



Carbon footprint of the CARBONES project

Summary

The partners of the CARBONES project asked Mathieu Labonne, as a certified consultant in carbon footprint, to evaluate the greenhouse gas emissions generated by the CARBONES project. This evaluation is called carbon audit in this report.

The normal perimeter should include part of the construction of data producers (satellites, flux tours...). Because of the difficulties to access these information, **the perimeter was limited to the direct sources of emissions generated by the partners** : consumption of energy for heating and electricity of the offices used for the project, daily commuting to work, travels for meetings or other needs (transportations + hotels), meals and use of computers during the project.

In total, greenhouse emissions account for an **equivalent of 51 tons of carbon or 189 tons of CO₂**. **Travels related to project meetings account for 45%. They also represent 6.6 tons of CO₂ per person/year.**

This evaluation shall be refined at the end of the project, using the tool that Mathieu Labonne developed for this assessment and supplied to NOVELTIS.

1. General introduction to the carbon constraint and “Bilan Carbone” method

An increasing number of companies try to assess the impacts and risks of their activities. The carbon constraint integrates the sum of the **responsibility in the global warming** through carbon emissions - mainly from the use of fossil fuels - generated by the activity, and of the **dependency to the price of fossil fuels**. Indeed, when one knows all the carbon emissions associated to an activity, one can easily assess the impact of an increase in oil prices on the company's costs.

Consequently, many companies or administrations are now using the “carbon indicator” as an integrated way to manage the risks associated to this double constraint. As an integrated and large environmental indicator, the carbon indicator can be used as an efficient management tool. It also gives a new approach of an activity which is useful to anticipate the future when the carbon constraint becomes crucial.

The first step of such a new kind of management and governance is to **make a carbon audit** in order to find a range of values for the different sources of greenhouse gas emissions.

A carbon audit counts all greenhouse gas (GHG) emissions used for an activity. It includes all the GHG emissions for which an activity is directly responsible (such as energy consumption, transportation, direct use of GHG...) including those that are indirectly generated by this activity, in particular the production of the goods necessary to this activity.



In France, a specific method was developed by a governmental institution (ADEME) in order to supply carbon audits. It is called “*Bilan Carbone*”. The principle is the same as the one developed in methods from other countries such as the GHG protocol: it multiplies activity data by emission factors. The *Bilan Carbone* method considers a very large scope of different sources of emissions, which enables to assess a large environmental impact and to estimate the whole dependency on fossil fuels. This aspect can lead to highlight the vulnerability of the activity related to the fossil fuels price.

2. Presentation of the CARBONES project and perimeter of its carbon audit

CARBONES is a EU-funded collaborative project part of the 7th Framework Programme. 14 partners from different countries and China are involved in this project.

It aims at developing a new approach for quantifying and understanding CO₂ surface fluxes. It is a global information system based on existing models which aims at giving climate modellers detailed information regarding CO₂ fluxes and carbon pools.

The products and diagnostics of the project will be publicly disseminated thanks to a user-friendly interface.

From the carbon footprint perspective, the project mainly deals with office work and meetings. The engineers and scientists working on the CARBONES project use existing data derived from different tools.

The table below gives all the sources of GHG emissions which would be taken into account in a full carbon audit. For each source of GHG emission, the right column says if it is included in the perimeter of the audit. Otherwise, it explains why.

Sources of GHG emissions associated with the project	Considered in the carbon budget?
Consumption of energy for office work	YES
Daily travels during the CARBONES project	YES
Lunch meals during the CARBONES project	YES
Travels (official and non-official CARBONES meetings) (including hotels)	YES
Depreciation of the office computers used for the project	YES
Depreciation of the different “data producers” (satellites, flux towers, supercomputers...)*	NO, too much work to estimate, but significant
Preparation – relationships with EU	NO, would add few % more
Services and products for the functioning of the laboratory	NO (for information around 0.2 tC/person in LSCE)

** it would mean to consider all the carbon emissions associated with the construction and maintenance of these data producers and to associate a part of these emissions to the project, depending on a ratio to be defined.*



3. Results of the carbon audit

a. Data collection

As the perimeter only integrates the emissions by partners' workers during the project, data were collected using an excel sheet questionnaire asking different information regarding the scientists' working environment and the different travels planned during the project.

