Design & Consultancy
for natural and
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CARBON FOOTPRINT 2015

Erasmus University Rotterdam

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Contacts

I-M. ERNST BA, BSC

Arcadis Nederland B.V.
P.O. Box 4205
3006 AE Rotterdam
The Netherlands

CONTENTS

1 INTRODUCTION

Erasmus University Rotterdam (EUR) asked Arcadis to calculate the carbon footprint for the complete campus over 2015 in a uniform way to gain insight in energy consumption, material use and waste production. The university gathered the necessary data for the underlying calculations. In this report the results are shown as well as advices for further improvement of the available data.

Deliverables

The deliverables encompass not only this report but also an excel sheet containing calculations, sources, assumptions and estimations.

2 STARTING POINTS

In this chapter, we briefly describe how the data for the carbon footprint has been obtained, analyzed and categorized and what principles are used along the way.
Detailed information on the data-gathering process can be found in Annex II.

2.1 Method

This carbon footprint is written in accordance with the NEN-ISO 14064 norm. The structure of the carbon footprint is based on methods from the Greenhouse Gas Protocol (GHG Protocol). This protocol discussed three scopes. The figure below shows the scopes and the associated emissions.

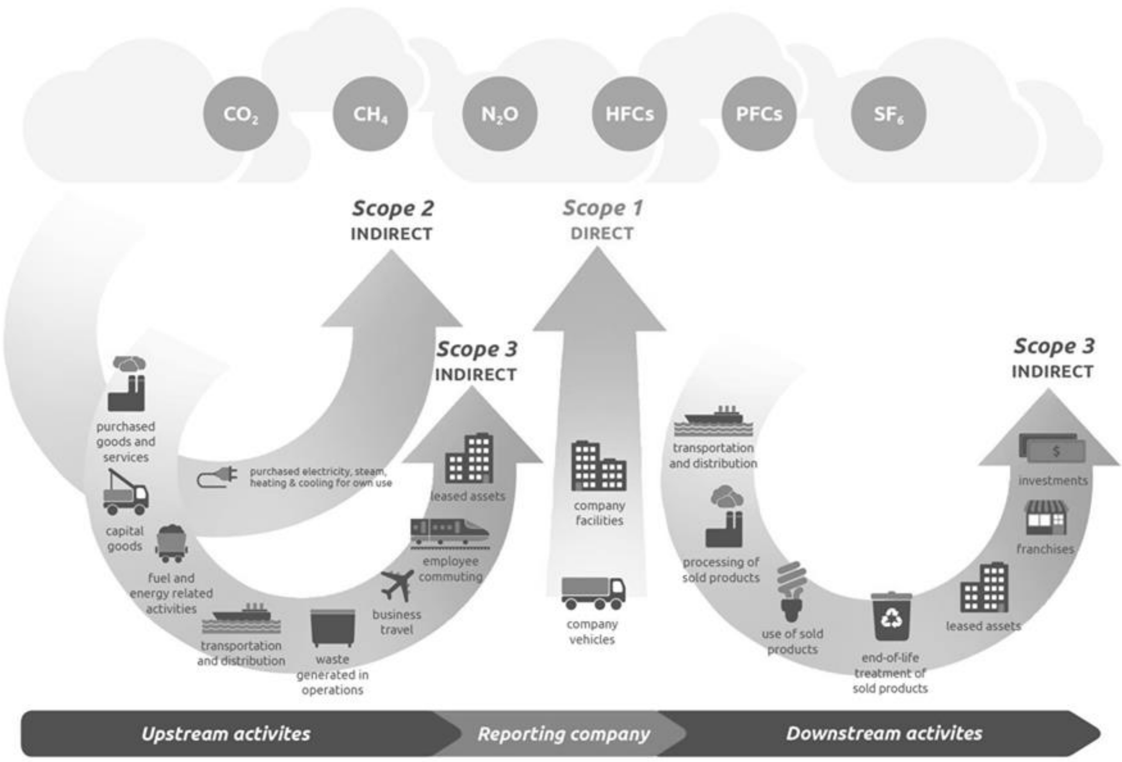

Figure 1: Definition of the scopes according to the GHG Protocol

These scopes are based on the extent to which the organization can influence the emissions in each scope.

