Bauhaus-Universität Weimar

ENVIRONMENTAL REPORT 2019

BAUHAUS-UNIVERSITÄT WEIMAR

Preface

The Bauhaus-Universität Weimar is taking a direct approach to the global safety concern that is climate change. Climate neutrality and sustainability are to become the standard. Following on from student initiatives – such as the climate strike – the university has started the process of firmly embedding this issue. Volunteer activities such as the Climate Working Group or the establishment of the Climate Officer position contribute in this connection. This environmental report is an important milestone for the Bauhaus-Universität Weimar on its way to becoming a climate-sensitive and environmentally-protective university.

Within this context, the Bauhaus-Universität Weimar – being intrinsically motivated – has responded to a call for tender for the EU initiative »New European Bauhaus«. The New European Bauhaus is a creative and interdisciplinary initiative that connects the EU's »European Green Deal« with living spaces and experiences. The application phase was used intensively to become more familiar with the existing strengths from a sustainability perspective, and to connect these in a target-oriented manner. Climate neutrality and sustainability will serve as supporting pillars for the institution, influencing it and its public image in the long term.

I am delighted that we are able to transparently include the public in this process. On behalf of the entire Presidium, I would like to thank everybody involved, especially Prof. Dr.-Ing. Eckhard Kraft and his team for their conceptualisation, coordination and leadership in the preparation of the report, as well as for their comprehensive advice to the University Directorate and administration with regard to climate issues.

Prof. Dr. Jutta Emes
p.p. President of the Bauhaus-Universität Weimar

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Bauhaus-Universität Weimar

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1 Foreword

The Bauhaus-Universität Weimar draws on its historical role model BAUHAUS to find answers to key questions – not only societal – using methods of today. In the anniversary year 2019, the university was able to look back on 100 years of Bauhaus. By awarding the Bauhaus. Professorship to the Executive Secretary of the United Nations Climate Change Secretariat, Ms Patricia Espinosa, in the anniversary year, Bauhaus-Universität Weimar committed itself to a focus topic of global significance. This became very clear during an opening discussion round entitled »Diplomacy and Participation – Pathways to Sustainable Solutions in Climate Policy« with her at the beginning of the anniversary year. The challenges are nothing new. Half a century ago, the Club of Rome's report entitled »The Limits to Growth« reached a global audience. The ever-advancing stage of climate change and its tangible effects are triggering social discussions about sustainability. The incipient change in investment behaviour favouring a future for the environment brings to light a multitude of contradictions and questions for broad social strata. Bauhaus-Universität Weimar is taking a multifaceted approach to addressing these issues in teaching, art and research. To be perceived as a credible ambassador of solutions in this connection, the institution must strive transparently for climate neutrality and the sensible, sustainable use of resources. For this, a state of resilience is necessary. This will enable the university to identify areas of action, formulate goals and implement specific measures in a timely manner.

I am very pleased that this environmental report represents an honest and resilient basis of environmental performance, teaching and research. May the report be a starting point for iterative process loops that actively influence sustainability at the Bauhaus-Universität Weimar. This can be the basis for the institution achieving its own sustainability code, which will allow us to take an avant-garde approach to this crucial topic, too.

The future is now!

Prof. Dr.-Ing. Eckhard Kraft
Climate Officer at the Bauhaus-Universität Weimar

2 Bauhaus-Universität Weimar in Numbers

The Bauhaus-Universität Weimar is characterised by its experimental environment, its familial atmosphere and, above all, by the people who study, research and work within. In 2019 (WS 19/20), a total of 4,197 students – including doctoral candidates – were enrolled in the 39 degree programmes of the four faculties. The proportion of international students was 27.7 %. The Bauhaus-Universität Weimar had approximately 720 full-time equivalent staff employed, the majority of whom were scientific and artistic staff members.

Students	4.197
Professors	89
Scientific and artistic staff	220
Scientific project staff	150
Non-scientific project staff	140
Non-scientific staff	230
Trainees	15

The Bauhaus-Universität Weimar had an annual budget of approximately 73 million euros. In 2019, 14.6 million euros of this sum was attributable to third-party funding (Bauhaus-Universität Weimar 2019).

The university utilises 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 order and two have UNESCO World Heritage status. The proportion of leased main usable area amounted to 17.3% (17 rented properties).

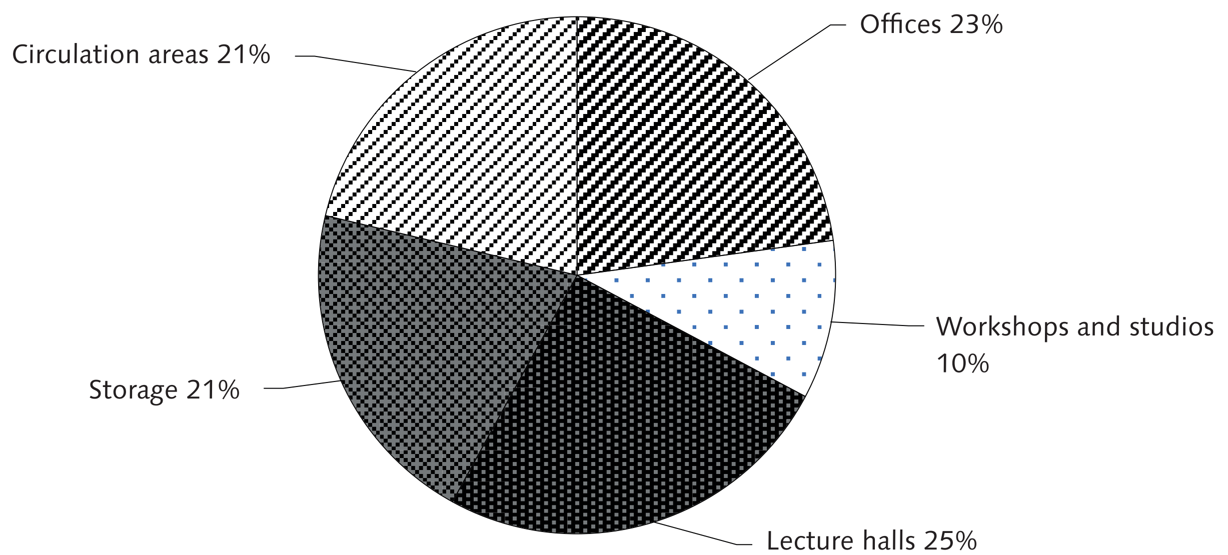


Figure 1: Usable area at the Bauhaus-Universität Weimar, 2019

3 Environmental Performance

Significant environmental emissions of the Bauhaus-Universität Weimar are now recorded; these can either be calculated from existing data or estimated. From the results, a CO_2 balance has been drawn up, hot spots pointed out and potential for savings and areas of action identified.

The following definition of environmental performance is based on DIN EN ISO 14001:2015, which defines environmental performance as measurable results related to the management of activities or services at the Bauhaus-Universität Weimar (BUW). Quantitative presentation and qualitative assessment of environmental performance are subdivided into the following categories: mobility; energy; waste; water and wastewater; and materials and procurement. An overall CO_2 balancing of all fields is subsequently determined. For a better overview and improved comparability, the described environmental performance for 2019 is presented as an overall overview in Table 1. The systematics, collection and evaluation of data are discussed in detail in the following sections of the chapter. In the interest of a uniform update of the environmental reports, a comparison of current consumption and emissions against the past 5-year average from 2014–2018 is presented in Table 1, insofar as data for these periods are available.