13 out of 14 partners replied. (all but THALES).

b. General results

office electricity and heating	9 605
daily travels to work	10 086
meals on working days	4 389
travels (transports, hotels...)	23 020
use of computers	4 531
TOTAL CARBON (kgC)	51 630
TOTAL CO2	189 310

This table gives the different sources of greenhouse gas emissions in kilograms of carbon equivalent.

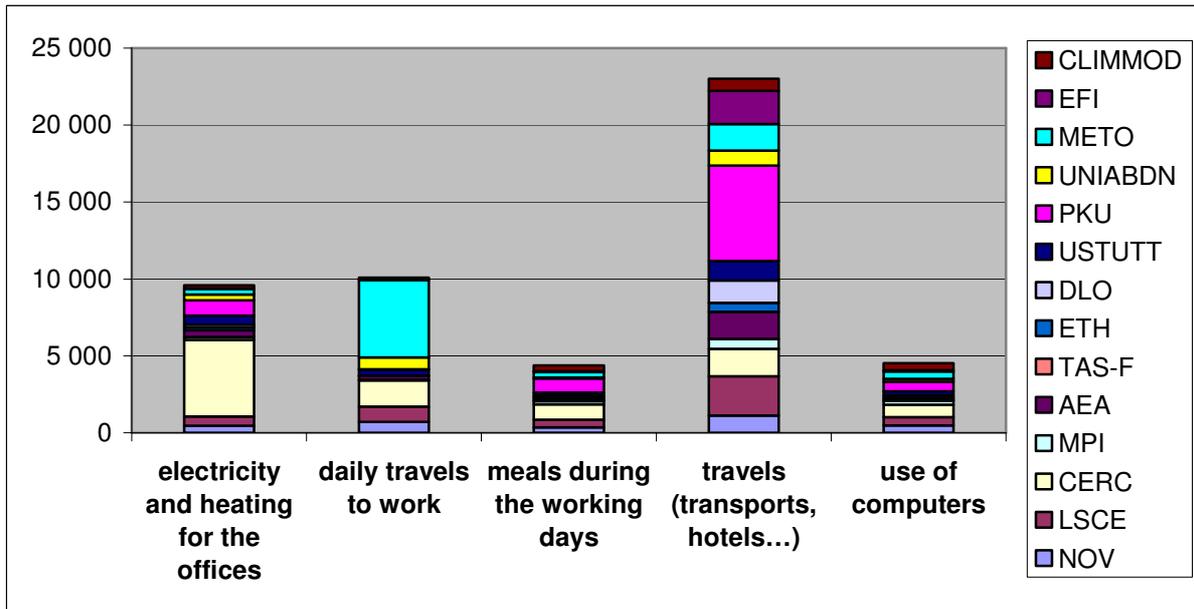
In total, more than **51 tons of carbon equivalent** are foreseen to be emitted by the CARBONES project.

