South Pole Carbon Report sull'Impronta a Compensazione di CO_2 per gli Anni 2010 a 2011

Cliente:

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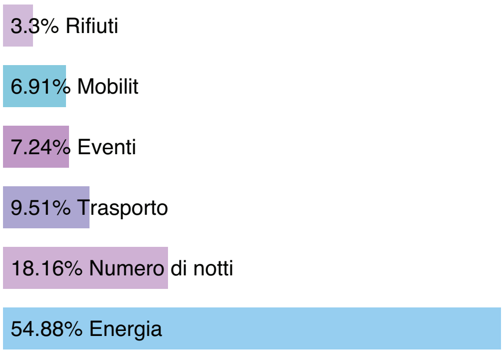
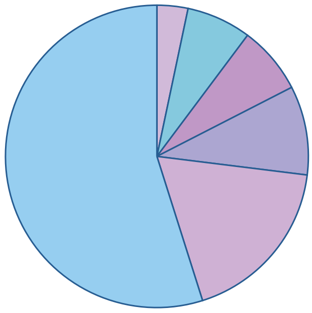
Emissioni riportate :





La maggioranza delle emissioni, corrispondenti a 54.88% del totale riportato provengono dalla categoria "Energia".

Rifiuti:

2.238 tCO_2e in questa categoria

con 2.238 tCO_2e emissioni generate fa:
1200 kg di rifiuti misti, 680 kg di carta consumata, 20 % di carta riciclata, 50 % di carta riciclata dopo l'utilizzo.

Mobilità:

4.682 tCO_2e in questa categoria

con 2.237 tCO_2e emissioni generate fa:
3000 km percorsi, 8 l/100km auto di medie dimensioni, a benzina, 4 persone o veicoli.

con 2.445 tCO_2e emissioni generate fa:
40000 km percorsi, in treno, 1 persone o veicoli.

Eventi:

4.905 tCO_2e in questa categoria

con 4.905 tCO_2e emissioni generate fa:
emissioni da cibo/bevande inclusi, 30 partecipanti, 3 giorni, viaggio in macchina, 200 km percorsi.

Trasporto:

6.445 tCO_2e in questa categoria

con 0.578 tCO_2e emissioni generate fa:
1200 distanza in km, 3 tonnellate (t) di carico, 20 efficienza del combustibile del camion in l/100km , 20 massimo tonnellaggio del camion in t, 75 % media di fattore di carico del camion.

con 5.867 tCO_2e emissioni generate fa:
20000 distanza in km, .4 tonnellate (t) di carico, Trasporto aereo.

Numero di notti:

12.301 tCO_2e in questa categoria

con 11.100 tCO_2e emissioni generate fa:
30 giorni, hotel a 4 stelle, 20 persone.

con 1.201 tCO_2e emissioni generate fa:
12 giorni, hotel a 3 stelle, 7 persone.

Energia:

 37.178 tCO_2e in questa categoria

con 37.178 tCO_2e emissioni generate fa:
8 personale, Europa, Ufficio, la maggioranza dei posti hanno aria condizionata, 2 anni.

Compensazione di CO2

Quando si parla di cambiamento climatico, è irrilevante dove avvengano le emissioni di CO2, cosìcome dove vengano ridotte. Ciò che conta è che la quantità totale di emissioni di gas serra sia viene ridotta. In quest' ottica, è importante ridurre le emissioni in una parte del globo, mentre queste vengono generate altrove: questo processo viene chiamato compensazione od offsetting.

Al fine di azzerare l'impatto sul clima, è necessario annullare anche quelle emissioni che non possono essere ridotte attraverso l'utilizzo dei cosidetti "carbon offsets" o certificati per la riduzione di emissioni.

I carbon offsets sono quantificati e venduti in tonnellate quadrate di anidride carbonica (tCO_2e) e riflettono riduzioni di emissioni di gas serra avvenute in un altro luogo tramite la creazione di progetti alimentati da energie rinnovabili o progetti per l'efficenza energetica.

Oltre a ridurre la quantità di CO_2 nell' atmosfera, i certificati per le riduzioni delle emissioni possono anche generare benefici aggiuntivi nei luoghi dove vengono creati, come ad esempio il miglioramento delle condizioni di vita, opportunità di educazione, impiego e sviluppo per le popolazioni locali. Al fine di assicurare la qualità e l'integrità dei certificati, è necessario implementare un sistema di verifica, certificazione e contabilità delle riduzioni di emssioni.