Table 1: Total consumption and emissions at the Bauhaus-Universität Weimar, 2019

		Performance	Change*
Air travel	[km]	1,734,388	
Vehicle fleet	[km]	167,686	
Electricity	[kWh]	5,281,744	+4%
Natural gas, heating oil	[kWh]	9,702,929	+3%
District heating	[kWh]	1,176,930	+3%
Residual waste**	[kg]	87,987	
LWP waste**	[kg]	17,708	
Paper waste**	[kg]	67,620	
Biowaste**	[kg]	63,177	
Water	[m³]	15,828	-18%
Wastewater	[m³]	17,578	-28%

*change in percentage compared to the 5-year average (2014–2018)
**incomplete data collection

Regarding environmental balances at Weimar dining halls, please refer to the Studierendenwerk Thüringen. An additional standardisation in terms of comparability of environmental performance ensues in accordance with DIN EN ISO 14031:2021, »Environmental management – Environmental performance evaluation – Guidelines«. For example, in each category, environmental performance is assessed in terms of a CO_2 equivalent so as to facilitate comparison across sectors. The corresponding overall overview of the CO_2 footprint from environmental performance is illustrated in Table 2.

Table 2: Total CO_2 footprint of the Bauhaus-Universität Weimar, 2019

		CO_2 footprint
flights	[t CO_2]	353,4
Vehicle fleet	[t CO_2]	38,5
Electricity	[t CO_2]	0,0
Natural gas, heating oil	[t CO_2]	1.941,7
District heating	[t CO_2]	235,5
Residual waste**	[t CO_2]	33,9
LWP waste**	[t CO_2]	12,4
Paper waste**	[t CO_2]	0,5
Biowaste**	[t CO_2]	0,6
Drinking water	[t CO_2]	4,2
Wastewater	[t CO_2]	2,5
Printer paper	[t CO_2]	11,5
Total	**[t CO_2]**	**2.634,7**

**incomplete data collection

In the following sections 3.1 to 3.6 environmental performance is explained in detail according to the subdivision from Table 2, the data basis is critically examined and initial conclusions are drawn with regard to completeness.

3.1 Mobility

In the area of mobility, basic distinction is made between business-related travel of employees and the university's own vehicle fleet. Trips made to and from the university by employees and students for the purpose of work and study, respectively, are excluded from the analysis.

Business-related travel

In 2019, systematic recording of employees' business-related travel was converted to the MACH-ERP system. This now allows targeted data queries concerning business-related travel, including the selected means of transport and travel distances. The previous management system does not allow targeted queries and, due to the inhomogeneity and quantity of the data, fully comprehensive individual evaluation is not possible. Thus, for the reference year 2019, only air travel within the scope of business-related travel was considered. This results in a sum of 556 individual flights from 278 outward and return flights, the majority of which is attributable to 326 flights (59 %) from within Europe; see Table 3. However, at 143.3t CO_2, transatlantic flights account for the largest proportion of total CO_2 emissions due to the longer distance travelled. The CO_2 footprint is calculated using the CO_2 calculator of the German Environment Agency (UBA 2021).

Environmental Performance

Table 3: Air travel by employees of the Bauhaus-Universität Weimar, 2019.

	Number of individual flights [-]	Distance travelled [km]	Emissions [t CO_2]
Europe	326	334,768	67.2
Asia	124	581,272	105.7
Americas	84	657,170	143.3
Africa	20	124,812	30.4
Oceania	2	36,366	6.7
Total	**556**	**1,718,250**	**353.4**

As described above, in the evaluation for 2019, only air travel can be considered. It may be assumed, however, that air travel generates the largest proportion of emissions. In any case, the conversion to the MACH-ERP system is to facilitate recording and evaluation of all business-related travel in future.

This includes trips with rental vehicles and private cars as well as train or bus journeys. The present report should therefore be viewed only as an initial stocktaking exercise. The scope of the balance will continue to refer to the employees of the Bauhaus-Universität Weimar.

Vehicle fleet

The vehicle fleet of the Bauhaus-Universität Weimar comprises eleven vehicles, which are differentiated in their function between the five segments Construction and Transport, Operational Technology (heating/sanitary, electronics), University Directorate, Internal Mail and the independent vehicle of the »Versuchstechnische Einrichtung« (experimental technology facility; VTE). The following data on kilometres driven, days of use and specific consumption are recorded and provided by the Service Centre for Facility Management – Vehicle Fleet. The two BMWs used by the University Directorate are leased vehicles with a term of one year; the annual exchange of these vehicles falls within the period under consideration. The consumption of both lease iterations was considered as a sum for the annual report; there is no separate differentiation between the models. The E-Citroën of the Internal Mail segment is an electric vehicle, whilst the remainder of the fleet runs on diesel. The Ford bus (9 seats), with an above-average mileage of 40,753 km (see Figure 2) and the BMW 730 and BMW 5 are used exclusively by the university's transport service. The Opel Astra, VW Caddy, and VW Crafter may be used freely by all members of the university.

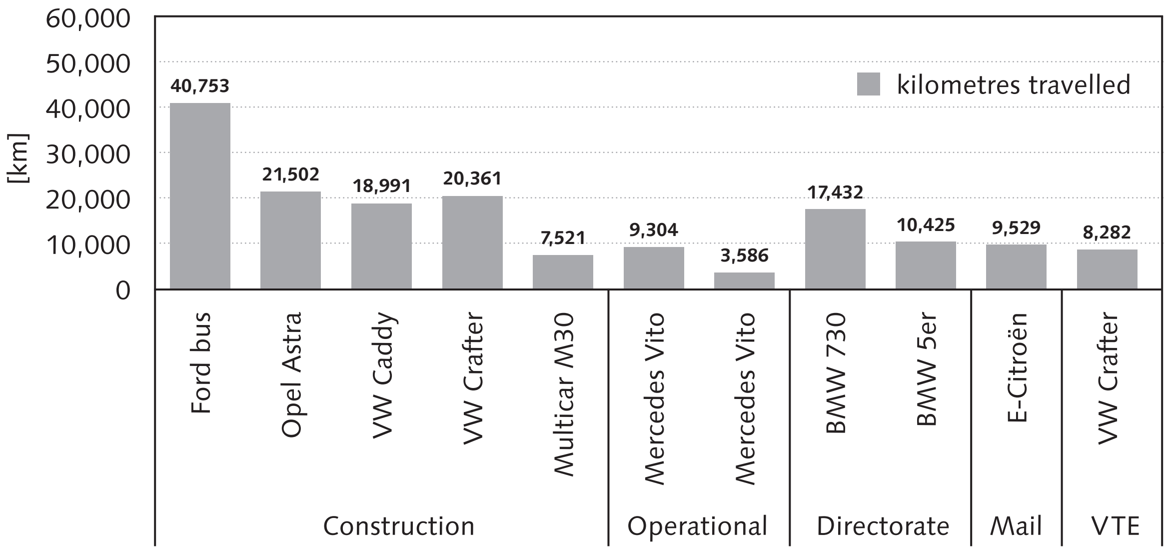


Figure 2: Mileage of the vehicle fleet of the Bauhaus-Universität Weimar vehicle fleet, 2019.

