

CO2 Footprint 2019

Carbon footprint 2019

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1. Introduction

The Erasmus University Rotterdam (EUR) annually reports on its carbon footprint for the complete university over 2019 in a uniform way to gain insight in energy consumption, material use, waste production, catering, and business- / commuting travel. 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 are compared to the analysis of the footprint 2018.

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.

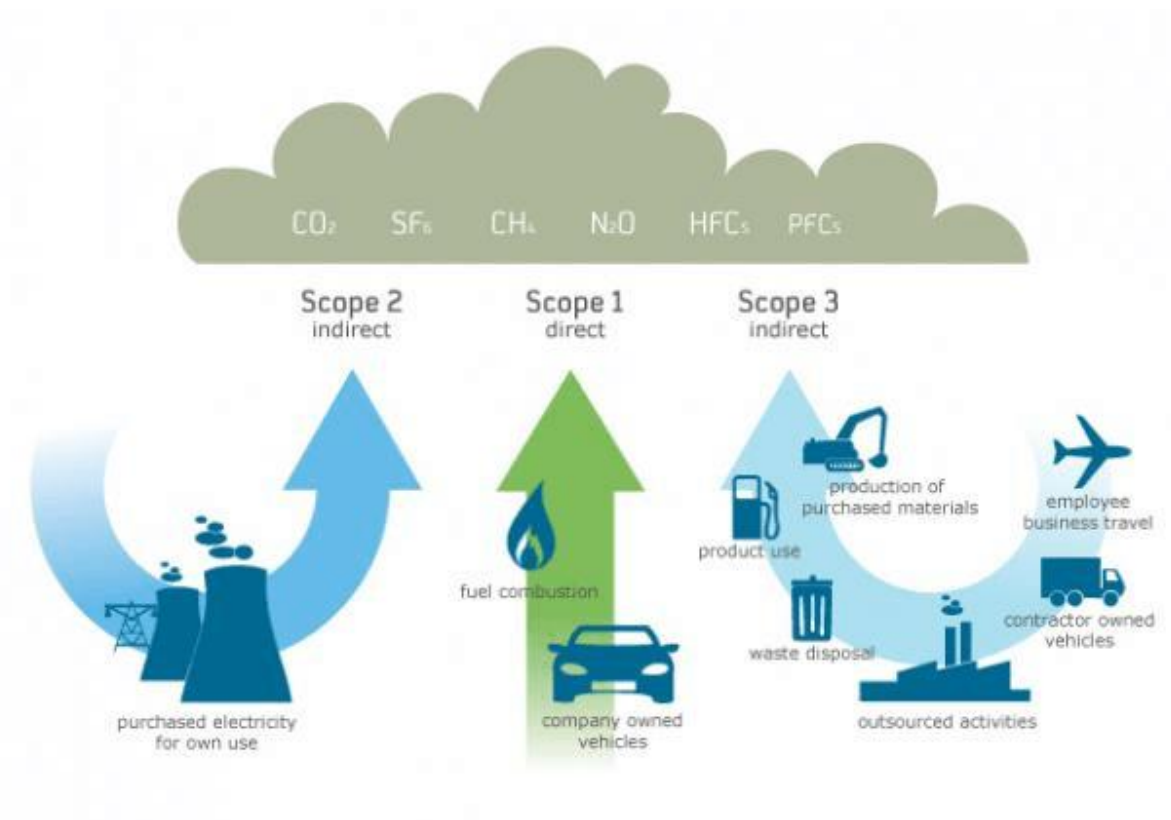


Figure 1. Definition of the scopes according to the GHG Protocol

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 CO₂ footprint:

2.1.1 Scope 1: The university can directly influence the CO₂-emissions.

- Fuel consumption university-owned vehicles/machines.
- Refrigerants.
- Cleaning detergent.

2.1.2 Scope 2: Emissions of CO₂ originating from power generation. The university can 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.