South Pole si impegna a ritirare definitivamente le riduzioni di emissioni collegate ai tuoi certificati acquistati sul nostro sito presso il registro di pertinenza. Questo garantisce la completa trasparenza della transazione, poichè impedisce che gli stessi certificati possano essere usati una seconda volta.

Le emissioni riportate sono compensate per conto del cliente da South Pole Carbon Asset Management Ltd. i seguenti certificati di riduzione emissioni: Crediti CCBS (Climate Community and Biodiversity Standard) e CarbonFix da Progetto di Riforestazione in Uganda.

Ulteriori informazioni su questo progetto possono essere trovate nell'allegato a questo report.

Impegno per l'obbiettivo 2°C

Il cliente si impegna all'obbiettivo 2°C delineato negli accordi di Copenhagen ed ha compensato le sue emissioni per un fattore pari a 2,5, i.e. 169.3725 tCO_2e. Una descrizione più dettagliata dell'obbiettivo 2°C può essere trovata nella prossima pagina.

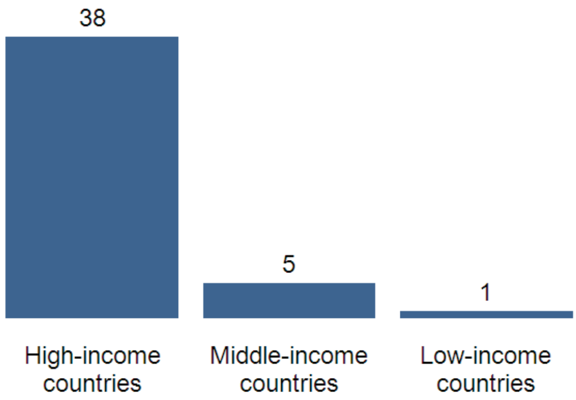
The 2°C Path

Governments worldwide are struggling to define binding targets for GHG emissions. The current pledges listed in the Copenhagen Accord will not allow us to reach the global goal of limiting average global warming to 2°. Even if the pledges are fulfilled, we are confronted with a probability of more than 50% that global warming will exceed 3° by the end of this century[1], leading to disastrous consequences[2]

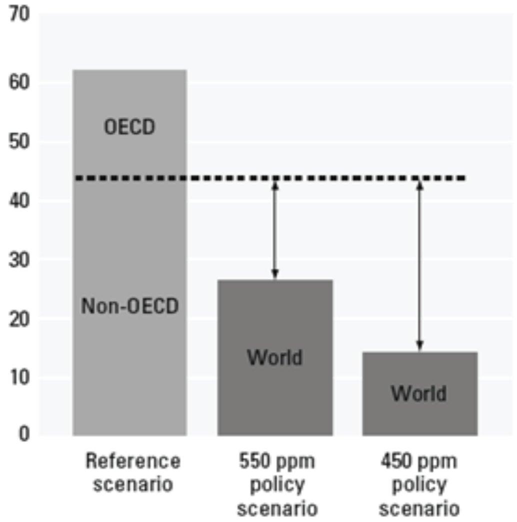
Given the urgency of the situation, international negotiations are taking longer than is reasonable. Climate neutrality is no longer a sufficient option. Due to the past emission track record of the OECD and developing countries, it is imperative that all industrialized nations take strong initiatives to get the world on track. But with economic development picking up quickly in the developing world, the 2° goal can no longer be achieved even by reducing OECD emissions to zero or going climate neutral.

Given the dire and urgent situation sketched above, South Pole is offering the option to compensate for emissions in a way that will (if adopted by all emitters in industrialized countries) allow the attainment of the 2° goal.

We calculated the amount of emission reductions needed in developing countries on top of climate neutrality in the industrialized world based on IEA[3] and World Bank[4] data and found that they are equivalent to 2.5 times the amount of our own emissions.



Cumulative historic per capita GHG emissions industrialization (indexed)



Even when reducing OECD Emissions to zero the 450 ppm (equivalent to 2°) goal cannot be reached

Sources:

[1] Malte Meinshausen, Joeri Rogelj et al, "Copenhagen Accord pledges are paltry", Nature, 2010

[2] IPCC, Working Group II, "Impacts, Adaptation and Vulnerability"

[3] IEA, Energy Technology Perspective 2008: Scenarios and Strategies to 2050, 2008

[4] The World Bank, World Development Report, 2010

CO_2 Calculations: Sources and Background Information

Waste:

Emissions from Waste result mostly from methane production in landfills. For paper waste, we factor in production as it has a significant and quantifiable impact on overall emissions.

