CO2 Footprint 2020

Carbon footprint 2020

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Contents

1. Introduction 3
2. Starting points 4
2.1 Method 4
2.1.1 Scope 1 4
2.1.2 Scope 2 5
2.1.3. Scope 3 5
2.2 Boundaries 5
2.3 Starting year 6
2.4 Influence Covid-19 6
3. Carbon footprint 2020 7
3.1 Results 7
3.2 Results per source of CO_2-emission 9
3.2.1 Direct emissions 9
3.2.2 Indirect emissions 10
3.2.3 Further indirect emissions 10
Appendices 14
Appendix 1 Conversion factors 14
Appendix 2 Calculation sheet 16

1. Introduction

The Erasmus University Rotterdam (EUR) annually reports on its carbon footprint for the complete university over 2020 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 footprints of earlier years. However, due to the Covid-19 pandemic results are difficult to compare. The total 2020 CO_2-footprint of the university is roughly 39% of the footprint of 2019.

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 comprises three scopes. The figure below shows the scopes and the associated emissions.

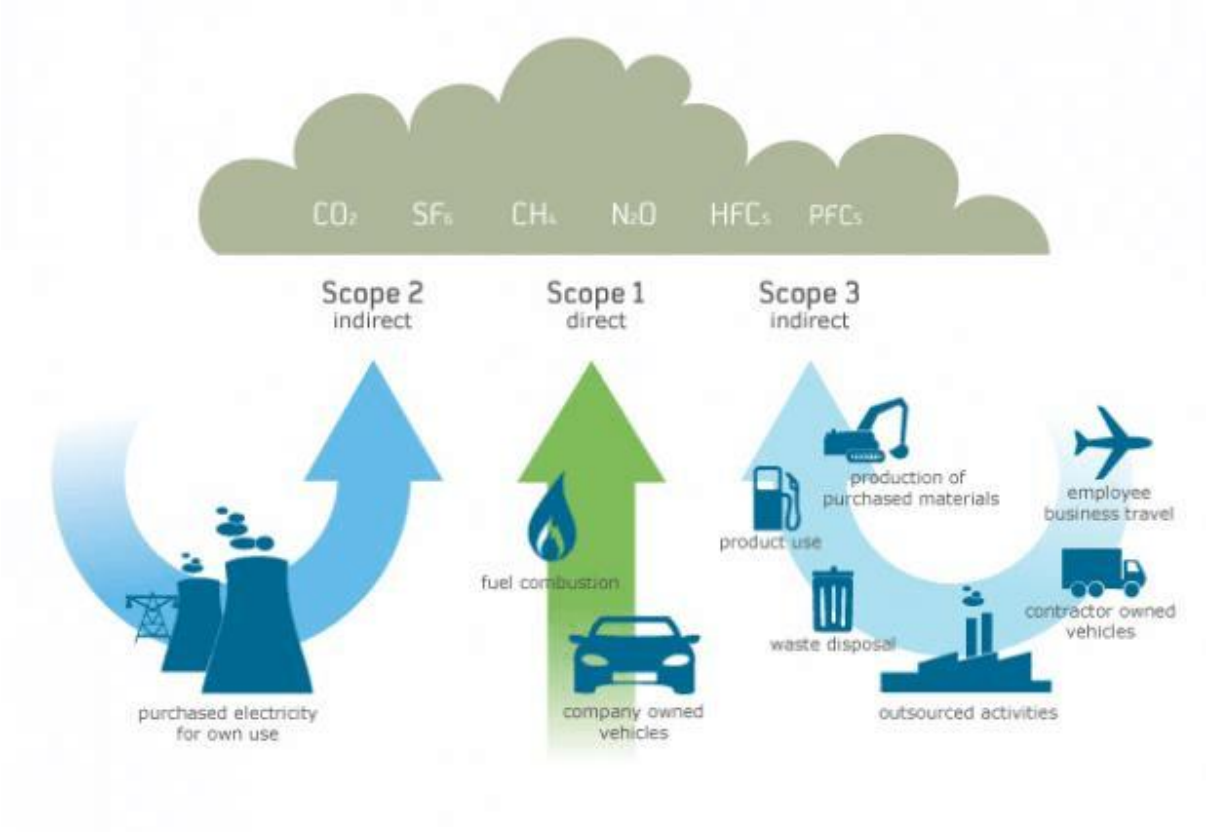

Figure 1. Definition of the scopes according to the GHG Protocol

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:

2.1.1 Scope 1**:** The university can directly influence the CO_2-emissions.

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

2.1.2 Scope 2: Emissions of CO_2 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 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 derived from 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 travelling of the students in the carbon footprint.

The Hatta housing complex, located on the campus, is excluded from the CO_2 footprint because it's 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 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 2020/ 31st of December 2019):

- 3.398 employees.
- 31.850 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.

2.4 Influence Covid-19

The Coronavirus made its appearance on February 27, 2020 with the first recorded infection in the Netherlands. In March 2020, the Dutch administration announced the first general measures to counter the coronavirus, such as washing hands, sneezing in the elbow, and no longer shaking hands. Mid-March, the Netherlands went into partial lockdown and the hotel and catering industry, schools and childcare closed. At the same time, an emergency package of measures is announced to protect jobs and incomes. In the months that follow, stricter measures are introduced, which turn out to have insufficient effect at the end of September. The Dutch administration therefore announced a partial lockdown mid-October. The partial lockdown will be extended at the end of October and intensified at the beginning of November. Mid-December, The Prime Minister announced a lockdown from his office that would remain in force until mid-April 2021[1].

The development of the coronavirus over 2020 and the gradual scaling up to a full lockdown has influenced the way in which the CO_2 footprint has been established. As stated in section 2.1, 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 traveling to and from the university students also generate a significant number of CO_2-emissions. Due to the largely disappearance of the physical presence of students, major differences per scope are noticeable, some of which are briefly explained below.

The emissions falling under scope 1 show virtually no changes compared to 2019. This is because the buildings were put into use in 2020, i.e., with less utilization capacity, so that cleaning activities and refrigerants were required to maintain the quality of the indoor climate. The same applies to a greater or lesser extent for heating the buildings on campus. Even with virtually no occupancy, a minimum base temperature of 15 degrees is maintained. This in order to guarantee the lifespan of the technical equipment/luminaire. There was however a significant drop in electricity use noticeable due to the closure of the campus. Due to the use of green electricity without CO_2-emissions this does not affect the CO_2-footprint.

Waste production in scope 3 shows a relatively low reduction figure in comparison with the other emission factors. This difference may be related to the fuel consumption of university-owned vehicles, since activities such as digital archiving of files, moving/towing goods and related matters are activities that are not inextricably linked to the presence of students. Because the other emission factors in scope 3 are subject to this, the overall overview shows a major shift in scope 2 and 3 compared to 2019. This gives scope 2, the heating of buildings, a substantially larger share in the total CO_2-footprint.

[1] https://www.rijksoverheid.nl/onderwerpen/coronavirus-tijdlijn

3. Carbon footprint 2020

3.1 Results

The total CO_2-emission of the university for 2020 is 5.866,3-ton CO_2. This equals an emission of 18.4-ton CO_2 per 100 students. The figure below shows the distribution of the different emissions.