project budget in euros	3 492 018
gC/euro	15
gCO2/euro	54

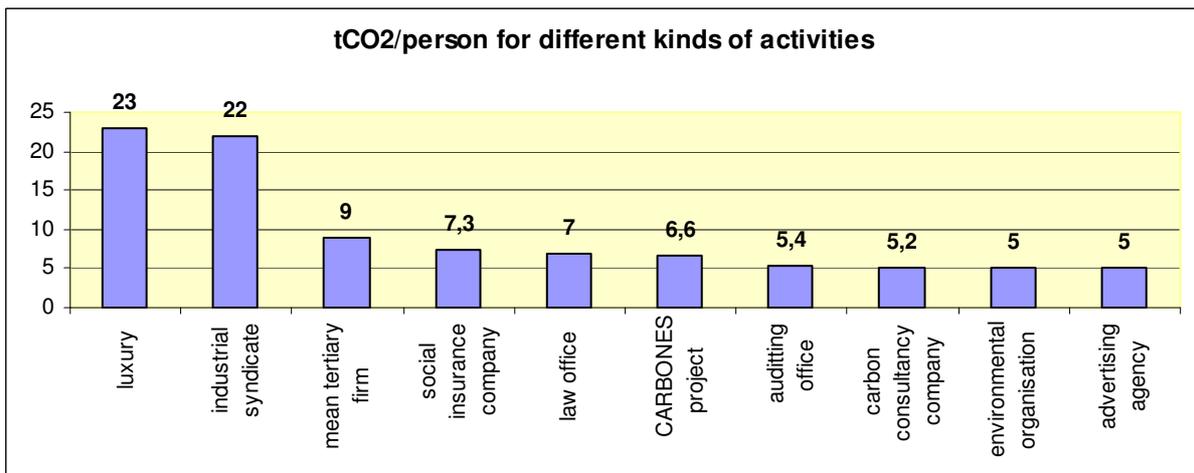
The financial ratio (gC/euro) gives an idea of the emission intensity of the investment. 15gC/euro is typically a service activity with low material support. It means that 15gC are emitted when for 1 euro invested in the project

number of person/year	28,7
kgC/person/year	1 801
kgCO2/person/year	6 604

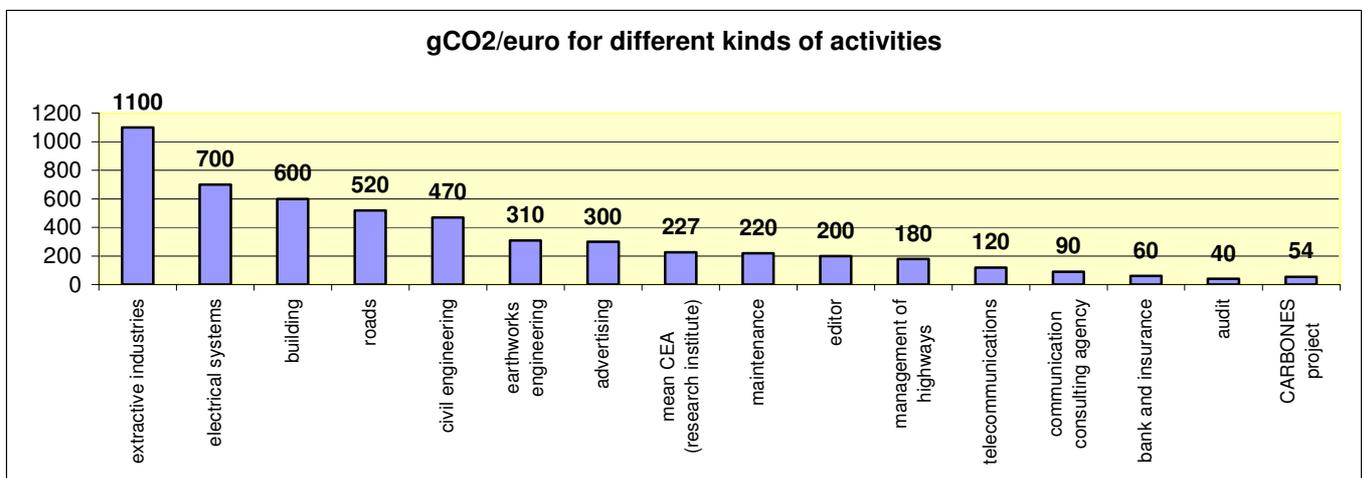
The ratio per person gives a total of 1,8 tC per person/year.



emissions per source of emission and per partner in kilogram of carbon equivalent



comparison of different service activities in France in tCO₂/person/year



comparison of different activities in France in gCO₂/euro of budget or turnover



c. Energy consumption

Calculations for **heating consumption** use this equation:

$$\text{Emissions (kgC)} = \text{number of months /12} * \text{surface of the office (m}^2\text{)} * \text{energy per surface per year (KWh/m}^2\text{.year)} * \text{emission factor depending on the energy source (kgC/KWh)}$$

The energy per surface per year is either calculated by data from partners (total consumption of the facility / total surface of the facility), either given by the level of insulation given by the partner (90 KWh/m².yr for “good”, 160 for “medium” and 220 for “bad”).

