Bauhaus-Universität Weimar

ENVIRONMENTAL REPORT 2023

BAUHAUS-UNIVERSITÄT WEIMAR

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Introduction

Dear readers, dear university members,

The environmental report is today an established tool that enables us to review past and future activities in the fields of environmental performance, teaching and research at the Bauhaus-Universität Weimar. It is an invaluable monitoring tool for the university as a whole as well as for me as Climate Officer to ascertain what we have achieved in this field here at the university in the past two years. I am therefore delighted to be able to introduce the environmental report for the first time with this foreword in my role as Vice President for Social Transformation. The fact that the 2021 environmental report was presented immediately after I was appointed Vice President by the Senate at the meeting on 9 June 2023 proved a happy coincidence. For it allowed me to take the authors' findings and appeals on board and begin addressing the associated tasks right away. The focus was on clarifying how the university addresses the topic of sustainability as a whole – not just the environmental dimension, though, but the social and economic ones, too.

A few years ago, in 2019, when I was a senator, I witnessed how students called on the Senate of the Bauhaus-Universität Weimar to declare a climate emergency. At the time, we didn't do as they asked, but rather decided to proactively address the climate crisis. A growing amount has been achieved at the university since then: Within teaching, the number of degree programmes addressing aspects of sustainability has increased steadily. Meanwhile in research, the questions considered increasingly focus on tackling the climate crisis. And most recently, in January 2024, the budgeted units resolved to invest 1 % of their budget in tangible improvement of the environmental performance. This is a clear sign of the university's commitment to the goal set by the Presidential Board newly appointed in 2023 to become a certified sustainable university in accordance with EMAS. It is a lot, but until we manage as a global society to slow climate change and mitigate its consequences, we must continue to work intensively on our own issues.

I would nonetheless like to emphasise a number of important, positive decisions: Since the summer of 2023, the department for sustainable development headed by Dr. Tonia Schmitz has been working under my leadership with the Sustainability Team to implement measures to boost sustainability at the university and develop criteria to quantify these measures in the areas of research, teaching, transfer, governance and construction/operation.

The two authors of this report are also part of the sustainability team: Environmental Officer Steven Mac Nelly (MSc) and, in an advisory role, Climate Protection Officer Prof. Dr.-Ing. Eckhard Kraft. My heartfelt thanks to them both for their commitment to preparing this report as well as to all those who contributed data and especially all members of the Bauhaus-Universität Weimar, who remain committed to our goal of becoming a sustainable university.

The challenges we face as a society are complex and require our collective action. Let us continue drawing on the blend of ingenious knowledge, design creativity and humanistic reflection for which the Bauhaus-Universität Weimar is renowned to achieve a more sustainable future. May the 2023 environmental report serve as inspiration to you all for this.

Warm wishes

Ulrike Kuch
Vice President for Social Transformation

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1 Foreword

The Bauhaus-Universität Weimar is publishing what is now its third environmental report. It is most pleasing that a routine has since been established to present the latest greenhouse gas emissions and progress on sustainability in a transparent and publicly accessible manner. A comparison with previous years allows us to follow the shift from work performed by volunteers to an institutionalised approach to this subject. It is increasingly also reflected in the structures at our university. A network of responsibility for sustainability is becoming discernible. University members' awareness of sustainability issues and their institution's greenhouse gas emissions is very high.

At the same time, the greenhouse gas emissions for the energy supply are stagnating. Hence it remains the most challenging area for us and ties closely with the need to retrofit existing buildings to enhance their efficiency. The university has limited influence here; responsibility primarily lies with the owners of the state properties.

We're delighted that this report reflects the development of our environmental performance, teaching and research. It serves as a guide for preparation of a sustainability agenda for the university. At the same time, it calls for a data-driven joint effort in collaboration with the state of Thuringia to significantly reduce greenhouse gas emissions. This will not only involve retrofitting the buildings themselves, but also their heating and cooling systems.

It's time to act!

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 thrives on its experimental environment and close-knit community, but above all on the people who study, research and work here. In 2022 (WS 22/23), a total of 4,116 students (including doctoral researchers) were enrolled in the 39 degree programmes offered by the university's four faculties. The share of international students lay at 26.3 %. The university employed approx. 775 full-time equivalent staff, the majority of whom were scientific and artistic staff members (BUW 2022).

Students	4,116
Share of international students [%]	26.3
Professors	86
Scientific and artistic staff	240
Scientific project staff	170
Non-scientific project staff	140
Non-scientific staff	280
Trainees	15

The Bauhaus-Universität Weimar had a budget of 89.9 million euros in 2023. Of this total, 23 million euros came from third-party funding.

The university uses 80 buildings in the Weimar municipal area as offices, workshops and studios, lecture halls, storage facilities and circulation areas (see Figure 1). Of these buildings, 28 are under preservation orders and two have UNESCO World Heritage status. The share of primary usable floor space that is rented lay at 17.3 % (17 rental properties).

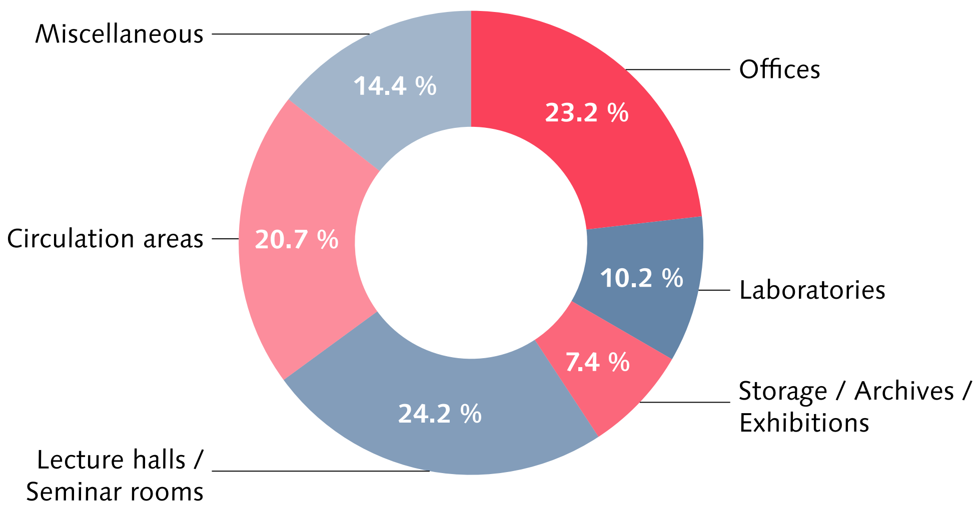

Figure 1: Share of net floor space

3 Environmental performance

The environmental performance of the Bauhaus-Universität Weimar is presented in the following. The data refers to the 2023 reporting year and was determined either directly from measurements and documentation or indirectly from calculations using the corresponding sources and estimates. These findings allow an overview to be gained of the greenhouse gas emissions, from which the shares in emissions, potential for savings and areas of action can then be determined. The ongoing assessment of environmental performance forms the basis for monitoring.

Environmental performance is defined in DIN EN ISO 14001:2015 as a measurable outcome of products or services that interact with the environment. These are subdivided into the categories of mobility, energy, waste, water and wastewater, and materials and procurement. The CO_2 emissions from each category have been determined. The classification, collection and evaluation of data are discussed in detail in the following sections of this chapter and the overall CO_2 emissions are then calculated.

The environmental data for the Bauhaus-Universität Weimar was recorded systematically for the first time in the 2019 environmental report. A template was established for this in the process based on DIN EN ISO 14001. This will be used again in subsequent environmental reports and thus help to ensure the uniformity and comparability of the annual data. The data was recorded consistently throughout the monitoring period in the years 2019, 2020, 2021, 2022 and 2023. An overview of the overall consumption at the Bauhaus-Universität Weimar is shown in Table 1, subdivided into categories to enable a comparison.

Table 1: Overall consumption in 2023

Category	Unit	Consumption	Change*
Air travel	[km]	1,077,150	+ 56.2 %
Vehicle fleet	[km]	130,256	+ 4.8 %
Power	[kWh]	4,567,869	− 8.5 %
Natural gas, heating oil	[kWh]	7,720,246	− 10.4 %
District heating	[kWh]	897,530	− 22.4 %
Residual waste**	[kg]	95,033	+ 4.2 %
Lightweight packaging**	[kg]	20,438	+ 15.0 %
Paper waste**	[kg]	74,527	− 7.9 %
Organic waste**	[kg]	60,703	− 3.1 %
Drinking water	[m³]	31,368	+ 119.4 %
Wastewater	[m³]	32,624	+ 103.2 %
Printer paper	[kg]	6,132	− 23.1 %

*Percentage change compared to four-year average (2019 – 2022)
**Data incomplete

Please refer to the Studierendenwerk Thüringen for details of the CO_2 footprints for the dining halls in Weimar. Further standardisation to ensure the comparability of environmental performance is carried out based on DIN EN ISO 14031:2021, »Environmental management – Environmental performance evaluation – Guidelines«. A CO_2 equivalent is calculated for each category to determine the environmental performance and enable a comparison across sectors. The corresponding overall CO_2 footprint for the Bauhaus-Universität Weimar is presented in Table 2.

Table 2: Overall CO_2 footprint in 2023

Category	Unit	CO_2 footprint	Change*
Air travel	[t CO_2]	224.9	+57.0%
Vehicle fleet	[t CO_2]	29.5	+4.4%
Power	[t CO_2]	0.0	0.0%
Natural gas, heating oil	[t CO_2]	1,365.3	−20.8%
District heating	[t CO_2]	179.6	−22.4%
Residual waste**	[t CO_2]	36.6	+4.3%
Lightweight packaging**	[t CO_2]	14.3	+15.0%
Paper waste**	[t CO_2]	0.5	−7.9%
Organic waste**	[t CO_2]	0.6	−3.1%
Drinking water	[t CO_2]	8.3	+119.4%
Wastewater	[t CO_2]	4.5	+103.2%
Printer paper	[t CO_2]	6.0	−23.1%
Total	**[t CO_2]**	**1,870.1**	**−14.7%**

*Percentage change compared to four-year average (2019–2022)
**Data incomplete

In the following sections, the environmental performance is explained in detail according to the categories defined in Table 2. The underlying data is examined critically and preliminary conclusions are drawn regarding its completeness.

3.1 Mobility

Business travel

In 2019, we began using the MACH-ERP system to systematically record employees' business travel. All relevant information is now saved in this system.

The personnel department uses this data to create an anonymised, automated »climate assessment« each year. The assessment includes travel using the following means of transport:

- planes
- trains
- public transport
- rental vehicles
- taxis
- coaches
- private vehicles
- ships

This information is provided as an Excel table.

Table 3: Climate assessment of business travel

Trip no.	Start date	End date	Origin	Destination	Means of transport	Costs (gross)	Trip details
57664	03.01.23	09.01.23	Weimar	Waikoloa	Plane (0%)	2024.29	FFM-Hawaii-FFM; includes meals
55481	09.01.23	19.01.23	Berlin	Dublin	Plane (0%)	156.96	Berlin-Dublin-Berlin
55518	15.01.23	16.01.23	Weimar	Istanbul	Plane (0%)	149.31	Istanbul-Berlin
55521	25.01.23	16.03.23	Berlin	Rio de Janeiro	Plane (0%)	1036.58	Berlin-Rio de Janeiro-Berlin
55721	02.02.23	10.03.23	Leipzig	Havanna	Plane (0%)	1387.89	FFM-Havana-FFM
55767	03.02.23	11.02.23	Weimar	Birsbane	Plane (0%)	2196.51	FFM-Brisbane-FFM

Notes on the table:

- Further information on the trip is provided in the »Trip details« column.
- Distances (in km) are only available for business travel by car, as these are offset against the mileage allowance.
- The »public transport« category includes travel by train, bus and tram. A differentiation between these is not possible from the available data.
- Collective bookings are made for smaller, regular business travel. It is not always clear how many trips are included in a collective booking.

The climate assessment, which contained 3,296 columns in the 2023 reporting year, can currently only be used to analyse the emissions from business travel to a limited extent. Based on the assumption that air travel accounts for the majority of the emissions from business travel, only these emissions are considered in the overview – as in previous reporting years.

To determine the annual emissions from air travel, the climate assessment was filtered for business travel by plane. The origin and destination as well as the trip details were then entered in the German Federal Environment Agency's flight emissions calculator (UBA2023). This generates and summarises the information on flight routes and the resulting CO_2 emissions, which are shown in Table 4. A total of 1,077,150 kilometres were travelled by plane during the reporting year.

Table 4: Overview of air travel (2019–2023)

Year	Continent	No. flights	No. journeys [km]	Emissions [t CO_2]	No. flights <1,000 km
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**	
2022	Europe	198	274,576	56.6	44
2022	Asia	50	209,635	40.3	
2022	America	10	31,244	6.9	
2022	Africa	17	135,142	32.8	
2022	Oceania	0	0	0.0	
2022	**Total**	**275**	**650,597**	**136.7**	
2023	Europe	178	231,085	46.7	64
2023	Asia	46	201,258	38.0	
2023	America	57	506,519	112.5	
2023	Africa	24	69,730	15.2	
2023	Oceania	4	68,558	12.6	
2023	**Total**	**309**	**1,077,150**	**224.9**	

As expected, there has been a significant overall increase in business travel (and therefore also in air travel) in the years following the Covid-19 pandemic. The number of flights increased from 31 in 2021 to 275 in 2022 and 309 in 2023. 47 % of the total distance covered (and thus the majority of flights) involved travel to America. Overall, intercontinental flights accounted for 79 % of the emissions from business travel. Figure 2 shows clearly that, in 2023, the number of flights and distance travelled by air was around half of the level in 2019.