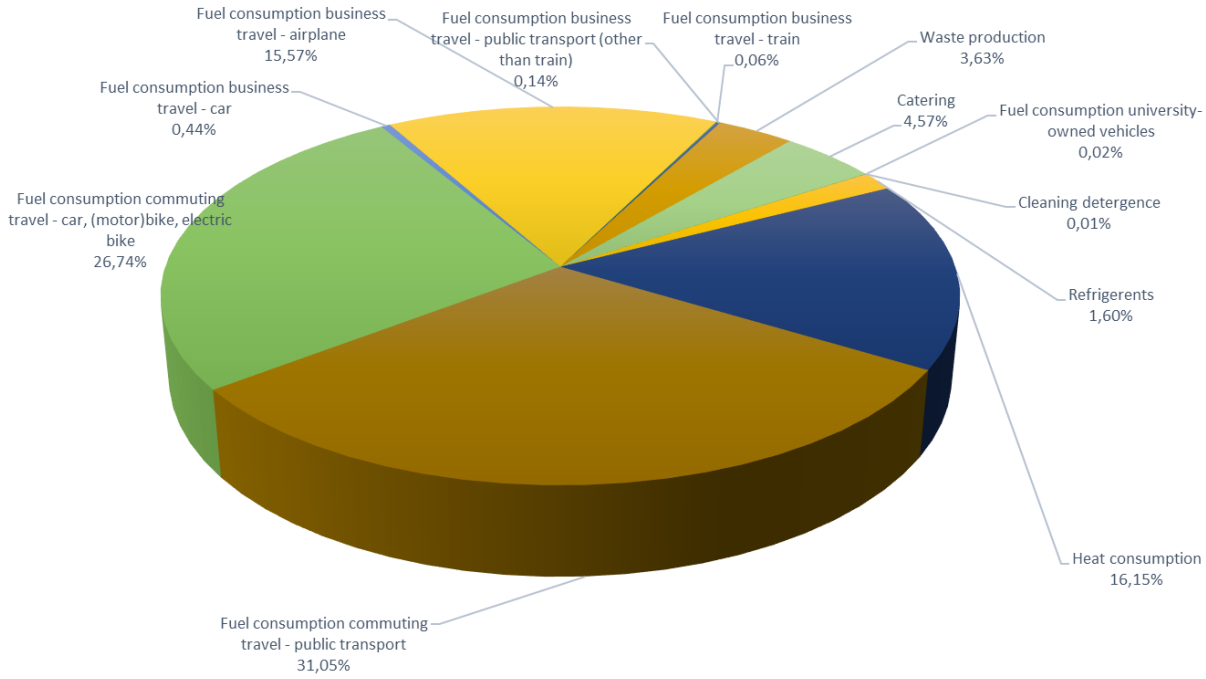

Figure 2. CO2-footprint Erasmus University Rotterdam 2020.

A substantial part of the emissions is caused by fuel consumption for commuting travel by public transport (31.1%), followed by the fuel consumption for commuting travel by car, motorbike, scooter, and electric bike (26.7%). Second next, after heat consumption, in line is the fuel consumption for business travel by plane (15.6%). That means that the largest part of the CO_2 footprint is caused by scope 3 emissions regarding mobility with 73.4% of the whole footprint.

EUR exclusively purchases renewable electricity since 2015. According to the most recent conversion factors for greenhouse gas reporting[2], 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 count for 0,53% and are therefore neglectable.

[2] www.co2emissiefactoren.nl

The gathering and processing of catering data after the carbon footprint of 2019 still maintains a continuous process. 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. Due to the Covid related absence of student activity on campus, there contribution regarding the CO_2-footprint decreased with nearly 80% compared to 2019.

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 (0.2-ton CO_2) than the total emission of one employee (1.7-ton CO_2).