The CO_2 footprint of the vehicles listed in Figure 3 is not calculated on the basis of mileage, rather via the fuel consumption in litres documented in logbooks, or the specific CO_2 emissions of 2.65 kg CO_2/l Diesel (UBA 2016), at 35.87 MJ/L (AGEB 2018).

Excluded from the diesel CO_2 consideration is the E-Citroën of the Internal Mail segment (9,529 km), as this is operated with green electricity and is recorded at 0 g CO_2/kWh; see chapter 3.2 Electricity, p. 14. Operation of the E-Car requires an output of 1,991 kWh.

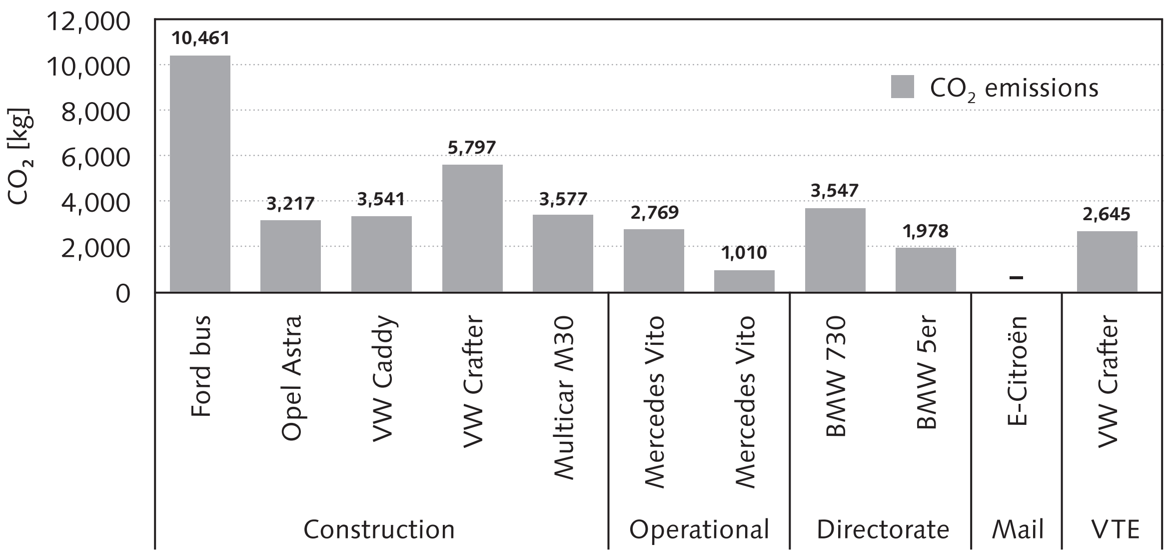


Figure 3: CO_2 footprint of the vehicle fleet of the Bauhaus-Universität Weimar, 2019

As expected, the high mileage of the Ford bus (approx. 40,000 km) also results in the highest CO_2 emissions. This is followed by the VW Crafter from Construction and Transport (approx. 20,000 km). In addition to the classification based on distance travelled, consideration of the vehicle fleet according to specific CO_2 emissions also makes sense. Such a consideration sees large vehicles such as the Multicar, the VW Crafter, the Mercedes Vitos and the Ford bus leading the statistics (>250 g CO_2/km); see Table 4.

Table 4: Key data and consumption of the vehicle fleet of the Bauhaus-Universität Weimar, 2019

	Distance [km]	Diesel [l]	CO_2 emissions [kg]	Specific CO_2 emissions [g CO_2/km]
Ford bus	40,753	3.941	10,461	257
Opel Astra	21,502	1,212	3,217	150
VW Caddy	18,991	1,334	3,541	186
VW Crafter	20,361	2,184	5,797	285
Multicar M30	7,521	1,347	3,577	476
Mercedes Vito	9,304	1,043	2,769	298
Mercedes Vito	3,586	381	1,010	282
BMW 730	17,432	1,336	3,547	203
BMW 5er	10,425	745	1,978	190
E-Citroën	9,529	(*1,991 kWh)	-	0
VW Crafter	8,282	997	2,645	319
Total	**158,157**	**14,519**	**38,541**	

*Consumption corresponds to the electrical work in kWh

3.2 Electricity

Electricity consumption of the Bauhaus-Universität Weimar is derived from the consumption and billing data of the Service Centre for Facility Management. These data were made available to the authors by the Service Centre for Facility Management in cooperation with the research project »Bauhaus2050: Energy efficient refurbishment of city quarters reducing CO_2 emissions allowing for heritage listed building stock in Weimar« of the professorships Building Physics (Prof. Dr. Conrad Völker) and Modelling and Simulation of Structures (Prof. Dr. Guido Morgenthal).

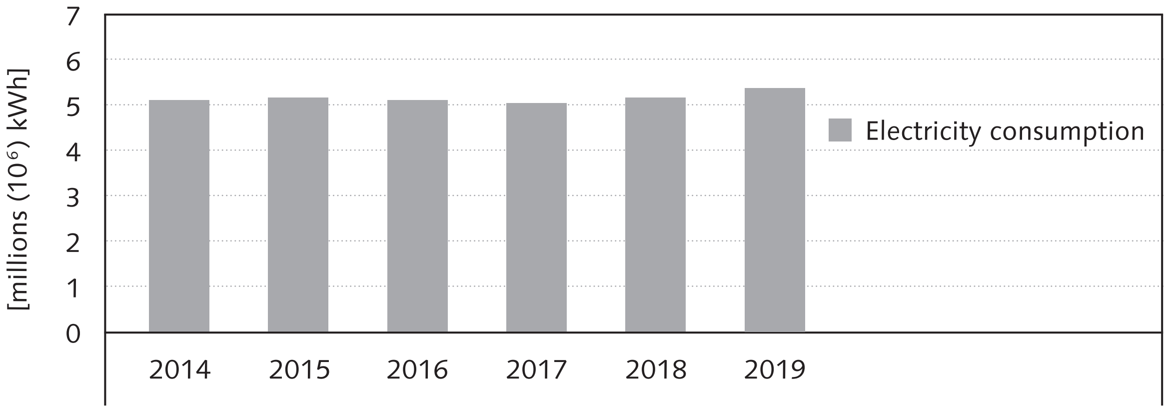


Figure 4: Electricity consumption at the Bauhaus-Universität Weimar, 2014 – 2019

As shown at the beginning in the overall overview (Table 1), electricity consumption in 2019 is 4% higher than the 5-year average from 2014 to 2018. The calculation basis is shown in Table 5.

Table 5: Electricity consumption of Bauhaus-Universität Weimar in kWh, 2014 – 2019

	Electricity consumption [kWh]
2014	5,069,258
2015	5,095,645
2016	5,057,364
2017	5,012,766
2018	5,122.415
2019	5,281,744

The Bauhaus-Universität Weimar obtains its electricity via a green electricity tariff from electricity supplier Thüringer Energie AG, which is based on a CO_2 footprint of 0.0 g CO_2/kWh. This results in a CO_2 footprint of 0.0 kg CO_2 for total electricity consumption in 2019; see Table 6.

