Bauhaus-Universität Weimar

ENVIRONMENTAL REPORT 2021

BAUHAUS-UNIVERSITÄT WEIMAR

Introduction

Dear colleagues and members of the university

You have before you the current Environmental Report of the Bauhaus-Universität Weimar. It represents a significant work commitment and signifies that our university is living up to its potential by working together to fight climate change.

In its update in the form of the second edition, the Environmental Report provides us with more than just relevant data. It is more than just a report, and since the release of the previous version from 2021 at the latest, we now know exactly where we stand. We have mapped out the relevant spheres of activity for the university, with these areas linked to the strategic objectives of the Presidium as a collective management body: implementing sustainability, combating climate change and protecting the environment in all departments. With the Environmental Report, we have set for ourselves concrete goals that assist us in measuring our progress while also providing ongoing motivation. This primarily includes raising awareness among all our members, that is, students and university employees alike. Here we set ourselves apart by taking current issues of the future into account in research as well as in our teaching and administration. That is what makes a university and what distinguishes us from other state institutions.

At the same time, we are aware that the Bauhaus-Universität Weimar, together with the other universities in the Free State of Thuringia, are among the major energy consumers. We are striving here to achieve climate neutrality in concert with the other universities while standing shoulder-to-shoulder on this issue with the state as a whole, as we know that we cannot do it alone. An important consideration is that the majority of our carbon footprint is due to heating. In this respect, it is obvious that renovation of the building infrastructure of our campus and reducing its energy consumption not only makes a significant contribution to CO_2 neutrality but also helps to stem the explosive increase in energy costs. That is why we, together with the other universities of Thuringia, are demanding the appropriate resources necessary to make all of this a reality, up to and including digital monitoring of the operation of each individual building.

We are realists in this endeavour: We know we can only achieve climate neutrality on campus if we view our campus as a separate district within the city. The wide-ranging building stock, which includes the primary building as a UNESCO World Heritage Site and the Digital Bauhaus Lab, is something that we not only utilise but also cherish. Our goal therefore must be to preserve existing buildings while supplementing them with new buildings that exceed the current climate targets and thus compensate for historic buildings that are less energy efficient. This also includes energy concepts such as on-campus energy generation and the transition to the use of non-fossil energy sources. We will continue to work together on this.

Dr. Horst Henrici
Chancellor of the Bauhaus-Universität Weimar

Contents

List of figures

List of tables

1 Foreword

The Bauhaus-Universität Weimar has succeeded in mapping its baseline status on greenhouse gas emissions and sustainability in a transparent and publicly accessible way – a true milestone for the university. This 2nd Environmental Report is an update that enables comparison over time, making it very clear that the greatest challenge is energy supply. This challenge is closely linked to the energy refurbishment needs of the existing buildings. At the same time, policy developments have demonstrated the potential for savings in ongoing operations.

In the near future, significant steps in the direction of a climate-neutral university will only be able to be achieved through the commitment of all members of the university as well as joint action between the university and the state as the owner of the relevant properties.

We are pleased that this Environmental Report is able to map the development of environmental performance, teaching and research. It will help in formulating a sustainability agenda for the university, raising awareness within the institution of the topic of sustainability, establishing a network of responsibility and localising budgets that can be relied on.

Let's make the changes that are necessary now!

M.Sc. Steven Mac Nelly
Environmental Officer

Prof. Dr.-Ing. Eckhard Kraft
Climate Officer

2 The Bauhaus-Universität Weimar in figures

The Bauhaus-Universität Weimar is manifested in its experimental environment and familial atmosphere, and particularly through the people who study, research and work at it. In 2021 (winter semester 2020/2021), a total of 4,111 students (including doctoral students) were enrolled in the 39 degree programmes offered by the four faculties. The share of international students was 26.3%. The Bauhaus-Universität Weimar employed some 775 full-time equivalent staff, the majority of whom were scientific and artistic employees (BUW 2021).

Students	4,111
Share of international students [%]	26.3 %
Professors	83
Scient. & art. employees	230
Scientific project employees	150
Non-scientific project employees	135
Non-scientific employees	245
Trainees	15

The Bauhaus-Universität Weimar had a budget of 71 million euros in 2021, with approximately 13.5 million euros coming from third-party funding.

The university uses 80 buildings in the city of Weimar as offices, workshops, lecture halls, storage, and traffic areas; see Figure 1. Of these buildings, 28 are listed on the historic register and two are included on the list of UNESCO World Heritage Sites. The share of primary usable floor space that was rented was 17.3% (17 rental properties).

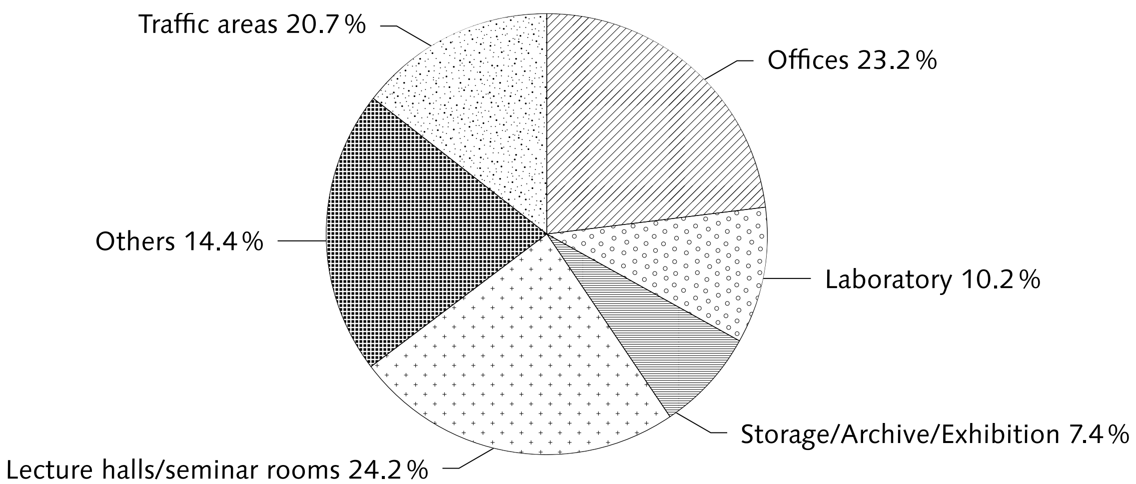

Figure 1: Share of net floor space at the Bauhaus-Universität Weimar

3 Environmental performance

In the following, the environmental performance of the Bauhaus Universität Weimar is presented with reference to the reporting year 2021. This data is determined either directly by measurement and documentation or indirectly by subsequent calculation with the corresponding sources and assumptions. Such results can be used to create a general overview of greenhouse gas emissions, from which emission shares, potential for improvement and action areas can be determined. The basis for monitoring is ongoing determination of environmental performance.

In the following, the definition of environmental performance is based on DIN EN ISO 14001:2015 as a measurable result of products or services interacting with the environment. The results are broken down into the areas of mobility, energy, waste, water and wastewater, materials and procurement. The resulting CO_2 emissions are determined in each area. The following sections of the chapter deal with the classification, collection, and evaluation of the data in detail, ending with a determination of the overall CO_2 emissions footprint.

The coronavirus pandemic had a major impact on many aspects of life, including ones related to the environment. Table 1 shows a general overview of the university's principal consumption. The change is a percentage change compared to the mean value of the last five years if the data for this evaluation is available.

Table 1: General consumption overview for the Bauhaus-Universität Weimar 2021

Environmental aspect	Unit	Consumption	Change*
Air travel	[km]	65,454	
Vehicle fleet	[km]	115,821	
Power	[kWh]	4,854,631	–5 %
Natural gas, heating oil	[kWh]	8,935,282	–12 %
District heating	[kWh]	1,271,410	+9 %
Residual waste**	[kg]	145,344	
Light packaging waste**	[kg]	26,957	
Paper waste**	[kg]	107,438	
Organic waste**	[kg]	44,161	
Drinking water	[m³]	9,813	–35 %
Wastewater	[m³]	11,918	–29 %

*Percentage change from the five-year average (2015-2020)
**Incomplete data collection

For the environmental footprints of the Weimar refectories, please refer to the Studierendenwerk Thüringen. An additional standardisation in terms of comparability of environmental performance is carried out based on DIN EN ISO 14031:2021 »Environmental management – Environmental performance evaluation – Guidelines«. To enable comparison across sectors, a CO_2-equivalent footprint is calculated for the environmental performance in the respective sections. The corresponding general overview of the carbon footprint from environmental performance is shown in Table 2.

Table 2: Total carbon footprint of the Bauhaus-Universität Weimar 2021

Environmental aspect	Unit	Carbon footprint
Air travel	[t CO_2]	14.4
Vehicle fleet	[t CO_2]	24.4
Power	[t CO_2]	0.0
Natural gas, heating oil	[t CO_2]	1,788.1
District heating	[t CO_2]	254,4
Residual waste**	[t CO_2]	56.0
Light packaging waste**	[t CO_2]	18.9
Paper waste**	[t CO_2]	0.7
Organic waste**	[t CO_2]	0.4
Drinking water	[t CO_2]	2.6
Wastewater	[t CO_2]	1.7
Printer paper	[t CO_2]	6.0
Total	**[t CO_2]**	**2,167.6**

**Incomplete data collection

In the following sections, environmental performance is explained in detail according to the breakdown in Table 2. The basis of the data is critically examined, and initial conclusions regarding the completeness of the data are drawn.

3.1 Mobility

Business travel

In 2019, the systematic recording of employee business travel was migrated to the MACH-ERP system, where all business travel accounting processes are now stored. By querying this database, the Personnel Department creates a »climate evaluation« for the respective year. Evaluation of the data is associated with the following limitations:

- Direct distance specifications in kilometres are only available for business travel by car, as such travel is offset against the flat-rate kilometre allowance.
- The travel category public transport contains bookings for business travel by train, bus and subway/light rail. The available data does not permit further differentiation.

- A collective booking is made for smaller-scale business travel that takes place on a regular basis. It is sometimes not clear how many instances of business travel are contained within a collective booking.

This means that evaluation of business travel is only possible to a limited extent. In the update of the Environmental Report 2019, we initially only examined air travel, assuming that it has the greatest impact on total emissions in the business travel group.

The restrictions on travel during the coronavirus pandemic generally led to a sharp decline in the number of flights taken. While 556 trips by air were made in 2019, only 84 and 31 were made in the following two years. Due to the longer distances travelled, the relative focus in terms of CO_2 emissions is on transatlantic flights.

Table 3: Overview of air travel 2019 to 2021

Year	Continent	Number of flights [-]	Distance travelled [km]	Emissions [t CO_2]	Number of flights <1 tkm [-]
2019	Europe	326	334,768	67.2	169
2019	Asia	124	581,272	105.7	
2019	America	84	657,170	143.3	
2019	Africa	20	124,812	30.4	
2019	Oceania	2	36,366	6.7	
2019	**Total**	**556**	**1,734,388**	**353.3**	
2020	Europe	54	70,222	14.3	18
2020	Asia	6	47,472	11.5	
2020	America	24	190,486	43.1	
2020	Africa	0	0	0.0	
2020	Oceania	0	0	0.0	
2020	**Total**	**84**	**308,180**	**68.9**	
2021	Europe	27	36,423	7.8	21
2021	Asia	0	0	0.0	
2021	America	0	0	0.0	
2021	Africa	4	29,030	6.6	
2021	Oceania	0	0	0.0	
2021	**Total**	**31**	**65,453**	**14.4**	

**Incomplete data collection

The carbon footprint is calculated using the Federal Environment Agency's CO_2 calculator (UBA 2023).

