ARCADIS Design & Consultancy for natural and built assets

CARBON FOOTPRINT 2018

Erasmus University Rotterdam

14 FEBRUARY 2020

Contact

MARIE ERNST
Adviseur Energie & Duurzaamheid

M +31 642185694
E marie.ernst@arcadis.com

Arcadis Nederland B.V.
P.O. Box 1018
5200 BA 's-Hertogenbosch
The Netherlands

CONTENTS

APPENDICES

1 INTRODUCTION

Erasmus University Rotterdam (EUR) asked Arcadis to calculate the carbon footprint for the complete university over 2018 in a uniform way to gain insight in energy consumption, material use and waste production. EUR 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.

The results will be compared to the analysis of the footprint 2017.

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 conversion factors can be found in Appendix I. Appendix II presents the calculation sheet (available as separate document).

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.

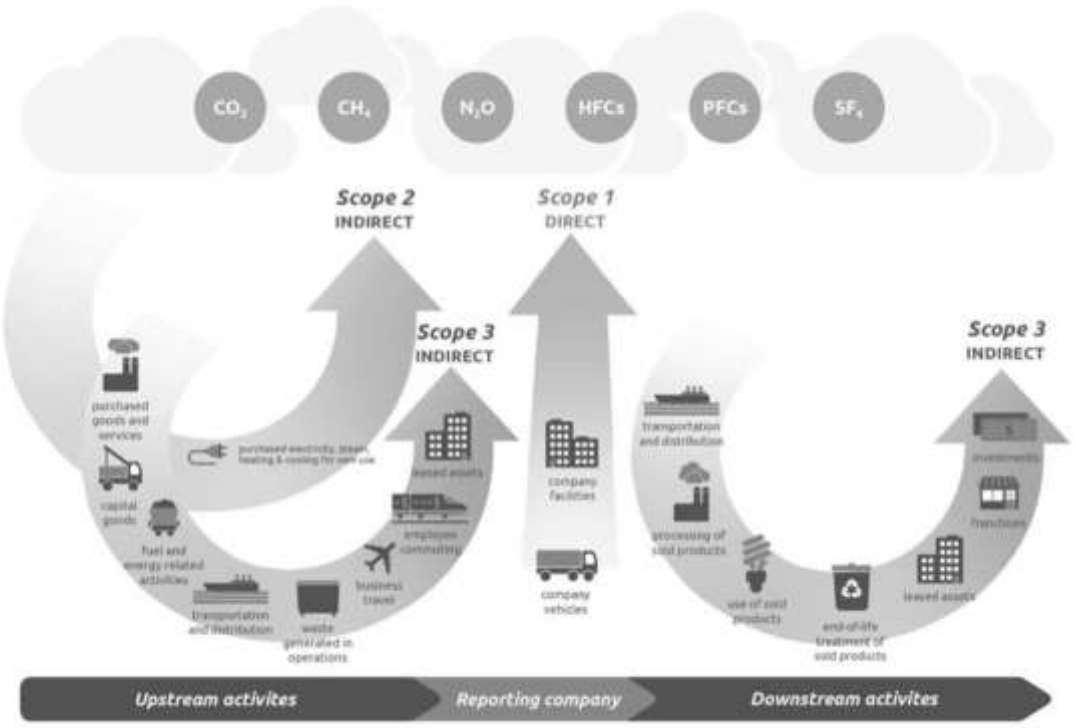

Figure 1 Definition of the scopes according to the GHG Protocol

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.

- 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 indirectly influence these emissions of CO_2 on a 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.
- Fuel use business travel - train.
- Fuel use business travel – public transport (other than train)
- Emissions from waste production (residual waste, paper, cardboard, organic waste, plastic, glass, swill).
- Catering.

Emissions of the students

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

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 EUR and therefor the emissions are not part of the footprint.

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 (1st of October 2018/ 31st of December 2017):

- 3089 employees.
- 28.900 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 2018

3.1 Results

The total CO_2-emission of the university for 2018 is 14,572.1 ton CO_2. This equals an emission of 46.1 ton CO_2 per 100 students. The figure below shows the distribution of the different emissions.