The scope 1, 2 and 3 emissions mentioned below are included in the CO_2 footprint:

1. Scope 1: The university is able to directly influence the CO_2-emissions.
   - Natural gas consumption.
   - Fuel consumption university-owned vehicles/ machines.
   - Refrigerants.
   - Cleaning detergence.

2. Scope 2: Emissions of CO_2 originating from power generation. The university is able to directly influence the emissions, but these emissions are emitted outside of the organizational boundary, for example at a power generation facility.
   - Electricity for buildings.
   - Heat for buildings.
3. Scope 3: The university is able to directly influence the emissions of CO_2 on a very limited basis.
   - Fuel use commuting - public transport (various modalities).
   - Fuel use commuting - private cars, motorbikes, scooters and electric bikes.
   - Fuel use business travel - private cars.
   - Fuel use business travel - flight travel.
   - Emissions from waste production (residual waste, paper, cardboard, organic waste, plastic, glass, swill).

Emissions of the students

Students have a major impact on the total CO_2 emissions of the university. Not only in the use of the buildings and facilities attached thereto. Students travelling to and from the campus generate a significant amount of CO_2-emissions. Because these emissions are indirectly caused by the university itself, it has been decided to include the emission of the students in the carbon footprint of the university.

Located on the campus is a student apartment complex (Hatta complex). This part of the campus is excluded from the CO_2 footprint because the Hatta complex is not owned by the university and therefor the emissions are not part of the footprint of the university.

2.2 Boundaries

This footprint includes all locations of Erasmus University Rotterdam, except the Hatta complex:

- Location Woudestein;
- Location ISS International Institute of Social Studies;
- Location EUC Erasmus University College.

During the analysis of the energy consumption data, the following number of students and employees have been taken into account:

- 2.823 employees (fte);
- 23.898 students.

2.3 Starting year

In 2011, the university has analyzed their CO_2 footprint for the first time. This footprint is the basis of the footprint for 2015. However, standardized methods, internal processes and conversion factors have changed throughout the past few years. Therefore, the starting year is chosen to be 2015.

3 CARBON FOOTPRINT 2015

3.1 Results

The total CO_2-emission of the university for 2015 is 14.671 ton CO_2. This equals an emission of 61,4 ton CO_2 per 100 students. The figure below shows the distribution of the different emissions.