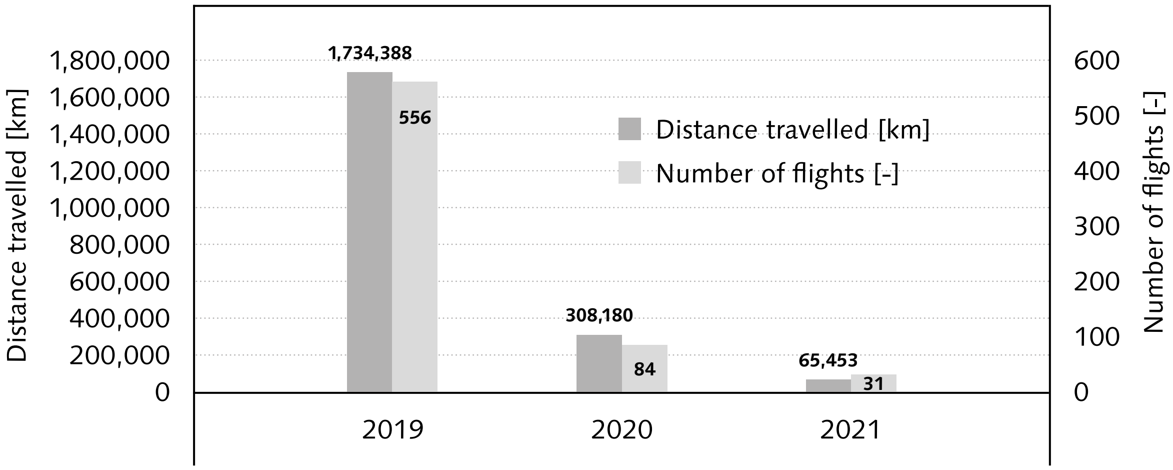

Figure 2: Number of flights and distance travelled

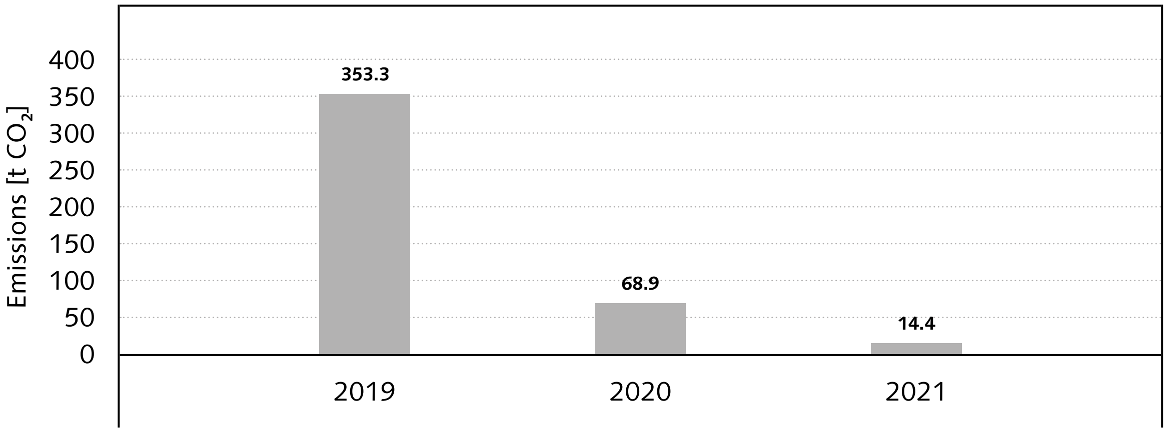

Figure 3: CO_2 emissions from flights

In the Presidium resolution of 17 February 2021, the following stipulation regarding air travel activities was made:

- The Presidium resolved that for business travel of less than 1,000 km with destinations that can be reached by other means of transport in less than 12 hours, the necessity of a flight must be critically examined and justified in a reasonable manner. It is necessary to go through the proper channels in these cases. (EPA 2021)

Due to the severe impact of the coronavirus pandemic on the number of air travel journeys made, it is currently impossible to determine the effect of this stipulation. To assess this stipulation, it is necessary for travel activities to be unrestricted. We currently assume that this will be possible starting from the reporting year 2023.

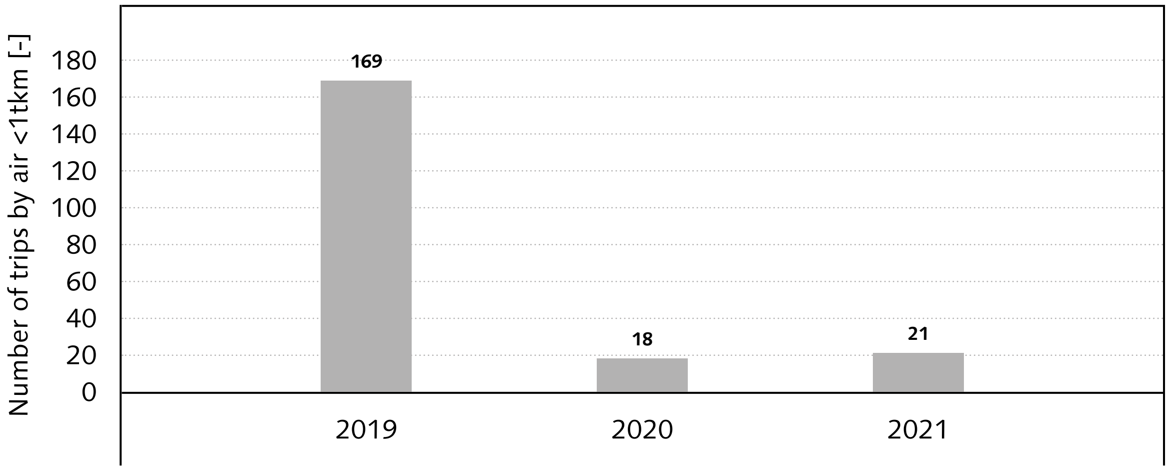

Figure 4: Number of trips by air < 1 tkm

Despite the reduction in total emissions in 2020 and 2021, the share of business travel of total emissions is significant, is expected to increase again in the coming years and thus represents an action area relating to mobility. To review future measures in terms of both potential and effectiveness, a more detailed account of business travel is required.

Vehicle fleet

The Bauhaus-Universität Weimar vehicle fleet comprises a total of 11 vehicles used in a wide variety of ways, including construction and transport, operating technology (heating/sanitation, electronics), University Directorate, in-house post and the autonomous vehicle of the Experimental Technical Facility (VTE). Each of these vehicles are associated with different mileage figures and associated emission values. The Service Centre for Facility Management determines and documents the vehicle data. The University Directorate vehicles are vehicles leased for one year whose data is summarised over the reporting year. The e-Citroën of the in-house post is currently the only electric vehicle in the fleet. The rest of the fleet is conventionally powered via petrol and diesel.

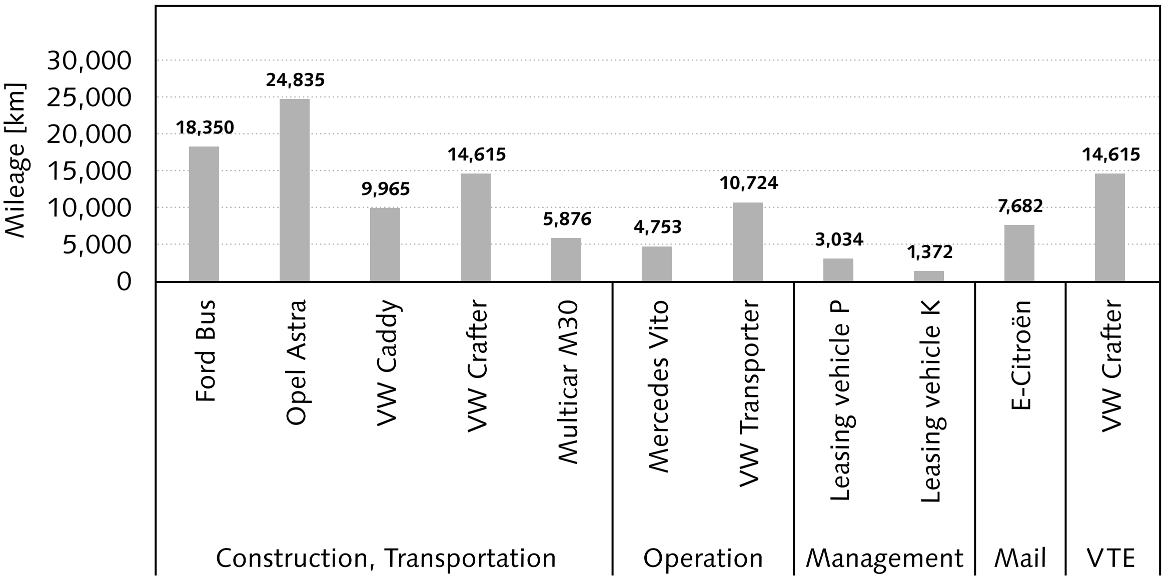

Figure 5: University vehicle fleet mileage 2021

The CO_2 emissions of the vehicles in Figure 3 are calculated for petrol and diesel based on the fuel consumption in litres documented in driver's logbooks and the specific CO_2 emissions (UBA 2022) (AGEB 2023). The specific emission factor for the electric vehicle is the value of 0 grams of CO_2 per kilowatt hour specified in the power labelling of the energy supplier (TEA 2022).

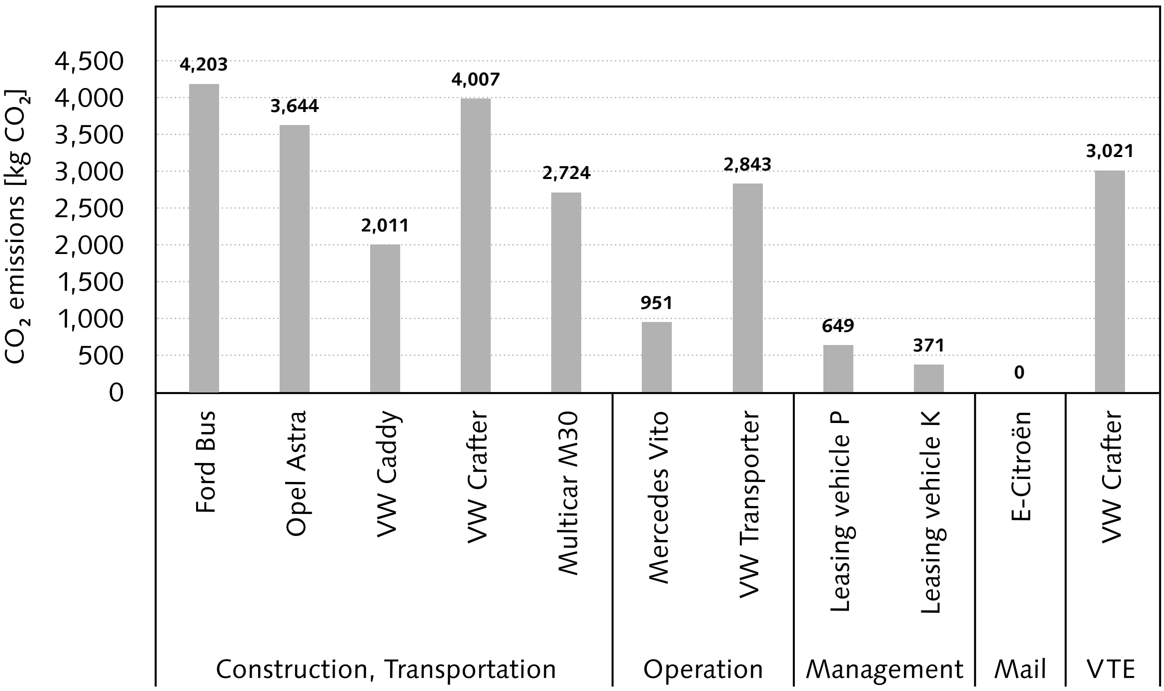

Figure 6: CO_2 emissions of the university vehicle fleet 2021

The effects of the coronavirus pandemic can also be seen in the mobility of the university vehicle fleet. The vehicles used for the technical operation of the facilities have a mileage that is comparable to previous years. However, the Ford bus, which is primarily used for passenger transport, as well as the two official vehicles of the Presidium, had significantly lower mileage than in previous years. The total mileage of the university vehicle fleet dropped by 27% in 2021 when compared to 2019. The reduction was 44% in 2020.

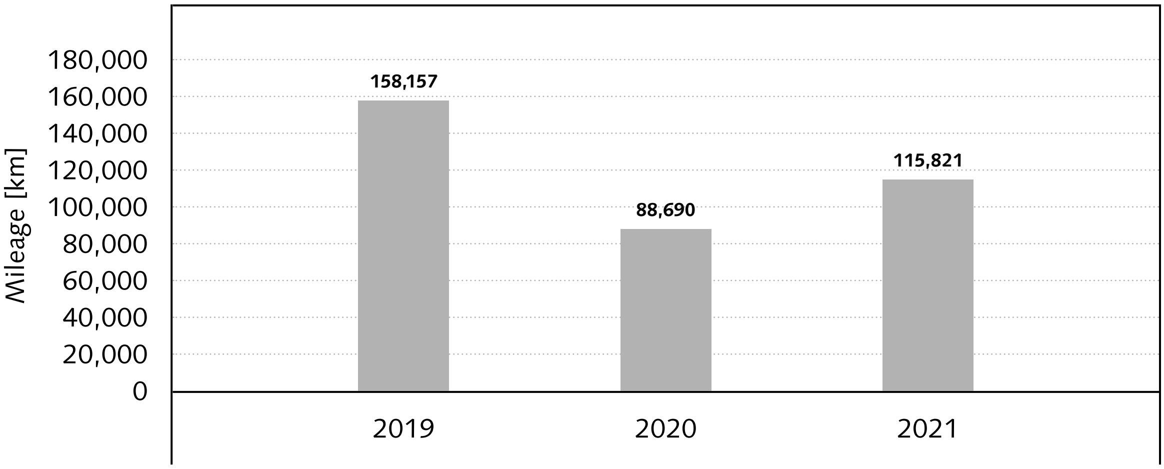

Figure 7: Comparison of university vehicle fleet mileage

Because the majority of vehicles in the fleet are conventionally powered, the calculated CO_2 emissions are similar to the mileage. Emissions were thus reduced by 37% in 2021 compared to 2019. In 2020, there was a 47% reduction compared to 2019. This reduction is solely due to the reduced mileage of the vehicle fleet and not to a technical change.