Environmental Performance

Table 6: CO_2 footprint ensuing from electricity consumption of the Bauhaus-Universität Weimar, 2019

	Electricity consumption [kWh]	Specific CO_2 footprint [g CO_2/kWh]	CO_2 footprint [kg CO_2]
Electricity	5,281,744	0.0	0.0

3.3 Heating energy

The data basis for heating energy consumption is the consumption and billing database of the Service Centre for Facility Management. All heating energy is in the form of heating oil, district heating and natural gas. The total heating energy requirement of the Bauhaus-Universität Weimar amounts to 10,879,859 kWh, as illustrated in Figure 5. In the reference year 2019, the energy requirement is composed of 9,702,929 kWh natural gas (89 %), 1,176,930 kWh district heating (11 %) and 0 kWh heating oil (0 %).

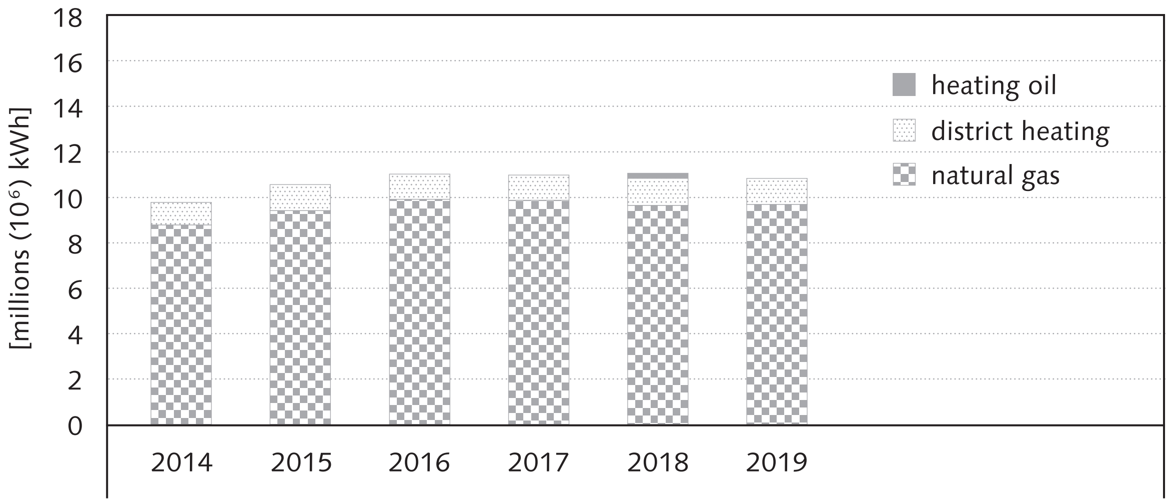


Figure 5: Energy consumption of the Bauhaus-Universität Weimar, 2014 – 2019

The numerical representation of the data series from Figure 5 can be seen for the years 2014 – 2019 in Table 7. As shown at the beginning in the overall overview (Table 1), the total energy requirement in 2019 is thus 3 % higher than the 5-year average from 2014 to 2018. Whereas heating oil and natural gas represent classic, fossil primary energy sources, district heating requires a more detailed top-down examination. This involves a gas-powered boiler in the building complex at Steubenstraße 6, 6a and 8. The gas boiler is located within the properties of the Bauhaus-Universität Weimar and is operated and maintained by the Weimar public utility company. However, it is not clear from the billing whether the kWh provided are billed in heat output or in kWh of natural gas. A distinction (inclusion of boiler efficiency) is necessary in the calculation of the CO_2 balance. In the further calculation, the second case – billed primary energy output of natural gas – was used.

Table 7: Energy consumption of the Bauhaus-Universität Weimar in kWh, 2014–2019

	Heating oil*	District heating	Natural gas
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

*Heating value heating oil: 9.80 kWh/l

Table 8 illustrates the conversion of specific CO_2 emissions per kWh into the total CO_2 footprint (UBA 2016). The heating value for heating oil was presumed to be 9.8 kWh/l for better comparability. For the heating energy consumption of the Bauhaus-Universität Weimar in 2019, this results in a CO_2 footprint of 2,177,206 kg CO_2.

Table 8: CO_2 footprint from heating energy consumption at the Bauhaus-Universität Weimar, 2019

	Specific CO_2 footprint [g CO_2/kWh]	Heating energy [kWh]	CO_2 footprint [kg CO_2]
Heating oil	266.4	0	0.0
District heating	200.1	1,176,930	235,520
Natural gas	200.1	9,702,929	1,941,687
Total		**10,879,859**	**2,177,206**

3.4 Waste

As with electricity and heating energy, the collection of data pertaining to produced waste is also carried out by the Service Centre for Facility Management. The disposal of different types of waste is also carried out by different waste management companies: household waste, biowaste and paper are disposed of fortnightly – and glass upon request – by the Weimar public utility company (municipal service), whilst the disposal of lightweight packaging (LWP) and extraordinary collections of bulk goods in skips are carried out by Remondis®. The fortnightly collection of waste ensues in waste containers with capacities of 60l, 80l, 120l, 240l or in mobile garbage bins (MGBs) with a capacity of 1,100l. In total, the Bauhaus-Universität Weimar has at its disposal 114 waste containers with capacities for 16.9 m^3 household waste, 5.4 m^3 biowaste, 7.7 m^3 LWP, 20.0 m^3 paper and 4.7 m^3 glass; see Table 9.

Table 9: waste containers

	60 l	80 l	120 l	240 l	1,100 l	Total
Household waste	1	-	5	31	8	**16,900 l**
Biowaste	-	1	8	18	-	**5,360 l**
LWP	-	-	-	-	7	**7,700 l**
Paper	-	-	-	10	16	**20,000 l**
Glass	-	-	-	6	3	**4,740 l**

During the regular collection of waste containers by the municipal service, no individual weighing is carried out on the vehicle. Due to this gap in data collection, the actual weight can only be estimated indirectly via literature and comparative values. Table 10 illustrates the average waste densities used in this report of the different types of waste. Furthermore, a specific filling level of 80% is assumed as an annual average for the waste containers. Due to the assumptions and uncertainties in the data collection, there are also uncertainties in the evaluation, the assessment of which is correspondingly imprecise.

Table 10: Average waste densities, according to (Ottow und Bidlingmaier 1997; EAV 2018)

	Household waste[1,2] [t/m^3]	Biowaste[1,2] [t/m^3]	LWP[2] [t/m^3]	Paper[1,2] [t/m^3]	Glass[2] [t/m^3]
Fresh	0.17	0.57	0.11	0.18	1.2

(1) Ottow and Bidlingmaier 1997, p. 145
(2) EAV 2018

The returnable containers are skips and rubble skips or document destruction bins. In these cases, the weight is transmitted directly by the waste disposal company via invoicing, meaning no conversion via literature and estimated values is necessary. The calculated waste volumes of the waste containers and returnable containers are shown in Table 11. According to the data, the largest individual waste type (excluding building materials) is domestic-waste-like commercial waste (household waste), accounting for 88.0 t (27.9 %). The separately collected waste materials LWP, paper and glass account for a total of 122.0t (38.7 %).