Mixed Waste

The Ministry for the Environment of New Zealand[1] provides excellent data on emissions from waste. We made the assumption that all waste is land filled without gas recovery, as this is prevailing practice of waste management in most countries. If you want to learn more about landfill gas recovery, please follow this link (http://www.southpolecarbon.com/videopopup259.htm to watch a video on one of our landfill gas recovery projects in China.

If your municipal waste is burned in a combined heat and power generating plant, do not account for the emissions from waste as this technology lowers the emissions from waste to almost zero.

[1] Ministry for the Environment of New Zealand, 2007, http://www.mfe.govt.nz/publications/climate/guidance-greenhouse-gas-reporting-sept09/html/page2.html

Paper

Depending on type of paper, country of production, and method of calculation the values for production vary between 0.5 and 2 tCO_2e/t paper. We assume an average of 1t CO_2e/t Paper. Additional emissions come from paper disposal. We estimate 1 tCO_2e/t Paper, including emissions from landfill. In Europe, about 75% of all paper goes to a landfill (from Van den Reek 1999). Using recycled paper reduces the emissions from paper production by an average of 76%. Recycling paper reduces emissions from landfill by 100%.

Mainly based on:

Van den Reek (1999), Reduction of CO_2 emissions by reduction of paper use for publication applications, University of Utrecht, http://www.chem.uu.nl/nws/www/publica/Publicaties1999/99048.pdf

with additional information from:

RWI, 1996, Band 2: Forschungsberichte der Verbaende, Verband Deutscher Papierfabrieken, CO_2-Monitoring der deutschen Industrie ökologische und ökonomische Verifikation, Untersuchungen des Rheinisch-Westfalischen Instituts für Wirtschaftsforschung; Essen, 134-150;

The State of the Paper Industry: Monitoring the Indicators of Environmental Performance - A collaborative report by the Steering Committee of the Environmental Paper Network (2007) http://www.environmentalpaper.com/documents/StateOfPaperIndSm.pdf

Vasara, P., Impact on global warming and carbon sequestration projects on the pulp industry, Seventh global conference on paper & the environment, 31 May – 1 June, 1999.

Bradley (1999) J., A life cycle assessment of graphic paper and print products, Seventh global conference on paper & the environment, 31 May – 1 June, 1999;

CO_2 Calculations: Sources and Background Information

Mobility:

The calculations in this section are based on average driving behavior, using emissions from fuel use factors only. Road and vehicle construction related emissions are excluded.

Cars

All emission calculations are based on DEFRA (2009).

All of the fuel conversion factors presented in the 2009 GHG Conversion Factors are based on the default emission factors used in the UK GHG Inventory (GHGI) for 2007 (managed by AEA). The CO_2 emissions factors are based on the same ones used in the UK GHGI and are essentially independent of application (assuming full combustion). However, emissions of CH4 and N2O can vary to some degree for the same fuel depending on the particular use (e.g. emission factors for gas and oil used in rail, shipping, non-road mobile machinery or different scales/types of stationary combustion plants can all be different). The figures presented in the 2009 GHG Conversion Factors are based on an activity-weighted average of all the different CH4 and N2O emission factors from the GHGI. The standard emission factors from the GHGI have been converted into different energy and volume units using information on Gross and Net Calorific Values (CV) from the Digest of UK Energy Statistics 2008 (BERR), available at: http://www.berr.gov.uk/whatwedo/energy/statistics/publications/dukes/page45537.html

Train

The emissions of UK trains from DEFRA (2009) are used as a best source to estimate average train emissions. The emissions are mainly related to electricity consumption, so they may vary considerably for other electricity mixes. To get a more precise estimate, one can divide train emissions by 0.50238 (UK electricity factor) and multiply by the electricity factor for each country. See DEFRA (2009), Annex 10 for a list of factors for several countries. Some trains still use diesel engines, so the estimate will be slightly distorted (see http://www.defra.gov.uk/environment/business/reporting/conversion-factors.htm)