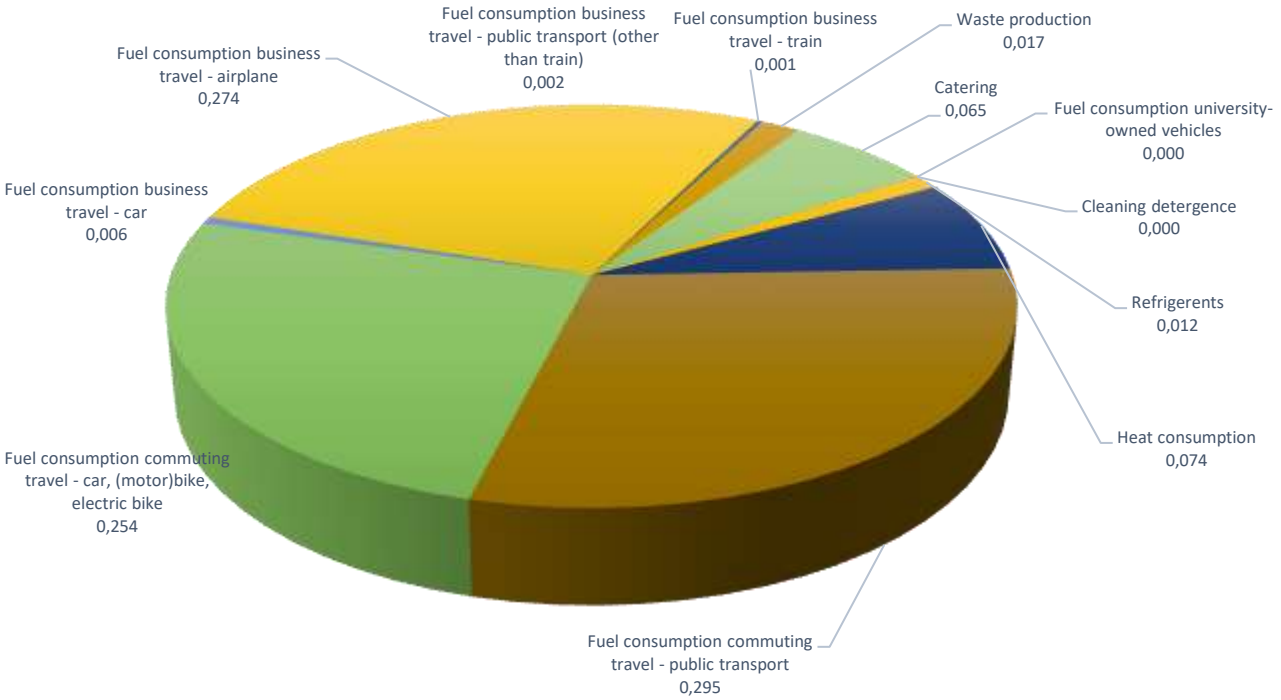

Figure 2 CO_2-footprint Erasmus University Rotterdam 2018

A substantial part of the emissions is caused by fuel consumption for business travel by plane (27.4%), followed by the fuel consumption for commuting travel by public transport (29.5%). Next in line is the fuel consumption for commuting travel by car, motorbike, scooter and electric bike (25.4%). That means that the largest part of the CO_2 footprint is caused by scope 3 emissions regarding mobility with 83.2% of the whole footprint.

EUR 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 at 0% in the figure above.

Also shown in the figure above are the percentages for the emissions of fuel consumption of the university-owned vehicles, fuel consumption for business travel by private car, cleaning detergence and fuel consumption of business travel by train. These emissions are neglectable (the highest one shows a percentage of 0.6%).

Catering has been expanded in the carbon footprint of 2018. The university was able to retrieve information regarding the consumption of coffee, tea, bread, meat, vegetables, fruit, cheese (kg/year), juices and soft drinks (ltr/year), diary (m^3/year), meal salads and complete meals (pieces/year). This results in an additional emission of 904.2 ton CO_2 (6.5% of total footprint).

Comparing this footprint to the footprint of 2017, some changes are visible. The overall footprint increased by 22%. The CO_2-emission has increased from ***11,938*** ton CO_2 in 2017 to ***14.572*** ton CO_2, mainly due to an increase of students and employees, travel by plane and the added data regarding catering.

[1] www.co2emissiefactoren.nl

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 (0.5 ton CO_2) than the total emission of one employee (4.7 ton CO_2).