The emission factor depends on the energy source used by the partner for heating. The choice is between fuel, natural gas, combined heating plant, electricity and biomass.

Calculations for **electricity consumption** (except heating) use this equation:

$$\text{Emissions (kgC)} = \text{number of months /12} * \text{surface of the office (m}^2\text{)} * \text{typical electricity consumption per surface per year for office work (KWh/m}^2\text{.year)} * \text{emission factor depending on the country (kgC/KWh)}$$

The typical electricity consumption for office work is given by the French energy agency: 121 KWh/m².year.

The emission factor of electricity depends on the country. The data are from International Energy Agency reports of 2004.

d. Daily commuting to work

Partners gave the commuting distance for each person involved, and his/her way of transportation.

The emission per km is given by the French energy agency (from *Bilan Carbone* emission factors table).

Transportation mode	kgC/km
Car	0,069
Car-sharing	0,034
Motorcycle	0,049
Bus	0,021
Bicycle	0,001
Train - UK	0,020
Tram - Switzerland	0,001
Underground or RER - France	0,002
Underground	0,002



e. Meals

For each partner, every people involved in the project indicated his/her average diet, and especially the level of meat consumption during lunches at work. The *Bilan Carbone* method includes all the meals that are taken during working hours.

Each diet has a certain carbon emission ratio per meal (results from previous studies). We consider 5 kinds of diet:

- vegetarian without dairy
- vegetarian with dairy
- meat at lunch less than 3 times per week
- meat at almost every lunch, white meat mainly
- meat at almost every lunch, red meat mainly.

f. Travels to meetings

Each partner gave the number of employees who are expected to attend each planned meeting and other related travels scheduled to occur during the project.

The different CARBONES meetings are given in the table below, with expected location:

Kick-Off - May 2010	TOULOUSE
Progress Meeting 2 - October 2010	PARIS
Annual meeting 1 - May 2011	PARIS
Mid term progress meeting	PARIS
Annual meeting 2 - 2012	LONDON
Progress meeting - 2012	PARIS
Final meeting - 2013	TOULOUSE
consecutive meetings of: CUAG 2 physical meeting + User Meeting 1 - 2011	LONDON
CUAG 3 virtual meeting - 2012	PARIS
User Meeting 2 - 2012	TOULOUSE

We consider that, except when specified by the partner, all travels are done by plane. The emission ratio per km by plane is given by the French energy agency depending on the distance of the flight. We consider all transports done in economy class.

Partners also gave the distance between their office and their airport in order to consider the ride to the airport.

Emissions generated by nights in hotels were also taken into consideration. Another carbon audit concluded to a ratio of around 2 kgC /night in hotel (meals during the meetings are supposed to be included in the meals section).

g. Use of computers

Each person involved uses different kind of computers (servers, PCs, MacBooks...). We consider the depreciation of the computers during their use for the CARBONES project, considering a 3 years lifetime.



Carbon emissions from the production of the different machines come from different publications and studies from the IT sector.

4. How to follow-up the carbon audit during the project

a. Adjusting data

Every partner was given its carbon emission report so that they can check the data they gave in the questionnaire.

They also can see their carbon emissions during the CARBONES project

It is possible to adjust the data directly in the general excel tool.

b. Testing different travel options

In the “travels” tab, it is possible to change the locations of the meetings (for instance to change from “LONDON” to “PARIS”) to see the difference in emissions according to location.