2.1.3. Scope 3: The university can indirectly influence these emissions of CO₂ 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 derived from students

Students have a major impact on the total CO₂ 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 CO₂-emissions. Because these emissions are indirectly caused by EUR itself, it has been decided to include the emission of the travelling of the students in the carbon footprint.

The Hatta housing complex, located on the campus, is excluded from the CO₂ footprint because it's not owned by EUR and therefore the emissions are not part of the footprint.

2.2 Boundaries

This footprint includes all locations of Erasmus University Rotterdam, except the Hatta housing 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 2019/ 31st of December 2018):

- 3.229 employees.
- 29.477 students.

2.3 Starting year

In 2011, the university has analyzed their CO₂ 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 2019

3.1 Results

The total CO₂-emission of the university for 2019 is 15.116,6-ton CO₂. This equals an emission of 51.3-ton CO₂ per 100 students. The figure below shows the distribution of the different emissions.

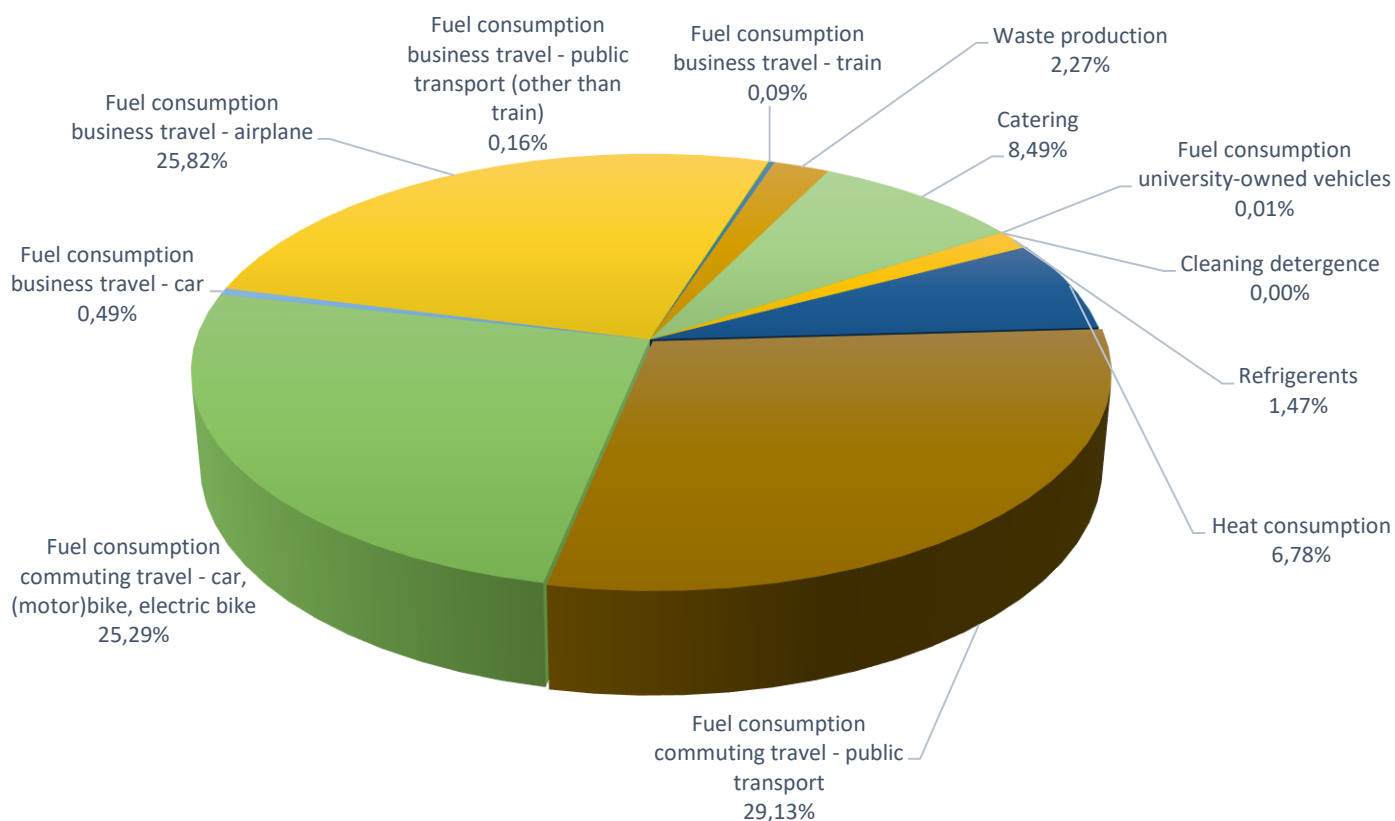


Figure 2. CO₂-footprint Erasmus University Rotterdam 2019.

A substantial part of the emissions is caused by fuel consumption for commuting travel by public transport (29.1%), followed by the fuel consumption for business travel by plane (25.8%). Next in line is the fuel consumption for commuting travel by car, motorbike, scooter, and electric bike (25.3%). That means that the largest part of the CO₂ footprint is caused by scope 3 emissions regarding mobility with 80.2% of the whole footprint.

EUR exclusively purchases renewable electricity since 2015. According to the most recent conversion factors for greenhouse gas reporting¹, renewable electricity is free of CO₂-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 detergent and fuel consumption of business travel by train. These emissions count for 0,59% and are therefore neglectable.

¹ www.co2emissiefactoren.nl