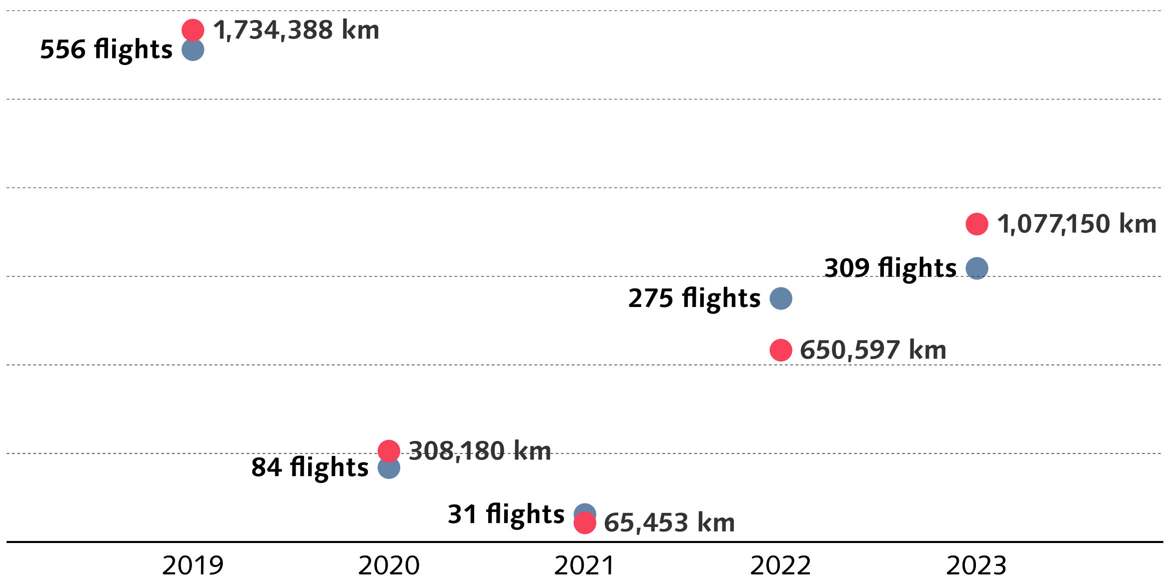

Figure 2: Number of flights and distances travelled

The number of flights did not immediately return to the 2019 level after the Covid-19 pandemic. This is probably due to the establishment of online meeting formats and cost increases. Greater environmental awareness among travellers with a more critical assessment of the need for air travel could also have led to the reduction in the number of flights.

The international security situation, which has been negatively affected by the conflicts in Ukraine and the Middle East in recent times, also impacts travel. Due to the virtually proportionate link to the distance travelled by plane, a similar development can be discerned in the amount of emissions (see Figure 3). In 2023, air travel led to 224.9 tonnes of CO_2 equivalent emissions, 36 % fewer emissions than in 2019.

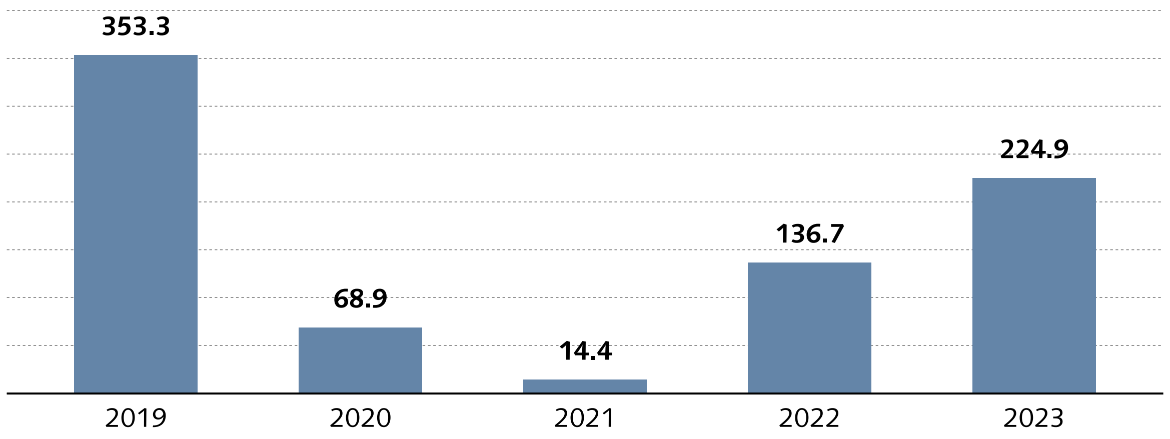

Figure 3: CO_2 emissions from flights [t]

The flights are for research activities and the international exchange in general. Due to the diverse parameters influencing flight emissions, it is only possible to predict the future development of these figures to a very limited extent. The number of flights is expected to continue to rise however.

The Presidential Board stipulated the following in its resolution dated 17 February 2021:

- The option of air travel must be considered and justified comprehensively when the destination of business travel is less than 1,000 km away but cannot be reached by other means of transport in less than 12 hours. The official procedure must be followed. (EPA 2021)

According to the UBA flight emissions calculator, the number of flights to destinations less than 1,000 kilometres away totalled 64 in 2023 (see Figure 4).

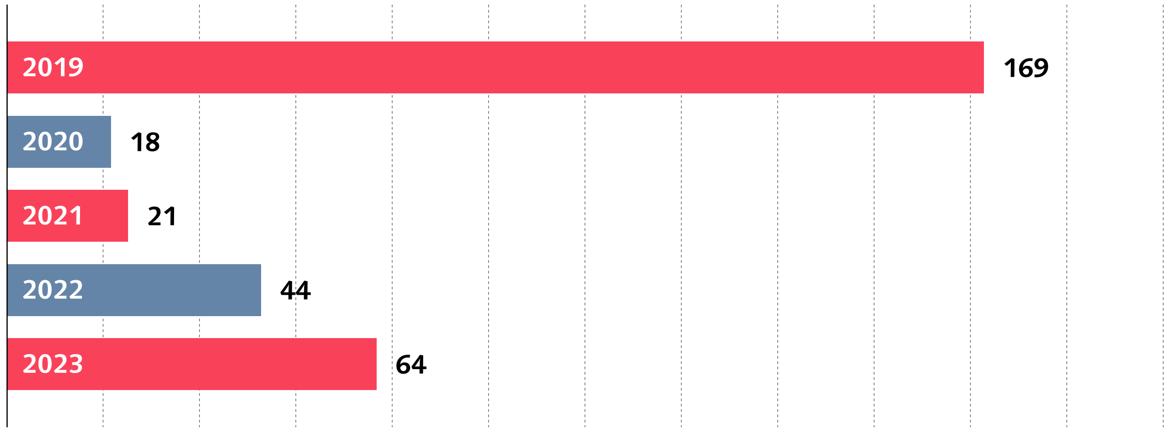

Figure 4: Number of flights under 1,000 kilometres

The justifications for the means of transport selected for business travel of less than 1,000 km are specified in the Thuringian travel expenses act (Thüringer Reisekostengesetz, ThürRKG). These include:

- business reasons
- private reasons
- economic reasons (costs)
- time-related reasons (other means of transport > 12 hours)

During a separate assessment, 102 business trips were considered in 2023, which could include air travel to destinations less than 1,000 kilometres away. The following justifications were determined for these flights.

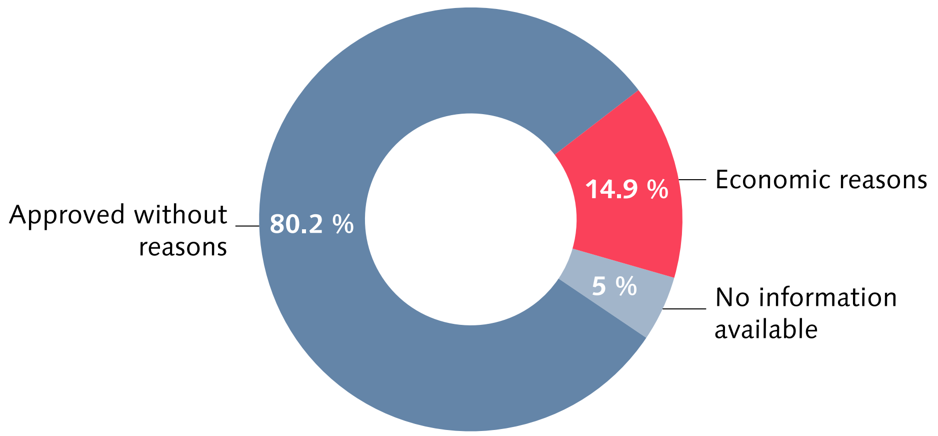

Figure 5: Reasons for flights under 1,000 kilometres in 2023

The vast majority of air travel (80.2 %) was approved without reasons by the person responsible for providing approval. 14.9 % of air travel was justified with economic reasons and no information was available for 5 % of air travel.

Due to capacity limitations, this environmental report does not include a detailed analysis of short-haul air travel. Meaningful improvement measures can nonetheless already be derived from the information available.

Improve reporting

- In future, the personnel department will indicate the IATA airport codes in the »Trip details« column of the climate assessment. This will enhance the value of the information provided on business travel.
- Adaptation of the climate assessment (BI report) would be a considerable IT undertaking. Artificial intelligence could be used to improve the assessment though.

Improve the flight emission values

- The Presidential Board's resolution dated 17 February 2021 on business travel of less than 1,000 kilometres provides guidance. Official instructions must now be determined based on this resolution to describe the procedure to follow, taking the applicable legislation into account.
- While the offsetting of CO_2 emissions is controversial, doing so would greatly improve the overall CO_2 footprint.

Vehicle fleet

The Bauhaus-Universität Weimar's vehicle fleet comprises a total of 11 vehicles, which are used for very different purposes. These include construction and transport, operational technology (heating/sanitation, electronics), university management, internal mail, and the independent vehicle of the university's testing facility (VTE). The vehicles have different efficiency levels, which in turn leads to different emissions. The vehicle-related data is determined and documented by the Service Centre for Facility Management. University management has leased vehicles for one year. The data for these is summarised over the reporting year. The internal mail service uses an e-Citroën; this is currently the only electric vehicle in the university vehicle fleet. The rest of the vehicle fleet is powered conventionally, by petrol or diesel.

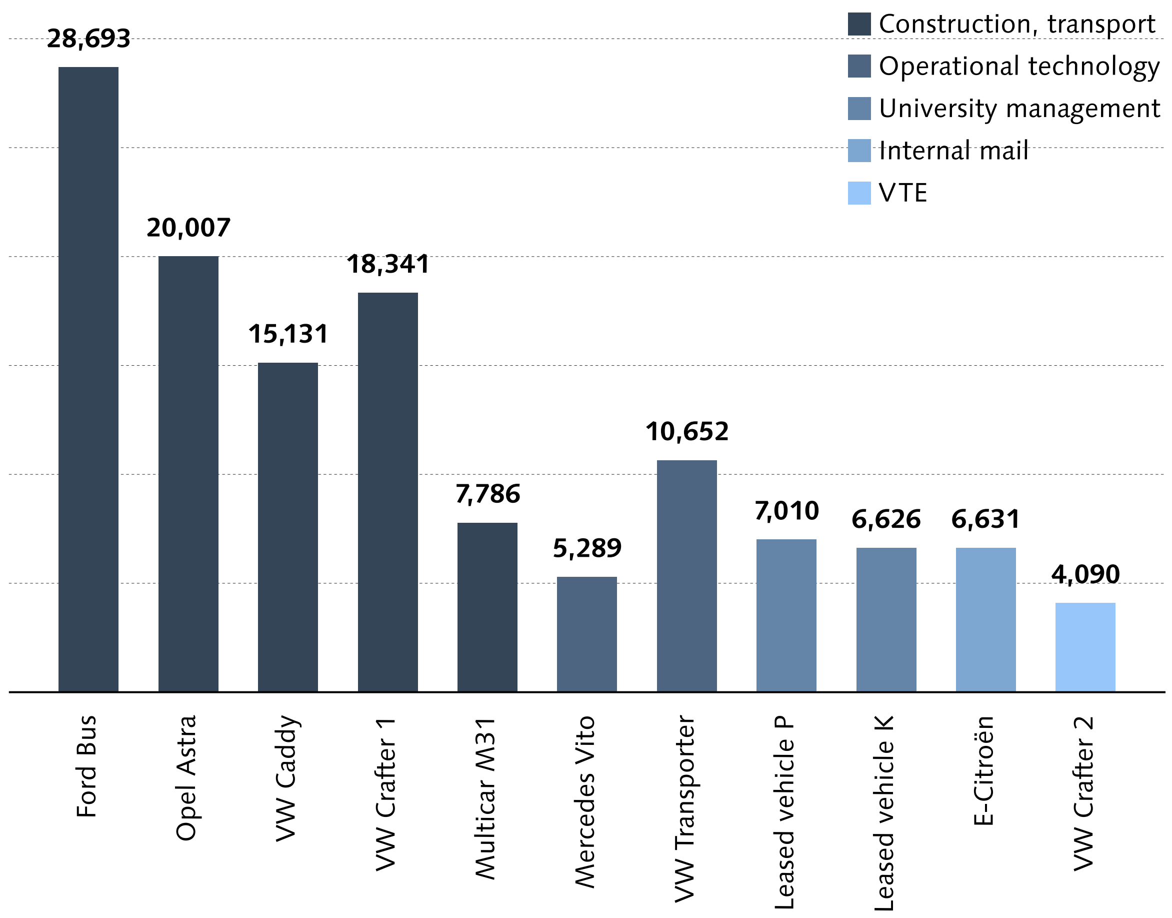

Figure 6: University vehicle fleet mileage in 2023 [km]

The CO_2 footprint of the vehicles in Figure 7 are based on the petrol/diesel consumption documented in the vehicle logbooks in litres and the specific CO_2 emissions (UBA 2022; AGEB 2023). For the electric vehicle, the emission factor specified is based on the value of 0 grams of CO_2 per kilowatt hour specified in the energy supplier's power labelling (TEA 2023).