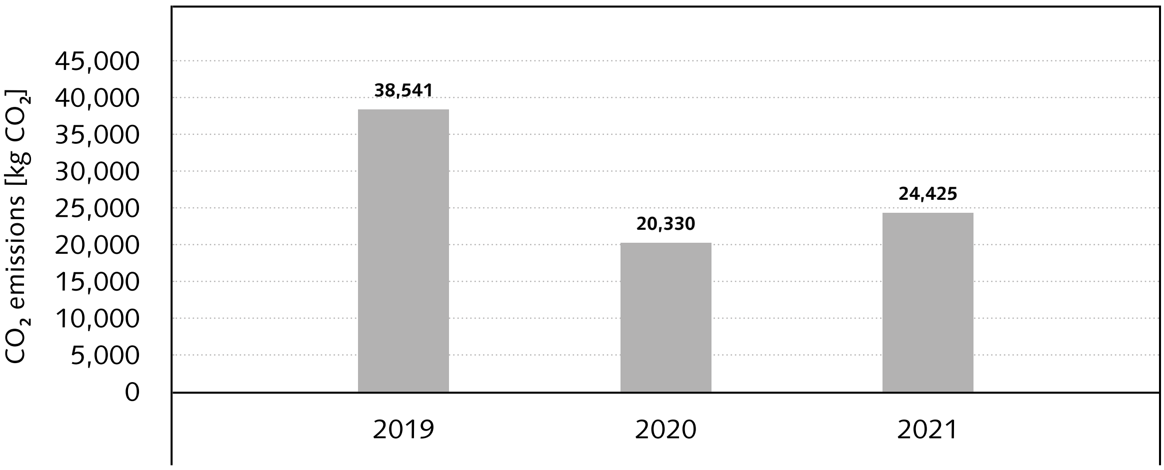

Figure 8: Comparison of university vehicle fleet emissions

As in the case of business travel, an increase in mileage is also to be expected in the following years in the area of passenger transport in the university vehicle fleet. Electrification of the vehicle fleet, in combination with the continued purchase of green power, has the potential to significantly reduce emissions even when the vehicles are fully utilised.

Table 4: General overview of the university vehicle fleet 2021

Year	Vehicle	Mileage	Fuel consumption	Average consumption	Spec. emission value	CO_2 emissions
		[km]	[l/kWh]	[l;kWh/ 100km]	[kg CO_2/l]	[kg CO_2]
2021	Ford bus	18,350	1,586	8.6	2.65	4,203
2021	Opel Astra	24,835	1,375	5.5	2.65	3,644
2021	VW Caddy	9,965	759	7.6	2.65	2,011
2021	VW Crafter	14,615	1,512	10.3	2.65	4,007
2021	Multicar M30	5,876	1,028	17.5	2.65	2,724
2021	Mercedes Vito	4,753	359	7.6	2.65	951
2021	VW Transporter	10,724	1,073	10.0	2.65	2,843
2021	Leasing vehicle P	3,034	274	9.0	2.37	649
2021	Leasing vehicle K	1,372	140	10.2	2.65	371
2021	E-Citroën	7,682	1,535	20.0	0	0
2021	VW Crafter	14,615	1,140	7.8	2.65	3,021
2021		**115,821**	**10,781**			**24,425**

3.2 Power

The power consumption of the Bauhaus-Universität Weimar is recorded in the consumption and billing data of the Service Centre for Facility Management. This data is documented for each meter in the Naflima database system.

Bauhaus-Universität Weimar had total power consumption of 4.8 GWh in 2021, which is about 5% below the average consumption of the last 5 years. The supplier Thüringer Energie AG supplies power to the university according to a green power rate plan that is based on a carbon footprint of 0.0 grams CO_2 per kilowatt hour (TEA 2022). Through the purchase of green power instead of conventional power, CO_2 emissions of approx. 1,600 tonnes could be avoided in 2021. This results in total emissions of 0 kilograms for the power purchased by the Bauhaus-Universität Weimar.

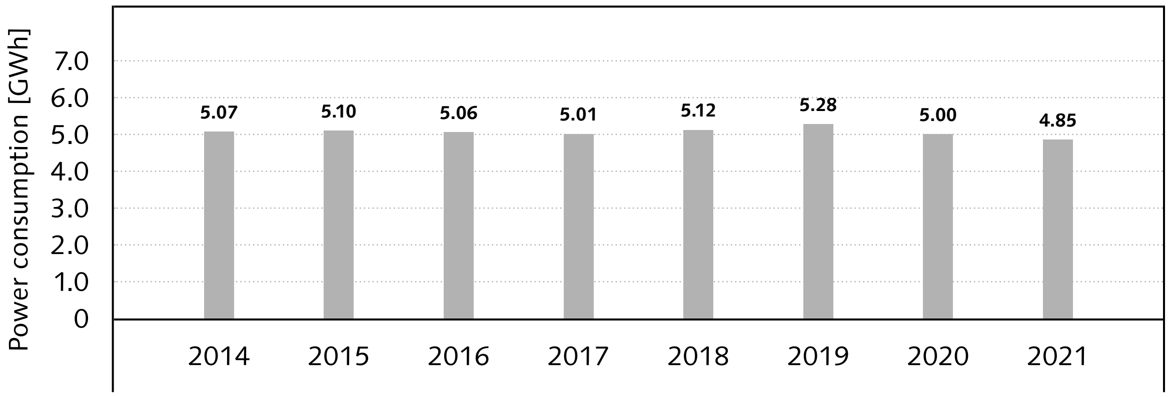

Figure 9: Comparison of power consumption

Electrical energy is primarily used in the area of lighting, powering IT infrastructure and operating electrical devices/equipment in laboratories and workshops as well as in studio areas. A structured consumption analysis to determine significant energy usage is not possible with the current state of the metering infrastructure.

3.3 Heating energy

The consumption data for the purchase of heating energy is also retrieved from the Naflima database of the Service Centre for Facility Management. In 2021, natural gas was the primary energy source. It is supplied both directly and through a district heating grid. It can be assumed that natural gas is used almost exclusively for heating buildings and that consumption by laboratory facilities is comparatively quite low and negligible. The university's heating requirements were 9.24 GWh in 2020 and 10.2 GWh in 2021. This results in a reduction of 4.15% for the reference year 2021 compared to the average of the previous five years. This is likely due to the lower utilisation of the premises as a result of the COVID-19 pandemic.

Table 5: Comparison of heating energy demand

Year	Fuel oil [kWh]	District heating [kWh]	Natural gas [kWh]
2014	0	973,815	8,752,777
2015	0	1,191,800	9,420,174
2016	0	1,151,010	9,921,623
2017	0	1,140,340	9,874,433
2018	137,200	1,238,430	9,660,783
2019	0	1,176,930	9,702,929
2020	0	1,124,970	8,114,044
2021	0	1,271,410	8,935,282

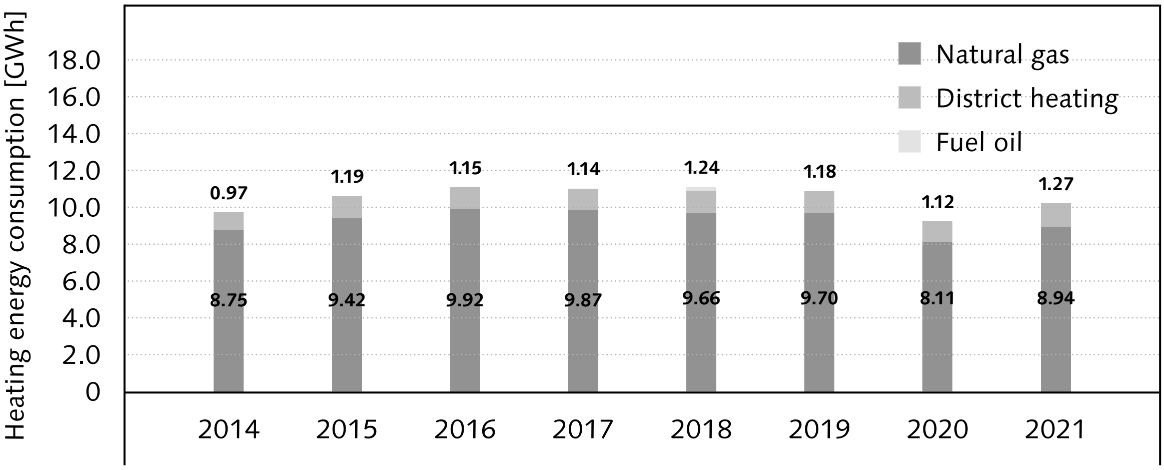

Figure 10: Comparison of heating energy demand

The following shows the conversion of specific CO_2 emissions to determine the total carbon footprint (UBA 2022). This results in a carbon footprint of 2,042,496 kilograms of CO_2 for the heating energy consumption of the Bauhaus-Universität Weimar in 2021.

Table 6: Emissions from heating

Energy source	Spec. carbon footprint [g CO_2/kWh]	Heating output [kWh]	Carbon footprint [kg CO_2]
Heating oil	266.4	0	0
District heating	200.1	1,271,410	254,426
Natural gas	200.1	8,935,282	1,788,070
Total		**10,206,692**	**2,042,496**

3.4 Waste

The Service Centre for Facility Management records the waste quantities. Various waste management companies then dispose of the different types of waste, with domestic waste, organic waste and paper being disposed of every two weeks and glass disposed of on request by the municipal utility Stadtwerke Weimar, while Remondis® takes care of light packaging and extraordinary collections of bulk materials in skip containers. The bi-weekly collection of waste takes place in 60 l, 80 l, 120 l, 240 l dumpsters or 1,100 l large-capacity refuse containers. The Bauhaus-Universität Weimar has 111 dumpsters with a total volume of 53.9 m^3 at its disposal.

Table 7: Overview of the Bauhaus-Universität Weimar dumpsters, 2021

Year	Waste type	60 l	80 l	120 l	240 l	1,100 l	Total volume [l]
2021	Domestic waste	1	0	6	31	8	17,020
2021	Organic waste	0	1	8	17	0	5,120
2021	Light packaging	0	0	0	0	7	7,700
2021	Paper	0	0	0	7	16	19,280
2021	Glass	0	0	0	6	3	4,740
2021	**Result**						**53,860**

That the waste is not individually weighed on the vehicle during when the dumpsters are emptied on a regular basis. Data on the amount of waste of each type is therefore not available but would be necessary to determine the CO_2 emissions resulting from recycling. The total weight is calculated through an approximation carried out under the following assumptions:

- The containers have an average fill level of 80%
- The average waste densities are associated with the values specified in the table below

Table 8: Average waste densities according to (OTB 1997) and (EAV 2023)

	Domestic waste(1,2) [t/m^3]	Organic waste(2) [t/m^3]	Light packaging(2) [t/m^3]	Paper(1,2) [t/m^3]	Glass(2) [t/m^3]
Fresh weight	0.17	0.57	0.11	0.18	1.2

(1) (OTB 1997)
(2) (EAV 2023)

The swap containers are skips and debris containers or document destruction bins. The waste management company communicates the weight in its invoices so that this information is directly available. The waste quantities calculated for the dumpsters and swap containers are shown below. Accordingly, the largest single waste type (excluding building materials) is household-type commercial waste, weighing 80.3 tonnes (24.1%). The separately collected waste materials of light packaging, paper and glass total 144.9 tonnes (43.6%). A total of 332.6 tonnes of non-hazardous waste was generated at Bauhaus-Universität Weimar in 2021.