Catering has been expanded in the carbon footprint of 2019. The university was able to retrieve information regarding the consumption of fruits, vegetables, bread, pastries, dairy, fats, meat, fish, poultry, tea and coffee. Next to the in-house caterer, Erasmus Sports is added to the list. This results in an additional emission of 1.283,2-ton CO₂ (8.49% of total footprint).

The table below shows the CO₂-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 CO₂-emission of one student is way lower (0.5-ton CO₂) than the total emission of one employee (4.7-ton CO₂).

Table 1. CO₂-emissions Erasmus University Rotterdam 2019

Types of emission per scope		CO ₂ -emission		CO ₂ -emission		
		Total [ton/ year]	Percentage [%]	Per student [ton/ 100 stud]	Per fte [ton/ fte]	Per GFA [ton/ 100m ²]
Direct emissions						
Fuel consumption university-owned vehicles	Scope 1	1.5	0.01%	0.005	0.000	
Cleaning detergence	Scope 1	0.4	0.00%	0.001	0.000	0.000
Refrigerents	Scope 1	221.9	1.47%	0.753	0.069	0.095
Indirect emission						
Electricity consumption	Scope 2	-	0.00%	0.000	0.000	0.000
Heat consumption	Scope 2	1.024.9	6.78%	3.477	0.317	0.437
Other indirect emissions						
Fuel consumption commuting travel - public transport	Scope 3	4.403.2	29.13%	14.938	1.364	
Fuel consumption commuting travel - car, (motor)bike, electric bike	Scope 3	3.822.9	25.29%	12.969	1.184	
Fuel consumption business travel - car	Scope 3	74.8	0.49%	0.254	0.023	
Fuel consumption business travel - airplane	Scope 3	3.903.6	25.82%	13.243	1.209	
Fuel consumption business travel - train	Scope 3	13.6	0.09%	0.046	0.004	
Fuel consumption business travel - public transport (other than train)	Scope 3	23.7	0.16%	0.080	0.007	
Waste production	Scope 3	342.9	2.27%	1.163	0.106	0.146
Catering	Scope 3	1.283.2	8.49%	4.353	0.397	0.547
Total (students & employees)		15.116.6	100%	51.283	4.682	1.224

Comparing this footprint to the footprint of 2018, some changes are visible. The overall footprint increased by 4%. The CO₂-emission has increased from **14.572,1-ton** CO₂ in 2018 to **15.116,6-ton** CO₂, mainly due to an increase of students and employees, waste production and the added data regarding catering.