Table 1 CO2-emissions Erasmus University Rotterdam 2018

Types of emission per scope		**CO_2-emission**	**CO_2-emission**		
		Total [ton/ year]	Per student [ton/ 100 stud]	Per fte [ton/ fte]	Per GFA [ton/ 100m²]
Direct emissions					
Fuel consumption university-owned vehicles	Scope 1	2.0	0.007	0.001	
Cleaning detergence	Scope 1	0.6	0.002	0.000	0.000
Refrigerents	Scope 1	170.9	0.591	0.055	0.073
Indirect emission					
Electricity consumption	Scope 2	-	0.000	0.000	0.000
Heat consumption	Scope 2	1,083.2	3.748	0.351	0,462
Other indirect emissions					
Fuel consumption commuting travel - public transport	Scope 3	4,302.5	14.888	1.393	
Fuel consumption commuting travel - car, (motor)bike, electric bike	Scope 3	3,707.4	12.828	1.200	
Fuel consumption business travel - car	Scope 3	85.1	0.294	0.028	
Fuel consumption business travel - airplane	Scope 3	3,991.1	13.810	1.292	
Fuel consumption business travel - train	Scope 3	13.1	0.045	0.004	
Fuel consumption business travel - public transport (other than train)	Scope 3	23.2	0.080	0.008	
Waste production	Scope 3	252.8	0.875	0.082	0.108
Catering	Scope 3	940.2	3.253	0.304	
Total (students & employees)		**14,572.1**	**50.422**	**4.717**	**0.642**

Figure 3 shows the distribution of emissions per scope. More than 91% of the total emission derives from the emissions of scope 3. As waste production only makes up for 1.7% and catering only makes up for 6.5% of the total percentage, mobility is responsible for nearly all CO_2-emissions of the university.

Compared to the emission per scope in 2017, the emissions of scope 1 slightly decreased as well as the emission of scope 2. Scope 3 on the other hand, mainly consisting of mobility, increased slightly from nearly 91.0% (10,862 ton CO_2) of the total footprint to 91.4% (13,315.4 ton CO_2) of the total footprint. Further below, the various emissions and the changes during 2018 are described in more detail.

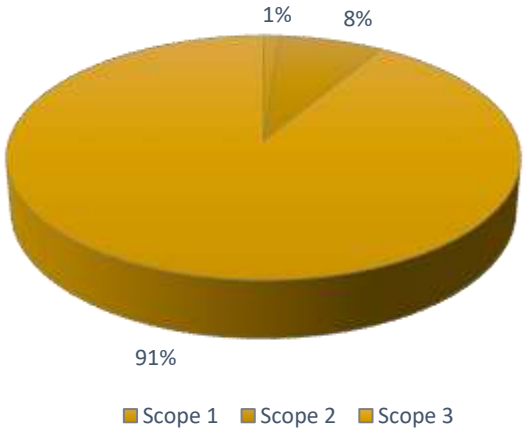

Figure 3 CO2-emissions per scope

3.2 Results per source of CO_2-emission

3.2.1 Direct emissions

The diagram below shows the impact of the various emissions of scope 1.

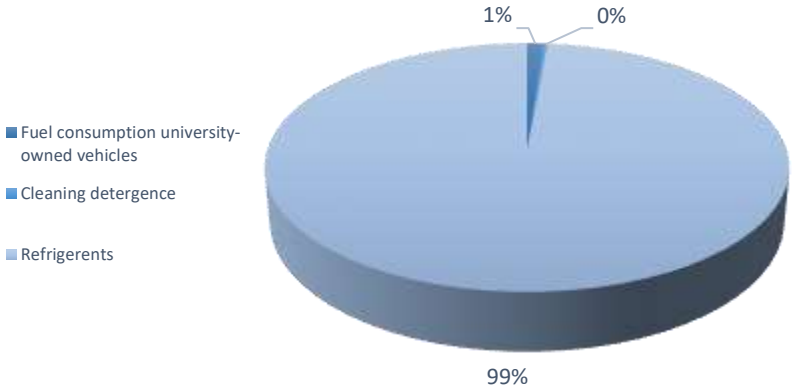

Figure 4 Emissions scope 1

University-owned vehicles

The total costs for fuel (diesel) for university-owned vehicles is € 816 for the year 2018. Using data from Statistics Netherlands[2], a translation from costs into used liters diesel is done. The average price for diesel over 2018 is € 1.34/ liter. The university used one vehicle during 2018. In 2018 the university-owned vehicles are responsible for 2.0 ton CO_2 (0.01% of total footprint). Compared to 2017 (1.8 ton CO_2), this is a slight increase.

