Freie Universität Berlin

Sustainability Agenda

Physics Department

2023/2024

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Legend

	The main objectives of the respective chapter
	Measures: They are numbered **Mx.x** and represent assignments that have been adopted by the departmental council and are meant to be executed by the person(s) in charge.
	Guidelines: They are numbered **Lx.x** and represent a guideline for future action at the department.
	Ideas: They are numbered **Ix.x** and represent suggestions for new measures at the department.

Remarks

1. When we write "CO_2 emissions", we usually mean the emission of CO_2 equivalents (CO_2eq), i.e. the emission of all greenhouse gases taken together, weighted according to their climate impact.
2. All web pages that we mention were accessed on 21/06/2022.

Introduction

Why does the Physics Department need a sustainability agenda?

Climate change, which is already having disastrous consequences and ultimately threatens to destroy the natural basis of human life, prompted Freie Universität Berlin to declare a state of climate emergency on 17 December 2019. The climate emergency declaration states:

„For Freie Universität Berlin, declaring a climate emergency stems from a sense of urgency and comprises the following resolutions:

- considering the possible consequences for the climate in all decisions and plans,
- attaining climate neutrality at Freie Universität Berlin by 2025,
- making sustainability and climate protection even more visible in research, teaching, and transfer in the future and systematically embedding these themes in our international networks,
- comprehensively integrating climate protection and sustainability in the curricula at Freie Universität Berlin,
- supporting the personal dedication to sustainability and climate protection of all members of the university through ideas and innovation management,
- continuing our efforts to promote sustainability and climate protection in our own areas of responsibility, i.e., within the administration and on campus,
- assessing and documenting our progress through periodic reports."

[Source: https://www.fu-berlin.de/en/sites/nachhaltigkeit/commitment/klimanotstand/
The underlining was done for clarity and is not part of the original text.]

The Physics Department is committed to the Climate Emergency Declaration of the Freie Universität and strives to take concrete steps in each of the above-mentioned areas of activity. The sustainability agenda of the Physics Department serves this goal.

We understand "Sustainability" in the sense of the UN's Sustainable Development Goals (SDGs), which cover numerous other areas in addition to climate protection. However, the focus of this sustainability agenda is on CO_2 neutrality. In the spirit of Freie Universität's climate emergency declaration, in addition to the technical infrastructure (building technology, etc.) and the operational management of teaching and research at the Physics Department, the appropriate integration of sustainability topics in the curriculum and in the spectrum of research topics is also seen as essential. Sustainability is seen as a cross-cutting university task, where, in analogy to the promotion of equality and diversity, it is important both to implement measures in the short term and to find the staying power for long-term development that is also sustainable in its organizational structures.

The measures, ideas and guidelines presented in this agenda support the future orientation, educational and role model function of the university. Universities are seen as 'reality labs' that explore and promote the transition to a creative, responsible approach to the natural environment and the limitations of natural resources.

The measures listed in this agenda represent assignments that have been adopted by the departmental council and are meant to be executed by the person(s) in charge. Most of them can be realised in the short term. They can or should be initiated immediately and implemented by the end of 2024, when a new edition of the sustainability agenda will be published. The majority of the guidelines and ideas can be implemented in the short term as well.

When we mention "responsible: dean's office", this includes the transfer of responsibility – for example to the building officer or the officer for studies and teaching. See Chapter 11 for the organisational anchoring of the sustainability agenda in the Physics Department.

The measures, guidelines and ideas introduced in the following chapters are summarised in the table "Overview of measures, guidelines and ideas".

Development Process of the Sustainability Agenda

The sustainability agenda was developed by the sustainability working group on behalf of the departmental council (FBR resolution of 14/07/2021). In order to develop the agenda in a process open to all members of the department, invitations were sent out to discuss the individual topics. The topics, which mostly correspond to the chapters of the sustainability agenda, were discussed in working groups on **21 dates** between **October 2021 and November 2022,** resulting in a catalogue of measures, ideas and guidelines.

The following group of people contributed to this process:

Jan Behrends (professor)
Jörg Behrmann (staff)
Holger Dau (professor, *editor*)
Cornelius Gahl (research associate)
Karsten Heyne (professor)
Olga Jarugski (staff)
Vismaya Jochem (student)
Tobias Kampfrath (professor)
Ferdinand Most (student)
Johanna Richter (student)
Fritz Röckenwagner (student)
Jenny Schlüpmann (staff, *editor*)
Christian Teutloff (research associate)
Sergey Trishin (research associate)
Benjamin Ünzelmann (student, *coordinator, editor*)

The agenda was first brought to the departmental council on 20 July 2022. It was discussed and the final version was adopted on **1 February 2023.** When translating the approved German agenda into an English version, errors or unclear formulations may have crept in. The German version is the formally valid version.

1 Energy Consumption of the Department

1.1 Goals

The main levers for reducing CO_2 emissions are saving energy and using renewable energy sources. The department should exploit, even more than it has done up to now, all possible technical and organisational measures in order to reduce electricity and heating energy consumption. Where it cannot be reduced further, the department should use renewable energy sources or even produce them itself.