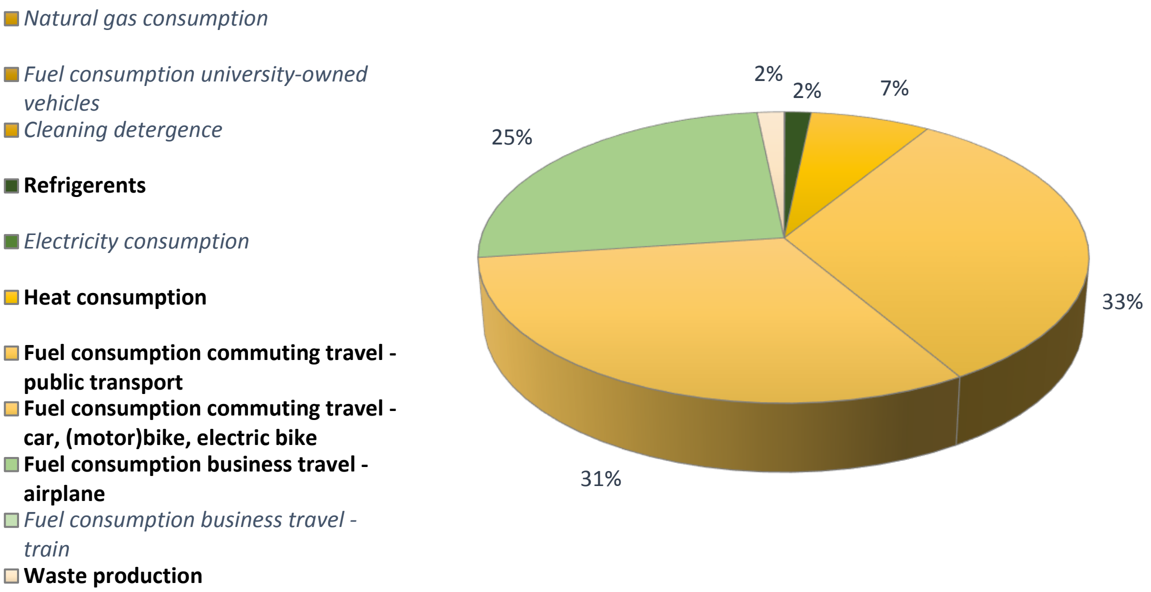

Figure 2: CO_2-footprint Erasmus University Rotterdam 2015

A substantial part of the emissions is caused by the fuel consumption for commuting travel by public transport (33%), followed by the fuel consumption for commuting travel by car, motorbike, scooter and electric bike (31%). Next in line is the fuel consumption for business travel by plane (25%). That means that the largest part of the CO_2-emissions is caused by scope 3 emissions regarding mobility with nearly 90% of the whole footprint.

The university exclusively purchases renewable electricity since 2015. According to the most recent conversion factors for greenhouse gas reporting[1], renewable electricity is free of CO_2-emissions. Therefore, electricity is present in the figure above.

Also not shown in the figure above are the percentages of the total for the emissions of natural gas, fuel consumption of the university-owned vehicles, cleaning detergence and fuel consumption of business travel with the train. The emissions are so low (the highest one shows a percentage of the total of 0,03%), that they have been left out of the figure.

The table below shows the CO_2-emissions of the university per scope and type of emission. The emissions are related to the number of students and employees and to the gross floor area. This is done because the Universities energy consumption is affected by these parameters. It is obvious that the total CO_2-emission of one student is way lower (0,61 ton CO_2) than the total emission of one FTE employee (5,1 ton CO_2).

[1] www.co2emissiefactoren.nl

Type of emission per scope		Total [ton/ year]	Per 100 students [ton/ 100 stud]	Per fte [ton/ fte]	Per gfa [ton/ 100m²]
Direct emissions					
Natural gas consumption	Scope 1	4,1	0,017	0,001	0,002
Fuel consumption university-owned vehicles/ machines	Scope 1	3,9	0,016	0,001	
Refrigerants	Scope 1	0,0	0,000	0,000	0,000
Cleaning detergence	Scope 1	229,7	0,961	0,081	0,105
Indirect emissions					
Electricity for buildings	Scope 2	-	0,000	0,000	0,000
Heat for buildings	Scope 2	1.058,6	4,430	0,375	0,482
Further indirect emissions					
Fuel use commuting - public transport (various)	Scope 3	4.783,5	20,016	1,694	
Fuel use commuting - private cars, motorbikes, scooters, electrical bikes	Scope 3	4.607,7	19,281	1,632	
Fuel use business travel – airplane	Scope 3	3.745,3	15,672	1,327	
Fuel use business travel – train	Scope 3	0,5	0,002	0,000	
Emissions waste production	Scope 3	237,8	0,995	0,084	0,108
Total (students & employees)		**14.671,1**	**61,390**	**5,197**	**0,697**

Table 1: CO_2-emissions Erasmus University Rotterdam 2015

Figure 3 shows the distribution of emissions per scope. 91% of the total emission is derives from the emissions of scope 3. As waste production only makes up for 2 percent of the 91% of scope 3, mobility is responsible for nearly all CO_2-emissions of the university.

