items	Estimate based on London 2012
Uniform (weight of each item)	265	grammes	Estimate based on London 2012
Catering (number of meals per person)	15	meals	Estimate
Catering (number of drinks per person)	25	drinks	Estimate
Waste (number of meal packages/person)	15	meals	Estimate
Waste (number of drink packages/person)	25	drinks	Estimate
Accommodation (avg. bed-nights/person)	5	bed-nights	Estimate
Travel (workforce) average by rail	150	pass-km	Estimate assuming local
Travel (workforce) average road fuel use	3	litres	Estimate assuming local
Overlay	42,750	tCO_2e	Based on 25% of London 2012
Other (medical, security etc.)	12,750	tCO_2e	Based on 25% of London 2012

Table 3: Operations assumptions

2.3 Venues (Construction)

Due to a lack of data on the volume and type of materials used to construct the venues in the mountain and coastal clusters, the carbon footprint for each was estimated based on capacity using the greenhouse gas emission per seat for the Beijing Olympic Stadium. A later analysis of data for the Fisht Stadium (based on information provided by Burro Happold) suggests that the emissions per seat for Sochi venues may be about 25% higher than Beijing. However, the lower estimate is used here. Capacity assumptions for each venue are given in Table 4 below.

Description	Quantity	Units	Notes
Coastal Cluster			
Fisht Stadium	40,000	seats	Data from SOCOG
Oval Skating Centre	8,000	seats	Data from SOCOG
Ice Cube Curling Centre	3,000	seats	Data from SOCOG
Bolshoy Ice Dome	12,000	seats	Data from SOCOG
Iceberg Skating Palace	12,000	seats	Data for SOCOG
Maly Ice Palace	7,000	seats	Data from SOCOG
Mountain Cluster			
Sanki Sliding Centre	9,000	seats	Data from SOCOG
RusSki Gorki Jump Complex	9,600	seats	Data from SOCOG
Laura Cross-Country Ski & Biathlon Centre	9,600	seats	Data from SOCOG
Roza Khutor Alpine Centre	10,000	seats	Data from SOCOG
Extreme Snowboard Park & Freestyle Centre	8,000	seats	Data from SOCOG

Table 4: Venue assumptions

2.4 Infrastructure (Construction)

A list of Sochi 2014-related infrastructure projects was provided by SOCOG. This listed more than 200 projects including sporting and non-sporting venues, support venues and transport infrastructure (road, rail). Within this list each project was assigned to a particular organization. For example, Olympstroy, Krasnodar Region Administration, Ministry of Natural Resources and Environmental Protection and so on. This information was cross-referenced with the summary data contained within the Green Building Implementation Reports (GBIR) to determine those projects most directly associated with the Games (as opposed to federal and regional improvement projects).

Of these, the footprint of those projects listed in Table 5 below were estimated using the proxy data (km, m^2) given.

Description	Quantity	Units	Notes
Transport Infrastructure - Olympstroy			
Roads	37	km	Data from GBIR
Transport Infrastructure - Others			
Roads	330	km	Data from GBIR
Bridges and tunnels	66.4	km	Data from GBIR
Rail	200	km	Data from GBIR
Support Venues			
Hotels, media, villages etc.	350,000	m2	Data from GBIR

Table 5: Infrastructure (construction) assumptions

3 Greenhouse Gas Emission Factors

3.1 Development of emission factors

Greenhouse gas emission factors were provided by BFF and reviewed by the Institute of Global Climate and Ecology in Moscow. Every effort was made to ensure that they were appropriate for the Russian context.

3.2 Emission factor set

Table 6 below lists the emission factors used in the screening assessment carbon footprint.

Description	kgCO2e	kgCO2e	Per unit
concrete	co2e	163	tonne
natural gas	co2e	0.22419	kWh
Russian Federation (average)	co2e	0.40424	kWh
plastic	co2e	3.1	kg
paper (virgin)	co2e	1.55	kg
textile	co2e	4.68	kg
packaging (drink)	co2e	0.04	drink
hot drink	co2e	0.22	drink
food packaging	co2e	0.82	meal
food (per meal)	co2e	2.5	meal
National rail (average)	co2e	0.06464	pass-km
long haul flying (average)	co2e	0.13199	pass-km
hotel	co2e	59	bed-night
petrol (100% mineral)	co2e	2.7227	litre
diesel (100% mineral)	co2e	3.1761	litre
construction (road)	co2e	3000000	km
construction (per km rail)	co2e	2200000	km
Beijing stadium	co2e	4100	seat
luxury car	co2e	0.28732	veh-km
construction (bridges and tunnels etc)	co2e	14000000	km
construction (general)	co2e	1172	m2

Table 6: List of emission factors

4 Compensation Options

These are summarised here and set out more fully in the *Sochi 2014 Screening Assessment Carbon Footprint* PowerPoint presentation.