Table 9: Waste quantities of the Bauhaus-Universität Weimar, (MUL 2012)

Year	Waste category	Dumpsters [t]	Swap containers [t]	Dumpsters and swap containers total [t]	Carbon footprint [t]
2020	Domestic waste	60.2	30.4	90.6	34.9
2020	Organic waste	60.7	0.0	60.7	0.6
2020	Green waste	0.0	34.6	34.6	0.4
2020	Light packaging	17.6	0.3	17.9	12.5
2020	Paper	72.2	8.3	80.5	0.5
2020	Glass	24.5	0.0	24.5	0.0
2020	Building materials	0.0	63.3	63.3	
2020	Bulky waste	0.0	3.0	3.0	1.3
2020	**Result**	**235.2**	**139.9**	**375.1**	**50.3**
2021	Domestic waste	60.2	20.1	80.3	30.9
2021	Organic waste	60.7	5.3	66.0	0.6
2021	Green waste	0.0	32.4	32.4	0.4
2021	Light packaging	17.6	0.2	17.9	12.5
2021	Paper	72.2	0.4	72.5	0.5
2021	Glass	24.5	0.0	24.5	0.0
2021	Building materials	0.0	37.4	37.4	
2021	Bulky waste	0.0	1.6	1.6	0.7
2021	**Result**	**235.2**	**97.4**	**332.6**	**45.6**

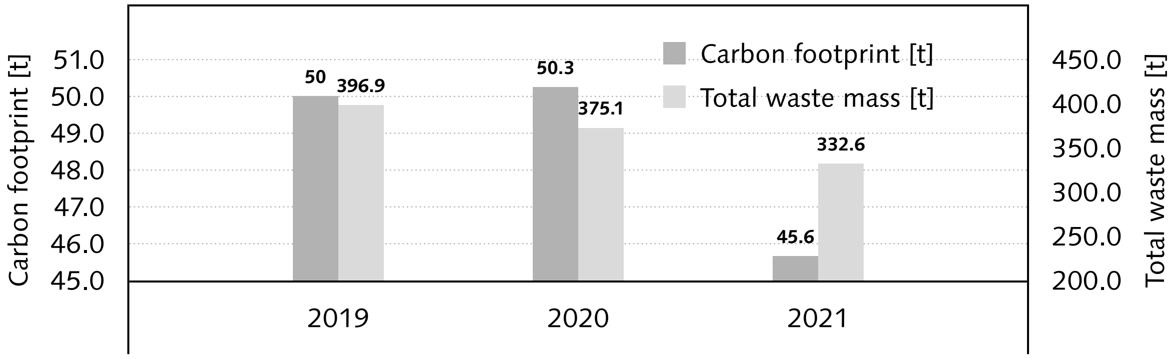

Figure 11: Comparison of waste mass and CO_2 emissions

A calculation tool from the University of Leoben is used to calculate the carbon footprint (MUL 2012). In the accompanying study, the authors explicitly point out that the climate footprint tool only applies to the Austrian state of Styria to a limited extent. However, the region is suitable as a comparative scenario. Processing, treatment, recycling and landfilling of waste material streams are all taken into consideration. No consideration is given to the way in which waste is transported, for which the relevant data would also need to be newly created for an individual case assessment in Weimar. No data is available on building materials. In this case, a separate climate footprint assessment for the disposal paths of the Bauhaus-Universität Weimar would be desirable.

A clear and reliable evaluation is not possible based on the calculated estimates for the dumpsters, the merely manual recordkeeping for the large-capacity refuse containers and the undocumented collection of glass. The following carbon footprint is based on data from 2010/2012 for Styria and should therefore only serve as qualitative evidence for the identification of CO_2 hot spots and not as a reliable key figure. For this reason, the waste quantities and CO_2 emissions were marked accordingly in the overviews in Table 1 and Table 2.

In the above figure on waste quantities and CO_2 emissions, a reduction in emissions can be seen towards the year 2021, accompanied by quantities that did not change as much. This can be explained by a slight decrease in the quantities of bulky and domestic waste. These waste types have properties that include the highest specific emission values, namely 0.385 tonnes of CO_2 per tonne of bulky waste and 0.449 tonnes of CO_2 per tonne of domestic waste.

In addition to household-type waste such as domestic waste, organic waste, green waste, light packaging, paper, glass, building materials and bulky waste, hazardous materials are also generated at the Bauhaus-Universität Weimar. The facilities carry out disposal on demand, and the Service Centre for Facility Management keeps records on a centralized basis using the Waste Catalogue Ordinance's waste code numbers, which are listed in the table below. The Hazardous Substances Officer documents the quantities of the Faculty of Civil Engineering. Remondis® classifies and disposes of the waste.

Table 10: Waste statistics in regard to hazardous waste 2021

EWC no.	Waste type	Total
06 06 04	Waste containing mercury	0.02 t
07 02 08	Other reaction and distillation residues	0.39 t
07 01 03	Organohalogen solvents, washing liquid and mother liquor	0.01 t
07 01 04	Other organic solvents	0.12 t
08 04 09	Toner waste	0.04 t
11 01 05	Acid pickling solution	0.04 t
11 01 07	Alkaline pickling solution	0.20 t
13 02 08	Other machine, gear and lubricating oils	120 l
16 02 11	Refrigerators	3 pcs.
16 02 13	Used equipment with hazardous components	1.20 t
16 05 07	Inorganic solvents	0.05 t
16 05 08	Organic solvents	1.14 t
16 06 01	Lead batteries	0.02 t
20 01 21	Fluorescent tubes	861 pcs.
20 01 33	Batteries and accumulators	0.02 t
20 01 35	Used equipment with hazardous components	1.36 t

Due to the uncertainty about the specific emission factors, a determination of the CO_2 emissions from the recovery of hazardous waste is dispensed with.

3.5 Drinking water and wastewater

The Service Centre for Facility Management records the annual drinking water and wastewater consumption data. The data can thus also be accessed by querying the Naflima database. The figure below shows the drinking water and wastewater consumption in recent years.

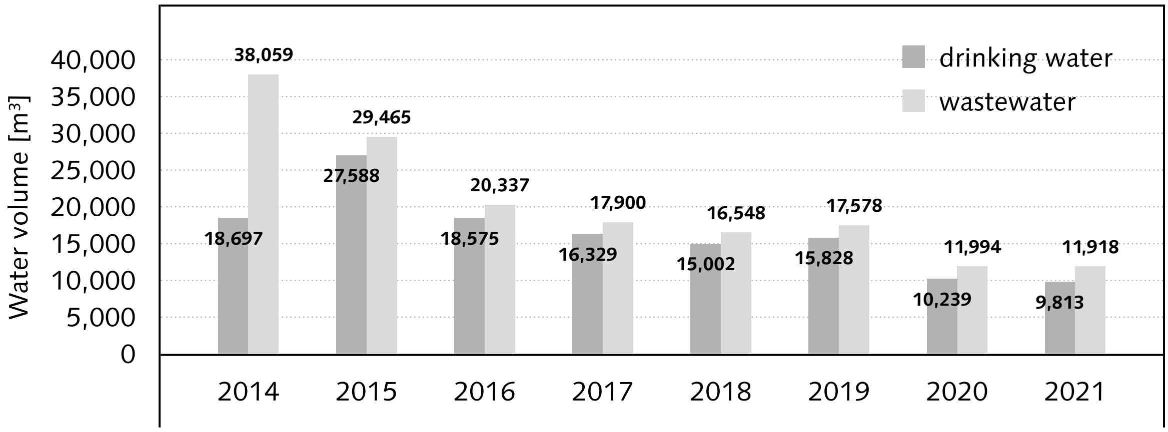

Figure 12: Comparison of wastewater and drinking water consumption

This figure shows a relatively large difference between drinking water and wastewater consumption in 2014. The municipal service of the city of Weimar indirectly determined the wastewater consumption in 2014. From today's perspective, it is not possible to conduct a causal analysis of this difference.

Table 11: Comparison of wastewater and drinking water consumption

	Drinking water [m³]	Wastewater [m³]
2014	18,697	38,059
2015	27,588	29,465
2016	18,575	20,337
2017	16,329	17,900
2018	15,002	16,548
2019	15,828	17,578
2020	10,239	11,994
2021	9,813	11,918

As shown in the environmental performance table at the beginning, in 2021 there was a 35% reduction in drinking water consumption from the five-year average. Wastewater consumption dropped by 29%. It can also be assumed here that the reduced use of the university properties during the coronavirus pandemic was the primary reason for this reduction in water consumption. This decrease in water consumption also reduced the carbon footprint for drinking water and wastewater.

Before the carbon footprint of the drinking water treatment can be calculated, the specific primary energy demand must first be determined (WZW 2023). This is calculated to be 1.41 kilowatt hours per cubic metre of drinking water. It can be assumed that the conventional energy mix for power supplied by the municipal utility Stadtwerke Weimar will be used for drinking water treatment (STW 2022). With the value of 262.3 grams of CO_2 per cubic meter determined on this basis, the total emission value for the drinking water supply is 2,574 kilograms of CO_2.

No specific wastewater treatment data is available for the wastewater treatment plants of the city of Weimar. According to the data from the literature, the basis for the calculation is 120 l/(EW·d) and a specific cleaning energy of 35.1 kWh/(EW·a) (KOL 2014). The calculated energy consumption of 0.8 kilowatt hours per cubic meter of wastewater that is assumed to be implemented with the municipal power mix of the city of Weimar results in a specific carbon footprint of 139.4 grams of CO_2 per cubic meter. If we multiply this by the wastewater consumption of the Bauhaus-Universität Weimar, we arrive at a total footprint of 1,659 kilograms of CO_2.

Table 12: Specific emission factor and carbon footprint of drinking water and wastewater in 2021

Specific carbon footprint of drinking water [g CO_2/m^3]	Total carbon footprint of drinking water [kg CO_2]	Specific carbon footprint of wastewater [g CO_2/m^3]	Total carbon footprint of wastewater [kg CO_2]
262.3	2574	139.4	1659

In this calculation model, the water consumption values and the specific emission factors are the crucial figures. While the carbon footprint can be reduced proportionally through lower water consumption, specific emission factors are expected to increase in the near future. The reactivation of coal-fired power plants in the wake of the energy crisis and the shutdown of nuclear power plants will most likely have a significant impact on emissions associated with drinking water and wastewater.

Table 13: Comparison of CO_2 emissions associated with drinking water and wastewater

	2014	2015	2016	2017	2018	2019	2020	2021
Drinking water [t CO_2]	4.9	7.3	4.9	4.3	4.0	4.2	2.7	2.6
Wastewater [t CO_2]	5.3	4.1	2.8	2.5	2.3	2.4	1.7	1.7
Total [t CO_2]	**10.2**	**11.4**	**7.7**	**6.8**	**6.3**	**6.6**	**4.4**	**4.2**

As consumption dropped, there was also a reduction in CO_2 emissions, which is quantified at 4.2 tonnes of CO_2 in 2021.

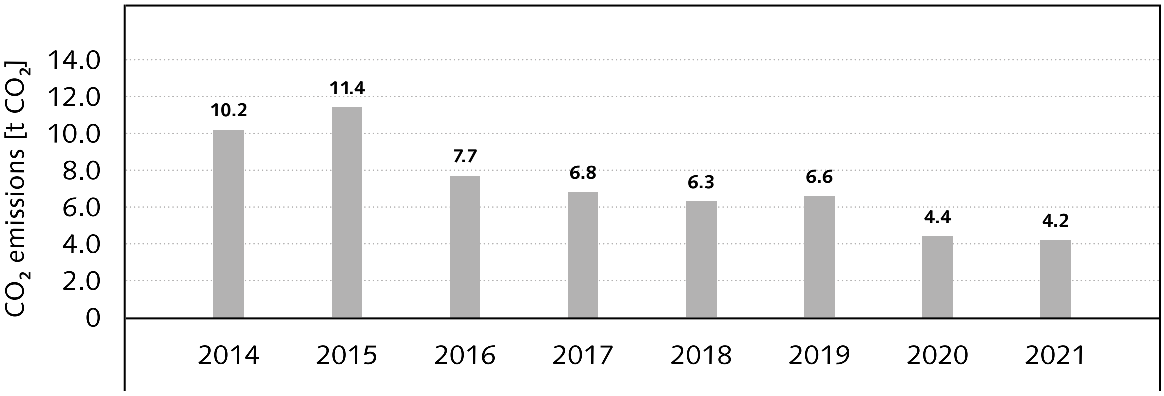

Figure 13: Comparison of CO_2 emissions associated with drinking water and wastewater

Regardless of the resulting CO_2 emissions, water is one of the key substances upon which life is based. The recent years of drought in Germany and other EU countries show that water shortages are associated with serious consequences. The Federal Government has adopted a national water strategy (BRG 2023) in response. The pure water consumption values are therefore highly significant.

3.6 Materials and procurement

It is widely known that greenhouse gas emissions not only come from the primary consumption of an energy source, such as fuel, but are also caused by the manufacture of products. These »grey« emissions are present to an extent that differs in all consumer goods. This means that procurement is another important topic area when considering emissions. It has not yet been possible to develop a system for calculating the footprint associated with the procurement activities of the Bauhaus-Universität Weimar. In this chapter, printer paper will serve as an example for the calculation of a footprint of procured goods, as such paper is purchased on a regular basis and in a manner that is standardised and well-documented. The data for this is already available from the Finance Department and can serve as a basis for evaluation.