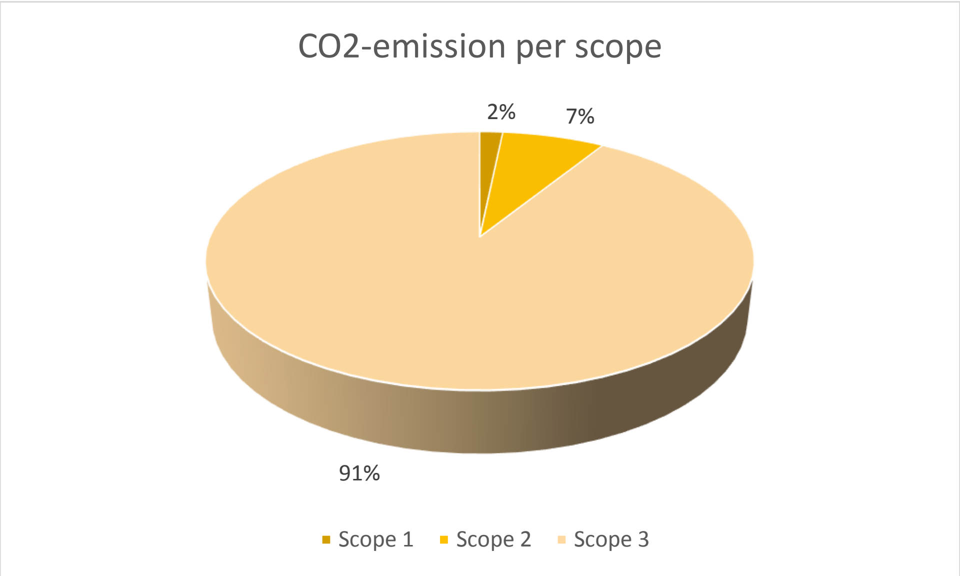

Figure 3: CO_2-emissions per scope

3.2 Results per source of CO_2-emission

3.2.1 Direct emissions

Natural gas - Energy data buildings

The energy data of the buildings are based on measurement data from invoices or manual readings of the gas meters.

In 2015 the natural gas consumption is responsible for 4,1 ton CO_2 (0,03%). The natural gas was used for the heating of the staff accommodation. Those apartments are no longer in use, therefore no natural gas will be consumed in the following years.

University-owned vehicles

The total costs for fuel (diesel) for university-owned vehicles is € 1.482,82 for the year 2015. Using data from Statistics Netherlands[2], a translation into used liters diesel could be done.

In 2015 the university-owned vehicles are responsible for 3,9 ton CO_2 (0,03%).

Refrigerants

Refilling of the refrigerants is done by a third party. They maintain a list of refrigerants that have been refilled/drained. This list has been used for this footprint.

In 2015 the use of refrigerants is responsible for 229,7 ton CO_2 (1,57%).

Cleaning detergence

In 2015 the use of cleaning detergence is close to zero, mainly because of a lack of valid data. The data for cleaning detergence is not complete.

3.2.2 Indirect emissions

Electricity - Energy data buildings

The energy data of the buildings are based on measurement data from invoices or manual readings of the electricity meters. The university only purchases renewable electricity. The electric cars are also charged with renewable electricity. Therefore, there is no CO_2-emission deriving from the use of electricity.

Heat consumption - Energy data buildings

The energy data of the buildings are based on measurement data from invoices (Eneco).

In 2015 the heat consumption is responsible for 1.058,6 ton CO_2 (7,22%).

3.2.3 Further indirect emissions

Commuting travel

Once every two years, the university conducts a mobility survey on the travel behavior of employees and students[3]. Based on the results of the data, the number of kilometers travelled by various modalities has been extrapolated for the total amount of students. The results of the survey of 2014 are used for the data of 2015 for employees and for students.

In 2015, the commuting travel by public transport is responsible for 4.783,5 ton CO_2 (32,60%). The commuting travel by car, motorbike, scooter and electrical bike is responsible for 4.607,7 ton CO_2 (31,41%).

Business travel by train and plane

The business travel made by train needs further attention. A limited number of employees is using the NS-business card for national train travels. Despite this accurate data, for the year 2015 only the months of July and October are available. Because of this, the data regarding business travel by train is not complete.

In 2015 the business travel by train is responsible for 0,5 ton CO_2.

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[2] www.cbs.nl

[3] Voortgangsrapportage Mobiliteitsbeleid; June 11th, 2015

The business travel made by plane is determined based on the destination of the flights. It has been assumed that the departure airport is solely Schiphol Airport, due to missing data on the departure airport. The distance (flight kilometers) is determined using the website http://nl.afstand.org/.

In 2015 the business travel by plane is responsible for 3.745,3 ton CO_2 (25,53%).

The business travel by car is not yet recorded.