Table 11: Waste volumes of the Bauhaus-Universität Weimar, 2019 (MUL 2012)

	Waste containers [t]	Returnable containers [t]	Total containers [t]	CO_2 footprint [t]
Household waste	58.6	29.4	**88.0**	33.9
Biowaste	63.2	-	**63,2**	0.6
Green waste	-	37.1	**37.1**	0.4
LWP	17.6	0.1	**17.7**	12.4
Paper	72.8	3.8	**76.6**	0.5
Glass	27.7	-	**27.7**	0.0
Building materials	-	81.7	**81.7**	-
Bulky waste	-	4.9	**4.9**	2.2
Total	**239.9**	**157.0**	**396.9**	**50.0**

A calculation tool from 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 climate balance tool applies to Styria only to a limited extent. However, the region is suitable for the purpose of a comparison scenario. The processing, treatment or recycling and landfilling of waste material flows are considered. Transport routes, which would also have to be newly created for an individual case analysis in Weimar, are not considered. No data is available concerning building materials. In this context, a separate climate balancing for the waste management processes of the Bauhaus-Universität Weimar would be desirable.

Because of the data calculated concerning waste containers, the fact that recording of MGBs is only done manually and that, in the case of glass, disposal is not documented, unambiguous and reliable evaluation is not possible. The following CO_2 balance is based on data for Styria from 2010/2012 and should therefore only serve as qualitative evidence for the identification of CO_2 hotspots and not as a reliable indicator thereof. The waste volumes and CO_2 emissions were therefore marked accordingly in the overviews in Table 1 and Table 2.

In addition to the domestic-like types of waste, such as household waste, biowaste, green waste, LWP, paper, glass, building materials and bulky waste, the Bauhaus-Universität Weimar also generates hazardous waste. This waste is disposed of on demand by the facilities and is recorded centrally by the Service Centre for Facility Management using the waste code from the Abfallverzeichnis-Verordnung (German waste catalogue ordinance); see Table 12. In addition, the volumes of the Faculty of Civil Engineering are documented by the Hazardous Substances Officer. The waste is classified and disposed of by Remondis®.

Table 12: Hazardous waste of the Bauhaus-Universität Weimar, 2019

Waste code	Description	Menge [kg]
09 01 01	Water-based developer and activator solutions	317
09 01 04	Fixing baths	167
08 01 12	Paint and varnish waste	258
16 05 04	Gases containing hazardous substances in pressurised containers	6
16 05 06	Laboratory chemicals consisting of or containing hazardous substances	558
08 03 12	Printing ink waste containing hazardous substances	35

Conversion of the disposed of hazardous waste into a CO_2 quivalent footprint was dispensed with due to the undifferentiated classification.

3.5 Drinking Water and Wastewater

As in the above categories, the consumption and billing data of the Service Centre for Facility Management serves as the data basis for drinking water consumption and wastewater generation.

Development of the drinking water requirement and corresponding wastewater generation for the years 2014 to 2019 is illustrated in Figure 6. As shown at the beginning in the overall overview (Table 1), drinking water consumption in 2019 is 18 % lower than the 5-year average from 2014 to 2018. Wastewater generation is as much as 28 % lower than the 5-year average. The difference ensues from the year 2014, for which a large discrepancy between drinking water consumption and wastewater generation is listed. However, the determination of wastewater generation is not an actual measurement, but rather an indirect calculation on the basis of drinking water consumption. This is carried out by the municipal service. How this discrepancy emerged in 2014 is not clear from the data submitted. The data were nevertheless included in the 5-year trend. The underlying numerical calculation basis for the graphical representation in Figure 6 is listed in Table 13.

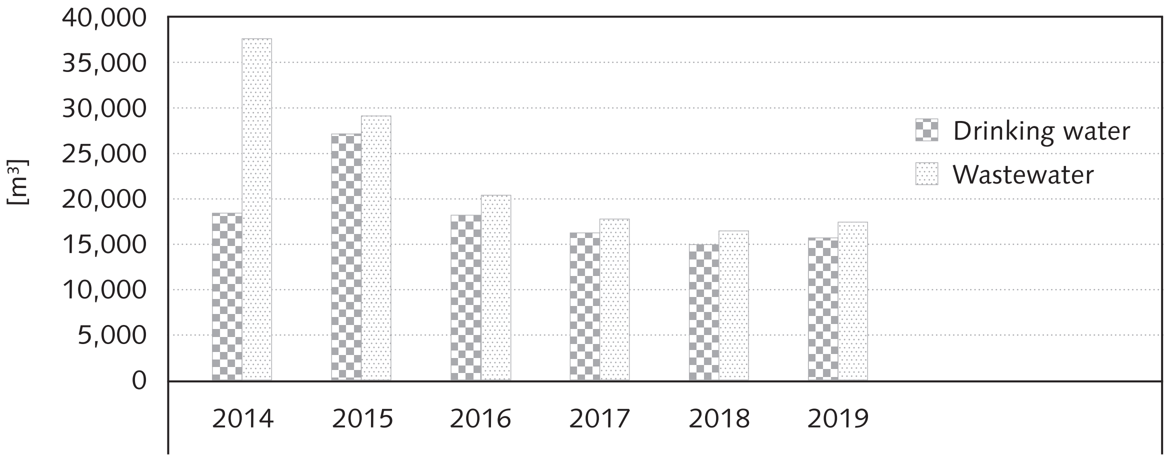


Figure 6: Drinking water consumption and wastewater generation at the Bauhaus-Universität Weimar, 2014 – 2019

Table 13: Drinking water consumption and wastewater generation at the Bauhaus-Universität Weimar in m³, 2014 – 2019

	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

For calculation of the CO_2 footprint, the necessary electricity and primary energy requirement for drinking water treatment and wastewater disposal and purification for Weimar must first be determined. No separate data on CO_2 equivalent expenditures are available from the public utility company; accordingly, assumptions had to be made in some cases, or – in the absence of key figures – reference had to be made to literature data. In the drinking water treatment of the Weimar public utility company, an energy consumption of 1.43 kWh per m³ of drinking water with 185 g CO_2/kWh applies (Wasserversorgung Weimar 2020). This results in the Bauhaus-Universität Weimar emitting 4,212 kg CO_2 in connection with the provision of treated drinking water. In the area of wastewater disposal, no city-specific key data are available for Weimar's wastewater utilities. The calculation is based on data from literature, for example a specific wastewater volume of 120 l/(PE·d) and a specific purification energy of 35.1 kWh/(PE·a) (Kolisch 2014). This results in a specific energy consumption of 0.80 kWh/m³ wastewater, which corresponds to 174 g CO_2/kWh in the municipal electricity mix of the Weimar public utility company (SW-Weimar 2020). The CO_2 footprint for the treatment of wastewater at the Bauhaus-Universität Weimar is thus 2,451 kg CO_2; see Table 14.