The commitments to compensate for the emissions arising from Sochi 2014 are open to interpretation. The quantity of greenhouse gases covered by these commitments ranges from 117ktCO_2e (Option 1) to more than 5.1MtCO_2e (Option 8).

The eight options are presented and illustrated in Figure 4 .

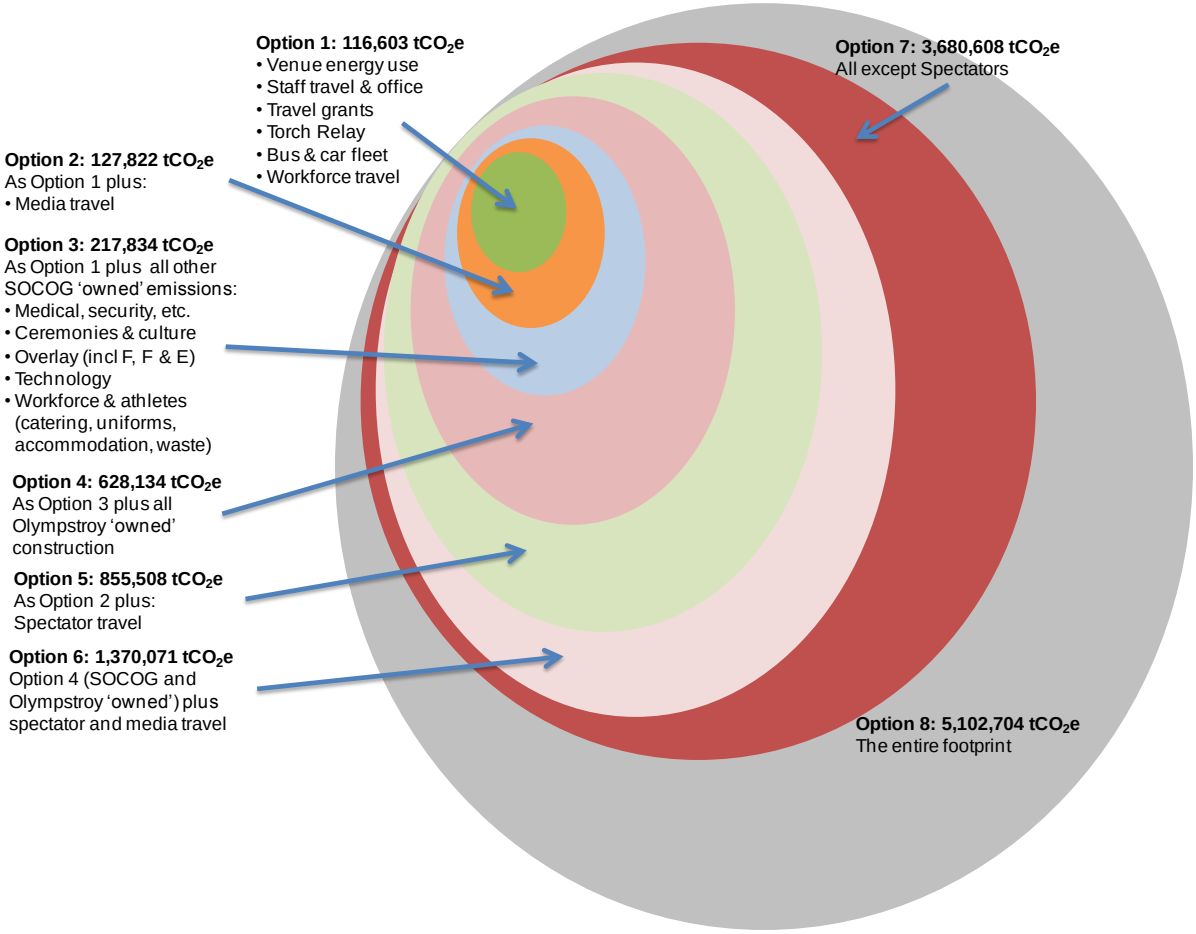

Figure 4: Eight compensation options