Waste production

The university monitors different waste streams. This list of registered waste volumes serves as an input for calculating the carbon footprint. In this footprint seven waste streams will be included:

- Residual waste.
- Paper and cardboard waste.
- Vegetable, fruit and garden waste.
- Plastic.
- Glass.
- Swill.
- (Domestic) electrical appliances.

Assumptions:

- Confidential waste is classified as paper waste.
- (Domestic) electrical appliances are seen as refrigerators (mostly used at the campus). Assumptions have been made about the materials of which a refrigerator consists of (10% plastic, 20% glass, 70% iron).

In 2015 the waste production is responsible for 237,8 ton CO_2 (1,62%). The amount recorded for the Hatta complex is based on an estimation.

3.3 Preview

Sustainability is one of the main strategic research topics on which the university wants to focus during the upcoming years. In the field of education, sustainability is playing a major role since a couple of years. The topic is no less relevant to the management of a business. During the last couple of years, the university has been eager to further improve the sustainability of the management. The focus has been on housing, mobility, energy and sustainable procurement.

The university therefore aims to improve the CO_2 footprint constantly. Attention is paid on the reliability and accuracy of the used data.

It mainly concerns the following aspects:

1. Data on catering.
2. Data on transport.
3. Data on cleaning detergence.

Catering

Part of scope 3 are emissions concerning the catering. For 2015, these emissions are not yet identified and calculated. Erasmus University Rotterdam pays additional attention to the CO_2 supply chain emissions. The university is committed to lower their emissions in the supply chain. Furthermore, students are regularly inquiring about the products available in the canteens.

While scope 1 and 2 cover direct emissions sources (e.g., fuel used in company vehicles and purchased electricity), scope 3 emissions cover all indirect emissions due to the activities of an organization. These include emissions from both suppliers and consumers. A complete chain analysis starts at the raw materials purchased and ends with the treatment of the waste at the end of the lifetime of the product delivered.

For this, the university's catering data will be gathered and analyzed the upcoming year.

Transport

An important part of the footprint are the emissions originating from transport. Various aspects are part of the analysis:

- Commuting travel students and employees
- Business travel employees

The commuting travel of the students and the employees is currently based on a mobility survey originating from 2014. The data gathering process can be improved in the upcoming years, especially the response to the survey can be stimulated to strengthen the analysis (> 40% response). A standardized way of monitoring the necessary data will enhance the accuracy of the data. As long as there is no overall monitoring system, a regular update of the survey can provide the university of a reliable dataset.

The business travel concerns train and air travel. In 2015, the data of the business train travel was shattered. Only the months July and October have been available to use in the footprint. Of course, this is less representative given the fact that July is a month in a holiday period. Nevertheless, it is a solid starting point and needs more attention next years.

The analysis of the air travel is based on total distances, dependent on the destination. In future years, the university will elaborate their analysis, separating the different flight distances (which, in the end, will result in different CO_2-emissions). Exact flight data can be recorded on a faculty level so it can be monitored and benchmarked. Usually a contract with a travel agency should provide this possibility if everyone books their trips through this agency. The latter is improved when non-agency declarations will not be honored. In the upcoming years, further steps will be taken to strengthen the analysis.

The distance travelled and the modality used for business travel should be recorded in declaration forms. If this is not possible, the focus should be shifted to flights only. That because international train travel and international car travel will be only a small fraction of the emissions.

Cleaning detergence

More exact and complete data on the ingredients of used cleaning detergence can be gathered during the next period. A detailed list of ingredients will make the footprint more accurate due to the more accurate data on which calculations of emissions will be based.