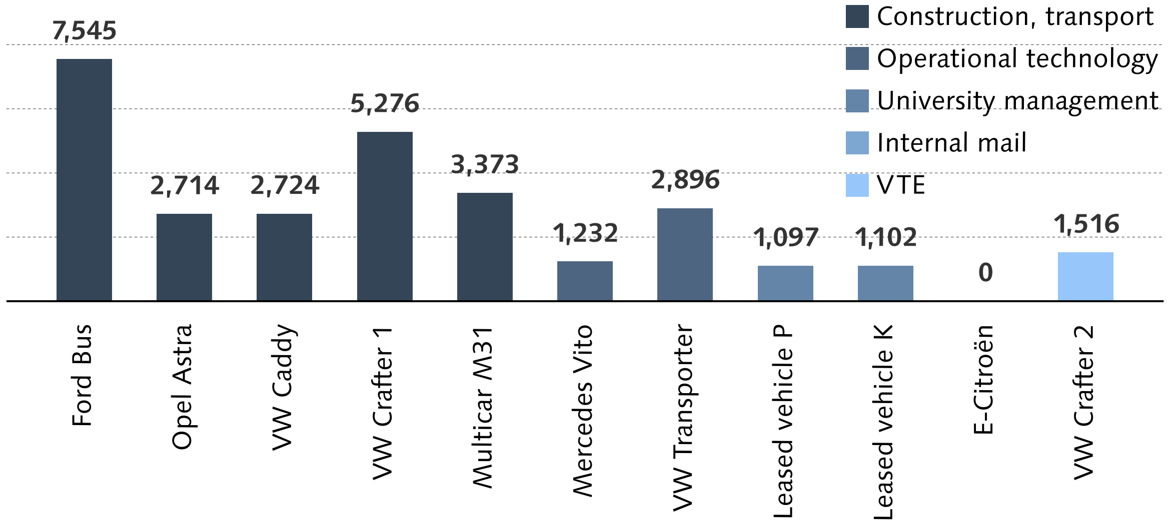

Figure 7: CO_2 emissions from the university vehicle fleet in 2023 [kg CO_2]

In terms of passenger transport, the Ford Bus was most efficient. The Opel Astra was used to transport smaller groups of passengers and had relatively low emissions due to its comparatively low fuel consumption of 5.1 litres of diesel per 100 kilometres. By contrast, the emissions for the leased vehicles used by university management are low due to the low mileage. The total mileage is summarised in Figure 8.

The effects of the Covid-19 pandemic are clearly discernible in the 2020 reporting year. While passenger transport was significantly reduced, the vehicle emissions from construction, operations and the internal mail service remained stable. In 2022 and 2023, the total mileage for the vehicle fleet lay at approx. 130,000 kilometres; it appears to be stabilising in this range.

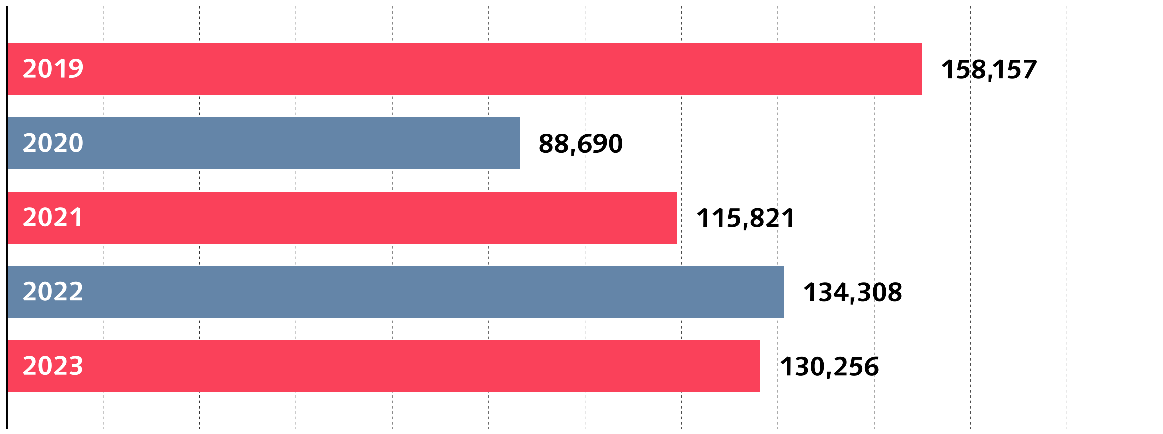

Figure 8: Comparison of the university fleet mileage [km]

Given that most of the vehicles in the university fleet are conventional vehicles, the CO_2 footprint calculated is similar to the annual mileage. The total emissions caused by the university vehicle fleet totalled approx. 30 tonnes of CO_2.

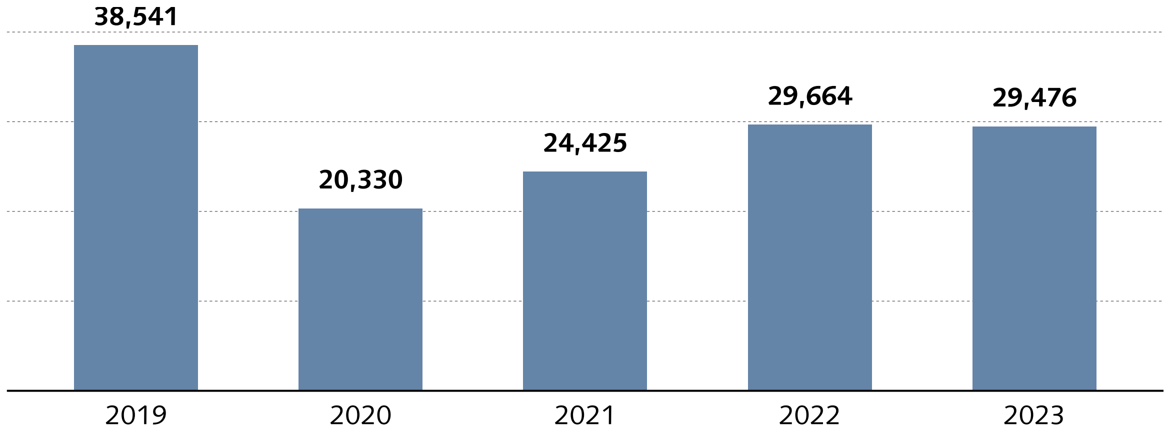

Figure 9: Comparison of emissions from the university fleet [CO_2]

Table 5 provides an overview of the university fleet mileage and resulting emissions.

Table 5: Overview of the university fleet in 2023

Year	Vehicle	Mileage	Fuel consumption	Average consumption	Specific emission value	CO_2 emissions
		[km]	[l/kWh]	[l;kWh/ 100km]	[kg CO_2/l]	[kg CO_2]
2023	Ford Bus	28,693	2,847	9.9	2.65	7,545
2023	Opel Astra	20,007	1,024	5.1	2.65	2,714
2023	VW Caddy	15,131	1,028	6.8	2.65	2,724
2023	VW Crafter	18,341	1,991	10.9	2.65	5,276
2023	Multicar M31	7,786	1,273	16.3	2.65	3,373
2023	Mercedes Vito	5,289	465	8.8	2.65	1,232
2023	VW Transporter	10,652	1,093	10.3	2.65	2,896
2023	Leased vehicle P	7,010	463	6.6	2.37	1,097
2023	Leased vehicle K	6,626	416	6.3	2.65	1,102
2023	E-Citroën	6,631	1,308	19.7	0	0
2023	VW Crafter	4,090	572	14.0	2.65	1,516
2023		**130,256**	**12,480**			**29,476**

The amendment to the guidelines published by the State of Thuringia for the procurement, administration, use, disposal, recycling and settlement of accident claims relating to company vehicles, which came into force on 20 June 2023, takes multiple environmental aspects of company vehicles into account (TFN 2023). The procurement, operation and installation of comprehensive charging infrastructure continue to pose major challenges.

Environmental performance

3.2 Power

The power consumption of the Bauhaus-Universität Weimar is determined from the consumption and billing data provided by the Service Centre for Facility Management. The measurements from each meter are documented in the Naflima database.

In 2023, the power consumption for the Bauhaus-Universität Weimar totalled 4.6 gigawatt hours. This is approx. 9 % lower than the average consumption in the previous four years. The power supplier Thüringer Energie AG supplies the university with green power based on a CO_2 carbon footprint of 0.0 grams of CO_2 per kilowatt hour (TEA 2023). In 2023, the university was able to avoid a total of 1,600 tonnes of CO_2 emissions by using green power. This results in total emissions of 0 kilograms of CO_2 for the power purchased by the Bauhaus-Universität Weimar.

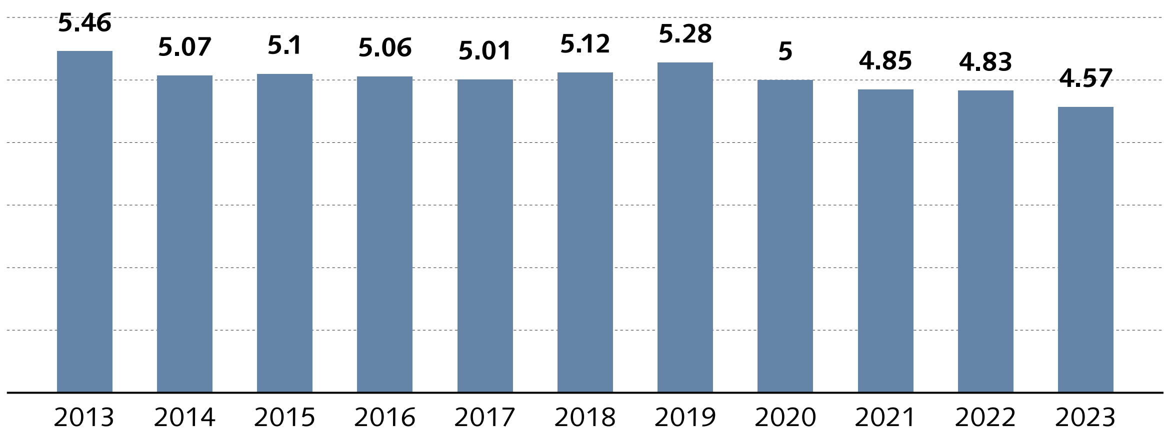

Figure 10: Comparison of power consumption [GWh]

Electrical power is mainly used for lighting, powering IT infrastructure and operating electrical devices/equipment in laboratories, workshops and studios as well as in general for the technical building equipment. Further savings in the power consumption are still advisable from an environmental and financial perspective.

3.3 Heating energy

The consumption data for the heating energy purchased is also obtained from the Naflima database of the Service Centre for Facility Management. In 2023, natural gas was the primary energy source. It was supplied directly and via a district heating network. It can be assumed that the natural gas is used almost exclusively to heat buildings and that consumption by laboratories is very low in comparison and therefore negligible. The university's heating requirements were 8.8 gigawatt hours in 2022 and 7.7 gigawatt hours in 2023.