The national rail factor refers to an average emission per passenger kilometre for diesel and electric trains in 2007-08. The factor is from the DfT Network Modelling Framework (NMF) Environmental Model and has been calculated based on: a) total electricity and diesel consumed by the railways for the year (sourced from ATOC), and b) the total number of passenger kilometres (from DfT rail statistics). The factor for conversion of kWh electricity into CO_2 is based on the 2006 grid mix (the most recent figure available at the time). CH4 and N2O emission factors were estimated from the corresponding emission factors for electricity generation and diesel rail (from the UK GHG Inventory), proportional to the CO_2 emission factors. The emission factors were calculated based on the relative passenger km proportions of diesel and electric rail, provided by DfT for 2006-7.

CO_2 Calculations: Sources and Background Information

Events:

With the exception of food, the events calculations predominately use the formulas described in the other categories (e.g. Mobility).

Emissions from meals can vary widely depending on what kind of food is consumed, where it comes from, and how it has been cooled. Brookes[1] estimates the transportation related food print of a local meal is ~8 times smaller than an overseas meal, with the overseas meal accounting with 5kg CO_2 for transport alone. At present, there is no accepted standard for carbon footprint calculation for meals. For some examples of food prints of different meals you can try out the calculator at: http://www.eatlowcarbon.org/Carbon-Calculator.html

As the footprint is heavily dependent on food choice, we decided to calculate using an average of 5 kg CO_2 per meal—too low for beef-based dishes and air-freight-transported tropical fruits, and too high for locally-sourced vegetable dishes.

[1] Will Brookes, “The Environmental Sustainability of the British Restaurant Industry: A London Case Study“, 2007

CO_2 Calculations: Sources and Background Information

Freight:

The calculations for different types of freight use CO2e/tkm as the primary unit, equal to the amount of emissions associated with the transportation of 1 ton of freight for 1 km.

Air Freight:

Air freight calculations are based on the same assumptions and data as passenger transports. Using DEFRA (2009) data and a power series for extrapolation, plus the factor for non-CO_2 stratospheric effects, gives the following formula:

Amount of CO_2 = 2*Distance*(31.606*Distance$^{-0.45}$) *tons of freight

Freight, including mail, are transported by two types of aircraft—dedicated cargo aircraft which carry freight only, and passenger aircraft which carry both passengers and their luggage as well as freight. The CAA data show that almost all freight carried by passenger aircraft is done on scheduled long-haul flights. In fact, the quantity of freight carried on scheduled long-haul passenger flights is nearly 5 times higher than the quantity of freight carried on scheduled long-haul cargo services. The apparent importance of freight movements by passenger services creates a complicating factor in calculating emission factors. The 2007 update emission factors for passenger services were calculated assuming all the CO_2 is allocated to the passengers. Given, however, the significance of air freight transport on passenger services, there were good arguments for developing a method to divide the CO_2 between passengers and freight, which was developed for the 2008 update. The CAA data provides a split of tonne km for freight and passengers (plus luggage) by airline for both passenger and cargo services. These data may be used as a basis for an allocation methodology. There are essentially three options, with the resulting emission factors presented in Table 2:

a. No Freight Weighting: Assume all the CO_2 is allocated to passengers on these services.

b. Freight Weighting Option 1: Use the CAA tonne km (tkm) data directly to apportion the CO_2 between passengers and freight. However, in this case the derived emission factors for freight are significantly higher than those derived for dedicated cargo services using similar aircraft.

c. Freight Weighting Option 2: Use the CAA tonne km data modified to treat freight on a more equivalent /consistent basis to dedicated cargo services. This takes into account the additional weight of equipment specific to passenger services (e.g., seats, galleys, etc) in the calculations.

Table 3: CO_2 emission factors for alternative freight allocation options for passenger flights based on 2009 GHG Conversion Factors

Freight Weighting	None		Direct		Equivalent	
Mode	Passenger tkm % of total	gCO_2 / pkm	Passenger tkm % of total	gCO_2 / pkm	Passenger tkm % of total	gCO_2 / pkm
Domestic Flights	100.0%	171.6	99.7%	171.0	99.7%	171.0
Short-haul Flights	100.0%	98.8	99.5%	98.3	99.5%	98.3
Long-haul Flights	100.0%	127.0	71.7%	91.0	88.4%	112.2