Table 14: CO_2 footprint from drinking water, wastewater at the Bauhaus-Universität Weimar, 2019

Specific CO_2 footprint Drinking water [g CO_2/m³]	Gesamt CO_2 footprint Drinking water [kg CO_2]	Spezif. CO_2 footprint Wastewater [g CO_2/m³]	Gesamt CO_2 footprint Wastewater [kg CO_2]
264.6	4,212	139.2	2,451

3.6 Materials and Procurement

The materials and procurement category covers numerous large and small procurements necessary for the operation of the university, research, project work and teaching. It has not yet been possible to develop a system for the documentation and balancing of all procurements. Utilisation of printer paper is used as an example for this discussion, partly because data concerning the use of printer paper are centrally recorded by the Service Centre for Facility Management within the scope of the »climate-neutral state administration 2030« project. Production of classic printer paper requires not only the raw materials wood and water, but also a great deal of energy. A large amount of energy is still required even when recycled paper is used as a substitute for wood fibres. Calculation of the CO_2 equivalent footprint for the use of printer paper is based on the consumption of ordinary DIN A4 paper. The Bauhaus-Universität Weimar thus consumes 2,374,775 sheets which, at 80 g/m², corresponds to 11.85 t of paper; see Table 15. The CO_2 balance of paper consumption is calculated using the online tool of the Initiative Pro Recyclingpapier, based on a study by the IFEU Institute (IPR 2006; IFEU 2006). A distinction is made in this connection between fresh fibre paper and recycled paper. Since it is not clear from the data collected whether fresh fibre (1,060 g CO_2/kg paper) or recycled paper (886 g CO_2/kg paper) is used, the average value (50:50) was used to calculate the footprint of 11.53 t CO_2; see Table 15.

Table 15: DIN-A4 paper consumption and CO_2 footprint of the Bauhaus-Universität Weimar, 2019

	Number of units [-]	Weight [t]	Specific CO_2-footprint [g CO_2/kg]	Total CO_2 footprint [t]
Paper	2,374,775	11.85	973	11.53

In future, it would be desirable to extend this to other areas of material procurement in the context of an environmental report. Although paper consumption is a classic parameter for measuring environmental balance, it is not sufficient to adequately represent the category of materials and procurement. To improve the data situation, priority should be given to developing a system for recording and balancing and to deriving guidelines for sustainable procurement.

3.7 CO_2 Footprint

The emissions presented above are compared and classified below. Total CO_2 emissions of the Bauhaus-Universität Weimar of 2,634.7 t CO_2 are presented in the form of a pie chart in Figure 2. This chart illustrates that heating energy (natural gas, heating oil, district heating), shown here as natural gas, accounts for the largest source of emissions by far (82.6 %) at the Bauhaus-Universität Weimar. At 1,176,930 kWh from the district heating supply and 9,702,929 kWh from direct consumption of natural gas, a total of 2,177.2 kg CO_2 is emitted. Due to the green electricity contract (0 g CO_2/kWh) of the Bauhaus-Universität Weimar, the electricity consumption of 5,281,744 kWh does not appear in the CO_2 balance. The second largest source of emissions (13.4 %) results from the employees' air travel, the sum of which is threefold the remainder of the combined emissions from the vehicle fleet, waste disposal, drinking and wastewater and the consumption of printer paper.

The overview in Figure 7 shows that natural gas and air travel account for more than 95 % of the CO_2 emissions. The greatest energy saving potential at the Bauhaus-Universität Weimar is therefore in the economisation of heating energy. It is important in this connection to investigate how the required heating energy can be reduced not only through structural and technical measures but also through improvements in regulation and control.

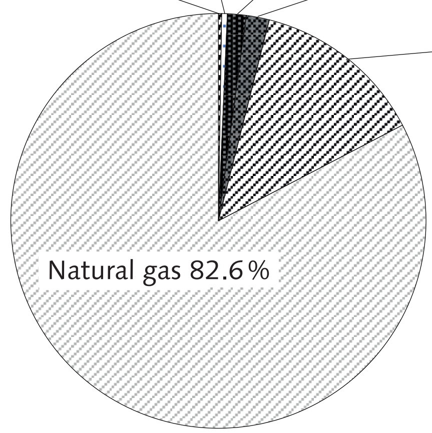


Figure 7: CO_2 balance by sector

Table 16: CO_2 balance by sector

		footprint CO_2 footprint	Proportion
Drinking water, wastewater	[t CO_2]	6.6	0.3 %
Printer paper	[t CO_2]	11.5	0.4 %
Vehicle fleet	[t CO_2]	38.5	1.5 %
Waste	[t CO_2]	47.4	1.8 %
Air travel	[t CO_2]	353.4	13.4 %
Natural gas	[t CO_2]	2,177.2	82.6 %
Total		**2,634.7**	

However, the focus of emission reduction should not be entirely on aspects of building physics. For example, the elimination of flights within Europe would reduce emissions from air travel by 19.0 %, or 67.2 t CO_2. In this context, sustainability strategies must also be developed for the other areas of action, such as vehicle fleet, waste disposal, drinking water consumption and procurement. However, the presentation of total emissions in Figure 7 only includes emissions that have already been recorded; undocumented emissions do not appear in the presentation. As described in the individual categories, it may be assumed that the presentation of emissions according to the subdivided environmental performance does not cover all emission sources of the university. The extent of the emission sources not covered can be estimated by looking at so-called scopes. Scopes distinguish CO_2 emissions by origin and were developed specifically for the evaluation of companies' climate balances. The model was introduced in »The Greenhouse Gas Protocol« by the World Business Council – an association comprising more than 200 companies – and the World Resource Institute (WRI). The scopes introduced therein differ as follows:

Scope 1 Direct emissions from university-owned sources such as heating, vehicles, etc.
Scope 2 Indirect emissions from the purchase of electricity
Scope 3 »Reporting category« for indirect emissions from goods and services purchased services that occur outside the university

Table 17 shows a graphical representation of environmental performance according to scopes 1 – 3. The labels are subdivided into: fully recorded X, partially recorded (X), not recorded O and not available –.

Table 17: Recording of CO_2 emissions according to scopes

	Scope 1	Scope 2	Scope 3
Business-related travel	-	-	(X)
Vehicle fleet	X	-	O
Electricity	-	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

Primary energy consumption such as diesel, electricity, heating oil and natural gas are already very well documented and can also be well balanced. It may be assumed that all scope 1 emissions are already recorded at the university and are included in the climate balance. Indirect emissions from the purchase of electricity (scope 2) are also recorded by the Service Centre for Facility Management. Due to the green electricity tariff of 0 g CO_2/kWh, however, electricity consumption does not appear in the CO_2 balance.
More difficult is the assessment of scope 3 emissions, such as emissions incurred via provision of energy sources (connection work, grid operation, tanker trucks, maintenance) or, in the case of the vehicle fleet, the production, maintenance and servicing of vehicles. There is also incomplete data regarding air travel (departure and destination airports, stopovers) and other business-related travel (private or leased vehicles, train travel, coach) of all members of the Bauhaus-Universität Weimar. Equally incomplete are the data concerning waste generation and waste management processes specific to Weimar, including transport routes. In this connection, determining city-specific parameters for the purpose of updating the environmental report would be desirable. Finally, consumption of copy paper naturally represents only a small proportion of all consumer goods procured by the university. A great deal of effort would be required with regard to data acquisition and CO_2 balancing in order to fully cover the area of procurement.