Table 6: Comparison of heating energy demand

Year	Heating oil [kWh]	District heating [kWh]	Natural gas [kWh]	Total [kWh]
2014	0	973,815	8,752,777	**9,726,591**
2015	0	1,191,800	9,420,174	**10,611,974**
2016	0	1,151,010	9,921,623	**11,072,633**
2017	0	1,140,340	9,874,433	**11,014,773**
2018	137,200	1,238,430	9,660,783	**11,036,413**
2019	0	1,176,930	9,702,929	**10,879,859**
2020	0	1,124,970	8,114,044	**9,239,014**
2021	0	1,271,410	8,907,805	**10,179,215**
2022	0	1,055,020	7,733,094	**8,788,114**
2023	0	897,530	6,822,716	**7,720,246**

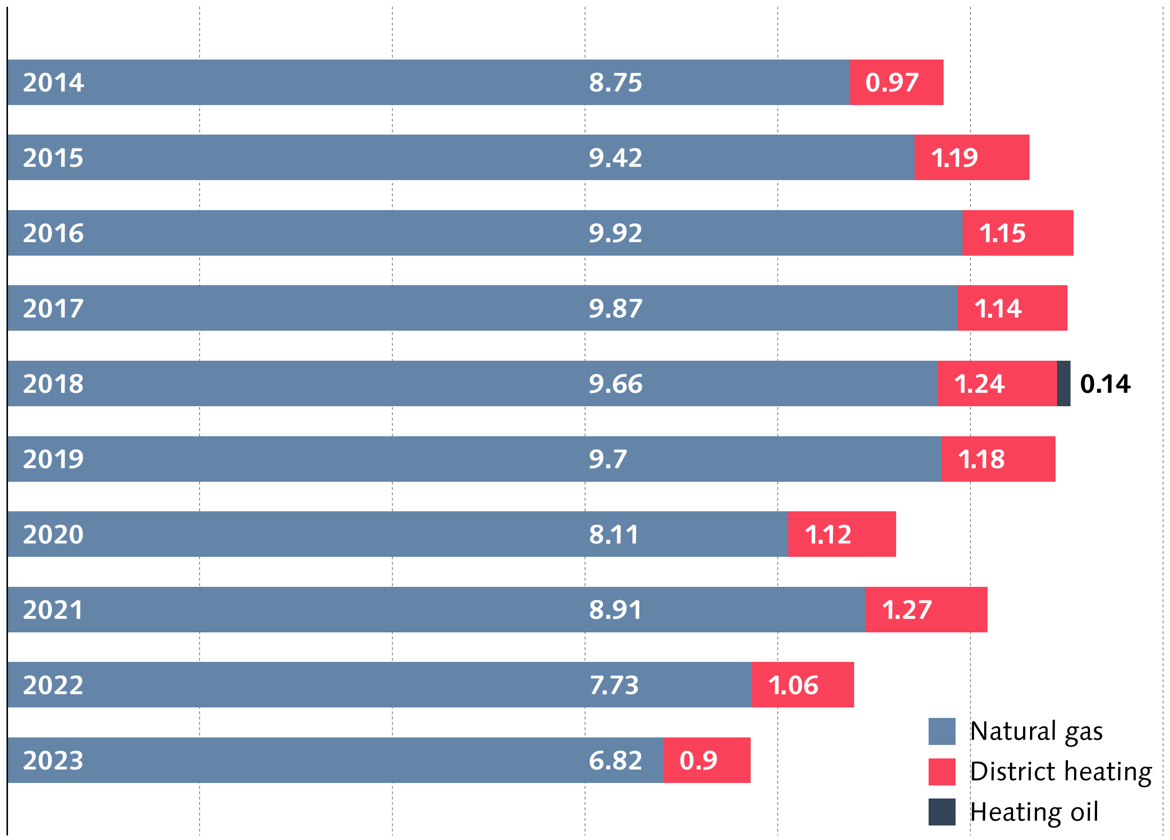

Figure 11: Comparison of heating energy demand [GWh]

In 2023, the CO_2 emissions from natural gas will be 10.4 % lower than the average for the previous four years. This corresponds to a saving of 29 % in the total heating demand in 2023 compared with the reference year of 2019.

These savings were achieved through retention of the centralised heating settings put in place in the wake of the energy crisis. It is the result of reduced flow temperatures and increased awareness among staff. Building work-related closures at Coudraystraße 7 led to further savings. The relatively mild winter in the reference year also had a positive effect. This is clear in the comparison with the degree day figures, which were determined using data from the German Weather Service (DWD 2023).

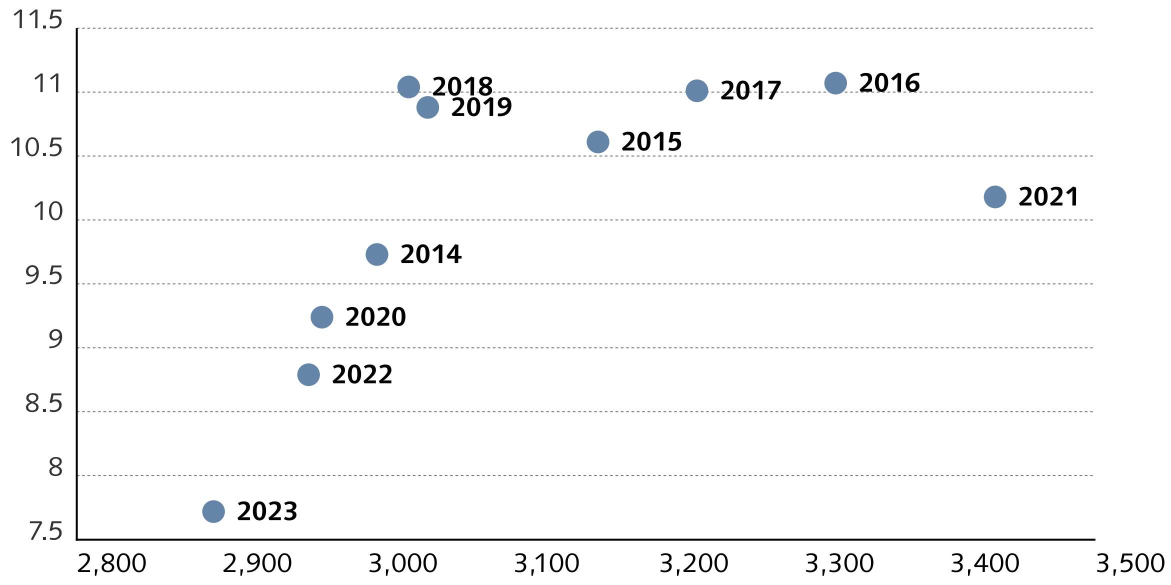

Figure 12: Degree days in relation to the heating energy demand

The specific CO_2 emissions are converted below to determine the total CO_2 footprint (UBA 2022). This results in a CO_2 footprint of 1,544.925 kilograms of CO_2 for heating energy in 2023.

Table 7: Emissions from heating

Energy source	Specific CO_2 footprint [g CO_2/kWh]	Heating output [kWh]	CO_2 footprint [kg CO_2]
Heating oil	266.4	0	0
District heating	200.1	897,530	179,608
Natural gas	200.1	6,822,716	1,365,317
Total		**7,720,246**	**1,544,925**

Technical measures must continue to be implemented to gradually reduce the emissions; the expertise and awareness among staff must in turn be increased.

3.4 Waste

The Service Centre for Facility Management records the volumes of waste. Different waste disposal companies are responsible for the disposal of different types of waste: Weimar's municipal utility company collects the domestic waste, organic waste and paper waste every two weeks; Remondis® collects the lightweight packaging, glass and, at irregular intervals, also bulky waste in skips. The waste for fortnightly collection is gathered in emptying containers with capacities of 60 l, 80 l, 120 l and 240 l as well as in large-capacity containers of 1,100l. The Bauhaus-Universität Weimar has a total of 111 emptying containers with a total volume of 53.9 cubic metres at its disposal.

Table 8: Overview of emptying containers in 2023

Year	Waste type	60l	80l	120l	240l	1,100l	Gesamtvolumen [l]
2023	Domestic waste	1	0	6	31	8	17,020
2023	Organic waste	0	1	8	17	0	5,120
2023	Lightweight packaging	0	0	0	0	7	7,700
2023	Paper	0	0	0	7	16	19,280
2023	Glass	0	0	0	6	3	4,740
2023	**Total**						**53,860**

No individual weighing is carried out on the vehicles during regular collection of the waste from the emptying containers by the municipal utility company. Hence no data is available on the amounts of these types of waste; this would be necessary to determine the CO_2 emissions from recycling. The total weight is therefore estimated according to the following assumptions:

- On average, the containers are 80 % full.
- The average waste densities correspond with the values indicated in Table 9.

Table 9: Average waste densities according to OTB (1997) and EAV (2023)

	Domestic waste[1,2] [t/m³]	Organic waste[2] [t/m³]	Lightweight packaging[2] [t/m³]	Paper[1,2] [t/m³]	Glass[2] [t/m³]
Fresh weight	0.17	0.57	0.11	0.18	1.2

[1] (OTB 1997) / [2] (EAV 2023)

The returnable containers are skips and rubble containers or file shredding bins. The weight is available as the waste disposal company indicates this in its invoices. The amounts of waste calculated for the emptying containers and returnable containers are shown below. According to the data, the largest individual waste type (excluding building materials) is domestic-type commercial waste, accounting for 95 tonnes (21.4 %). The waste materials collected separately (lightweight packaging, paper, glass) account for a total of 119.4 tonnes (27 %). A total of 443.4 tonnes of non-hazardous waste were generated at the Bauhaus-Universität Weimar in 2023.

Table 10: Waste volumes as per MUL (2012)

Year	Waste type	Emptying containers [t]	Returnable containers [t]	Total [t]	CO_2 footprint [t]
2022	Domestic waste	60.2	45.2	105.4	40.6
2022	Organic waste	60.7	0.0	60.7	0.6
2022	Green waste	0.0	44.1	44.1	0.5
2022	Lightweight packaging	17.6	0.0	17.6	12.3
2022	Paper	72.2	21.7	93.9	0.6
2022	Glass	24.5	0.0	24.5	0.0
2022	Building materials	0.0	53.5	53.5	
2022	Bulky waste	0.0	2.8	2.8	1.3
2022	**Total**	**235.2**	**167.3**	**402.5**	**55.9**
2023	Domestic waste	60.2	34.9	95.0	36.6
2023	Organic waste	60.7	0.0	60.7	0.6
2023	Green waste	0.0	71.2	71.2	0.8
2023	Lightweight packaging	17.6	2.8	20.4	14.3
2023	Paper	72.2	2.3	74.5	0.5
2023	Glass	24.5	0.0	24.5	0.0
2023	Building materials	0.0	89.0	89.0	
2023	Bulky waste	0.0	7.9	7.9	3.6
2023	**Total**	**235.2**	**208.2**	**443.4**	**56.3**

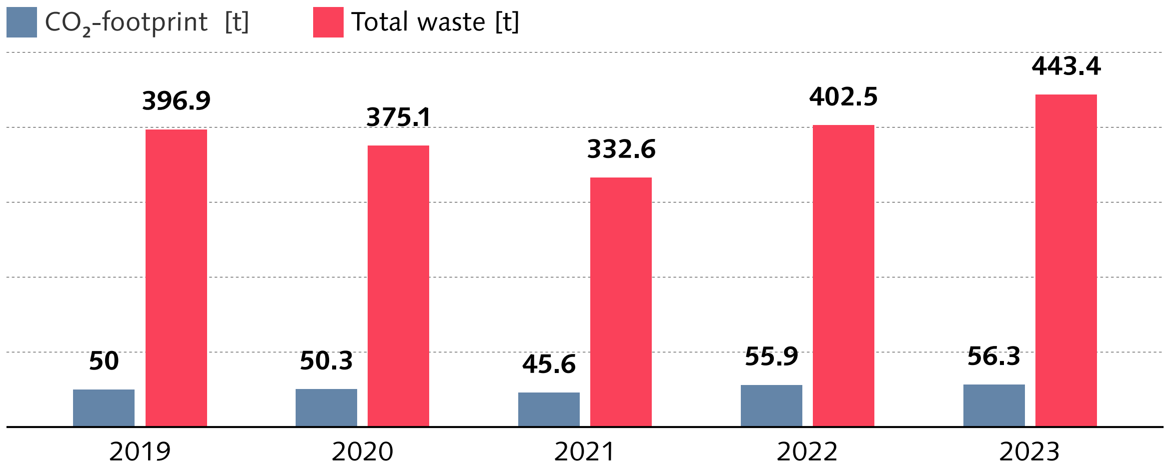

Figure 13: Comparison of waste volumes and CO_2 emissions [t]

A tool developed by the university of Leoben was used to calculate the CO_2 footprint (MUL 2012). In the accompanying study, the authors explicitly point out that the tool only applies to Styria to a limited extent. However, the region is suitable as a comparison scenario. The processing, treatment or recycling and disposal at landfill sites of waste material flows are taken into account. Transport routes, which would also have to be newly created for an individual case assessment in Weimar, are not considered. No data is available on the building materials. Ideally, a separate climate assessment should be conducted for the disposal paths of the Bauhaus-Universität Weimar; these would also be advisable from a waste law perspective.

A clear and reliable evaluation is not possible based on the estimates calculated for the waste containers, the exclusively manual recordkeeping for the large-capacity containers and the undocumented collection of glass. The following CO_2 footprint is based on the data for Styria from 2010/12 and should therefore only serve as qualitative evidence for the identification of CO_2 hotspots and not as a reliable indicator. The waste quantities and CO_2 emissions have been marked as incomplete accordingly in the overviews in Tables 1 and 2.

In the above figure on the waste volumes and CO_2 emissions, a stagnation in emissions can be discerned from 2022 to 2023, accompanied by increasing quantities. Though the amount of domestic waste decreased in 2023, the amount of lightweight packaging and bulky waste increased, which meant that the emissions remained almost constant overall.