Refrigerants

Refilling of the refrigerants is done by a third party. They maintain a list of refrigerants that have been refilled/ drained. In 2018 the use of refrigerants is responsible for 170.9 ton CO_2 (1.2% of total footprint). Compared to 2017 (42.9 ton CO_2) this is an increase, almost four times more.

Cleaning detergence

[2] www.cbs.nl

In 2018 cleaning detergents were responsible for an emission of 0.6 ton CO_2 (0.004% of total footprint). Compared to 2017 (0.6 ton CO_2) this remained the same.

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 2018 the heat consumption is responsible for 1,083 ton CO_2 (7.4% of total footprint). Compared to 2017 (1,031 ton CO_2), this is a slight increase.

Since 2017, the university is compensating its emissions deriving from their heat consumption and has offset 1,083.2 tons of CO_2 equivalents in the year 2017 with GS cookstoves for Kenia, Tanzania and Uganda. Climate Neutral Group invests in emission reduction projects which combine energy, environment and developmental solutions into sustainable business opportunities in developing countries.

3.2.3 Further indirect emissions

The diagram below shows the impact of the various emissions of scope 3.

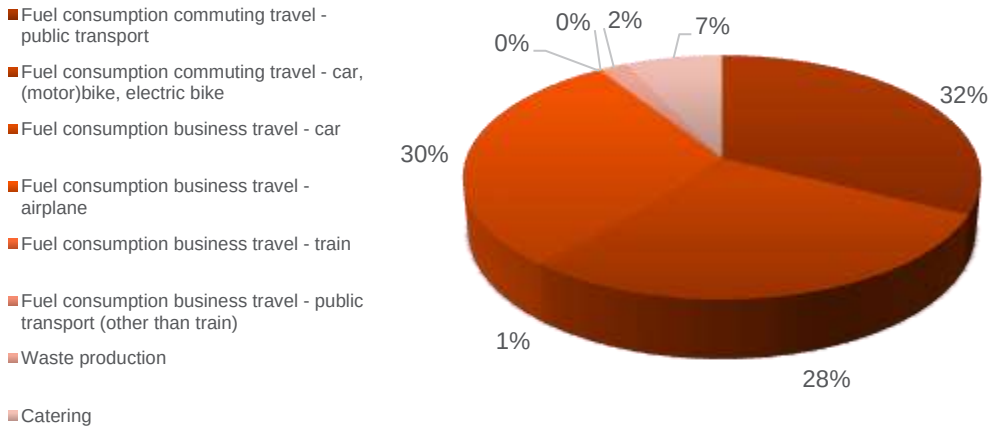

Figure 5 Emissions scope 3

Commuting travel

Once every two or three years, the university conducts a mobility survey on the travel behavior of employees and students[3]. The upcoming survey is planned to be conducted in 2020. Based on the results of the data of the last survey, the number of kilometers travelled by various modalities has been extrapolated for the total amount of students and employees. The results of the survey of 2016 are used for the data of the footprint of 2018.

In 2018, commuting travel by public transport is responsible for 4,302.5 ton CO_2 (29.5% of total footprint). Commuting travel by car, motorbike, scooter and electrical bike is responsible for 3,707.4 ton CO_2 (25.4% of total footprint).

In 2017, commuting travel by public transport was responsible for 4,065.5 ton CO_2 and commuting travel by car, motorbike, scooter and electrical bike was responsible for 3,508.8 ton CO_2. This increase in both categories is mainly due to the increase of the amount of students (5.9% increase) and employees (5.4% increase). No additional measures have been implemented.

Business travel by private car, train and plane

To be able to analyze the emissions for business travel, the invoices of the employees (€ 0.19/ kilometer) have been used to calculate the result. In 2018 business travel by private car is responsible for 85.1 ton CO_2 (0.6% of total footprint). Compared to the emissions in 2017, a slight reduction is visible (1.3%).

A number of employees is using their NS-business card for national train travels. Accurate data is derived from the business card overview. The invoices handed in manually are added to the overall data.