4 Research and Teaching

4.1 Research projects

Research at the Bauhaus-Universität Weimar is multifaceted, international and interdisciplinary. The unique university profile arises in the Bauhaus tradition from the 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 other research fields such as »City, Architecture and Environment«, »Material and Construction« and »Art.Design.Science«, which play an essential and identity-affirming role.

As the name suggests, the research area »City, Architecture and Environment« has a special connection to the environment. The social challenges and profound changes affecting our environment today - demographic shift, mobility, globalisation, multiculturalism, scarcity of resources - necessitate new concepts for the urban and living space. In this research field, new methods, theories and technologies are comprehensively explored and tested. The spectrum ranges from urban research and appliedarchitectural research to research of theory and history to ecology, energy, climate and infrastructure research. The framework for the university's cross-institutional research activities is formed by research training groups, its own institutes as well as renowned symposia and conferences.

Another research focus with special reference to environmental topics is »Materials and Construction«. Construction and materials have always determined technological progress in our society. New developments in technology require availability of construction and materials with specific and custom properties. The development and application of construction materials taking into account energy-efficient and ecological aspects in basic research as well as applied research therefore form an important part of this ever-developing area of research.

In accordance with the »Guidelines for Transparency in Science and Research« of Thuringian universities, a publicly available annual report on all of the university's ongoing research projects has been being published since 2017.

The report includes all third-party funded research projects the were active in the previous year. The de minimis limit is 5,000 euros. Projects below this threshold are reported in the form of a summary. The indicated funding amounts refer to the approvals for the total duration of the respective project.

The following selection of projects provides exemplary insight into the multitude of environmentally relevant topics currently being worked on within the scope of research projects at the Bauhaus-Universität Weimar starting in 2019. A database of all third-party funded projects at the Bauhaus-Universität Weimar can be found on the website of the Thüringer Landespräsidentenkonferenz (TLPK; Thuringian state presidents' conference).

Research and Teaching

Urban Rural Assembly (URA)
Subproject: Urban-Rural Landscapes & Spatial Typologies
Landscape Architecture and Planning
(Prof. Dr.-Ing. Sigrun Langner)
2019 to 2020; 98,315 euros; BMBF

MoveUrban – Investigation of governance options and operator models for space-efficient housing and mobility concepts in growing urban and new suburban neighbourhoods
Infrastructure Economics and Management
(Prof. Dr. Thorsten Beckers)
December 2019 to May 2022; 260,509 euros; BMBF

TRAIL2 – Transformation in Rural Areas 2
Subproject: dataTRAIL: For the systematic and efficient collection of data and processing of building energy quality standards
Building Physics
(Prof. Dr.-Ing. Conrad Völker)
November 2019 to October 2022; 776,638 euros; BMWi

smoodPLAN – Establishing a holistic system to improve energy efficiency in neighbourhoods Neighbourhood-related data acquisition and processing
Modelling and Simulation of Structures
(Prof. Dr. Guido Morgenthal),
Building Physics (Prof. Dr.-Ing. Conrad Völker),
Computer Vision in Engineering
(Prof. Dr.-Ing. Volker Rodehorst)
July 2019 to June 2022; 1,102,690 euros; BMBF

Sektorlyseur – Compact high-pressure electrolyser for integrated energy uses
Urban Energy Systems (Prof. Dr. Mark Jentsch)
June 2019 to May 2021; 135,982 euros; TAB

Twenty20 – HYPOS – Investment Project
Urban Energy Systems (Prof. Dr. Mark Jentsch)
June 2019 to December 2019; BMBF

MeSRa – Development of gravity-driven membrane purification plant for wastewater and partial streams
Urban Water Management and Sanitation (Prof. Dr.-Ing. Jörg Londong)
June 2019 to May 2021; 267,186 euros; BMBF

Photox – Use of photocatalytic ozonation at a municipal wastewater treatment wastewater treatment plant for the elimination of trace substances
Urban Water Management and Sanitation (Prof. Dr.-Ing. Jörg Londong)
June 2019 to May 2021; 183,468 euros; BMBF

VertiKKA – Vertical climate control system
Urban Bioengineering for Resource Recovery (
Prof. Dr.-Ing. Silvio Beier),
Building Physics (Prof. Dr.-Ing. Conrad Völker)
April 2019 to March 2022; 442,401 euros; BMBF

Innovative vulnerability and risk assessments of urban areas against flooding events Earthquake Damage Analysis Center
(Dr.-Ing. Jochen Schwarz)
February 2019 to January 2021; 283,878 euros; BMBF

4.2 Courses

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.

Undergraduate degree programmes with a focus on environment and ecological sustainability in the 2019 programme portfolio include the degree programmes »Bauingenieurwesen [Konstruktion Umwelt Baustoffe]« and »Urbanistik«. Regarding Master's degree programmes, the »Bauphysik und energetische Gebäudeoptimierung«, »Umweltingenieurwissenschaften« and »Wasser und Umwelt« degree programmes must be mentioned.

In future, the Bauhaus-Universität Weimar will also offer the Bachelor's degree programme »Umweltingenieurwissenschaften«. The Master's degree programme »European Urban Studies« also intends to hone its profile in the direction of the environment and sustainability. The subject area of environmental justice will be expanded with a postdoctoral position in »Spatial & Environmental Justice« within all urban studies degree programmes.

Teaching in the field of architecture will support and expand on the aforementioned thematic field with a new permanent position (80 %/0.8 FTE) with the denomination »Praktiken der Nachhaltigkeit«. In addition, a postdoctoral position in the field of »Climate Integrated Architectural Design« will be filled.

The environment thematic is also to be expanded in the Faculty of Art and Design. Ideas for a new degree programme with a focus on sustainability called »Art Design Technology« are currently being discussed.

In the course of the 100th Bauhaus anniversary, a one-off »Bauhaus.Semester« took place in the 2019 summer semester. This offered numerous cross-faculty courses with a focus on environment and sustainability. The continuation of individual courses from this special semester – so-called »Bauhaus.Modules« – is also intended beyond 2019. Within the »Bauhaus. Semester« and the »Bauhaus.Modules«, the following environmental- and sustainability-related teaching formats were offered (Table 18). The cross-faculty overview is the first of its kind in this subject area at the Bauhaus-Universität Weimar and is to be expanded and supplemented in the coming years.

Also under discussion is the proposal to specifically label existing courses on the topics of environment, ecological sustainability, resources and resilience in the course catalogue. In this context, another consideration is to examine new degree programmes, or new degree programmes to be accredited, in terms of the visible extent to which they are committed to the subject of sustainability. Alternatively, the link between the modules and the Sustainable Development Goals (SDG) of the UN could be identified and evaluated.