Table 1. CO2-emissions Erasmus University Rotterdam 2020

Types op 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/ 100m²]
Direct emissions						
Fuel consumption university-owned vehicles	Scope 1	1,4	0,02%	0,004	0,000	
Cleaning detergence	Scope 1	0,4	0,01%	0,001	0,000	0,000
Refrigerents	Scope 1	94,1	1,60%	0,296	0,028	0,040
Indirect emission						
Electricity consumption	Scope 2	-	0,00%	0,000	0,000	0,000
Heat consumption	Scope 2	947,2	16,15%	2,979	0,279	0,404
Other indirect emissions						
Fuel consumption commuting travel - public transport	Scope 3	1.821,8	31,06%	5,729	0,536	
Fuel consumption commuting travel - car, (motor)bike, electric bike	Scope 3	1.568,9	26,74%	4,934	0,462	
Fuel consumption business travel - car	Scope 3	25,6	0,44%	0,081	0,008	
Fuel consumption business travel - airplane	Scope 3	913,6	15,57%	2,873	0,269	
Fuel consumption business travel - train	Scope 3	3,7	0,06%	0,012	0,001	
Fuel consumption business travel - public transport (other than train)	Scope 3	8,0	0,14%	0,025	0,002	
Waste production	Scope 3	213,2	3,63%	0,670	0,063	0,091
Catering	Scope 3	268,4	4,58%	0,844	0,079	0,114
Total (students & employees)		**5.866,3**	**100%**	**18,4**	**1,726**	**0,649**

Comparing this footprint to the footprint of 2019, some changes are visible. The overall footprint decreased by 61%. The CO_2-emission decreased from *15.116,6*-ton CO_2 in 2019 to *5.866,3*-ton CO_2, mainly due to the pandemic, working from home and online lessons.

Figure 3 shows the distribution of emissions per scope. More than 82% of the total emission derives from the emissions of scope 3. As waste production only makes up for 3.6% and catering only makes up for 4.6% of the total percentage, mobility is responsible for nearly all CO_2-emissions of the university.

Compared to the emission per scope in 2019, the emissions of scope 1 slightly increased as the emission of scope 2 more than doubled. Scope 3 on the other hand, mainly consisting of mobility, decreased from 92% (13.867,9-ton CO_2) of the total footprint to 82% (4.823.2-ton CO_2) of the total footprint. Further below, the various emissions and the changes during 2020 are described in more detail.

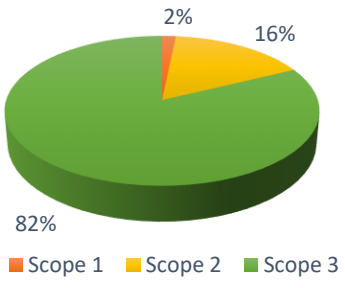

Figure 3. CO2-emissions per scope

Table 2. CO2-emissions 2020 compared with the CO2-emissions of 2019

		2019	2020	Difference
Direct emissions		Ton CO2	Ton CO2	Ton CO2
Fuel consumption university-owned vehicles	Scope 1	1,5	1,4	-8%
Cleaning detergence	Scope 1	0,4	0,4	-3%
Refrigerents	Scope 1	221,9	94,1	-58%
Indirect emission		Ton CO2	Ton CO2	Ton CO2
Electricity consumption	Scope 2	-	-	0%
Heat consumption	Scope 2	1.024,9	947,2	-8%
Other indirect emissions		Ton CO2	Ton CO2	Ton CO2
Fuel consumption commuting travel - public transport	Scope 3	4.403,2	1.821,8	-59%
Fuel consumption commuting travel - car, (motor)bike, electric bike	Scope 3	3.822,9	1.568,9	-59%
Fuel consumption business travel - car	Scope 3	74,8	25,6	-66%
Fuel consumption business travel - airplane	Scope 3	3.903,6	913,6	-77%
Fuel consumption business travel - train	Scope 3	13,6	3,7	-73%
Fuel consumption business travel - public transport (other than train)	Scope 3	23,7	8,0	-66%
Waste production	Scope 3	342,9	213,2	-38%
Catering	Scope 3	1.283,2	268,4	-79%
Students & Employees		Ton CO2	Ton CO2	Number
Per student (ton / 100 students)		51,28	18,45	-64%
Per FTE (ton / FTE)		4,68	1,73	-63%
Total (students & employees)		**15.116,6**	**5.866,3**	**-61%**

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.