In 2018 business travel by train is responsible for 13.1 ton CO_2 (0.1% of total footprint). Compared to emissions in 2017, an increase is visible (4.5%)

Business travel by plane is determined based on the destination of the flights and possible stop-overs. For the major part of the flights, the destination is known. For a certain amount of flights (5%) an assumption had to be made regarding the destination airport. It has been assumed that the departure airport is solely Schiphol Airport, due to missing data on the departure airport. Above described uncertainty factors result in an inaccuracy of the assigned emission which in reality may even be higher. The distance (flight kilometers) is determined using the website http://www.travelmath.com/flight-distance/. According to the distances (national, European and intercontinental) the emissions are calculated.

In 2018 business travel by plane is responsible for 3,991.1 ton CO_2 (27.4% of total footprint). Compared to 2017 (2.833,2 ton CO_2), an increase is visible.

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 are included:

- Residual waste.
- Paper and cardboard 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 university). Assumptions have been made about the materials of which a refrigerator consists of (10% plastic, 20% glass, 70% iron).

[3] Voortgangsrapportage Mobiliteitsbeleid; June 11th, 2015

In 2018 the waste production is responsible for 252.8 ton CO_2 (1.7% of total footprint). Compared to 2017 (252.7 ton CO_2) nearly no difference is visible.

Catering

In the carbon footprint of 2017, catering was included for the first time. The university was able to retrieve the data regarding coffee beans. This year, more data for has been included in the catering. For drinks, data for coffee, tea and juices and soft drinks have been included. For meals and lunches, data for bread, meat, dairy, vegetables, fruit have been included; as well as the data for the amount of (generalized) meal salads and meals consumed.

In 2018 the catering was responsible for 940.2 ton CO2 (6.5% of total footprint). Compared to 2017 (79.3 ton CO_2), this is a large increase due to adding more data.

3.3 Preview

Sustainability is one of the main strategic research topics on which the university wants to focus during the upcoming years. Also it has been included in the new EUR strategic vision “Erasmus Strategy 2024”. In the field of education and research, 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 operation (‘bedrijfsvoering’). The focus has been on real estate, mobility, energy, waste management, catering 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.

This mainly concerns the following aspects:

1. Data on transport.
2. Data on catering.

Catering

Part of scope 3 are emissions concerning the catering. For 2015 and 2016, these emissions were not identified because there was no data available and in 2017 only data for coffee was available. 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 even more catering data will be gathered and analyzed the upcoming year. Right now, the university was able to retrieve information on coffee, tea, juices and soft drinks, bread, meat, dairy, vegetables, fruit; as well as the data for the amount of (generalized) meal salads and meals consumed.

This is a first step in the right direction to calculate the emissions of the catering in total. Also a new contract with the catering company has been concluded during 2019. EUR has included reporting on SKU level (Stock Keeping Unit).

Transport

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

- Commuting travel of students and employees
- Business travel of employees

The commuting travel of the students and the employees is currently based on a mobility survey originating from 2016. 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 with a reliable dataset. The upcoming survey is planned to be conducted in 2020.

The business travel made by plane is determined based on the destination of the flights. For the major part of the flights, the destination is known. For a certain amount of flights an assumption had to be made. It also has been assumed that the departure airport is solely Schiphol Airport, due to missing data on the departure airport. By making certain assumptions, the university has elaborated their analysis, separating the different flight distances.

Nevertheless, further improvement is possible. 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 this aspect of the analysis.

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

Also transport of products to the university (suppliers of the university and catering) has not been included in the analysis. The university is intending to include this emission stream and will collect the relevant data.

The university has planned to set up a new mobility policy upcoming year, focusing on reducing travel by car and stimulating public transport.

APPENDIX 1 CONVERSION FACTORS

Variables

Year	2018				
Owner	Jan-Cees Jol				
Students	28.900	students	289	100 students	
Employees	3.089	employees			
GFA	234.676	m²	2.347	100 m²	

Locatie	Woudestein	EUC	ISS
GFA (m²)	213.263	5.727	15.685

Peildatum stud. 1 okt 2018 / medewerkers 31 dec 2017 natuurlijke personen (geen fte) / unieke studenten (incl Erasmus MC bepaald op 27 sept 2019 uit BICC)

CO_2-conversion factors Most recent update: December 11th, 2018 according to: http://co2emissiefactoren.nl/