Table 18: Teaching formats with environmental relevance 2019

Teaching format and leadership	Topic
Summer school project: Dipl.-Ing. (FH) Philippe Schmidt M.Sc.	Cultural Landscapes & Urban Resilience
Project: J. Paulus, M. Weiland	Laboratory for the New Land - In a country after our time. Visions for the society of tomorrow.
Project: Prof. U. Plank-Wiedenbeck, P. Kohl, W. Mros, J. Uhlmann	bauhaus.mobil
Project: Prof. Dr.-Ing. E. Kraft, A. Lück, T. Schmitz	Sustainable and resource-saving festival planning using the example of the anniversary festival »Backup and Beyond – 20 years of backup_festival«
Lecture; J. Uhlmann, M. Rünker, Prof. Dr.-Ing. U. Plank-Wiedenbeck, P. Schmidt	International Case Studies
Project: Jun.-Prof. A. Toland, A. Ney	Degrow Design
Lecture series: N. Franz	The Coming Catastrophe
Project: Prof. Dr.-Ing. E. Kraft, Prof. L. Bachhuber, Prof. Dr.-Ing. J. Londong	Reassessing Material/Matter New Thinking
Project: Prof. Dr.-Ing. U. Plank-Wiedenbeck, M. Fedior, J. Uhlmann	Mobility as a Service
Tutorial: M. Günther, P. Knopf, J. Kühn	Ferns, pigeons & cows – an ecological community experiment
Draft: J. Kühn, M. Ahner, T. Ten Brummelhuis	0.1 MILLIGRAM IRON

5 Contribution to Sustainability

Sustainability is considered a guiding principle in the endeavour to shape societies of today, to facilitate the fulfilment of their legitimate interests and simultaneously secure and strengthen their future scope for development.

From the above explanations regarding the environmental aspect in research and teaching as well as the calculations on environmental performance, a very comprehensive picture of the status quo at the Bauhaus-Universität Weimar in 2019 has already emerged.

The German government's goal of climate neutrality by 2045 has been instrumental in the Bauhaus-Universität Weimar forming its own self-image of forging ahead with efforts to reduce its CO2 emissions. In addition, per end of 2019, 69 German municipalities and cities have already declared a climate emergency, which aims to measure all future local and political decisions concerning the issue of climate.

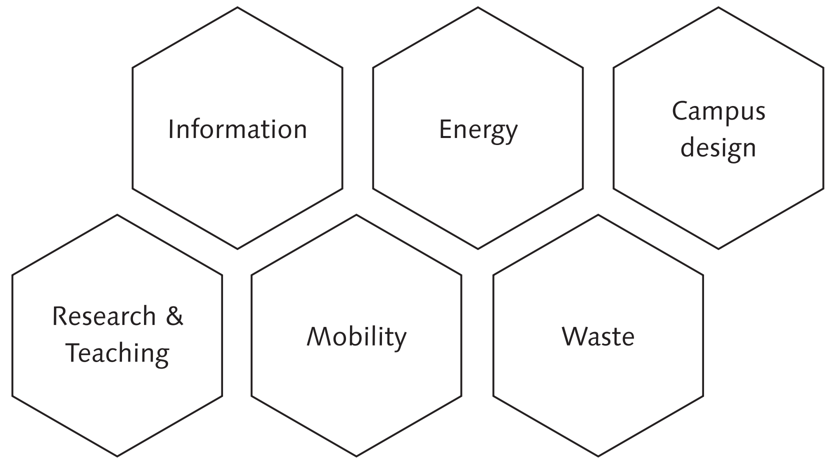
Students at the Bauhaus-Universität Weimar also clearly expressed their opinion in November 2019. They invoked a week-long climate strike. Very constructively, their goal was not the mere suspension of courses but the substitution of courses with teaching and discussion formats on sustainability, including climate neutrality and climate justice. In December 2019, students submitted to the President of the university a list of demands for a »Climate Neutral Bauhaus-Universität Weimar«. The President referred to these demands when submitting proposals to the Senate.

For the university, this is about its own contribution to a sustainable society and the responsible use of common goods. Further measures are undoubtedly necessary in order to live up to these aspirations.

The next important steps are therefore to formulate and initiate definitive, verifiable goals, strategies and activities. For this purpose, areas of action that thematically unite the planned goals and measures are to be identified. In addition to economic and social sustainability, the areas of action in this environmental report focus primarily on the ecological orientation of the concept of sustainability. Ideally, the areas of action will have a noticeable impact on all levels of the university – i.e., on the institutional and structural level, the content and didactic level and on the level of the student world.

The contribution to sustainability at the structural level of the university as an institution is primarily focused on the careful use of finite resources in construction and business. The didactic level includes expanding the range of courses on topics relevant to climate and sustainability, as well as enabling students to successfully participate in the social debate on common goods worthy of protection. Sustainable action at the content level also includes a reflective approach to one's own research and teaching that takes into account their social inclusion without restricting the fundamental right of academic freedom. Ecological sustainability is multifariously embedded in the student world. Many sustainability initiatives at the Bauhaus-Universität Weimar come from or are organised by students – be it by student representatives such as the StudierendenKonvent (StuKo; Student Government), the Fachschaftsräte (FSR; Faculty Student Councils) or in independent groups.

The following areas of action for deriving definitive measures and goals for the Bauhaus-Universität Weimar are initially recommended:



Information and education
The core of this area of action is the dissemination of information on university environmental management as well as the networking and support of internal and external initiatives on environmental protection and sustainability. Improvement of environmentally friendly procurement should also be identified as a goal.

Energy
In terms of environmental performance - especially CO_2 consumption by category – it is clear that a great emphasis is placed on energy. Based on optimised recording of consumption with regard to electrical and heating energy, it is necessary to determine savings potential and provide concepts for improved energy management. To this end, further support for implementation within the framework of pilot measures by the state of Thuringia is an absolute must.

Mobility
The second largest proportion of CO_2 emissions is generated in connection with university-related mobility. Within this area, there are numerous topics for which environmental goals and measures can be formulated; for example, with regard to business-related travel, selected means of transport, the university's vehicle fleet, as well as in the ecological evaluation of all traffic flows of the Bauhaus-Universität Weimar.

Waste
Ziele und Maßnahmen im Handlungsfeld Abfall betreffen beispielsweise die verbesserte Trennung und Erfassung der unterschiedlichen Abfallfraktionen. Ergänzende Maßnahmen zur Steigerung der Abfallvermeidung sollen ebenso ergriffen werden.

Research and Teaching
An annual survey of courses related to ecological sustainability – which was started here – is to be regarded as the first measure in this area of action and is aimed at publicising and promoting courses on topics relevant to climate and sustainability. Furthermore, goals and measures in connection with scientific and artistic research are to be developed in future.

Campus design
A sustainable design of the university campus can be promoted in various ways. Increasing local biodiversity in a targeted manner; promoting local rainwater infiltration; limiting and reducing the proportion of sealed surfaces on university grounds; these are but a few examples. Measures to ecologically enhance existing recreational and green spaces can observably increase the quality of time spent on campus for all members of the university.

The task of subsequent environmental reports will be to further specify the goals of the individual areas of action and to provide them with measures, responsibilities and schedules. Only in doing this will it be possible to observe progress and effectiveness in the respective areas of action in future. The introduction of process loops in which goals and measures are discussed, implemented, evaluated and in which problems are eliminated is advantageous in this connection.

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6 Information on Involvement

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