The production of printer paper requires large amounts of water, wood and energy. Even if recycled paper is used in place of wood fibres, a large amount of energy and water is still required for the production of paper.

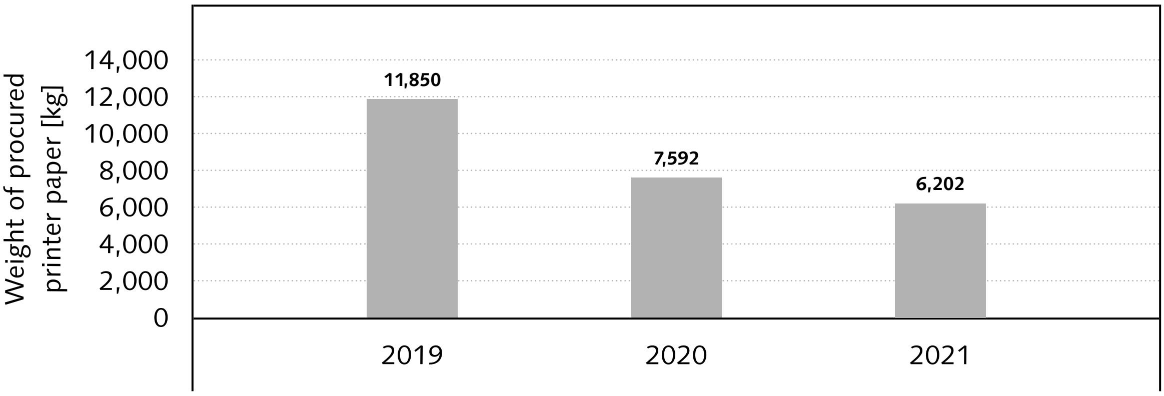

Figure 14: Comparison of procured printer paper

Paper consumption has dropped by 48% compared to the reference years of 2019 to 2021. The reduced amount of time that employees and students spent in their offices and classrooms almost certainly affected this figure. The available data does not allow an assessment of the extent to which a change in behaviour in the direction of reduced requirements for printed information. However, this could become possible in the evaluations of subsequent years.

The calculation of emissions associated with printer paper refers to the procurement of ordinary DIN A4 paper. The Bauhaus-Universität Weimar consumed 1,215,925 sheets in 2021. At 80 grams per square metre, the total weight of the paper would be 6,202 kilograms. The carbon footprint is determined using the online calculator of Initiative Pro Recyclingpapier based on a study by the IFEU Institute (IPR 2006; IFEU 2006). Since it is not possible to determine from the available data whether the paper is recycled (886 grams of CO_2 per kilogram) or conventional (1,060 grams of CO_2 per kilogram), the arithmetic mean is assumed to be 973 grams CO_2 per kilogram, as in the previous year's assessments. This results in a carbon footprint for printer paper of 6 tonnes in 2021.

Table 14: Comparison of printer paper weight and emissions

Year	**Sheets**	**Weight [kg]**	**Specific carbon footprint [g CO_2/kg]**	**Total carbon footprint [t]**
2019	2,374,775	11850	973	11.5
2020	1,477,800	7592	973	7.4
2021	1,215,925	6202	973	6.0
2022	**1,215,750**	**6254**	**973**	**6.1**

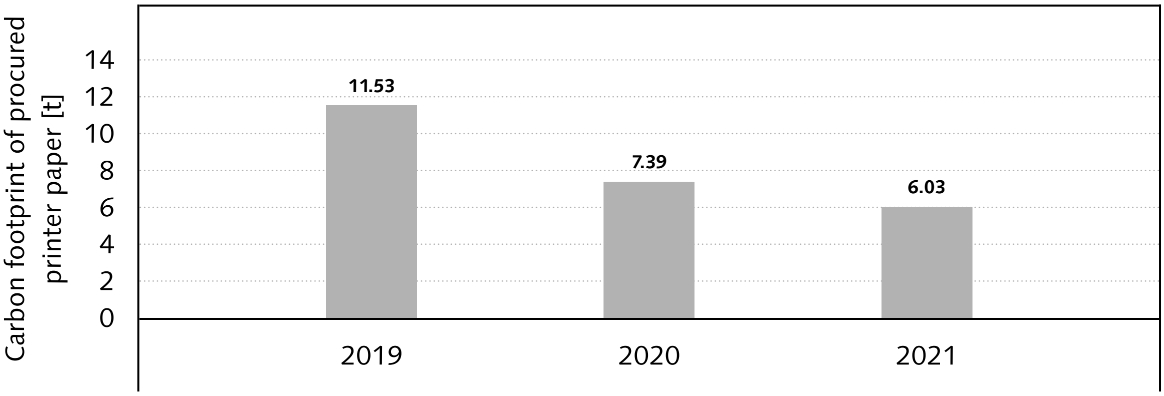

Figure 15: Comparison of carbon footprint of procured printer paper

Next to avoiding printing altogether, prudent procurement and use of recycled printer paper is the most effective way to reduce printer paper consumption, as such paper has a significantly lower impact than paper made from primary fibres in all relevant environmental impact categories (WDK 2022).

Paper consumption is a classic, representative parameter for the evaluation of the category of procurement, but it covers the scope of procurement only to a limited extent. To get a more detailed picture, it is necessary to develop a system that includes additional procurement categories. The internal guideline document for procurement is the 2011 version of the Procurement Policy, but this document does not take the aspects of environmentally friendly and sustainable procurement into consideration (MDU 2011).

3.7 Summary of CO_2 emissions

The emissions determined in this report are summarised, classified and compared below.

Table 15: Comparison of emissions

Year	Emission type	Emissions [t CO_2]	Share of CO_2 emissions [%]
2019	Drinking water, wastewater	6.6	0.3 %
2019	Printer paper	11.5	0.4 %
2019	Vehicle fleet	38.5	1.5 %
2019	Waste	47.4	1.8 %
2019	Air travel	353.4	13.4 %
2019	Natural gas	2,177.2	82.6 %
2019	**Total**	**2,634.6**	**100.0 %**
2020	Drinking water, wastewater	4.4	0.2 %
2020	Printer paper	7.4	0.4 %
2020	Vehicle fleet	20.3	1.0 %
2020	Waste	50.3	2.5 %
2020	Air travel	68.9	3.4 %
2020	Natural gas	1,848.9	92.4 %
2020	**Total**	**2,000.1**	**100.0 %**
2021	Drinking water, wastewater	4.2	0.2 %
2021	Printer paper	6.0	0.3 %
2021	Vehicle fleet	24.4	1.1 %
2021	Waste	45.6	2.1 %
2021	Air travel	14.4	0.7 %
2021	Natural gas	2,042.5	95.6 %
2021	**Total**	**2,137.1**	**100.0 %**

The emission values compiled in this report show total CO_2 emissions of 2,137.1 tonnes for the Bauhaus-Universität Weimar in 2021, representing a reduction from the 2019 reference year of 18.9%. This drop is mainly due to lower utilisation rates during the coronavirus pandemic.

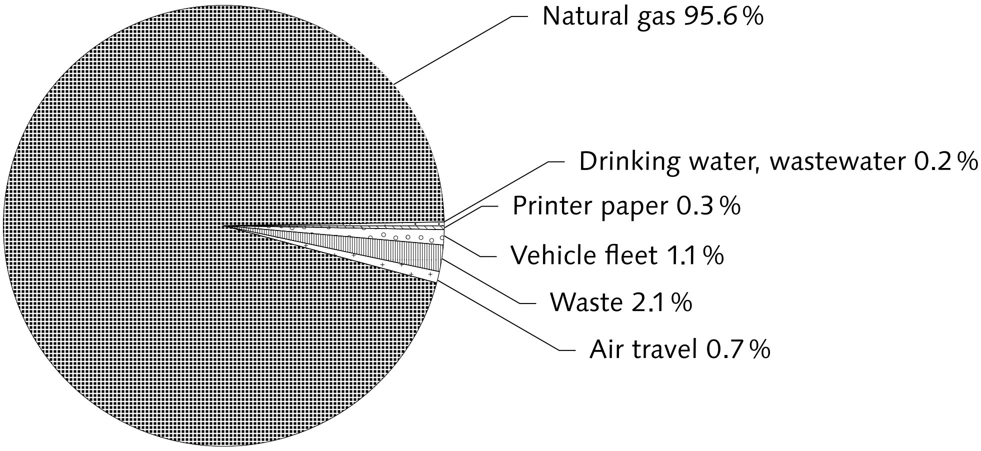

Figure 16: Share of CO_2 emissions in 2021

Natural gas

As in previous years, the emission source with the highest emission value for 2021 was natural gas. With a value of 2,042.5 tonnes of CO_2, the emission value is below the level from 2019. However, due to reductions in other emission categories, natural gas has a high specific share of 95.6%. The use of natural gas for directly heating buildings or supplying district heating thus represents both the greatest potential for savings and the greatest challenge with regard to the university's building stock. Large-scale savings can only be made a reality through investments in technological upgrades.

Power

The university uses green power from Thüringer Energie AG. This power is associated with 0 kilograms of CO_2 and has no share in total emissions.

Waste

At 45.6 tonnes and 2.1%, the university's waste has the second-highest share of total emissions. The proportion of waste disposed of in dumpsters in fixed locations accounts for more than two-thirds of this share. The share of disposal through swap containers is subject to greater annual fluctuations.

Vehicle fleet

With a comparatively low share of 1.1%, the university's vehicle fleet already has the third-highest emission value. Due to lower levels of passenger transport, there was a reduction in emissions compared to 2019.

Air travel

At 14.4 t, air travel accounts for 0.7% of total emissions in 2021. As recently as 2019, air travel amounted to 353.4 tonnes and had a share of 13.4%. It can be assumed that the number of journeys by air and the associated emissions will increase again starting from 2022. For unavoidable air travel, offsetting through specialised providers or regional initiatives is one way to reduce the associated emissions.

The total emission values for 2020 and 2021 are significantly lower than in 2019. The lower use of the premises in face-to-face instruction, as well as the limited mobility, had a significant influence on this figure. The ongoing monitoring of emission levels over the next few years will show the effect of technical and organisational measures on the university's reduction of emissions.

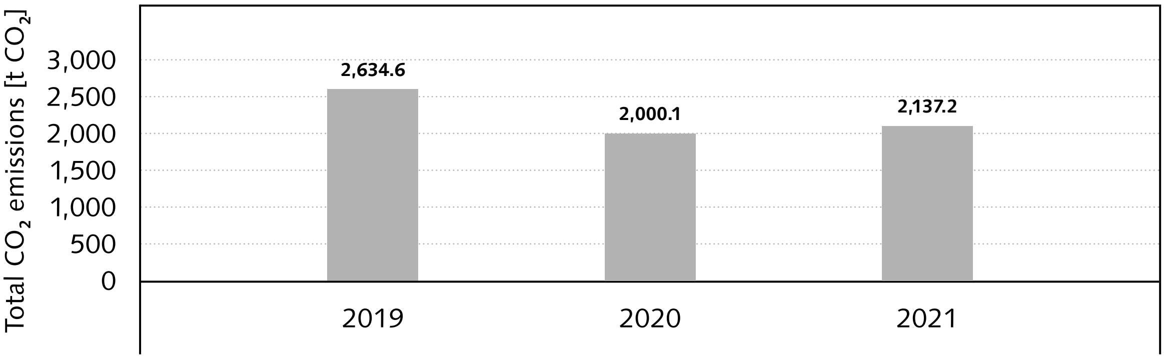

Figure 17: Comparison of CO_2 emissions associated with the Bauhaus-Universität Weimar

The majority of the determined emissions are caused by boundary conditions of building physics. However, measures to reduce emissions should not focus exclusively on this area:

- Some emission factors vary annually and are quite capable of representing a significant share of total emissions
- This Environmental Report can only represent a portion of the emissions emanating from the university

The extent of undocumented emissions can be assessed by classifying sources into scopes, each of which is differentiated according to origin. The World Resource Institute (WRI) and an association of more than 200 companies operating under the name of the World Business Council launched the relevant model in the »Greenhouse Gas Protocol«, which distinguishes between the following categories (WRI 2004):

Table 16: Scopes according to (WRI 2004)

Scope	Definition/university application area
Scope 1	Direct emissions from university-owned sources such as heating systems, vehicles and so on
Scope 2	Indirect emissions from the purchase of power
Scope 3	Reporting category for indirect emissions incurred outside the university from the purchase of goods and services

The table below shows a graphical record of environmental performance by scope. The labelling is broken down into: fully recorded X, partially recorded (X), not recorded O and not present -.