Figure 3 shows the distribution of emissions per scope. More than 92% of the total emission derives from the emissions of scope 3. As waste production only makes up for 2.3% and catering only makes up for 8.5% of the total percentage, mobility is responsible for nearly all CO₂-emissions of the university.

Compared to the emission per scope in 2018, the emissions of scope 1 slightly increased as the emission of scope 2 decreased. Scope 3 on the other hand, mainly consisting of mobility, increased slightly from nearly 91.4% (13.315,4-ton CO₂) of the total footprint to 92% (13.867,9-ton CO₂) of the total footprint. Further below, the various emissions and the changes during 2019 are described in more detail.

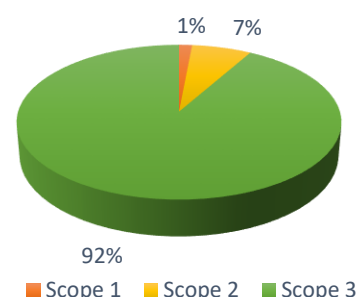


Figure 3. CO₂-emissions per scope

Table 2. CO₂-emissions 2019 compared with the CO₂-emissions of 2018

		2018	2019	Difference
Direct emissions		Ton CO ₂	Ton CO ₂	Ton CO ₂
Fuel consumption university-owned vehicles	Scope 1	2,0	1,5	-24%
Cleaning detergence	Scope 1	0,6	0,4	-31%
Refrigerents	Scope 1	170,9	221,9	30%
Indirect emission		Ton CO ₂	Ton CO ₂	Ton CO ₂
Electricity consumption	Scope 2	-	-	0%
Heat consumption	Scope 2	1.083,2	1.024,9	-5%
Other indirect emissions		Ton CO ₂	Ton CO ₂	Ton CO ₂
Fuel consumption commuting travel - public transport	Scope 3	4.302,5	4.403,2	2%
Fuel consumption commuting travel - car, (motor)bike, electric bike	Scope 3	3.707,4	3.822,9	3%
Fuel consumption business travel - car	Scope 3	85,1	74,8	-12%
Fuel consumption business travel - airplane	Scope 3	3.991,1	3.903,6	-2%
Fuel consumption business travel - train	Scope 3	13,1	13,6	4%
Fuel consumption business travel - public transport (other than train)	Scope 3	23,2	23,7	2%
Waste production	Scope 3	252,8	342,9	36%
Catering	Scope 3	940,2	1.283,2	36%
Students & Employees		Ton CO ₂	Ton CO ₂	Number
Per student (ton / 100 students)		50,42	51,28	2%
Per FTE (ton / FTE)		4,51	4,68	4%
Total (students & employees)		14.572,1	15.116,6	4%

3.2 Results per source of CO₂-emission

3.2.1 Direct emissions

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

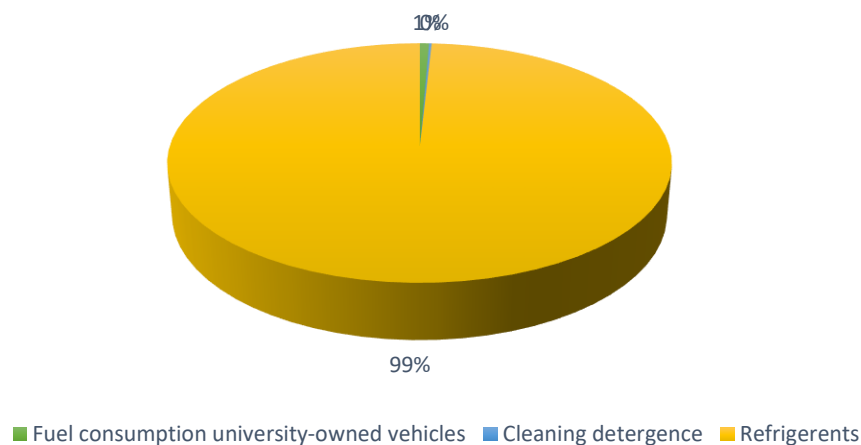


Figure 4. Emissions scope 1.