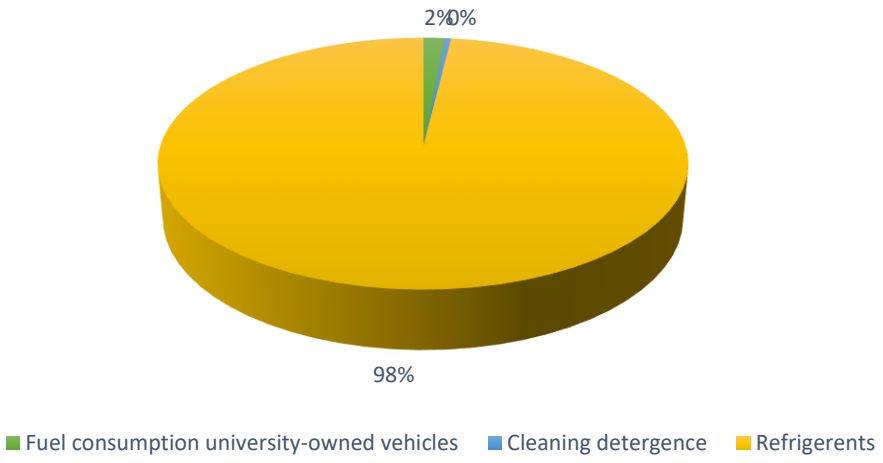

Figure 4. Emissions scope 1.

University-owned vehicles

The total costs for fuel (diesel) for university-owned vehicles is € 550 for the year 2020. Using data from Statistics Netherlands[3], a translation from costs into used liters diesel is done. The average price for diesel over 2020 is € 1.24/ liter. The university used one vehicle during 2020. In 2020 the university-owned vehicles are responsible for 1.4-ton CO (0.02% of total footprint). Compared to 2019 (1.5-ton CO_2), this is a slight decrease.

[3] 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 2020 the use of refrigerants is responsible for 94,1-ton CO_2 (1.6% of total footprint). Compared to 2019 (221.9-ton CO_2) this is a decrease of 58%.

Cleaning detergents

In 2020 cleaning detergents were responsible for an emission of 0.4-ton CO_2 (0.01% of total footprint). Compared to 2019 (0.4-ton CO_2) a decrease of 3%.

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 2020 the heat consumption is responsible for 947,2-ton CO_2 (16.2% of total footprint). Compared to 2019 (1.024,9-ton CO_2), this is a slight decrease.