1.2 Status quo

Electricity consumption (turnover of electrical energy) in the department building is significantly higher than heating energy consumption: **3.8 GWh per year for electricity consumption** compared to **2.75 GWh per year for heating energy consumption** (average of the years 2017 to 2019). When put into relation with the area (26 700 m²), electricity consumption is thus 140 kWh/(year m²) and heating energy consumption is 100 kWh/(year m²). Typical values for research buildings are 25 kWh/(year m²) for electricity consumption and 90 kWh/(year m²) for heating energy consumption.

The department's electricity consumption is therefore significantly higher than the reference value. The higher consumption is caused on the one hand by the building's air handling system, water cooling and helium liquefaction. On the other hand, a lot of electricity is needed in the experimental physics working groups – for (large) electrical devices and for the air conditioning of some laboratories. So far, no itemised consumption data is available.

For the helium liquefaction, it should be mentioned that the electricity is consumed in order to sustainably recover the helium gas. Helium is a finite resource that would be lost without recovering it. Moreover, liquefaction is much more economical than procuring new helium. The department supplies the entire Berlin area (*Helium-Verbund*) with liquid helium and uses only about 16% of it itself. Therefore, only part of the electricity demand for the helium liquefaction can be attributed to the department.

In terms of heating energy consumption, the department is slightly above the typical value for research buildings.

The department purchases green electricity, under a contract with the Berlin Senate, from the *Berliner Stadtwerke* (Berlin public utility company), whose CO2 balance is formally[1] **zero** g CO2eq/kWh. For comparison: one kilowatt hour of electricity in the German electricity mix causes 366 g CO2eq/kWh (data from the Federal Environment Agency for 2020).[2]

For heating, the department is supplied with district heating from Vattenfall. This enters the CO2 balance with 42.3 g CO2eq/kWh.[3]

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[1] Sources: https://berlinerstadtwerke.de/klimaneutrales-berlin/ and https://berlinerstadtwerke.de/produkte/berlinstrom/
"The green electricity provided by the Berliner Stadtwerke EnergiePartner GmbH is **guaranteed to come from European hydropower plants.**" This is certified by TÜV Rheinland.
Criticism of the Consumer Protection Centre on guarantees of origin (2021): "The electricity behind it is generally produced anyway. Its 'green' quality is shifted to the buyer's electricity through the purchase of a guarantee of origin. [...] Overall, however, there is just as much 'green' and 'grey' electricity afterwards as there was before – it doesn't help the climate." (Source: https://www.verbraucherzentrale.de/wissen/energie/preise-tarife-anbieterwechsel/ist-ein-tarif-mit-oekostrom-und-oekogas-ueberhaupt-sinnvoll-8207)
However, for their green electricity berlinStrom, the Berliner Stadtwerke assure an investment guarantee in new renewable energy plants. This means that "the additional environmental benefit is **linked to the additional expansion of plants for the generation of electricity from renewable energies**". "At least 0.1 €Cent/kWh (net without VAT) of declared green electricity must flow into further renewable energy projects." (Source: https://www.certipedia.com/quality_marks/0000023040)
Criticism of the Consumer Protection Centre on the investment guarantee: "The amount of renewable energy produced in plants owned by Berliner Stadtwerke GmbH and promoted and marketed within the framework of the EEG, as well as the photovoltaic plants from landlord-to-tenant electricity models, **arithmetically exceed the sales volumes of the electricity by berlinStrom when considered over a calendar year"**. (It is not guaranteed that the necessary amount of green electricity from own plants is available at all times, only as an annual average).
Conclusion: Reducing electricity consumption is still important. It would be better if Berliner Stadtwerke produced all renewable electricity on their own.

[2] Source: https://www.umweltbundesamt.de/themen/klima-energie/energieversorgung/strom-waermeversorgung-in-zahlen#Strommix

[3] Source: Certificate of the TU Dresden, valid until 2024, https://wärme.vattenfall.de/binaries/content/assets/waermehaus/downloads_fernwarme/co2-zertifikat---verbundnetz.pdf

1.3 Measures and Guidelines

1.3.1 Optimisation in the Laboratories

- **L1.1** (Responsible: working groups) In air-conditioned laboratories with high waste heat from electrical equipment, **the air conditioning often works against the waste heat.** In that case, slightly increasing the room temperature setpoint can be beneficial.

1.3.2 Optimisation of Building Infrastructure

- **M1.1** (Responsible: dean's office, Technische Abteilung, facility managers) It will be checked whether **the operation of the heating system can be optimised** to avoid using (additional) electric heating.
- **M1.2** (Responsible: dean's office, Technische Abteilung, facility managers) The **window insulation** is to be improved, for example by renewing the sealing lips.
- **M1.3** (Responsible: dean's office, Technische Abteilung, facility managers) **Incandescent lamps and fluorescent tubes** will gradually be replaced by energy-saving LED lighting. The process will be fully completed by the end of 2025 at the latest.
- **M1.4** (Responsible: dean's office, Technische Abteilung, facility managers) It will be examined where energy savings can be achieved through the **use of motion detectors,** especially in the corridors and lavatories. Wherever it makes sense, motion detectors will be installed.