University-owned vehicles

The total costs for fuel (diesel) for university-owned vehicles is € 639 for the year 2019. Using data from Statistics Netherlands², a translation from costs into used liters diesel is done. The average price for diesel over 2019 is € 1.36/ liter. The university used one vehicle during 2019. In 2019 the university-owned vehicles are responsible for 1.5-ton CO₂ (0.01% of total footprint). Compared to 2018 (2.0-ton CO₂), this is a slight decrease.

² www.cbs.nl

Refrigerants

Refilling of the refrigerants is done by a third party. They maintain a list of refrigerants that have been refilled/drained. In 2019 the use of refrigerants is responsible for 221.9-ton CO₂ (1.47% of total footprint). Compared to 2018 (170.9-ton CO₂) this is an increase of 30%.

Cleaning detergents

In 2019 cleaning detergents were responsible for an emission of 0.4-ton CO₂ (0.003% of total footprint). Compared to 2018 (0.6-ton CO₂) a decrease of 31%.

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 CO₂-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 2019 the heat consumption is responsible for 1.024,9-ton CO₂ (6.8% of total footprint). Compared to 2018 (1,083-ton CO₂), this is a slight decrease.

3.2.3 Further indirect emissions

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

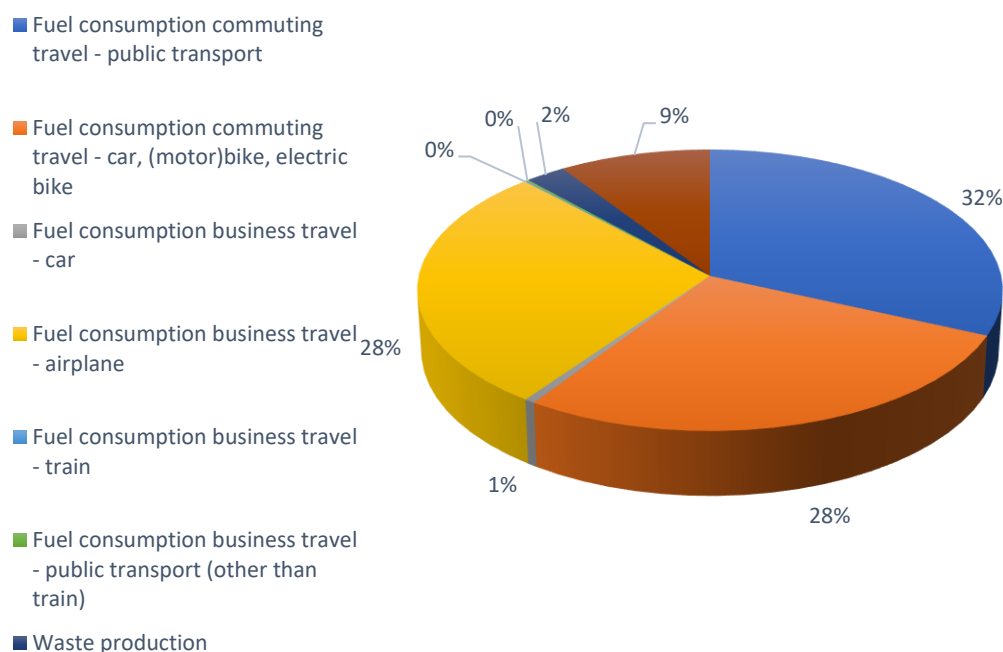


Figure 5. Emissions scope 3

Commuting travel

Once every two or three years, the university conducts a mobility survey on the travel behavior of employees and students. 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 2019.

In 2018, commuting travel by public transport is responsible for 4,302.5-ton CO₂ (29.5% of total footprint). Commuting travel by car, motorbike, scooter, and electrical bike is responsible for 3,707.4-ton CO₂ (25.4% of total footprint).

In 2019 commuting travel by public transport is responsible for 4,403,2-ton CO₂ (29.1% of total footprint). Commuting travel by car, motorbike, scooter, and electrical bike is responsible for 3,822,9-ton CO₂ (25.3% of total footprint).