The basis of freight weighting Option 2 is to account for supplementary equipment (such as seating and galleys) and other weight for passenger aircraft compared to dedicated cargo aircraft in the allocation. The Boeing 747 cargo configurations account for the vast majority of long-haul freight services and over 90% of all tkm for dedicated freight services. Comparing the freight capacities (taken from BA World Cargo's website[1]) of the cargo configuration (125 tonnes) to passenger configuration (20 tonnes), we can assume that the difference represents the tonne capacity for passenger transport. This 105 tonnes includes the weight of passengers and their luggage (around 100 kg per passenger according to IATA), plus the additional weight of seating, the galley, and other airframe adjustments necessary for passenger service operations. For an average seating capacity of around 350 passengers, this means that the average weight per passenger seat is just over 300 kg. This is around 3 times the weight per passenger and their luggage alone. In the Option 2 methodology, a factor of 3 difference is used to upscale the CAA passenger tonne km data, increasing this as a percentage of the total tonne km, as shown in Table 2.

It does not appear that there is a distinction made (other than in purely practical size/bulk terms) in the provision of air freight transport services in terms of whether something is transported by dedicated cargo service or on a passenger service. The related calculation of freight emission factors (discussed in a later section) leads to very similar emission factors for both passenger service freight and dedicated cargo services for both domestic and short-haul flights. This is also the case for long-haul flights under freight

[1] British Airways World Cargo provides information on both passenger and dedicated freight services at: http://www.baworldcargo.com/configs/

weighting Option 2. Under Option 1, the passenger service factors are substantially higher than those calculated for dedicated cargo services. Therefore, it seems preferable to treat freight on an equivalent basis by utilising freight weighting Option 2.

Option 2 was selected as the preferred methodology to allocate emissions between passengers and freight for the 2008 and 2009 GHG Conversion Factors.

Trucks

The calculations are based on DEFRA (2009) data. Unless you enter specific values for Vehicle Type, Efficiency and Load Factor, UK average values are used. To account for differences in efficiency between fully loaded trucks and empty trucks, we followed the assumption of linearity and used average factors from DEFRA (2009).

Tables 6 and 7 (adapted from DEFRA (2009)

Difference between empty truck and full truck from halve load fuel efficiency in % of halve load fuel efficiency

3.5t – 7.5t, rigid	7.5t - 17t rigid	> 17t rigid	< 33t articulated	> 33t articulated	Fleet average
0.08	0.125	0.18	0.2	0.25	0.19

Typical maximum transport capacity

3.5t – 7.5t, rigid	7.5t - 17t rigid	> 17t rigid	< 33t articulated	> 33t articulated	Fleet average
2.025 t	6.243 t	9.545 t	15 t	19.1 t	12.9 t

The factors are based on road freight statistics from the Department for Transport (DfT, 2008)[2], taken from a survey on average miles per gallon and average loading factor for different sizes of rigid and articulate HGVs in the fleet in 2007, combined with test data from the European ARTEMIS project showing how fuel efficiency (and hence CO_2 emissions) varies with vehicle load.

The miles per gallon (mpg) figures in Table 5.1 of DfT (2008) are converted to gCO_2 per km factors using the standard fuel conversion factor for diesel in the 2009 GHG Conversion Factors tables. Table 1.15 of DfT (2008) shows the percent loading factors are on average mostly between 40-60% in the UK HGV fleet. Figures from the ARTEMIS project show that the effect of load becomes proportionately greater for heavier classes of HGVs. In other words, the relative difference in fuel consumption between running an HGV completely empty or fully laden is greater for a large >33t HGV than it is for a small <7.5t HGV. From an analysis of the ARTEMIS data, it was possible to derive the figures for the change in CO_2 emissions for a vehicle completely empty (0% load) or fully laden (100% load) on a weight basis compared with the emissions at half-load (50% load). The data show that the effect of load is symmetrical and largely independent of the HGVs Euro emission classification and type of drive cycle. So, for example, a >17t rigid HGV emits 18% more CO_2 per kilometre when fully laden and 18% less CO_2 per kilometre when empty relative to emissions at half-load.