In addition to the domestic-like types of waste such as domestic waste, organic waste, green waste, lightweight packaging, paper, glass, building materials and bulky waste, hazardous waste is also generated at the Bauhaus-Universität Weimar. The facilities must request its collection and this is then recorded centrally by the Service Centre for Facility Management using the European Waste Catalogue (EWC) codes (as indicated in the table below). The Hazardous Substances Officer additionally documents the quantities of hazardous waste produced by the Faculty of Civil Engineering. Remondis® classifies and disposes of the waste.

Environmental performance

Table 11: Statistics on hazardous waste in 2023

No.	EWC code	Waste type	Total
1	06 04 04	Waste containing mercury	0.04
2	07 03 04	Other organic solvents	0.96
3	08 01 11	Waste paint and varnish	0.04
6	11 01 05	Acid pickling solution	0.17
7	11 01 07	Alkaline pickling solution	0.26
8	16 02 13	Hazardous components	0.46
9	16 05 07	Inorganic solvents	0.08
10	16 05 08	Organic solvents	0.01
11	16 06 03	Batteries containing mercury	0.53
12	17 02 04	Windows	0.10
13	20 01 21	Fluorescent tubes	0.13
14	20 01 33	Other batteries and accumulators	0.05
15	20 01 35	Used equipment containing hazardous components	2.21
Total			**5.05**

Most of the hazardous waste is organic solvents or equipment such as data storage devices containing hazardous components.

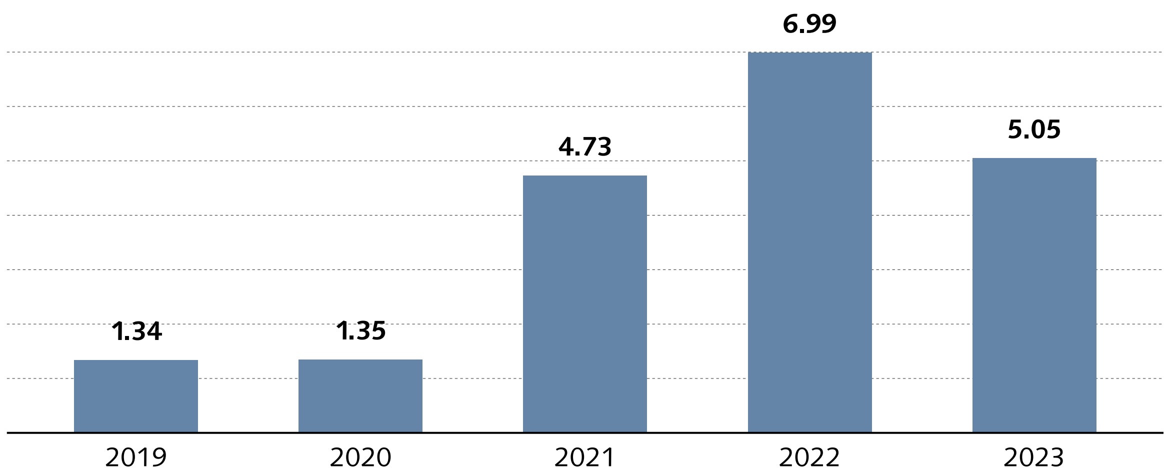

Figure 14: Comparison of hazardous waste volumes [t]

Due to the uncertainty regarding the specific emission factors, the CO_2 emissions from the recycling of hazardous waste has not been calculated. However, waste volumes will be a key metric that must continue to be monitored if an environmental management system is to be established.

3.5 Drinking water and wastewater

The Service Centre for Facility Management keeps a record of the annual drinking water and wastewater consumption data. Hence it can also be obtained from the Naflima database. The drinking water and wastewater consumption in recent years is shown below.

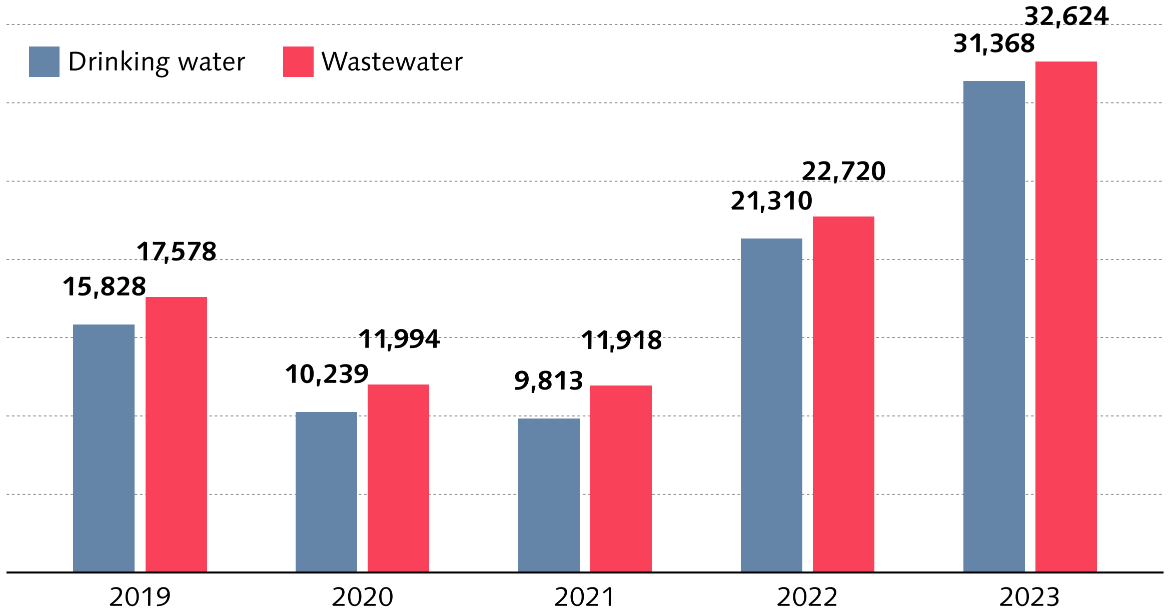

Figure 15: Comparison of wastewater and drinking water consumption [m³]

A significant increase in the quantities of wastewater and drinking water consumption can be discerned from 2022 onwards. Drinking water consumption increased by 98 % from the reference year of 2019 to 2023. These relatively high consumption values can be explained by the following events in the respective consumption years:

Reference year of 2022

- Defective pipes at Coudraystraße 10, which led to one-off consumption of 6,381 m³.

Reference year of 2023

- Accident in the building at Bauhausstraße 7b. This went unnoticed for a long time, resulting in one-off consumption of 17,480 m³.
- This represents around half of the total annual consumption

Table 12: Comparison of wastewater and drinking water consumption

	Drinking water [m³]	Wastewater [m³]
2019	15,828	17,578
2020	10,239	11,994
2021	9,813	11,918
2022	21,310	22,720
2023	31,368	32,624

Preventing malfunctions and accidents undoubtedly presents a major challenge. The in part old building stock and corresponding infrastructure mean that such issues cannot specifically be identified. Timely renewal of the infrastructure on a decisive scale cannot be expected. One way to detect issues in the drinking water system more rapidly would be to add a warning function to the (energy) monitoring system.

To calculate the CO_2 footprint of drinking water treatment, the specific primary energy requirement was first 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 town's municipal utility company (Stadtwerke Weimar) will be used for drinking water treatment (STW 2022). The value of 262.3 grams of CO_2 per cubic metre determined gives a total emission value for the drinking water supply of 2,574 kilograms of CO_2.

No specific wastewater disposal data is available for Weimar's wastewater treatment plants. The calculation is therefore based on the data obtained from literature, namely 120 litres per daily energy demand and a specific cleaning energy of 35.1 kilowatt hours per annual energy demand (KOL 2014). The energy consumption calculated of 0.8 kilowatt hours per cubic metre of wastewater, which is assumed to have been supplied using Weimar's municipal power mix, results in a specific CO_2 footprint of 139.4 grams of CO_2 per cubic metre. If this is multiplied by the university's wastewater consumption, the total footprint is 1,659 kilograms of CO_2.

Table 13: Specific emission factor and CO_2 footprint for drinking water and wastewater in 2023

Specific CO_2 footprint for drinking water [g CO_2/m³]	Total CO_2 footprint for drinking water [kg CO_2]	Specific CO_2 footprint for wastewater [g CO_2/m³]	Total CO_2 footprint for wastewater [kg CO_2]
262.3	2574	139.4	1659

The water consumption and specific emission factors are decisive in this calculation model. The CO_2 footprint can be reduced proportionally through lower water consumption.

These values could be reduced by introducing a warning system and using water responsibly. The specific emission values depend on the conventional power mix; the increased use of renewable energy is expected to lead to reductions in the long term.

Table 14: Comparison of CO_2 emissions from drinking water and wastewater

	2019	2020	2021	2022	2023
Drinking water [t CO_2]	4.2	2.7	2.6	5.6	8.3
Wastewater [t CO_2]	2.4	1.7	1.7	3.2	4.5
Total [t CO_2]	**6.6**	**4.4**	**4.3**	**8.8**	**12.8**

When consumption increases, the resulting CO_2 emissions also increase. These are estimated at 12.8 tonnes of CO_2 in 2023.

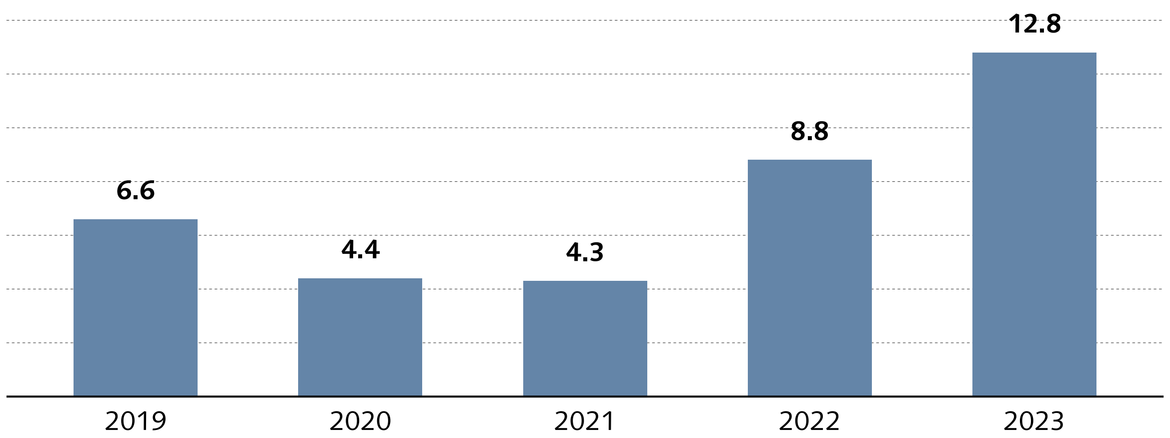

Figure 16: Comparison of CO_2 emissions from drinking water and wastewater [t CO_2]

Regardless of the CO_2 emissions, water is of crucial importance. The droughts in Germany and other EU countries in recent years show that a lack of water has serious consequences. The German federal government has adopted a national water strategy (BRG 2023), the raw values for water consumption will become highly significant accordingly.

3.6 Materials and procurement

It is widely recognised that greenhouse gases are not only emitted during the primary consumption of energy sources such as fuel, but also during the manufacture of products. Known as “grey emissions”, they exist for all consumer goods, regardless of their size. Hence procurement is another area for which the emissions are considered. It has not yet been possible to develop a system to calculate the CO_2 footprint for items procured by the Bauhaus-Universität Weimar. In this chapter, printer paper serves as an example for calculation of the CO_2 footprint of procured goods, as is purchased at regular intervals and well documented. This data can already be obtained from the finance department and serve as a basis for evaluation.

Large quantities of water, wood and energy are needed to produce printer paper. Indeed, large amounts of energy and water are still required to produce paper even if it is made from recycled fibres rather than from virgin fibres.

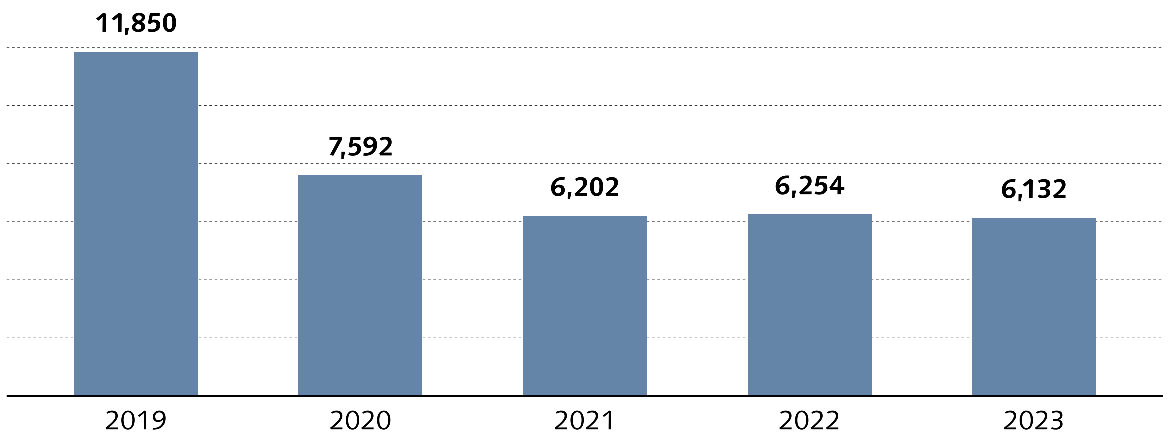

Figure 17: Comparison of procured printer paper [kg]

Paper consumption has been reduced by 48 % compared to the reference years of 2019 to 2021 and thus almost halved. This is most likely due to the reduced physical presence of employees and students. The extent that a change in behaviour has led to a reduced need for printed information cannot be determined from the available data however. The demand for paper appears to remain lower in 2022 and 2023.