This increase in both categories is mainly due to the increase of the number of students (2 % increase) and employees (4.5% 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 2019 business travel by private car is responsible for 74.8-ton CO₂ (0.5% of total footprint). Compared to the emissions in 2018, a reduction of 12% is visible.

Several employees use 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 2019 business travel by train is responsible for 13.6-ton CO₂ (0.09% of total footprint). Compared to emissions in 2018, an increase is visible (4%)

Business travel by plane is determined based on the destination of the flights and possible stopovers. 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 2019 business travel by plane is responsible for 3,903.6-ton CO₂ (25.8% of total footprint). Compared to 2018 (3.991,1-ton CO₂), a decrease of 2% is visible. There is a decline noticeable of 10% on the 'mid-range' flights (between 700 – 2500 km), whereas 'short-range' flights (<700 km) and 'long-range' flights (>2500 km) respectively increased with 3% and 13%.

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).

In 2019 the waste production is responsible for 342.9-ton CO₂ (2,3% of total footprint). Compared to 2018 (252.8-ton CO₂) a decrease is of 36% is noticeable.

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 and tea. This year, more data and parties has been included in the catering. In 2019 the catering was responsible for 1283.2-ton CO₂ (8.5% of total footprint). Compared to 2018 (940,2-ton CO₂), this is a large increase due to adding more data and an extra party.

Appendix 1 Conversion factors

Variables

Year	2019				
Owner	Jan-Cees Jol				
Students	29.477	students	294,77	100 students	
Employees	3.229	employees			
GFA	234.676	m²	2.347	100 m²	
Peildatum stud. 1 okt 2018 / medewerkers 31 dec 2018 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 CO ₂ / km			
Train (average)	0,039	kg CO ₂ / km			
Car (average)	0,220	kg CO ₂ / km			
Residual waste	0,523	kg CO ₂ / kg	* Municipal solid waste {NL} treatment of, incineration APOS, S		
Coffeecups		kg CO ₂ / kg			
Paper waste	0,676	kg CO ₂ / kg	* The recycle 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	0,1250	kg CO ₂ / kg	* Biogas {RoW} market for biogas APOS, S Soortelijk gewicht: 400 kg/m³		
Plastic	2,573	kg CO ₂ / kg	* The recycle 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	0,324	kg CO ₂ / kg			
Swill	0,1250	kg CO ₂ / kg	* Biogas {RoW} market for biogas APOS, S Soortelijk gewicht: 400 kg/m³		
Appliances	2,0200	kg CO ₂ / kg	* Cast iron {GLO} market for APOS, S		
Asito Element	1,5200	kg CO ₂ / kg	* Important ingredient: hydrogen peroxide, diluted (1%): Hydrogen peroxide, without water, in 50% solution state {GLO} market for APOS, S		
Decalcifier	6,2700	kg CO ₂ / kg	* Mainly consists of citric acid: Citric acid {GLO} market for APOS, S		
Hand soap	1,3800	kg CO ₂ / 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 CO ₂ / km			
Airplane EU 700-2500 km	0,2000	kg CO ₂ / km			
Airplane Interco > 2500 km	0,1470	kg CO ₂ / km			
Airplane (average)	0,2140	kg CO ₂ / km			
Bread	0,8450	kg CO ₂ / kg	* Wheat grain {GLO} market for Cut-off, U		
Meal salad	1,4868	kg CO ₂ / kg	* Aaname: 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 CO ₂ / kg	* Aaname: 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 CO ₂ / kg	* Red meat, live weight {GLO} market for Cut-off, U		
Dairy	329,0000	kg CO ₂ / m³	* Dairy {GLO} market for Cut-off, U		
Cheese	16,1000	kg CO ₂ / 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	4,1800	kg CO2/ kg	* Wuppertal Institute
Tea	2,2900	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 linostrapper	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 Calculation sheet

See separate document.