It might be surprising to see that the CO_2 factor for a >17t rigid HGV is greater than for a >33t articulated HGV. However, these factors merely reflect the miles per gallon figures from the DfT survey that consistently show worse mpg fuel efficiency, on average, for large rigid HGVs than large articulated HGVs once the relative degree of loading is taken into account. This might reflect the usage pattern for different types of HGVs, especially where large and rigid HGVs are spending more time travelling at lower, more congested urban speeds and are operating at lower fuel efficiency than articulated HGVs which are spending more time travelling at higher speeds in free-flowing traffic conditions on motorways where fuel efficiency is closer to optimum. Under the drive cycle conditions more typically experienced by large articulated HGVs, the CO_2 factors for large rigid HGVs may be lower than indicated in our calculation. For the 2009 GHG Conversion Factors, emission factors for CH4 and N2O have also been added for all HGV classes. These are based on the emission factors from the UK GHG Inventory (managed by AEA). CH4 and N2O emissions are assumed to scale relative to vehicle class/CO_2 emissions for HGVs.

Train

This factor can be expected to vary with rail traffic route, speed, and train weight. Freight trains are hauled by electric and diesel locomotives. The vast majority of freight is carried by diesel rail, and correspondingly CO_2 emissions from diesel rail freight are over 90% of the total. Traffic, route, and freight specific factors are not currently available, but would present a more appropriate means of comparing modes (e.g. for bulk aggregates, intermodal, and other types of freight). CH4 and N2O emission factors have been estimated from the corresponding emissions for diesel rail from the UK GHG Inventory, proportional to the CO_2 emissions. In the absence of a more suitable tonne km data for freight, the emission factors were calculated based on the relative passenger km proportions of diesel and electric rail provided by DfT for 2006-7.

Ship

Factors for representative ships are derived from information in both the EMEP-CORINAIR Handbook (2003)51 and in a report by Entec (2002)52. These factors included fuel consumption rates for engine power and speed while cruising at sea associated with different vessels. The factor used refers to gCO_2 per deadweight tonne km. Deadweight tonnage is the weight of the cargo, etc., that when added to the weight of the ship's structure and equipment brings the vessel down to its designated waterline. This implies that the factors are based on a fully loaded vessel. Because the ship's engines are propelling the weight of the ship itself, which is a significant proportion of the overall weight of the vessel and its cargo, reducing the cargo load from the deadweight tonnage will not lead to a proportionate reduction in the amount of fuel required to move the vessel a given distance. For example,

[2] "Transport Statistics Bulletin: Road Freight Statistics 2007", June 2008, SB (08) 21. Available at:

http://www.dft.gov.uk/pgr/statistics/datatablespublications/freight/goodsbyroad/roadfreightstatistics2007 decreasing the cargo load to half the ship's deadweight will not reduce the ship's fuel consumption by a half. As a consequence, the factors expressed in gCO_2 /tonne km freight will be higher for ships that are only partially loaded (i.e. loaded to less than the vessel's deadweight tonnage). Figures on typical loading factors for different vessels are not currently available in the public domain. The CO_2 factors will be reviewed and updated when the loading factors become available to provide factors that are more representative of vessel movements from UK ports. CH4 and N2O emission factors have been estimated from the corresponding emissions for shipping from the UK GHG Inventory for 2007, proportional to the CO_2 emissions.

We used the average of all ship types excluding small ferries to derive the factor. Small ferries were excluded as their emissions higher than the next larger category by more an order of magnitude and represent only a small fraction of the overall ship transport. There is no data on the average freight ship size available.

Van / Light Transport Vehicle < 3.5 tons

On the basis of DfT statistics from a survey of company owned vans, an average load factor of 40% was assumed for each vehicle type. For the 2009 GHG Conversion Factors, emission factors for CH4 and N2O have been added for all van classes. These are based on emission factors from the UK GHG Inventory (managed by AEA). N2O emissions are assumed to scale relative to vehicle class/CO_2 emissions for diesel vans. Emission factors per tkm were calculated from the average load factor of 40% in combination with the average freight capacities of the different vans.

Cooling

Transportation of refrigerated or frozen goods is associated with significantly higher emissions than other transport. Currently there is no appropriate data to account for the difference.

CO_2 Calculations: Sources and Background Information

Overnight Stays:

The emissions from hotels are based on a survey in Switzerland—the most detailed study available. Comparing that survey's findings with international data showed that the values are very similar.