3.2.3 Further indirect emissions

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

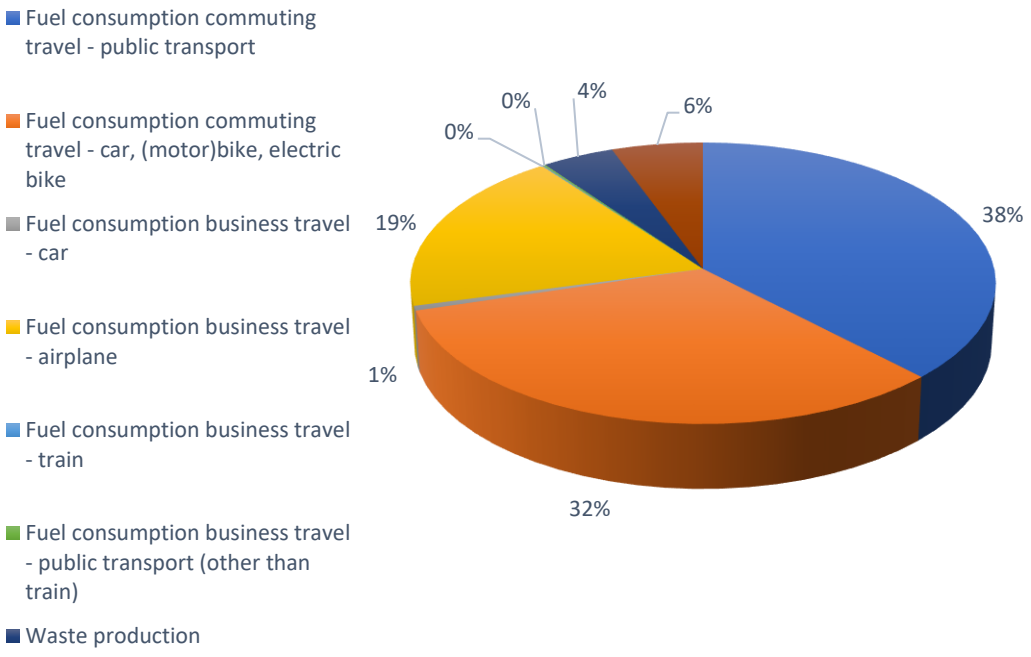

Figure 5. Emissions scope 3

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 was planned to be conducted in 2020 but could not take place because of the pandemic. 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 2020.

In 2019, commuting travel by public transport is responsible for 4.403,2-ton CO_2 (29.1% of total footprint). Commuting travel by car, motorbike, scooter, and electrical bike is responsible for 3.822,9-ton CO_2 (25.3% of total footprint).

In 2020 commuting travel by public transport is responsible for 1.821,8-ton CO_2 (31% of total footprint). Commuting travel by car, motorbike, scooter, and electrical bike is responsible for 1.568,9-ton CO_2 (26,7% of total footprint).

This decrease in both categories is mainly due to the impact of the pandemic. With the closure of universities announced on the 12th of March 2020, the limited opening for exams on the 15th of July and the lockdown at the beginning of December we estimated the occupancy rate to be 60% less in relation to 2019. Parameters hereby used are based on the Corona pandemic timeline of 2020 and the measures taken by the government:

- 40 study weeks a year for students of which:
    - 12 weeks fully deployable
    - 12 weeks not deployable
    - 16 weeks limited deployable (20%)[4]

- 46 weeks a year for employees of which:
    - 12 weeks fully deployable
    - 12 weeks not deployable
    - 22 weeks limited deployable (20%)[4]

No additional measures have been implemented.

[4] Service document HO - aanpak Coronavirus COVID-19. DD: 10-7-2020

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 2020 business travel by private car is responsible for 25,6.-ton CO_2 (0.4% of total footprint). Compared to the emissions in 2019, a reduction of 66% 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 2020 business travel by train is responsible for 3,7-ton CO_2 (0.06% of total footprint). Compared to emissions in 2019, a decrease is visible (73%)

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.

Table 3. Total amount of return flights travelled in kilometers.

Travel by plane	2019	2020	Difference
< 700 km	1.730.446	338.470	-80%
700 - 2500 km	2.962.226	741.466	-75%
> 2500 km	19.028.636	4.522.216	-76%

In 2020 business travel by plane is responsible for 913,6-ton CO_2 (15.6% of total footprint). Compared to 2019 (3,903.6-ton CO_2), a decrease of 77% 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).

In 2020 the waste production is responsible for 213,2-ton CO_2 (3,6% of total footprint). Compared to 2019 (342.9-ton CO_2) a decrease of 38% 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 2020 the catering was responsible for 268,4-ton CO_2 (4.6% of total footprint). Compared to 2019 (1283.2-ton CO_2), this is a large decrease due to government related Covid restrictions and therefore the absence of student activity.

Appendices

Appendix 1 Conversion factors

Variables

Year	2020			
Owner	Jan-Cees Jol			
Students	31850	students	318,5	100 students
Employees	3398	employees		
GFA	234676	m²	2.347	100 m²

Peildatum stud. 1 okt 2019 / medewerkers 31 dec 2019 natuurlijke personen (geen fte) / unieke studenten (incl Erasmus MC bepaald op 1 juni 2021 uit BICC)

Locatie	Woudestein	EUC	ISS
GFA (m²)	213.263	5.727	15.685

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		
Coffeecups		kg CO2/ kg			
Paper waste	0,676	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	0,1250	kg CO2/ kg	* Biogas {RoW}| market for biogas | APOS, S || Soortelijk gewicht: 400 kg/m³		
Plastic	2,573	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	0,324	kg CO2/ kg			
Swill	0,1250	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/ m³	* 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	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 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 Calculation sheet

See separate document.