The emissions calculated for printer paper are based on the procurement of standard DIN-A4 paper. The Bauhaus-Universität Weimar consumed 1,215,925 sheets of paper in 2021. With a sheet weight of 80 grams per square metre, the total weight is 6,202 kilograms. Initiative Pro Recyclingpapier offers an online calculator that can be used to determine the CO_2 footprint. It is 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 made of recycled fibres (886 grams of CO_2 per kilogram) or virgin fibres (1,060 grams of CO_2 per kilogram), the arithmetic mean is assumed to be 973 grams of CO_2 per kilogram, as in the previous year's assessment. This results in a CO_2 footprint of 6 tonnes for printer paper in 2021.

Table 15: Comparison of printer paper weights and emissions

Year	Sheets	Weight [kg]	Specific CO_2 footprint [g CO_2/kg]	Total CO_2 footprint [t]
2019	2,374,775	11,850	973	11.5
2020	1,477,800	7,592	973	7.4
2021	1,215,925	6,202	973	6.0
2022	1,215,750	6,254	973	6.1
2023	**1,206,400**	**6,132**	**973**	**6.0**

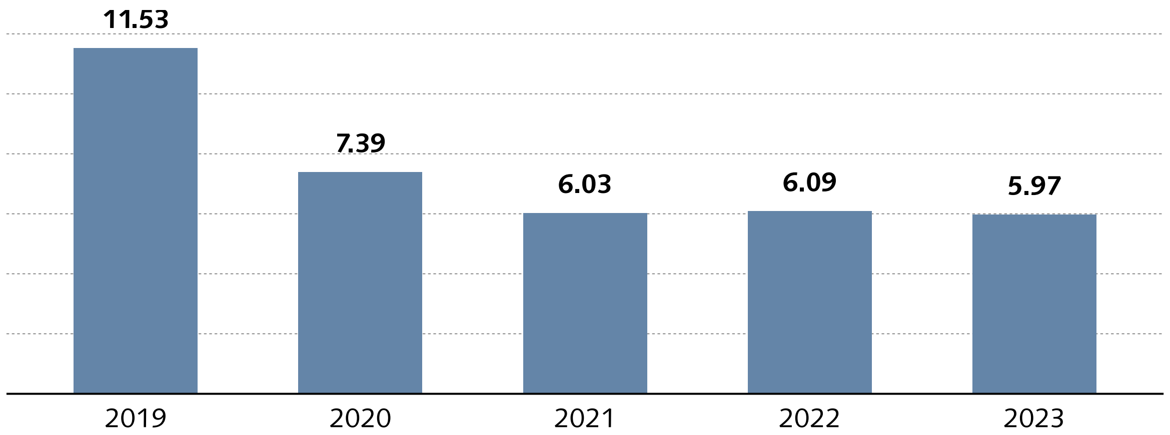

Figure 18: Comparison of CO_2 footprint for procured printer paper [t]

The sharp decrease in demand for paper since 2019 can clearly be discerned in Figure 18. Demand appears to be stabilising at approx. 6 tonnes of printer paper per year. Besides avoiding printing, the procurement and use of recycled printer paper is the most effective measure, as this has a significantly lower impact in all relevant environmental impact categories than paper made from virgin fibres (WDK 2022).

An assessment using the sustainability calculator of the Initiative Pro Recyclingpapier shows the savings for these environmental services when recycled paper is used consistently. (IPR 2023)

Table 16: Comparison of printer paper weights and emissions

Paper consumption	Paper weight [kg]	Wood weight [kg]	Drinking water [l]	Energy [kWh]	CO_2eq [kg CO_2]
Virgin fibre paper	0	12,965.90	303,079	78,252	5,966
Recycled paper	6,741	0	67,417	25,083	4,947
Absolute saving	–	–	235,661	53,169	1,018
Relative saving	**–**	**100.0 %**	**77.8 %**	**67.9 %**	**17.1 %**

By consistently procuring recycled printer paper, a CO_2 saving of 17.1 % could be achieved within this reporting framework. The consumption of wood, water and energy during production is another important environmental consideration.

While paper consumption is a classic, representative parameter for assessing the procurement category, it does not adequately reflect the entire scope of procurement. To gain more in-depth insights, a system must be developed that includes further procurement categories. The procurement policy last amended in 2011 lays out the internal guidelines for procurement. The aspects of environmentally-friendly and sustainable procurement have not yet been taken into account in this, however, hence it is currently being revised. (MDU 2011)

3.7 Summary of CO_2 emissions

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

Table 17: 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	4.3	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**	**2,137.2**	**100.0**
2022	Drinking water, wastewater	8.8	0.4
2022	Printer paper	6.1	0.3
2022	Vehicle fleet	29.7	1.5
2022	Waste	55.9	2.8
2022	Air travel	136.7	6.8
2022	Natural gas	1,758.6	88.1
2022	**Total**	**1,995.7**	**100.0**
2023	Drinking water, wastewater	12.8	0.7
2023	Printer paper	6.0	0.3
2023	Vehicle fleet	29.5	1.6
2023	Waste	56.3	3.0
2023	Air travel	224.9	12.0
2023	Natural gas	1,544.9	82.4
2023	**Total**	**1,874.4**	**100.0**

The emissions compiled in this report result in total CO_2 emissions of 1874.4 tonnes for the Bauhaus-Universität Weimar in 2023. This represents a 28.9 % reduction compared to the reference year of 2019. This can mainly be attributed to natural gas being used less to heat buildings.

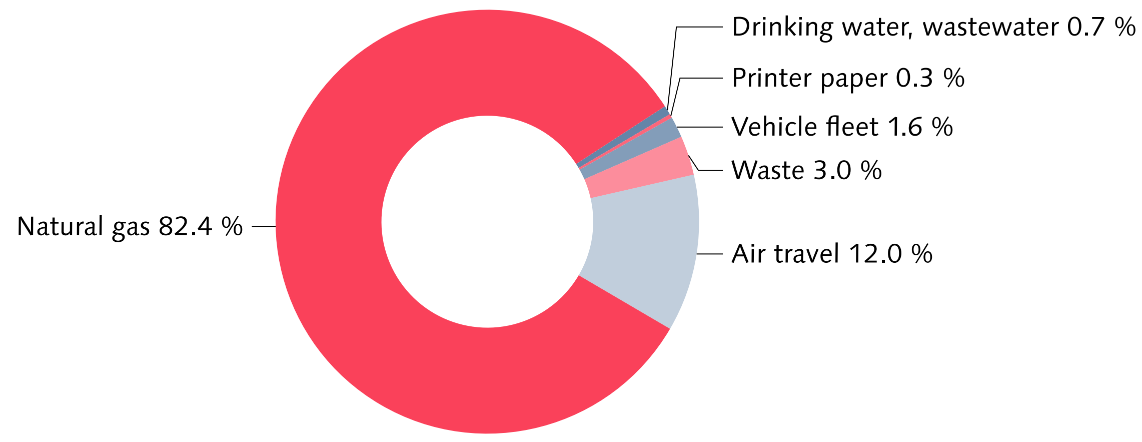

Figure 19: Share of CO_2 emissions in 2023

Natural gas

As in the previous years, natural gas once again caused the most emissions in 2023. However, with a value of 1,544.9 tonnes of CO_2, it led to fewer emissions than in 2019. Natural gas has a high specific share of 82.4 % overall due to a reduction in the other types of emissions. The use of natural gas for directly heating buildings or supplying district heating thus represents both the greatest potential for savings (with regard to the university's building stock) and the biggest challenge. Large-scale savings can only be achieved by investing in technological measures and more conscious behaviour by building users.

Power

The university obtains green power from Thüringer Energie AG, hence it does not contribute any CO_2 to the total emissions. Saving power remains an important target nonetheless.

Waste

The university produced 56.3 tonnes of waste in 2023. This accounts for 3 % of the total emissions – the third largest contributor to the total emissions. More than two thirds of the waste was collected from the emptying containers provided in fixed locations. The share of waste collected in returnable containers is subject to greater annual fluctuation.

Vehicle fleet

With a comparatively low share of 1.6 %, the university's vehicle fleet already constitutes the fourth largest contributor to emissions. The emissions appear to have stabilised at approx. 30 tonnes of CO_2.

Air travel

Air travel accounted for 12 % of the total emissions in 2023 and 224.9 tonnes of CO_2. It is thus the second largest source of emissions. With the travel restrictions in place during the Covid-19 pandemic now lifted, air travel once again accounted for a similarly high proportion of the emissions as in 2019. However, the distances travelled and number of flights are around one third lower than in the reference year of 2019. This trend appears to be continuing. In the year under review, an average of one in five flights were for travel of less than one thousand kilometres. Offsetting through specialist providers or regional initiatives would be one way to reduce the emissions from unavoidable air travel. As things currently stand, a joint state-wide initiative is being planned for this.

The total emissions are significantly lower in 2023 and 2022 than in 2019. In 2020 and 2021, the university premises were used less and mobility was restricted due to the Covid-19 pandemic. By contrast, the heating regime was adjusted in 2022 and 2023, which helped to reduce the total emissions. The ongoing monitoring of emissions over the coming years will determine the influence that technical and organisational measures actually have on reducing emissions at the university.

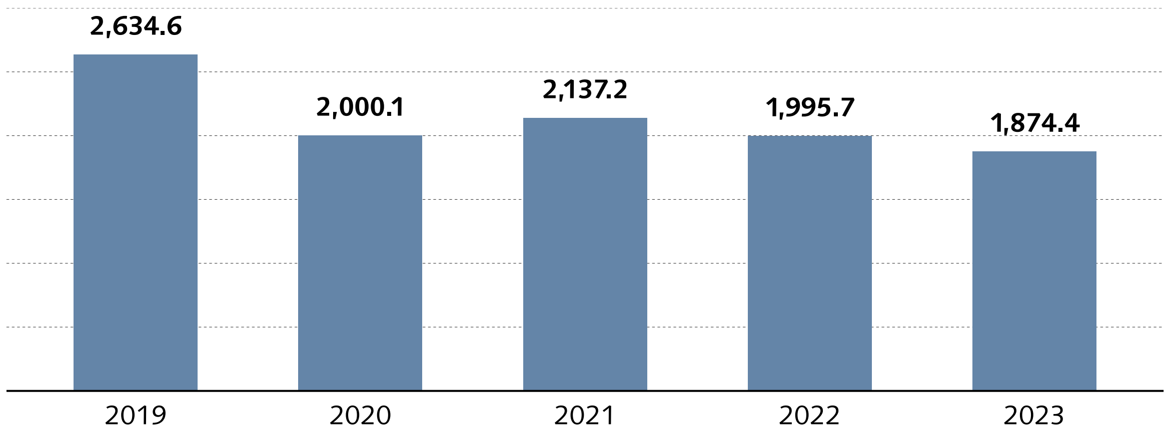

Figure 20: Comparison of annual CO_2 emissions at the Bauhaus- Universität Weimar [t CO_2]

Most of the emissions determined are caused by boundary conditions of building physics. The measures to reduce emissions should not focus exclusively on this area however.

- Some emissions vary every year and can well represent a significant share of the total emissions.
- This environmental report can only represent a portion of the emissions the university causes.

The extent of undocumented emissions can be assessed by classifying sources into scopes, each of which is differentiated according to their origin. The World Business Council for Sustainable Development, which is a community of more than 200 businesses, and the World Resource Institute (WRI) have introduced the »Greenhouse Gas Protocol« as a model that distinguishes between the following categories (WRI 2004):

Table 18: Scopes according to WRI (2004)

Scope	Definition / application at the university
Scope 1	Direct emissions from university-owned sources such as heating, vehicles, etc.
Scope 2	Indirect emissions from the purchase of power
Scope 3	Reporting category for indirect emissions from goods and services purchased outside the university

The environmental performance is presented in Table 19 below by scope, subdivided into the categories of fully recorded [X], partially recorded [(X)], not recorded [O] and not available [–].

Table 19: CO_2 emissions classified by scope

Emission type	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 primary energy consumption considered in Scope 1 relates almost entirely to the diesel and gas consumption and can therefore be measured. Scope 2 can also be measured in full. It relates to the power consumption, which can be obtained from the Service Centre for Facility Management. As the university obtains green power, the power consumption does not contribute to the CO_2 footprint. Comprehensive recording of the emissions in Scope 3 is a considerably more extensive undertaking. In some cases, it can only be calculated based on estimates and assumptions. Several possibilities for recording the Scope 3 emissions are detailed in Table 20.