APPENDIX II - CONVERSION FACTORS

Variables

Year	2015			
Owner	Jan-Cees Jol			
Students	23.898	students	238,98	100 students
Employees	2.823	employees		
GFA	219.675	m²	2.197	100 m²

Locatie	Woudestein	EUC	ISS
GFA (m²)	198.262	5.727	15.685

CO_2-conversion factors — Most recent update: March 6th, 2016 — according to: http://co2emissiefactoren.nl/

Scope 1			
Natural gas	1,884	kg CO_2/ Nm³	
Gasoline	2,740	kg CO_2/ liter	* E95 NL
Diesel	3,230	kg CO_2/ liter	* NL
R22T	1.810	kg CO_2/ kg	
R134a	1.430	kg CO_2/ kg	
R407c	1.774	kg CO_2/ kg	
R410a	2.088	kg CO_2/ kg	
R507	3.985	kg CO_2/ kg	
Scope 2			
Electricity grey	0,526	kg CO_2/ kWh	
Electricity green	-	kg CO_2/ kWh	* Wind, water, zonne
Heat STEG	22,000	kg CO_2/ GJ	* Cijfers conform hopgave Eneco
Scope 3			
Public transport (average)	0,061	kg CO2/ km	
Train (average)	0,039	kg CO2/ km	
Car (average)	0,220	kg CO_2/ km	
Residual waste	0,527	kg CO2/ kg	* Municipal solid waste {NL}| treatment of, incineration | Alloc Def, S
Paper waste	-	kg CO2/ kg	* The recylce process of paper and comparable materials generates energy to be used in the production process of new paper. For that the emission regarding paper and comparable materials is set to '0' due to the recycling step.
Fruit, vegetables, garden	0,0001	kg CO2/ kg	* Biogas {GLO}| market for | Alloc Def, S || Soortelijk gewicht: 400 kg/m³
Plastic	-	kg CO2/ kg	* The recylce process of plastic generates energy to be used in the production process of new plastic. For that the emission regarding plastic is set to '0' due to the recycling step.
Glass	-	kg CO2/ kg	* The recylce process of glass generates energy to be used in the production process of new glass. For that the emission regarding glass is set to '0' due to the recycling step.
Swill	0,0001	kg CO2/ kg	* Biogas {GLO}| market for | Alloc Def, S || Density: 400 kg/m³
Appliances	2,0300	kg CO2/ kg	* Cast iron {GLO}| market for | Alloc Def, S
Asito Element	1,2700	kg CO2/ kg	
Decalcifier	8,7000	kg CO2/ kg	* Mainly consists of citric acid: Citric acid {GLO}| market for | Alloc Def, S
Carpet cleaner		kg CO2/ kg	
Airplane < 700km	0,2970	kg CO2/ km	
Airplane EU 700-2500 km	0,2000	kg CO2/ km	
Airplane Interco > 2500 km	0,1470	kg CO2/ km	
Airplane (average)	0,2140	kg CO2/ km	
Bread	0,6570	kg CO2/ kg	*Wheat grain {GLO}| market for | Alloc Def, S
Salade	3,0100	kg CO2/ kg	*Lettuce {GLO}| market for | Alloc Def, S
Meat	7,5000	kg CO2/ kg	*Red meat, live weight {GLO}| market for | Alloc Def, S
Dairy	234,0000	kg CO2/ m³	* Dairy {GLO}| market for | Alloc Def, S; assumption: 10 liter milk= 1 kg chees
Apple	0,3210	kg CO2/ kg	* Apple {GLO}| market for | Alloc Def, S
Banana	0,2190	kg CO2/ kg	* Banana {GLO}| market for | Alloc Def, S

EUR Commuting			
Other	0,0610	kg CO2/pkm	
Car (single)	0,2200	kg CO2/pkm	
Car (carpooling)	0,2200	kg CO2/pkm	
Car + public transport	0,2200	kg CO2/pkm	
Scooter	0,0590	kg CO2/pkm	*Afstudeerscriptie mobiliteit
Bus	0,1400	kg CO2/pkm	
Electrical bike	0,0070	kg CO2/pkm	
Bike	-	kg CO2/pkm	
Bike + public transport	0,0610	kg CO2/pkm	
Metro	0,0950	kg CO2/pkm	
Motorbike	0,1360	kg CO2/pkm	*Afstudeerscriptie mobiliteit
Walking	-	kg CO2/pkm	
Tram	0,0840	kg CO2/pkm	
Train	0,0390	kg CO2/pkm	
Train + other	0,0610	kg CO2/pkm	

Arcadis Nederland B.V.

P.O. Box 4205
3006 AE Rotterdam
The Netherlands
+31 (0)88 4261 261

www.arcadis.com

Our reference: