Carbon Calculator Architecture

Good carbon calculators need to meet three primary requirements. They should educate the user and should be easy to use. They should also be accurate.

Since offsetting carbon emissions is an unregulated industry in the U.S., the generalization that you get what you pay for holds true almost without exception. Offsetting through one provider may be cheaper than offsetting through another, but what are you getting in return. To answer this question, we invite you to review the "Factors to Consider in Choosing a Program" at www.carbonoffsets.org.

For more information on how Sustainable Travel International calculates greenhouse gas emissions, please review this document.

Air Travel Emissions

- For calculating GHG emissions from air travel we use a very similar approach to the one used by the World Resource Institute.
- Our calculations are based on CO2equivalent values per distance. We have one standard value for short distances below 2000 km (0.30 kg CO2eq/km) and one for long distances above 6000 km (0.19 kg CO2eq/km)
- For flight distances between 2000 km and 6000 km we use a linear interpolation to calculate the emissions.
- The distance between two airports is calculated according to their geographical coordinates.
- Our standard emission values are based on fuel consumption according to:
  1) Two basic aircraft types for short/long distances
  2) Specific fuel consumption of these aircraft types
  3) Average number of passengers per flight
- Sources for these values include: European Environment Agency (EEA) and International Civil Aviation Organization (ICAO), Atmosfair, ATWOnline (ATW Media Group), and the Intergovernmental Panel on Climate Change (IPCC)
- Direct CO2 emissions due to kerosene combustion are calculated according to IPCC guidelines
- The IPCC has estimated total radiative forcing of air travel to be 1-5 times larger in the stratosphere than in the troposphere and calculated the average for full radiative forcing to be a factor of approximately 2.7 (IPCC, 1999.) Therefore, to estimate the impact of air travel a multiplier should be used on the CO2 emissions from jet fuel to account for full radiative forcing.
- The climate impact of other GHG emissions (NOx, CO) and additional effects of aircraft emissions (cirrus clouds and contrails) are accounted by a radiative forcing index (RFI) of 2 (based on the IPCC special report on aviation and on the more recent EU research program "TRADEOFF")

Automotive Emissions

- Emissions caused by car driving are a function of distance, fuel efficiency and emission factor (emissions per volume of gasoline).
- The resulting emissions are CO2 equivalent, i.e. including all greenhouse gases and not only CO2.
- Sources for emission factors: Bafu (Federal Office for the Environment) and IPCC

Home Electricity Emissions

- Electricity emissions are a function of energy consumption of the apartment, persons per household and emission factor (emissions of CO2 equivalent per kWh).
- To keep our on-line calculators as user-friendly as possible (*), we use statistical, average values of energy consumptions for each part of the world (USA, EU, and Switzerland). To do detailed calculations exact values would be necessary.
- Sources for these average values are: Energy Information Administration (US), Eurelectric (Belgium), Federal Office Wiesbaden (Germany); VDEW (Germany)
- The average consumption of considered country is multiplied by accurate emission factor and divided by the total number of persons per household.
- Sources for emission factors: Bafu (Federal Office for the Environment) and IPCC

Home Heating Emissions

- Heating emissions are a function of apartment size, persons per household, emission factor, energy consumption per square feet and apartment type.
- Clients can only choose between three home sizes (small: 645 sq ft /medium: 1076 square ft /large: 1722 square ft). These sizes are STI assumptions and not based on statistical information.
- Heating energy demand of different homes: 16.7 kWh/sq ft for average houses, 5.6 kWh/sq ft for energy efficient buildings.
- Source: Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (Germany) and www.energiesparhaus.at (Austria)
- Resulting values are not country specific. Same situation in USA, EU and Switzerland is assumed.
- Sources for emission factors: Bafu (Federal Office for the Environment) and IPCC.

Hotel Stays

North America

- The U.S. Energy Information Administration calculates that the average building in the “Lodging” category uses 29.3 kilowatt-hours (100 thousand BTU) of energy per square foot per year.
- This calculation includes electricity consumption as well as energy usage associated with, for example, space heat and hot water.
- Based on this number, STI has computed the average total amount of greenhouse gas emissions emitted per typical room night to be approximately 33.7 pounds per night (Source: Bonneville Environmental Foundation)
- Although determining total kilowatt-hours of electricity consumption per square foot per year and dividing the amount by the total number of rooms in a hotel would be ideal, this information is hotel-specific and may not be readily available, so this calculation is a reasonable approximation that can be used for any U.S. hotel property.
- The average room size is estimated to be 300 square feet.

Europe

- The calculations for Europe are similar to the US calculations. Electricity and heating emissions are calculated by using an emission factor (specific for the European Union), an assumed room size, electricity demand per sq ft and heating energy demand per sq ft.
- Source for electricity demand at 13.94 kWh/square ft per year: Credit Suisse Statistics (Switzerland)

- Sources for heating demand at 11.15 kWh/sq ft per year: Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (Germany) and www.energiesparhaus.at (Austria)
- Source for emission factors: United Nations Conference on Trade and Development (http://www.unctad.org/en/docs/iteipc20037_en.pdf).
- The average room size is estimated to be 162.54 square feet (Travel Research International, Price Waterhouse Cooper).

Notes

- Most of the assumptions detailed above are not used in calculating complex greenhouse gas emission equations. They are made and in place to keep our online calculator as simple and as user-friendly as possible for online users.