Table 17: Recording of CO_2 emissions according to scope

Emission category	Scope 1	Scope 2	Scope 3
Business travel	-	-	(X)
Vehicle fleet	X	-	O
Power	-	X	O
Heating oil	X	-	O
District heating	X	-	O
Natural gas	X	-	O
Waste	-	-	(X)
Drinking water	-	-	X
Wastewater	-	-	(X)
Printer paper	-	-	(X)

X fully recorded; (X) partially recorded; O not recorded; - not available

The area of primary energy consumption Scope 1 is almost completely recorded with diesel and gas, allowing a footprint to be calculated. Scope 2 is also fully covered with power provided by the Service Centre for Facility Management. Due to the purchase of green power, it does not show up in the carbon footprint.

Comprehensive recording of emissions from Scope 3 is a much more extensive task, with footprint measurement only possible through the use of approximations and assumptions in some cases. There is potential with regard to the recording of emissions from Scope 3, with this potential listed in the table below.

Table 18: Potential for recording emissions from Scope 3

Emission category	Potential for recording emissions from Scope 3
Business travel	• Details of air travel (departure airport, destination airport, stopovers) • Other means of transport (car, train, bus) • Carbon footprint from everyday transport
Vehicle fleet	• Acquisition, servicing/maintenance of vehicles
Power Heating oil District heating Natural gas	• Establishment of grid operation (maintenance, connection, etc.)
Waste	• Weight of waste from dumpsters • Hazardous waste
Drinking water	• City-specific variables for drinking water treatment
Wastewater	• City-specific variables for wastewater treatment
Printer paper	• Other procurements

4 Research and teaching

4.1 Research projects

Research at the Bauhaus-Universität Weimar is wide-ranging as well as trans- and interdisciplinary.

The unique profile of the university traces its roots to the Bauhaus tradition and its combination of technical, scientific and creative/artistic work. In addition to the primary research areas of »Digital Engineering« and »Cultural Studies Media Research«, there are other research fields, such as »City, Architecture and Environment«, »Material and Construction« and »Art.Design.Science«, which play an essential role and help form the identity of the institution. The focal points are continuing to develop.

The societal challenges and profound changes in our environment today, including demographic shifts, mobility, globalisation, multiculturalism and resource scarcity, require new concepts for our urban and living spaces. In this research area, new methods, theories and technologies are explored and tested in all their dimensions. The spectrum ranges from urban research and applied architectural research to theoretical and historical research to research on ecology, energy, climate and infrastructure. Research groups, research training groups, institutes and renowned symposia and conferences form the backbone of the university's cross-institutional research activities.

Construction materials and other materials have always determined the technical progress of our society. New developments in technology require the availability of construction materials and other materials with tailored properties. This means that the development and application of building materials under energy-efficient and environmental aspects in basic and applied research form an important part of this fast-changing research area.

Media plays a crucial role in the development of a sustainable and environmentally conscious society. By analysing the relationship between media and sustainability, key insights can be provided on how media can be used to promote sustainable development. This work relates to the use of media to raise awareness about sustainability issues, how media can foster people's participation in sustainability initiatives or how media can break down barriers to the implementation of sustainability goals. In this way, such research contributes to the identification and furtherance of solutions to societal challenges.

In accordance with the »Guidelines for Transparency in Science and Research« of Thuringia's universities, an annual report on all ongoing research projects at universities began to be published and made available to the general public in 2017. The report also contains the active externally funded research projects of the Bauhaus-Universität Weimar. The de minimis limit is 5,000 euros, with projects below this threshold being reported together in total. The specified funding totals refer to the approved grants for the total duration of the respective project. The Transparency Guideline and the associated database can be viewed at: https://www.tlpk.de/downloads/transparenz-in-forschung-und-wissenschaft/ on the website of the Thuringian State Presidents' Conference.

The following selection of projects provides insight in the form of examples of the variety and diversity of topics relevant to the environment and sustainability that are currently being worked on as part of Bauhaus-Universität Weimar research projects that began in 2020 and 2021.

TRAPA India – Transition road maps for solving the urban wastewater problem of Indian cities, including sludge from settling pits and faecal sludge, based on resource-oriented systems and business models
TP: Technical options, approaches to implementation and transition strategies
Faculty of Civil Engineering
Professorship: Biotechnology in Resources Management (Prof. Dr.-Ing. Eckhard Kraft)
Term: 1 May 2020 to 30 April 2020
Third-party grant provider(s): BMBF / Funding amount: 242,740.13 euros

Urban-Rural Assembly (URA) – Strategic tools for strengthening integrated spatial urban-rural relationships and regional value chains using the example of the Huangyan-Taizhou region of China
Faculty of Architecture and Urbanism
Professorship: Landscape Architecture and Planning (Prof. Dr.-Ing. Sigrun Langner)
Term: 1 December 2020 to 30 November 2024
Third-party grant provider(s): BMBF / Funding amount: 433,234.22 euros

Bauhaus.MobilityLab Studio
Faculty of Civil Engineering
Professorship: Transport System Planning (Prof. Dr.-Ing. Uwe Plank-Wiedenbeck)
Term: 1 April 2020 to 31 March 2023
Third-party grant provider(s): BMWi / Funding amount: 1,873,262.97 euros

Granulometric optimisation of clinker-efficient cements – effects on durability and sustainability of concrete
Faculty of Civil Engineering
Professorship: Construction Materials – F.A. Finger Institute for Building Materials Engineering (Prof. Dr.-Ing. Horst-Michael Ludwig)
Term: 1 September 2020 to 28 February 2023
Third-party grant provider(s): DBU / Funding amount: 194,664.00 euros

C2inCO_2 – Calcium carbonation for industrial use of CO_2
Subproject 5: Product performance
Faculty of Civil Engineering
Professorship: Construction Materials – F.A. Finger Institute for Building Materials Engineering (Prof. Dr.-Ing. Horst-Michael Ludwig)
Term: 1 February 2020 to 31 January 2023
Third-party grant provider(s): BMBF / Funding amount: 646,117.31 euros

Gypsum recycling as an opportunity for the southern Harz region; development of processes for treatment of unutilised gypsum waste types (RCGipsStartBUW)
Faculty of Civil Engineering
Professorship: Construction Materials – F.A. Finger Institute for Building Materials Engineering (Prof. Dr.-Ing. Horst-Michael Ludwig)
Term: 1 January 2020 to 31 December 2022
Third-party grant provider(s): BMBF / Funding amount: 544,015.44 euros

DENKRAUM – Strategies and methods for conservation assessment and preservation of room truss constructions in line with conservation requirements
Faculty of Civil Engineering
Project management: PD Dr.-Ing. habil. Volkmar Zabel (Structural Engineering and Component Strength)
Term: 1 December 2020 to 31 November 2023
Third-party grant provider(s): DFG / Funding amount: 318,960.00 euros

Functionalisation of smart materials under multi-field requirements for transport infrastructure
Faculty of Civil Engineering
Professorships: Construction Materials – F.A. Finger Institute for Building Materials Engineering (Prof. Dr.-Ing. Horst-Michael Ludwig – project management) together with Construction Chemistry and Polymer Building Materials (Prof. Dr.-lng. Dipl.-Chem. Andrea Osburg), Structural Engineering and Component Strength (Prof. Dr.-lng. habil. Carsten Könke), Stochastics and Optimisation (Prof. Dr. rer. nat. Tom Lahmer), Modelling and Simulation – Mechanics (Prof. Dr.-lng. Timon Rabczuk), Computing in Civil Engineering (Prof. Dr.-lng. Kay Smarsly)
Term: 1 June 2020 to 31 September 2025
Third-party grant provider(s): Carl Zeiss Foundation / Funding amount: 4,225,000.00 euros

Impacts of climate change on buildings and neighbourhoods – Structural integrity, indoor climate and energy efficiency
Faculty of Civil Engineering/Architecture and Urbanism
Professorships: Complex Structures (project managment Dr.-Ing. Lars Abrahamczyk), together with Steel and Hybrid Construction (Prof. Dr.-Ing. Matthias Kraus), Modelling and Simulation – Construction (Prof. Dr. Guido Morgenthal), Computing in Civil Engineering (Prof. Dr.-Ing. Kay Smarsly) and Building Physics (Prof. Dr.-Ing. Conrad Völker)
Term: 1 January 2020 to 30 June 2022
Third-party grant provider(s): TMWWDG/ESF Research Group / Funding amount: 625,341.83 euros

ZuHeiBau25 – Future Index Home and Building Culture 2025 (Vogtlandpioniere)
Faculty of Architecture and Urbanism
Professorships: Conservation and History of Architecture (Prof. Dr. phil. habil. Hans-Rudolf Meier) together with Landscape Architecture and Planning (Prof. Dr.-Ing. Sigrun Langner) and Urban Studies and Social Research (Prof. Dr. Frank Eckardt)
Term: 1 February 2020 to 31 January 2023
Third-party grant provider(s): BMBF / Funding amount: 235,180.58 euros

KoopWohl – Urban co-production of participation and common good. Local negotiation processes between civil society stakeholders and municipal administrations
Faculty of Architecture and Urbanism
Institute: Institute for European Urban Studies (project management Dr. Lisa Vollmer)
Term: 1 January 2020 to 31 December 2022
Third-party grant provider(s): BMBF / Funding amount: 503,145.17 euros

WIR!-H2-Well Mobility
Subproject: Analysis of relevant submarkets of hydrogen mobility and estimation of the effects with regard to transport, economy and environment as well as creation of development scenarios under various boundary conditions for differentiated target groups
Faculty of Civil Engineering
Professorship: Transport System Planning (Prof. Dr.-Ing. Uwe Plank-Wiedenbeck)
Term: 1 December 2020 to 30 November 2023
Third-party grant provider(s): BMBF / Funding amount: 228,565.54 euros

Research training group Media Anthropology
Faculty of Media
Professorships: Philosophy of Audio-Visual Media (Prof. Dr. Christiane Voss – spokesperson) together with Junior Professorship Image Theory (Prof. Dr. Julia Bee), Media Philosophy (Prof. Dr. Lorenz Engell), Junior Professorship European Media Culture (Prof. Dr. Eva Krivanec), Archive and Literature Research (Prof. Dr. Jörg Paulus), History and Theory of Cultural Technologies (Prof. Dr. Bernhard Siegert) and Media Sociology (Prof. Dr. Andreas Ziemann)
Term: 1 April 2020 to 30 September 2024
Third-party grant provider(s): DFG / Funding amount: 4,031,860.00 euros

MetaReal – Immersive knowledge access, collaborative exploration and intelligent retrieval in a digital world copy
Faculty of Media/Civil Engineering
Professorships: Virtual Reality Systems (Prof. Dr. Bernd Fröhlich) together with Computer Vision in Engineering (Prof. Dr. Volker Rodehorst), Content Management and Web Technologies (Prof. Dr. Benno Stein) and Theory of Media Worlds (Prof. Dr. Henning Schmidgen)
Term: 1 January 2020 to 30 June 2024
Third-party grant provider(s): TMWWDG / Funding amount: 1,341,865.00 euros

SCIP-Plastics – Sustainable capacity building to reduce irreversible pollution of marine systems by plastics
Faculty of Civil Engineering
Professorship: Biotechnology in Resources Management (Prof. Dr.-Ing. Eckhard Kraft)
Term: 7 December 2021 to 30 November 2024
Third-party grant provider(s): BMU, ZUG / Funding amount: 3,896,800.00 euros

Inter-municipal cooperation and transformation as the basis for a regional circular economy and sustainable regional development in the district of Saarlouis
Subproject 6: Strategy development and inter-municipal transformation and knowledge management, digital tools and sustainable residential areas
Faculty of Civil Engineering
Professorship: Technologies of urban material flow utilisation (Prof. Dr.-Ing. Silvio Beier)
Term: 1 July 2021 to 30 June 2024
Third-party grant provider(s): BMBF / Funding amount: 417,454.13 euros

OLE – Organisation of rural energy concepts
Subproject 1: Overcoming organisational and legal barriers to inter- and intra-municipal cooperation between different sectors
Faculty of Civil Engineering/Architecture and Urbanism
Professorship: Urban Water Management and Sanitation (Prof. Dr.-Ing. Jörg Londong) together with Infrastructure Economics and Management (Prof. Dr. Thorsten Beckers) and Building Physics (Prof. Dr.-Ing. Conrad Völker)
Term: 1 July 2021 to 30 June 2023
Third-party grant provider(s): BMBF / Funding amount: 386,285.21 euros

h2well-compact – Compact hydrogen supply system for decentralised mobility applications – Modelling, coordination of implementation and monitoring of the overall system
Faculty of Civil Engineering
Professorship: Energy Systems (Prof. Dr. Mark Jentsch)
Term: 1 June 2021 to 31 May 2024
Third-party grant provider(s): BMBF / Funding amount: 285,717.00 euros