Scope 1					
Natural gas	1,890	kg CO_2/ Nm³		1,884	2016
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	0,523	kg CO2/ kg	* Municipal solid waste {NL}| treatment of, incineration | APOS, 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	0,0016	kg CO2/ kg	* Biogas {RoW}| market for biogas | APOS, 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	0,0016	kg CO2/ kg	* Biogas {RoW}| market for biogas | APOS, S || Soortelijk gewicht: 400 kg/m³		
Appliances	2,0200	kg CO2/ kg	* Cast iron {GLO}| market for | APOS, S		
Asito Element	1,5200	kg CO2/ kg	* Important ingredient: hydrogen peroxide, dilluted (1%): Hydrogen peroxide, without water, in 50% solution state {GLO}| market for | APOS, S		
Decalcifier	6,2700	kg CO2/ kg	* Mainly consists of citric acid: Citric acid {GLO}| market for | APOS, S		
Hand soap	1,3800	kg CO2/ kg	* Mainly consists of fat and sodium hydroxide (estimation: 50%) Sodium hydroxide, without water, in 50% solution state {GLO}| market for | APOS, S		
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	0,8450	kg CO2/ kg	* Wheat grain {GLO}| market for | Cut-off, U
Meal salad	1,4868	kg CO2/ kg	* Aanname: 500gr groenten p maaltijdsalade || 50% Lettuce {GLO}| market for | Cut-off, U {3,67}; 20% Tomato, fresh grade {GLO}| market for tomato, fresh grade | Cut-off, U {0,518}; 30% Cucumber {GLO}| market for | Cut-off, U {3,45}
Meal	2,7594	kg CO2/ kg	* Aanname: 400gr groente en 100gr vlees p maaltijd || 50% Lettuce {GLO}| market for | Cut-off, U {3,67}; 20% Tomato, fresh grade {GLO}| market for tomato, fresh grade | Cut-off, U {0,518}; 30% Cucumber {GLO}| market for | Cut-off, U {3,45}; Red meat, live weight {GLO}| market for | Cut-off, U {15,7}
Meat	15,7000	kg CO2/ kg	* Red meat, live weight {GLO}| market for | Cut-off, U
Dairy	329,0000	kg CO2/ m^3	* Dairy {GLO}| market for | Cut-off, U
Cheese	16,1000	kg CO2/ kg	* Cheese, from cow milk, fresh, unripened {GLO}| market for | Cut-off, U
Fruit	0,4924	kg CO2/ kg	* Aanname: 40% Apple {GLO}| market for | Cut-off, U {0,451}; 30% Banana {GLO}| market for | Cut-off, U {0,411}; 30% Pear {GLO}| market for | Cut-off, U {0,629}
Vegetables	2,9736	kg CO2/ kg	* Aanname: 50% Lettuce {GLO}| market for | Cut-off, U {3,67}; 20% Tomato, fresh grade {GLO}| market for tomato, fresh grade | Cut-off, U {0,518}; 30% Cucumber {GLO}| market for | Cut-off, U {3,45}
Juices	0,9848	kg CO2/ liter	* Aanname: 2 kg fruit voor 1 l sap || 40% Apple {GLO}| market for | Cut-off, U {0,451}; 30% Banana {GLO}| market for | Cut-off, U {0,411}; 30% Pear {GLO}| market for | Cut-off, U {0,629}
Coffee	10,8500	kg CO2/ kg	* Wuppertal Institute
Tea	5,2000	kg CO2/ kg	* Tea, dried {GLO}| market for tea, dried | Cut-off, U
Asito Waspoeder	2,1300	kg CO2/ kg	* Main ingredient: sodium carbonate (30%), similar to Sodium percarbonate, powder {GLO}| market for | APOS, S
Asito linostripper	4,3000	kg CO2/ kg	* Main ingredient not available. 2nd benzyl alcohol (30%): Benzyl alcohol {GLO}| market for | APOS, S

EUR Commuting			
Other	0,0610	kg CO2/pkm	
Car (single passenger)	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	
Bike electric	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+ Tram/Bus/Metro	0,0610	kg CO2/pkm	

APPENDIX 2 CALCULTATION SHEET

COLOPHON

CARBON FOOTPRINT 2018

CLIENT
Erasmus University Rotterdam

AUTHOR
Renée Beelen

OUR REFERENCE

DATE
14 February 2020

STATUS
Final

Arcadis Nederland B.V.

P.O. Box 1018
5200 BA 's-Hertogenbosch
The Netherlands
+31 (0)88 4261 261

www.arcadis.com