Table 20: Possibilities for determining Scope 3 emissions

Emission type	Possibility for determining Scope 3 emissions
Business travel	• flight details (departure and destination airports, stopovers) • other means of transport (car, train, bus) • CO_2 footprint from daily travel
Vehicle fleet	• vehicle acquisition, maintenance/servicing
Power	• establishment of network operation (maintenance, connection, etc.)
Heating oil	
District heating	
Natural gas	
Waste	• weight of waste in emptying containers • hazardous waste
Drinking water	• town-specific parameters for drinking water treatment
Wastewater	• town-specific parameters for wastewater treatment
Printer paper	• other procurements

4 Research and teaching

4.1 Research

The research conducted at the Bauhaus-Universität Weimar is diverse, international and interdisciplinary.

The university's unique profile has its roots in the Bauhaus tradition and its combination of technical, scientific and creative/artistic work. In addition to the main research areas of

»Digital Engineering« and »Cultural Scientific Media Research«, there are further research fields such as »City, Architecture and Environment«, »Material and Construction« and »Art. Design. Science«, which play an essential role and help to shape the university's profile. The specialist areas are continually being developed further.

Societal challenges and profound changes in our environment today, such as the demographic shift, mobility, globalisation, multiculturalism and resource scarcity, make new concepts necessary for our urban and living space. New methods, theories and technologies are explored and tested comprehensively within this research field. They range from urban research and applied architectural research through theoretical and historical 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 technological developments rely on the availability of construction materials and other materials with tailored properties. Hence the development and use of building materials that take energy efficiency and environmental aspects into account form a key focus in both basic and applied research within this rapidly evolving research field.

For their part, media play a crucial role in the development of a sustainable, environmentally conscious society. Analysing the relationship between media and sustainability enables important insights into how media can be used to promote sustainable development. This relates to the use of media to raise awareness for sustainability issues, how media can support people's participation in sustainability initiatives or in what ways media can help to break down barriers for sustainability goals to successfully be achieved. Such research helps to identify and further solutions to the challenges that our society is facing.

In accordance with the »Guidelines for Transparency in Science and Research« that apply at universities in Thuringia, 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 details all third party-funded research projects currently underway at the Bauhaus-Universität Weimar. The de minimis limit is 5,000 euros. Projects below this threshold are reported in a summary. The funding amounts specified refer to the grants approved for the entire duration of the respective project.

The transparency guidelines and associated database can be viewed on the website of the Thuringian State Presidents' Conference (www.tlpk.de/downloads/transparenz-in-forschung-und-wissenschaft).

The projects detailed in the following selection serve as examples of the variety and diversity of topics relevant to the environment and sustainability for which projects were initiated at the Bauhaus-Universität Weimar in 2022 and 2023.

Organic coating system – Development of a new system of sustainable organic-based adhesion promoters and coatings based on liquid cellulose / Subproject: Development of a sustainable biocidal active system for coatings using liquid cellulose.
Faculty of Civil Engineering
Professorship: Construction Chemistry and Polymer Materials / F.A. Finger Institute for Building Materials Science (Prof. Dr.-Ing. Andrea Osburg)
Project duration: 1 December 2023 to 30 November 2025
Third-party funding: BMWK / Funding amount: €219,985.00

ThIWert 2.0 – Thuringian Innovation Centre for Recyclable Materials
Faculty of Civil Engineering
Professorship: Resource Management (Prof. Dr.-Ing. Eckhard Kraft)
Project duration: 24 November 2023 to 30 September 2028
Third-party funding: TMWWDG / Funding amount: €1,565,473.11

RED-OX-EMikro: Modular RED-OX combination process for the elimination of micropollutants in wastewater
Faculty of Civil Engineering
Professorship: Technologies of Urban Material Flow Utilisation (Prof. Dr.-Ing. Silvio Beier)
Project duration: 1 November 2023 to 28 February 2026
Third-party funding: BMWK / Funding amount: €218,739.00

GypsumFlow – Experimental development of organic cellulose-based fluidising agents for calcium sulphate binders / Subproject: Development of calcium sulphate self-levelling screeds using sustainable organic-based fluidising agents.
Faculty of Civil Engineering
Professorship: Construction Chemistry and Polymer Materials / F.A. Finger Institute for Building Materials Science (Prof. Dr.-Ing. Andrea Osburg)
Project duration: 1 October 2023 to 30 September 2024
Third-party funding: TMWWDG / Funding programme: FTI-Thüringen TECHNOLOGIE
Funding amount: €179,726.40 / BUW contribution (total funding: €394,511.04)

phoTECH – urban air: Photonic processes as a technological basis for cleaning indoor air, industrial air, biogenic air and urban air / Subproject 4.2: Active systems Faculty of Civil Engineering
Professorship: Biotechnology in Resource Management (Prof. Dr.-Ing. Eckhard Kraft
Project duration: 1 August 2023 to 31 July 2026
Third-party funding: BMBF / Funding amount: €818,309.10

phoTECH biogen: Photonic degradation of biogenic and industrial pollutants
Subproject 3.5: Photonic degradation of biogenic and industrial pollutants at the Bauhaus-Universität Weimar
Faculty of Civil Engineering
Professorship: Biotechnology in Resource Management (Prof. Dr.-Ing. Eckhard Kraft)
Project duration: 1 August 2023 to 31 July 2026
Third-party funding: BMBF / Funding amount: €293,927.67

WIR! alliance – Gypsum recycling – RC screed
Faculty of Civil Engineering
Professorship: Construction Materials / F.A. Finger Institute for Building Material Science (Prof. Dr.-Ing. Horst-Michael Ludwig)
Project duration: 1 August 2023 to 31 December 2025 / Third-party funding: BMBF | Funding amount: €423,236.22

Olivine-based cements – basic research for CO_2-neutral binders
Faculty of Civil Engineering
Project lead: F.A. Finger Institute for Building Material Science (Dr.-Ing. habil. Frank Bellmann)
Project duration: 1 July 2023 to 31 October 2025
Third-party funding: DFG / Funding amount: €197,004.00

WIR! alliance H2Well – energy4CHP: Design, modelling, development and implementation of a multi-source heating system with thermal component activation
Faculty of Civil Engineering
Professorship: Energy Systems (Prof. Dr. Mark Jentsch)
Project duration: 1 June 2023 to 31 December 2025
Third-party funding: BMBF / Funding amount: €912,698.51

ANCHOR – Anthropocene Nutrient and water Control for HOlistic resilience and Recovery
Faculty of Civil Engineering
Professorship: Biotechnology in Resource Management (Prof. Dr.-Ing. Eckhard Kraft)
Project duration: 1 May 2023 to 30 April 2026
Third-party funding: EU – INTERREG / Funding amount: €270,133.80

ReadyCarbonCret – Development of practical ready-mixed concretes for carbon-reinforced cast-in-place concrete components
Faculty of Civil Engineering
Professorship: Construction Materials / F.A. Finger Institute for Building Material Science (Prof. Dr.-Ing. Horst-Michael Ludwig)
Project duration: 1 May 2023 to 30 April 2025
Third-party funding: BMWK / Funding amount: €235,482.18

FarmWater – Water reuse in agriculture
Faculty of Civil Engineering
Professorship: Technologies of Urban Material Flow Utilisation (Prof. Dr.-Ing. Silvio Beier)
Project duration: 1 May 2023 to 28 April 2026
Third-party funding: BMBF / Funding amount: €335,124.10

WIR! alliance H2Well – pho2zon: Electrolysis oxygen for use in wastewater treatment – elimination of micropollutants through ozonation and photocatalysis – development, implementation and monitoring of ozonation using electrolysis oxygen treatment and coordination of implementation of the overall system
Faculty of Civil Engineering
Professorship: Energy Systems (Prof. Dr. Mark Jentsch)
Project duration: 1 May 2023 to 31 December 2025
Third-party funding: BMBF / Funding amount: €504,689.20

Enacting Gregory Bateson's ecological aesthetics in architecture and design
Faculty of Architecture and Urbanism
Project lead: Theory and History of Modern Architecture (Dr. Dulmini Perera)
Project duration: 1 February 2023 to 31 January 2025
Third-party funding: DFG / Funding amount: €119,831.00

EMI-V – Research Group for Emission Minimisation in Transport
Faculty of Civil Engineering
Professorship: Transport System Planning (Prof. Dr.-Ing. Uwe Plank-Wiedenbeck)
Project duration: 1 January 2023 to 31 December 2025
Third-party funding: TMWWDG / Funding amount: €247,388.46

WIR! alliance – RENAT.BAU – Reselekt – Resource-saving binders and concretes based on selectively crushed waste concrete / Subproject 1: Coordination, procurement of waste concrete, formula development and material characterisation
Faculty of Civil Engineering
Professorship: Construction Materials / F.A. Finger Institute for Building Material Science (Prof. Dr.-Ing. Horst-Michael Ludwig)
Project duration: 1 January 2023 to 31 December 2025
Third-party funding: BMBF / Funding amount: €484,870.39

WIR! alliance – RENAT.BAU – KALZTON – Development of artificial pozzolans using Thuringian clays, leftover materials and stockpiled materials, considering the firing atmosphere to achieve a cement-like firing colour and high pozzolanic activity / Subproject 2: Mortar and concrete
Faculty of Civil Engineering
Professorship: Construction Materials / F.A. Finger Institute for Building Material Science (Prof. Dr.-Ing. Horst-Michael Ludwig)
Project duration: 1 January 2023 to 31 December 2025
Third-party funding: BMBF / Funding amount: €114,974.88

Experiment-supported development of an engineering model to describe the effects of frost on sustainable concretes
Faculty of Civil Engineering
Professorship: Construction Materials / F.A. Finger Institute for Building Material Science (Prof. Dr.-Ing. Horst-Michael Ludwig)
Project duration: 1 December 2022 to 30 November 2025
Third-party funding: DFG / Funding amount: €304,100.00

StrohGold – Load-bearing lightweight straw construction
Architecture and Urbanism
Professorship: Structural Design (Prof. Dr.-Ing. Jürgen Ruth)
Project duration: 1 October 2022 to 30 September 2024
Third-party funding: Federal Office for Building and Regional Planning within the Federal Institute for Research on Building, Urban Affairs and Spatial Development / Funding amount: €160,349.71

RENAT.BAU – database
Faculty of Civil Engineering | Professorship: Construction Materials / F.A. Finger Institute for Building Material Science (Prof. Dr.-Ing. Horst-Michael Ludwig)
Project duration: 1 October 2022 to 30 September 2025
Third-party funding: BMBF / Funding amount: €168,905.10

INNOWATER – Innovative, knowledge-based neighbourhood development for energy and resource-efficient living
Faculty of Civil Engineering
Professorship: Technologies of Urban Material Flow Utilisation (Prof. Dr.-Ing. Silvio Beier)
Project duration: 16 September 2022 to 31 August 2023
Third-party funding: DBU / Funding amount: €120,957.00

WIR! alliance – Gypsum recycling – Setting regulator / Subproject 1: Preparation, material characterisation and formula development
Faculty of Civil Engineering
Professorship: Construction Materials / F.A. Finger Institute for Building Material Science (Prof. Dr.-Ing. Horst-Michael Ludwig)
Project duration: 1 September 2022 to 31 August 2025
Third-party funding: BMBF / Funding amount: €437,642.69

InMeA: Intelligent methods for the automated comprehensible analysis of extensive infrastructure, traffic and environment data
Faculty of Civil Engineering
Professorship: Stochastics and Optimisation – Institute of Structural Mechanics (Prof. Dr. rer. nat. Tom Lahmer)
Project duration: 1 September 2022 to 31 August 2025
Third-party funding: BMBF / Funding amount: €555,125.26

HoLa – High-performance charging for long-haul trucking
Faculty of Civil Engineering
Professorship: Infrastructure Economics and Management (Prof. Dr. Thorsten Beckers)
Project duration: 1 September 2022 to 31 December 2024
Third-party funding: BMDV / Funding amount: €366,166.32

Research and teaching

HBVSens – Hybrid timber bridges with adhesive bonding / Subproject 1: Research into long-term load-bearing behaviour under mechanical and thermal stress Faculty of Civil Engineering
Professorship: Steel and Hybrid Structures (Prof. Dr.-Ing. Matthias Kraus)
Project duration: 1 August 2022 to 31 July 2025
Third-party funding: BMEL / Funding amount: €263,046.84

VertiKKA2 – Implementation, monitoring and further development of the vertical climate control system
Faculty of Architecture and Urbanism
Professorships: Technologies of Urban Material Flow Utilisation (Prof. Dr.-Ing. Silvio Beier), Building Physics (Prof. Dr.-Ing. Conrad Völker)
Project duration: 1 July 2022 to 30 June 2024
Third-party funding: BMBF / Funding amount: €548,414.64

Bauhaus.MobilityLab-EcoSys (extension)
Faculty of Civil Engineering
Professorship: Transport System Planning (Prof. Dr.-Ing. Uwe Plank-Wiedenbeck)
Project duration: 1 April 2020 to 31 March 2023 / Extension: 22. April 2022
Third-party funding: BMWi / Funding for project extension: €240,383.23 | New total funding amount: €2,113,646.20

GeoFlow – Identifying mechanisms of action of conventional superplasticisers and novel organic-based superplasticisers in calcium-free geopolymer model systems Faculty of Civil Engineering
Professorship: F.A. Finger Institute for Building Material Science – Construction Chemistry and Polymer Materials (Prof. Dr.-Ing. Andrea Osburg)
Project duration: 1 April 2022 to 31 September 2024
Third-party funding: DFG / Funding amount: €474,883.00

4.2 Teaching

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 2022 and 2023 degree programme portfolios, the undergraduate degree programmes with a predominant focus on the environment and ecological sustainability include the degree programmes in »Environmental Engineering« and »Urban Studies«. Relevant master's degree programmes include »Building Physics and Energy-Efficient Building Design«, »User-Oriented Building Renovation«, »Environmental Engineering« and »Water and Environment«. The master's degree programmes in »Construction Materials Engineering« and »Natural Hazards and Risks in Structural Engineering« include more 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 degree programmes mentioned comprise a largely recurring range of modules and are implemented by the Faculty of Architecture and Urbanism and the Faculty of Civil Engineering.