TheGiS – Development of a process to increase the recovery rate of a thermal grey water recycling system using intelligent storage technology
Subproject: Scientific and technical support for the development of a process to increase the recovery rate of a thermal grey water recycling system using intelligent storage technology
Faculty of Civil Engineering
Professorship: Urban Water Management and Sanitation (Prof. Dr.-Ing. Jörg Londong)
Term: 1 January 2021 to 31 December 2022
Third-party grant provider(s): BMWi / Funding amount: 191,111.00 euros

ThlWertBioMobil – Mobilisation of biomass use from secondary raw material sources in Thuringia
Faculty of Civil Engineering
Professorship: Professorship Biotechnology in Resources Management (Prof. Dr.-Ing. Eckhard Kraft)
Approved period: 1 January 2021 to 31 December 2022
Third-party grant provider(s): TMWWDG/ESF Research Group / Funding amount: 112,065.97 euros

LaStrohBau – Load-bearing straw bale construction for agricultural structures and residential buildings
Faculty of Civil Engineering
Professorship: Modelling and Simulation of Structures (Prof. Dr. Guido Morgenthal)
Term: 1 September 2021 to 29 February 2024
Third-party grant provider(s): TMIL / Funding amount: 128,576.00 euros

Clay panel construction – prefabricated load-bearing solid clay walls
Faculty of Architecture and Urbanism
Professorship: Structural Design and Structural Engineering (Prof. Dr.-Ing. Jürgen Ruth)
Term: 1 January 2021 to 31 December 2022
Third-party grant provider(s): BMI / Funding amount: 146,448.69 euros

INUMO – INTEGRATED URBAN MOBILITY – Digital methods for interactive scenario development of sustainable transport infrastructure for emerging cities in Ethiopia
Faculty of Architecture and Urbanism
Professorship: Computer Science in Architecture (Prof. Dr. Sven Schneider)
Term: 1 June 2021 to 31 March 2023
Third-party grant provider(s): BMBF / Funding amount: 479,755.69 euros
(plus 399,949.06 euros from the DAAD)

BioFass – Biologically inspired façades based on multi-agent technology and crowd intelligence
Subproject: Materials engineering development of a photocatalytic façade panel
Faculty of Civil Engineering
Professorship: Construction Materials – F.A. Finger Institute for Building Materials Engineering (Prof. Dr.-Ing. Horst-Michael Ludwig)
Term: 1 July 2021 to 30 June 2022
Third-party grant provider(s): BMBF / Funding amount: 114,493.30 euros

WIR! Renat.Bau Strategy
Subproject 3: Higher education
Faculty of Civil Engineering
Professorship: Construction Materials – F.A. Finger Institute for Building Materials Engineering (Prof. Dr.-Ing. Horst-Michael Ludwig)
Term: 1 December 2021 to 30 November 2024
Third-party grant provider(s): BMBF / Funding amount: 100,006.60 euros

WiR! Gypsum recycling – Devices for the development of building materials and additives for gypsum recycling
Faculty of Civil Engineering
Professorship: Construction Materials – F.A. Finger Institute for Building Materials Engineering (Prof. Dr.-Ing. Horst-Michael Ludwig)
Term: 1 July 2021 to 30 December 2022
Third-party grant provider(s): BMBF / Funding amount: 778,830.75 euros

Lightweight gypsum – Development of lightweight gypsum from foamed gypsum using substitute building materials
Faculty of Civil Engineering
Professorship: Construction Materials – F.A. Finger Institute for Building Materials Engineering (Prof. Dr.-Ing. Horst-Michael Ludwig)
Term: 1 May 2021 to 30 September 2023
Third-party grant provider(s): TMWWDG / Funding amount: 150,000.00 euros

ZerMoGips – Development of non-destructively deconstructible, reusable gypsum building products for the creation of variable, modular components
Faculty of Civil Engineering
Professorship: Construction Materials – F.A. Finger Institute for Building Materials Engineering (Prof. Dr.-Ing. Horst-Michael Ludwig)
Term: 1 May 2021 to 30 September 2023
Third-party grant provider(s): TMWWDG / Funding amount: 112,500.00 euros

NaMin – Use of renewable raw materials and mineral secondary raw materials in systems containing calcium sulphate
Faculty of Civil Engineering
Professorship: Construction Materials – F.A. Finger Institute for Building Materials Engineering (Prof. Dr.-Ing. Horst-Michael Ludwig)
Term: 1 May 2021 to 30 September 2023
Third-party grant provider(s): TMWWDG / Funding amount: 450,000.00 euros

Effects of additives on the recycling of calcium sulphate building materials
Faculty of Civil Engineering
Professorship: Construction Materials – F.A. Finger Institute for Building Materials Engineering (Prof. Dr.-Ing. Horst-Michael Ludwig)
Term: 1 May 2021 to 30 April 2024
Third-party grant provider(s): BMBF / Funding amount: 376,970.40 euros

REALight – Lightweight granulates and FGD gypsum from construction and demolition waste
Faculty of Civil Engineering
Professorship: Construction Materials – F.A. Finger Institute for Building Materials Engineering (Prof. Dr.-Ing. Horst-Michael Ludwig)
Term: 1 February 2021 to 31 January 2024
Third-party grant provider(s): BMBF / Funding amount: 310,388.93 euros

LEICHT_DISS – Weight reduction in lightweight structures of dynamically loaded systems through new energy-dissipative elements
Subproject: Integration of lightweight construction as a design philosophy based on the MBSE method
Faculty of Civil Engineering
Professorship: Stochastics and Optimisation (Prof. Dr. rer. nat. Tom Lahmer)
Term: 1 December 2021 to 30 November 2024
Third-party grant provider(s): BMWi / Funding amount: 142,067.22 euros

3D images that show the situation in areas affected by floods/heavy rain
Faculty of Civil Engineering
Earthquake Damage Analysis Centre (EDAC) (Dr.-Ing. Jochen Schwarz) together with Junior Professorship Complex Structures (Prof. Dr.-Ing. Lars Abrahamczyk) and Professorship Modelling and Simulation – Construction (Prof. Dr. Guido Morgenthal)
Term: 8 August 2021 to 31 August 2022
Third-party grant provider(s): District Government Düsseldorf NRW / Funding amount: 170,639.00 euros

Kommunen innovativ – EW-K2: Development of sustainable municipal energy and heat concepts, taking into account compatibility with the overarching sector coupling strategy Fontanestadt Neuruppin as a trailblazer, subproject 1
Faculty of Civil Engineering
Professorship: Infrastructure Economics and Management (Prof. Dr. Thorsten Beckers)
Term: 1 July 2021 to 30 June 2024
Third-party grant provider(s): BMBF / Funding amount: 317,836.20 euros

Board and plank trusses as state-of-the-art timber constructions that reduce the need for materials
Faculty of Architecture and Urbanism
Project management: Conservation and History of Architecture (Dr.-Ing. Iris Engelmann)
Term: 1 May 2021 to 30 April 2024
Third-party grant provider(s): DFG / Funding amount: 332,154.00 euros

CONCERT-CCair – Cross-scale component solution for predicting the rheological properties of cement paste, taking cement substitutes and their influence on thixotropy and the deaeration behaviour of concrete into consideration
Focus programme »Opus Fluidum Futurum – The rheology of reactive, multiscale, multiphase building material systems«
Faculty of Civil Engineering
Professorship: Construction Materials – F.A. Finger Institute for Building Materials Engineering (Prof. Dr.-Ing. Horst-Michael Ludwig)
Term: 1 April 2021 to 28 March 2024
Third-party grant provider(s): DFG / Funding amount: 378,308.00 euros

Assessment and vulnerabilities of standardised existing buildings under the influence of extreme natural hazards
Faculty of Civil Engineering
Earthquake Damage Analysis Centre (EDAC) (Dr.-Ing. Jochen Schwarz)
Term: 1 February 2021 to 31 January 2023
Third-party grant provider(s): DFG / Funding amount: 283,800.00 euros

Resilient infrastructure based on cognitive buildings
Faculty of Civil Engineering
Professorship: Computing in Civil Engineering (Prof. Dr.-Ing. Kay Smarsly)
Third-party grant provider(s): DFG / Funding amount: 317,850.00 euros

THE NEW REAL: Past, Present and Future of Computation and the Ecologisation of Cultural Techniques
Faculty of Media
Professorship: History and Theory of Cultural Technologies (Prof. Dr. Bernhard Siegert)
Term: 1 April 2021 to 31 March 2024
Third-party grant provider(s): NOMIS Foundation / Funding amount: 490,000.00 euros

4.2 Teaching events

The four faculties of the Bauhaus-Universität Weimar offer degree programmes as well as individual lectures with seminars and student projects on environmental topics and ecological sustainability.

In the 2020 and 2021 degree programme portfolios, the undergraduate degree programmes with a predominant thematic focus on the environment and ecological sustainability include the degree programmes »Environmental Engineering« and »Urban Studies«. In the area of master's degree programmes, the degree programmes »Building Physics and Energy-Efficient Building Design«, »User-Oriented Building Renovation«, »Environmental Engineering« and »Water and Environment« are worth mentioning. The master's degree programmes »Building Materials Engineering« and »Natural Hazards and Risks in Structural Engineering« have a more extensive proportion of modules on the topics of climate, environment and sustainability. The latter degree programme is largely based on the UN's Sustainable Development Goals (SDGs). The listed degree programmes have module offers that largely recur and are based in the Faculty of Architecture and Urbanism as well as in the Faculty of Civil Engineering.

The master's degree programme »European Urban Studies« also intends to hone its profile in the direction of the environment and sustainability. Within all urban studies degree programmes, the topic area of environmental justice was bolstered by the postdoc positions »Spatial & Environmental Justice« and »Climate Integrated Architectural Design«. A temporary position (0.8 FTE) »Sustainability Practices« was filled.

Something that sets the Bauhaus-Universität Weimar apart is its project-based course of study. The project contents mostly reflect current academic topics as well as topics of public discourse. For the reporting period, a pronounced increase in instructional projects on climate, the environment and sustainability could be observed. The Faculty of Art and Design and the Faculty of Media provide essential support for these project formats. The instructional project contents feature astonishing diversity in the named topic areas. The degree programmes »Media Studies« and »Media Culture« are examples of this. These changing, as well as recurring, course offerings can be viewed in the archive of the Bauhaus-Universität Weimar course catalogue.

As part of the celebration of the 100th anniversary of the Bauhaus, the »Bauhaus.Semester« took place for the first time in the summer semester 2019 and offered numerous cross-faculty courses related to the environment and sustainability. The continuation of this initiative in the form of the »Bauhaus.Modules« has been continuously successful. We drop specific attention to these instructional offerings due to their special character of visibly spanning the various faculties. The following teaching formats with a reference to the environment and sustainability took place within the framework of the »Bauhaus.Modules« (Table 20).

Table 19: Bauhaus.Modules relating to the environment 2020 and 2021

Teaching format and leadership	Topic
Lectures, lecture series: J. Cepl, D. Dakic-Trogemann, F. Eckardt, S. Frisch, H. Meier, J. Paulus, A. Toland, M. Welch Guerra, M. Werchohlad	Heterotopie Ilmpark
Seminar: A. Brokow-Loga, F. Fetzer, T. Geyer	Climate Justice Now!
Seminar: M. Welch Guerra	Smart Cities – The Key to Solving All Urban Problems?
Scientific module: T. Schmitz, A. Schwinghammer	SUPER LOCAL: Sustainable Concepts for Growing Food within Your Own Four Walls
Scientific module, seminar: B. Buden, D. Dakic-Trogemann, I. Weise, R. Walch	MIND PALACES. Return of the Repressed in Three Shots
Scientific module: A. Toland, B. Körner	Convivial Dreams: Care-Work, Compassionate Art & Design, and Coming Together in a Time of Limited Contact
Seminar: J. Paulus, M. Weiland	City Narrative II. Practical Impetus – or: The City As Text
Specialist module, specialist course: S. Beier, R. Hilbel, K. Mänz	The Journey from the Field to Your Skin – Understanding the Textile Chain and Sustainability (Theory)
Specialist module, specialist course: S. Beier, R. Hilbel, K. Mänz	The Journey from the Field to Your Skin – Implementing Sustainability Concepts for the Garment Industry (Practice)
Seminar: S. Ahe, A. Brokow-Loga, F. Fetzer	Campus Conquest – Higher Education Policy Interventions
Seminar: D. Perera	'Critical Ecology' Matters: An Interactive Cardkit Introducing Tomás Maldonado's Work
Seminar: T. Baron, J. Kühn T. Geyer, P. Räpple, F. Fetzer	Material of the Future

Teaching format and leadership	Topic
Seminar: S. Schütz, T. Vogl	Market-ready Sustainable Interior Design
Seminar: R. Podlaszewska	The Future of Urban Tourism
Specialist module, specialist course: A. Bhattacharyya, I. Weise, S. Patharakorn	How to Draw Resistance
Project: A. Toland, J. Emes, S. Rudder, E. Kraft, T. Haupt, T. Schmitz, T. Janson, P. R. Koch	Climate Action: Climate Action: Permaculture and Local Economy in Urban Space
Scientific module: A. Toland, K. M.Voigt, E. Dierson	Beyond Honey – Bees, Art and the Human Race
Lecture: A. Schwinghammer, T. Schmitz	SUSTAIN: Infrastructure(s)
Seminar: M. Ahner, A. Brokow-Loga, T. Burkhardt, T. Gebauer, P. Räpple	Kaput? The Act of Repair as Applied Critique of Consumerism and Creative Practice
Scientific module: A. Schwinghammer	Futurabilities: Ecology, Consumer Culture & Speculative Design
Project: A. Toland	More than worms: radical composting for urban transformation
Tutorial: S. Rudder	Campus 4 Seasons – Freiraum Pavillon
Seminar: L. Link, D. Perera	In Search of a Pattern That Connects: Gregory Batesons ecological aesthetics and designing within a more than human world

Under discussion is the proposal that existing courses on the topics of environment, ecological sustainability, resources and resilience be specially marked in the course catalogue. In this context, consideration is also being given to subjecting degree programmes that are new or that are to be newly accredited to an examination of the visible extent to which they feel committed to the topic area of sustainability. Alternatively, the proximity of the modules to the UN Sustainable Development Goals could be demonstrated and evaluated. The work will involve gaining an understanding of and describing the term »sustainability«.