Table 8

Hotel Star Rating	Average Energy Consumption per Guest	Average CO_2 Emissions per Guest
Zero – Two Star	38 kWh	11.6 kg
Three Star	47 kWh	14.3 kg
Four Star	61 kWh	18.5 kg
Five Star	109 kWh	33.1 kg

This is calculated from the average energy consumption of hotels (according to class) and the average mix of energy sources. The differences in energy source mix is not taken into account as it was absent from the study. The energy supply for 0-3 star hotels was only available per turnover, so to calculate the per guest values we used an estimate of the average price of 0-3 star hotels taken from a sample of 25 hotels in each category located in the same region.

Table 9

Average energy consumption mix	Average Energy Consumption
Electricity	36.8%
Fuel Oil	49.8 %
Gas	9.8%
Renewables	3.6%

Sources

http://www.hotelpower.ch/sites/default/files/Energieeffizienz_und_CO2_-Emissionen_in_Schweizer_Hotellerie_2003.pdf

DEFRA, Green house gas conversion factors, 2009, http://www.defra.gov.uk/environment/business/reporting/conversion-factors.htm

Because energy intensity was given in relation to turnover (not guests for these categories), we had to estimate the average price of 0-3 star hotels from a sample of 25 hotels in each category located in the same region.

CO_2 Calculations: Sources and Background Information

Energy:

The emission data for offices is mostly based on a survey of large companies in the UK. It distinguishes four types of offices with different space and electricity needs.

Energy consumption is very similar in most offices[1] in industrialized countries. We based our calculations on UK values[2] as these are the most precise data available. We used country specific electricity emission factors to extrapolate office emissions for other regions. There are data from the US and Japan that indicate that office energy use is very similar all over the industrialized world. We assume that western standard offices in developing countries have similar energy requirements, and calculated the emissions accordingly. We used DEFRA (2009) values for Africa, Latin America, and the Middle East. As DEFRA (2009) doesn't provide a value for the Asian average electricity emission factor, we used the average of China, India and Indonesia and separated it from the value for South Korea and Japan as there are large differences in CO_2 intensity. Energy use in UK offices is typically split into 80% electricity and 20% gas[2]. We used this assumption for all regions. We did not include any considerations regarding weather conditions or insulation standards, but are hoping to get better data in the future. If your offices in developing countries are on significantly lower standards, you need to assess their energy needs individually as there are no benchmarks available.

Air conditioning / cooling contributes a large share to office electricity use. We based our calculations on Goodall [2] and Hitchin [3]. The data in Goodall are derived from a variety of offices throughout the UK. Consequently, we had to assume that their samples application of air condition is in line with the average for the country (i.e., covering roughly 20% of the floor area[3].)

Table 10: Average emissions from office operations per employee in tCO_2e per employee per year

Type of Office	Air Conditioning	EU	Australia	Africa	Latin America	Middle East	China, India, Indonesia	Japan & South Korea
Pure Office	With AC	2.32	4.99	3.91	1.58	4.26	5.13	2.64
	Without AC	1.62	3.27	2.61	1.15	2.82	3.36	1.81
Office and some Retail	With AC	2.81	5.98	4.7	1.92	5.11	6.15	3.18
	Without AC	2.1	4.27	3.39	1.49	3.67	4.38	2.35
Mostly Retail	With AC	4.56	9.58	7.56	3.15	8.21	9.85	5.15
	Without AC	3.85	7.87	6.25	2.72	6.77	8.08	4.32
Media and Entertainment	With AC	4.74	9.97	7.86	3.28	8.54	10.24	5.36
	Without AC	4.04	8.25	6.55	2.85	7.1	8.48	4.53

For the direct input of energy use, we used the standard values from DEFRA (2009). The calculation of electricity emissions is based on the EU average electricity mix.

[1] e.g. US Government," Commercial Buildings energy consumption survey, consumption and expenditure, table C3A in the US and "Estimation of life cycle energy consumption and CO_2 emission of office buildings in Japan", Michiya Suzuki & Tatsuo Oka, 1998[2] "Carbon emissions and the service sector", Christian Goodall, 2007, http://www.lowcarbonlife.net/downloads/Emissions%20data%20from%20companies.pdf

[3] "Local Cooling: Global Warming? UK Carbon Emissions from Air-Conditioning in the Next Two Decades" ,E R Hitchin, C Eng BSc MCIBSEMIGasE and C H Pout, BSc D Phil Building Research Establishment, Watford , UK http://www.cibse.org/pdfs/Carbon%20emissions%20air%20con.pdf