The Faculty of Architecture and Urbanism also aims to heighten its focus on the environment and sustainability through the master's degree programme in »European Urban Studies«. The subject area was expanded by creating and filling part-time positions within the fields of »Climate Integrated Architectural Design« and »Sustainability Practices«.

The »Planning.Constructing.Heritage« research focus within which the aspects of heritage, sustainability and spatial justice are considered shapes teaching within the Faculty of Architecture and Urbanism. By reflecting on the more recent heritage at an early stage, extensive expertise has been gained in the current discussions on sustainability. This has allowed a credible leadership role to be taken as well as to the ability to guide the necessary shift towards a culture of transformation and orientation to existing structures in architecture and urban planning. This includes exploring the further development of existing premises to preserve the building substance.

One feature unique to the Bauhaus-Universität Weimar is its project-based courses. Their content mostly reflects current specialist subjects and topics in the public discourse. A great many project-based courses on the climate, environment and sustainability were implemented during the reporting period. The Faculty of Art and Design and Faculty of Media provide essential support for these project formats. The teaching project content is tremendously diverse, covering a whole array of subjects. Examples include the »Media Studies« and »Media Culture« degree programmes . These changing and recurring courses can be viewed in the archive of the Bauhaus-Universität Weimar's course catalogue.

As part of the celebrations marking 100 years of Bauhaus, a »Bauhaus.Semester« was held in the summer semester 2019. Countless cross-faculty courses with relevance to the environment and sustainability were offered. This new format has successfully been continued with the »Bauhaus. Modules«. In light of their special, tangibly cross-faculty character, attention is drawn specifically to these here. The following teaching formats relating to the environment and sustainability were implemented as part of the »Bauhaus.Modules«:

Table 21: Bauhaus.Modules relating to the environment in 2022 and 2023

Teaching format and responsible staff	Topic
Seminar: Bhattacharyya, F. Dossin, M. Karpf, H. Meier, J. Price, O., Trepte, J. Velazquez Rodriguez	Heritage Futures – Time Capsule
Seminar: P. Gotthard, M. Maldaner Jacobi, G. Seidelmann	PING-PONG-POCKET
Seminar: P. Koch, M. Maldaner Jacobi, S. Rudder, S. Signer	Solar Talks
Project: G. Biastoch, S. Kühlewindt, K. Steiger, E. Kraft, C.Hill	Textile Environments
Seminar: P. Sassi, M. Welch Guerra	Where should the journey lead? Critical perspectives on tourism
Tutorial: J. Heinemann, H. Storck	Naturwerk – A sound sculpture for Nohra landscape park
Seminar: F. Eckardt	HerCity Weimar – Concepts for gender-sensitive planning
Project: C. Völker, A. Benz	Bauhaus Urban Energy Hub – Module 2: Technical planning
Seminar: C. Wündsch, J. Zorn	Entrepreneurship & Innovation: Biodiversity Challenge!
Seminar: J. Ruth, L. Daube, K. Linne	ClayLab
Seminar: A. Brokow-Loga, F. Lackus	Housing issues and the climate crisis
Project: A. Palko	New environmental aesthetics
Specialist module: M. Wehrmann	Time | Forest | Media – A Bauhaus of the forest

Teaching format and responsible staff	Topic
Project: E. Kraft, S. Berner, D. Gaeckle, F. Wehking, P. Müller, S. Mehlhorn	After the Co(al)lapse: Envision the future!
Project: C. Völker, L. Benetas, J. Arnold	Bauhaus Urban Energy Hub – Module 4: Construction phase
Seminar: F. Lackus, J. Hülsmann, D. Müller	Who creates land? In search of the creators of landscape in Thuringia
Seminar: M. Marcoll	KlasseKlima@Bauhaus
Scientific module: A. Toland	Toxic Commons: Attending to the aftermath of energy economies
Seminar: J. Ruth, L. Kirschnick	Wood-Lab – Trash to Treasure
Seminar: H. Sander, K. Ziebarth	Another world is possible – Challenging green capitalism
Seminar at the SDG Campus: N. Baron, F. Eckardt	The UN Sustainable Development Goals in practice
Project: C. Völker, L. Benetas, J. Arnold	Bauhaus Energy Hub – Module 5: Planning interior fittings & energy self-sufficiency

Participation in self-learning programmes on the »SDG Campus« is currently being trialled. The Bauhaus-Universität Weimar cooperates with the HCU Hamburg here. Four further modules are currently being developed.

4.3 Entrepreneurship

The Startup Hub »neudeli« serves as a central contact point for members of the university interested in setting up a business. Together with relevant university stakeholders, it supports the development of academic start-ups and spin-offs. The special profile of the Bauhaus-Universität Weimar, with its interplay of science, art and technology, harbours great potential for innovative, creative and sustainable business ideas that will make our society more diverse and sustainable. In addition to technology-oriented and creative/artistic start-ups, environmentally-friendly and socially-sustainable ideas are also supported. Examples of start-up projects from 2023 include:

trans.forma_
Iffat Khan, David Beckert
Tackling the plastic waste crisis by using recycled LDPE plastic waste from retailers to make shade sails, jackets, bags and furniture.

FABILE
Anna Haag
Durable and stylish solid furniture made from regional woods and manufactured in Thuringia.

E-TERRY
Martha Wenzel, Michael Rieke, Fabian Rösler
An autonomous field robot designed to make farming easier and more sustainable for farmers.

5 Contribution to sustainability

This report marks the fifth anniversary of presentation by students of a list of demands to the President for a »climate-neutral Bauhaus-Universität Weimar«. The climate working group formed in its wake developed various focal points such as identifying areas of action and conducting a preliminary assessment of the university's CO_2 footprint.

When the students' involvement ended in 2023, the working group was dissolved. The impetus provided by the working group has nonetheless helped to gradually increase the relevance of environmental protection and sustainability at the Bauhaus-Universität Weimar. Examples include creation of the full-time position of Environmental Officer and the Presidential Board's decision on short-haul flights for business travel.

A number of measures made effective contributions to sustainability at the university in the years under review. The Bauhaus-Universität Weimar is endeavouring to make its structural development sustainable. The Senate working group on campus development, which was responsible for preparing the campus development guidelines, was founded to this end. The Presidential Board elected in 2023 was responsible for electing the first Vice President for Social Transformation and forming a staff unit for sustainable development for the first time under . A sustainability team was set up on the initiative of the Vice President. It comprises the following members:

Dr. Ulrike Kuch
Vice President for Social Transformation
(since June 2023)

Dr.-Ing. Tonia Schmitz
Staff Unit for Sustainable Development
(since August 2023)

Steven Mac Nelly (MSc)
Environmental Officer
(since September 2022)

Milla Semisch (BSc)
Student – MSc in Urban Studies
(since September 2022)

Lukas Schulz
Student – BSc in Civil Engineering
(since April 2024)

Advisor:
Prof. Dr.-Ing. Eckhard Kraft
Climate Protection Officer
(since October 2020)

Table 22: Savings from conversion to LEDs in the University Library

Consumption	Reference year: 2020	2023	2024
Energy consumption [kWh/a]	109,874	65,549	51,874
Savings kWh/a compared to 2020	0	44,325	58,001
Savings [%]	0	40	53
Price for power [€/kWh]	0.2123	0.34	0.4
Costs [€/a]	23,326	22,287	20,749
Saving compared to 2020 [€]	0	1,040	2,577

Independent, functional sustainability working groups have been established within a number of organisational units at the Bauhaus-Universität Weimar.

These include:

- sustainability working group of the Faculty of Civil and Environmental Engineering,
- sustainability working group of the University Library
- socio-ecological spatial research working group
- StuKo sustainability department

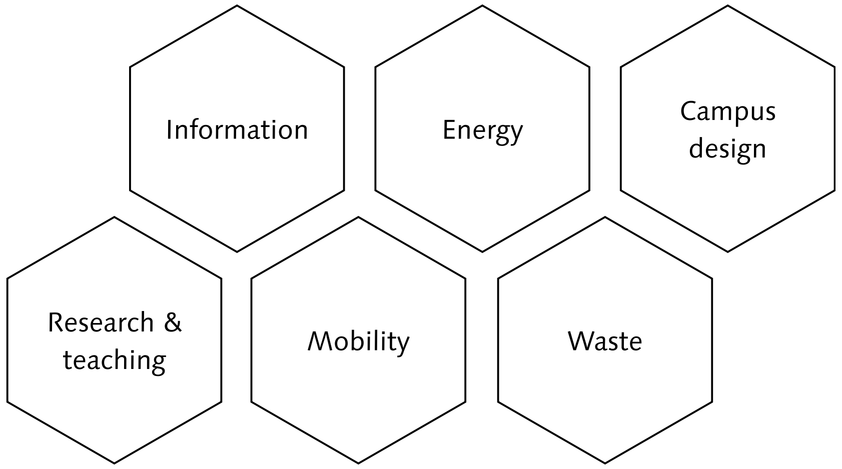

Figure 21: Areas of action

The current areas of action shown in Figure 21 are explained in greater detail below.

Information

Since the inaugural publication on the 2019 reporting year, the environmental report has become a relevant monitoring tool for all sustainability issues at the Bauhaus-Universität Weimar. This reporting system must be continued and adapted to the requirements of the university's strategy and restructured as necessary.

The energy crisis in 2022 and 2023 showed that information on energy consumption is hugely importance. A suitable system must be set up to monitor this and this in turn represents a building block in an energy management system.

Environmental and sustainability issues are increasingly attracting attention both inside and outside the Bauhaus-Universität Weimar. To cater to this interest, a website must be set up that communicates the relevant content on environmental aspects and sustainability.

The Bauhaus-Universität Weimar is a member of the German Society for Sustainability at Higher Education Institutions (DG HochN). Its workshops, seminars and opportunities for networking with other universities should be expanded effectively and made available to all university members.

The Bauhaus-Universität Weimar is committed to continuously improving its operational environmental protection. The Eco-Management and Audit Scheme (EMAS) should be considered as a means to safeguard this and ensure its independent review.

Energy

The successes to date show that great potential exists to save energy. This potential must be identified and also tapped into during future energy projects as part of the energy management.

The necessary human and financial resources must be provided here as well as a suitable organisational structure. An amount totalling 1 % of the annual budget could provide an effective basis for this type of project.

Mobility

A process is to be developed in cooperation with the state of Thuringia to compensate for unavoidable business travel by plane. The requirement to check the need to cover distances of less than 1,000 kilometres by plane is to be converted into a fixed regulation that members of the university are able to comply with in a comprehensible manner.

The new collective labour agreement reached by the federal states means that, in future, bike leasing will in principle be possible. However, the Free State of Thuringia is responsible for setting the requirements for implementation. The option of bike leasing should continue to be monitored and introduced rapidly when possible.

Waste

The need for a waste management officer has existed for some time now. To improve the waste disposal processes at the Bauhaus-Universität Weimar and to raise awareness among its members, a waste management officer is to therefore now be appointed.

All faculties, central university facilities and university administration must ensure separate collection and thus recycling wherever possible. This also applies for both teaching projects and student projects. Revision of the Procurement Policy should form the starting point for avoiding waste.

Research and teaching

The links between the diverse research projects and teaching should be made more tangible. Existing courses relating to the environment, ecological sustainability, resources and resilience should be marked specifically in the course catalogue. It is also being considered in this context whether new or re-accredited degree programmes should be evaluated to determine the extent to which they visibly contribute to the topic of sustainability. Alternatively, the links between the modules and the UN's SDGs could be identified and evaluated. The perception of sustainability should be defined individually for each study format. A fundamental evaluation of the curricular anchoring of sustainability topics must be initiated.

Campus design

The work within the Senate's working group for campus development has shown that the structural development of university buildings is a central component for achieving future sustainability goals. The guidelines for structural development of the campus drawn up by the working group explicitly address this and thus provide a basis for the future concept. Sustainable design of the campus should gradually be continued, monitored by an independent office for campus development. This work should focus on the conversion to a climate-neutral university, taking both qualitative and quantitative requirements into account as appropriate. Important projects for the coming years are outlined in the guidelines and include climate-neutral heating planning, further development of the university's outdoor facilities and ongoing determination of the space requirements.

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