5 Making a contribution to sustainability

In December 2019, the students handed over to the President a list of demands for a »climate-neutral Bauhaus-Universität Weimar«. Based on the proposal, the Senate resolved in January 2020 to form a Senate working group under the name »Climate Working Group«. A student spokesperson and a spokesperson for the professors and junior professors (Hochschullehrer) represented this group on an equal footing. The Climate Working Group, as a voluntary association of university members from all status groups and the administration who are interested in and committed to protecting the climate, identified and developed the following priorities:

- Action areas
- Institutionalisation through the addition of a new staff position
- Compilation of a starting footprint in regard to CO_2 emissions
- Prohibition of business travel by air below a travel distance of 1,000 kilometres starting from March 2021 and
- Procurement of a cargo bike by the Bauhaus-Universität Weimar

The following of these initial proposals could be implemented for the Bauhaus-Universität Weimar:

- Appointment of a Climate Officer in a part-time position in brackets (10/2020 – 03/2023)
- Inclusion of a full-time position of an Environmental Officer in the main office in the economic plan
- Prohibition of business travel by air for distances of less than 1,000 kilometres, with the exception of justified special urgency
- Initiative for the procurement of a cargo bike and
- Publishing of the 2019 Environmental Report

The students discontinued their participation in the Climate Working Group at the end of 2021. Since that time, the positions of Climate Working Group spokespersons have also been vacant.

The action areas that were already recommended will remain in place and are backed up with the following recommended measures for 2022 and 2023.

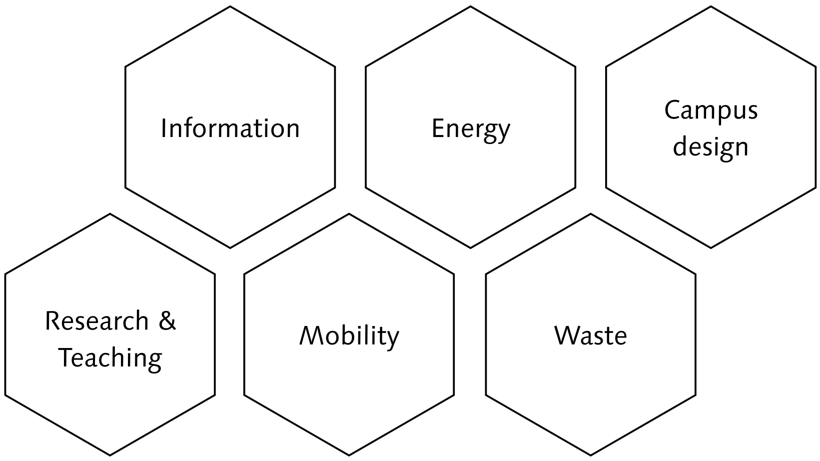

Figure 18: Action areas

Information

The temporary full-time position of Environmental Officer is to be filled. The position should be of a technical nature. To ensure a minimum degree of independence, the position should preferably be assigned to the Chancellor's Office. The link between the administration and the faculties must be strengthened. Efforts will be made to form a Climate Council.

Energy

Campus development can no longer proceed without a reduction in CO_2 emissions. The installation of a modern data logging system that collects information from each building is essential for the assessment. Based on this information, buildings are to be identified for pilot measures for energy-efficient building upgrades and improved energy management.

Mobility

Arrangements to compensate for necessary air travel are being found. Incentives for more sustainable mobility are being created.

Waste

In all faculties, central facilities and the administration, separate collection and thus the possibility of recycling must be ensured. This also applies to both teaching projects and student projects. The starting point for waste prevention should be the revision of the Procurement Policy.

Research and teaching

The way in which the wide range of research projects and teaching dovetail with each other should be given greater visibility. Existing courses on the topics of the environment, ecological sustainability, resources and resilience should be specially marked in the course catalogue. In this context, consideration is also being given to subjecting degree programmes that are new or that are to be newly accredited to an examination of the visible extent to which they feel committed to the topic area of sustainability. Alternatively, the proximity of the modules to the UN Sustainable Development Goals could be demonstrated and evaluated. The understanding of sustainability is to be individually defined for all study formats. A fundamental evaluation of how sustainability topics are embedded in the curriculum needs to be launched.

Campus design

Within the framework of campus development, measures that achieve ecological enhancement are to be defined. This must be made tangible for all university members through an increase amenity values and quality of life on campus.

For all action areas, it is necessary for greater penetration of the institutions to be achieved. Climate aspects must become a natural part of the university's self-administration. In addition to content issues, this also includes the provision of budgets relating to the topic area. On this basis, the involvement of all university members can be achieved.

6 Bibliography

(AGEB 2023): Energy unit converter. AG Energiebilanzen e.V. Available online at https://ag-energiebilanzen.de/energieeinheitenumrechner/, retrieved on 26 Jan 2023

(BRG 2023) Information from the Federal Government on the National Water Strategy at: https://www.bundesregierung.de/breg-de/suche/nationale-wasserstrategie-2171158#:~:text=Die%20Versorgung%20mit%20Trinkwasser%20zu,sind%20Kernziele%20der%20Nationalen%20Wasserstrategie, last retrieved on 20 Apr 2023

(BUW 2021): Bauhaus-Universität Weimar Annual Report 2021

DIN EN ISO 14031:2021: Environmental management – Environmental performance evaluation – Guidelines.

DIN EN ISO 14001:2015: Environmental management systems – Requirements with guidance for use.

(EAV 2023): Waste types according to the European Waste List (AVV – Waste List Regulation), conversion factors. Published by the Bavarian State Office for Statistics at https://statistik.bayern.de/service/erhebungen/bauen_wohnen/abfall/abfallarten/index.phpUmrechnungsfaktoren (bayern.de), retrieved on 07 Feb 2023

(EPA 2021): Excerpt from the minutes of the 7th Presidium meeting TOP 7 on the topic of Climate Working Group: Catalogue of measures to reduce greenhouse gas emissions associated with business travel

(UBA 2023) CO_2 calculator for flights of the Federal Environment Agency: https://uba.co2-rechner.de/de_DE/mobility-flight, retrieved on 26 Jan 2023

(OTB 1997): Ottow, Johannes; Bidlingmaier, Werner (1997): Environmental Biotechnology: Gustav Fischer Verlag. P. 145

(UBA 2022) Updated Life Cycle Assessment of Graphic and Tissue Paper TEXTE 123/2022 Frank Wellenreuther, Andreas Detzel, Martina Krüger, Mirjam Busch

(UBA 2022): CO_2 emission factors for fossil fuels. With the collaboration of Kristina Juhrich. Published by the Federal Environment Agency. Specialist area emission situation (I 2.6). Dessau-Roßlau (28/2022).

(KOL 2014) Kolisch (2014): Optimisation of the energy yield of municipal wastewater treatment plants through a process- and site-oriented network strategy. Ministry for Climate Protection, Environment, Agriculture, Nature Conservation and Consumer Protection of the State of North Rhine-Westphalia.

(UBA 2009) Energy efficiency of municipal wastewater treatment plants; Fricke, Klaus; Federal Environment Agency

(STW 2022) Stadtwerke Weimar Stadtversorgungs-GmbH; Power labelling, energy mix and environmental impact, information on power deliveries on the 2021 data basis pursuant to Section 42 of the German Energy Industry Act (EnWG), retrieved on 19 Jan 2023

(TEA 2022) Power labelling of the power supply pursuant to Section 42 of the Energy Industry Act (EnWG) of TEAG Thüringer Energie on the basis of data for 2021 at https://www.thueringerenergie.de/Ueber_uns/Mediathek/Veroeffentlichungspflichten/Stromkennzeichnung, retrieved on 20 Jan 2023

(KOL 2014): Optimisation of the energy yield of municipal wastewater treatment plants through a process- and site-oriented network strategy. Ministry for Climate Protection, Environment, Agriculture, Nature Conservation and Consumer Protection of the State of North Rhine-Westphalia.

(MUL 2012): Climate Footprint Tool 2.0. With the collaboration of Roland Pomberger, Philipp Puchbauer and Therese Schwarz. University of Leoben, Chair of Waste Processing Technology and Waste Management. Available online at https://klima.unileoben.ac.at/, retrieved on 10 Jan 2023.

(IFEU 2006): Ecological comparison of office paper types depending on the fibre raw material, commissioned by »Initiative Pro Recyclingpapier«. Institut für Energie- und Umweltforschung Heidelberg GmbH.

(IPR 2006): Sustainability calculator – Papiernetz. Initiative Pro Recyclingpapier 2021. Available online at https://www.papiernetz.de/informationen/nachhaltigkeitsrechner/, last checked on 13 Apr 2023

(WDK 2022): Wellenreuther, Frank; Detzel, Andreas; Krüger Martina; Updated life cycle assessment of graphic and sanitary paper; published by the Federal Environment Agency; 2022

(MDU 2011): Communications of the Bauhaus-Universität Weimar; Procurement Guideline of the

Bauhaus-Universität Weimar; Issue 32/2011 from 29 Sep 2011

(WRI 2004): The Greenhouse Gas Protocol. A Corporate Accounting and Reporting Standard, revised edition. Available online at https://ghgprotocol.org/corporate-standard, last checked on 20 Apr 2023.

(WZV 2023): Website of the Wasserzweckverband Weimar at: https://www.wasserversorgung-weimar.de/enms/, retrieved on 15 Feb 2023

7 Information on participation

We are grateful for their cooperation and especially for the qualified provision of data:

Service Centre for Facility Management, Head: Dipl.-Ing. Architect Claudia John
Service Centre for Security Management, Head: Dipl.-Ing Dirk Schmidt
Hazardous Substances Officer of the Faculty of Civil Engineering:
Dipl.-Ing. (FH) Stefan Stäblein
University Communications, Head: Yvonne Puschatzki, M.A.

Research Operations Office, Head of Department: Dr. rer. nat. Kristina Schönherr
Office of Student and Academic Affairs, Head of Department:
Dipl.-Kulturwiss. (Media) Gudrun Kopf
Finance Department, Head: Dipl.-Betriebswirt Hagen Hausbrandt
Personnel Department, Head of Department: Beate Haltmeyer-Forstner

Deans Offices
Faculty of Architecture and Urbanism: Prof. Jörg Springer
Faculty of Art and Design: Prof. Björn Dahlem
Faculty of Civil Engineering: Prof. Dr.-Ing. Matthias Kraus
Faculty of Media: Dr. Simon Frisch

8 Imprint

Publisher: Bauhaus-Universität Weimar

Editing and processing:
Prof. Dr.-Ing. Eckhard Kraft, Climate Officer at the Bauhaus-Universität Weimar
Steven Mac Nelly, M. Sc., Environmental Officer at the Bauhaus-Universität Weimar

Design, layout: University Communications
Typesetting: Franziska Labitzke
Photos: Cover (Annie Spratt auf Unsplash); Seite 2 (Carolin Klemm); Seite 6 (Marcus Glahn); Seite 33, 45 (Tobias Adam)

Weimar, 24 May 2023

Bauhaus-Universität Weimar, Geschwister-Scholl-Straße 8, 99423 Weimar

www.uni-weimar.de