1.3.3 Optimisation of User Behaviour

- **M1.5** (Responsible: Technische Abteilung, Sustainability & Energy Unit) The Sustainability & Energy Unit of the FU **offers training courses** for staff in technical services (facility managers, control technology) **on optimising energy consumption.**

1.3.4 Measuring Important Technical Data

- **M1.6** (Responsible: building officer) The **energy consumption and the associated CO_2 emissions for the air conditioning of the laboratories, cooling water systems, helium liquefaction, etc. are determined annually and made available within the department.** This serves as a basis for further energy-saving measures.
- **M1.7** (Responsible: dean's office, working groups, Sustainability & Energy Unit, building officer) The Sustainability & Energy Unit will **launch a pilot project at the Physics Department to measure electricity consumption.** The aim is to collect data on individual electrical appliances in order to be able to think about effective saving measures on the basis of this data. The Sustainability & Energy Unit acquires a "deZem measuring case" (https://www.dezem.de/en/mobile-metering-case/) and makes it available to the department for the duration of the project. The electricity consumption data measured at the department (from laboratory air-conditioning, electrical equipment, etc.) is recorded by an online monitoring system. It is also possible to set up an additional account so that the department can evaluate the data directly. The project is to be coordinated in cooperation with the Technische Abteilung and the Betriebstechnik. (The Technische Abteilung is currently evaluating smart

meters for the ventilation installations as well as entire buildings or rooms, but so far not for individual appliances).

1.3.5 Structural and Energy-related Measures

- **M1.8** (Responsible: dean's office, Technische Abteilung) The Physics Department ensures that **the lowest possible energy consumption, a construction method with low CO_2 emissions and other sustainability aspects are considered timely** (i.e. already in the planning phase) **and play a significant role in the planned new physics building** or renovation of the current building (time scale: 10 years).
- **M1.9** (Responsible: dean's office, Technische Abteilung) It will be checked whether **further photovoltaic systems can be installed** on buildings associated with the Physics Department, for example on the roof of the SupraFab building (check efficiency).
- **M1.10** (Responsible: liquid hydrogen and helium supply, working groups) In recent years, helium losses at the department have increased drastically (to 20-25% at present, while the long-term average was around 10%). **The causes must be found and the losses reduced again.**
- **I1.1** (Responsible: dean's office, Technische Abteilung) The department is investigating whether a **pilot project for the combined use of photovoltaics** (solar panels that are/will be installed on a roof belonging to the Physics Department), **fuel cells and hydrogen storage** makes sense as an exemplary measure for demonstration purposes.[4]

[4] In summer, the surplus electricity produced by a photovoltaic system is used to produce hydrogen from water. In winter, the reverse process is used to generate electricity from the hydrogen produced in summer.

2 Assessing CO_2 Emissions and 'Scientific CO2nduct'

2.1 Goals

The gathering and publication of CO_2 emission data, on the one hand at departmental level and on the other at individual level, is important for several reasons. It creates the basis for a better awareness and encourages thinking about effective measures to reduce emissions.

The department compiles comprehensive statistics on the CO_2 emissions it causes. These statistics are regularly updated – including progress over time – and published on the department's website.

2.2 Status quo

2.2.1 Assessment at Department Level

So far, only CO_2 emissions from electricity and heating energy consumption can be determined. For (green) electricity consumption, the CO_2 emissions are 0 g CO_2eq/kWh, and for heating energy consumption, a value of 42.3 g CO_2eq/kWh must be applied according to the certificate of the TU Dresden (see section 1.2). Based on the values for heating energy consumption (2.75 GWh on average for the years 2017 to 2019), the department's heating-related CO_2 emissions amount to 116 t CO_2eq/year.

In the areas of mobility as well as goods and services, the CO_2 emissions at departmental level are not yet known.[5]

2.2.2 ‚Scientific CO2nduct'

Some scientific staff members of the Institute for Theoretical Physics have founded the initiative 'Scientific CO2nduct' (https://scientific-conduct.github.io/). The members of the initiative determine the CO_2 footprint of their scientific publications. They publish the footprint together with the corresponding paper and – voluntarily – compensate these CO_2 emissions. If possible, the offsets are paid from funds of the working group, if not, they are compensated privately by the authors of the publication. The initiative also collects suggestions on how to reduce the CO_2 footprint caused by publications. For experimental physicists, the hurdle for voluntary participation in the initiative is still high (the CO_2 emissions are higher and more difficult to assess), since the examples and suggestions so far all come from theoretical physics groups.

A clear summary of the motivation and options of the 'Scientific CO2nduct' initiative can be found in the following article by a team of authors from Berlin, London and Singapore, recently published in Physics Communications (four of the six authors are from our Physics Department):

> Transparent reporting of research-related greenhouse gas emissions through the scientific CO2nduct initiative
> Ryan Sweke, Paul Boes, Nelly Ng, Carlo Sparaciari, Jens Eisert & Marcel Goihl,
> https://doi.org/10.1038/s42005-022-00930-2

[5] So far, only the emissions caused by FU members' commuter traffic (approx. 2550 t CO_2eq/year) and the emissions caused by paper consumption (71 t CO_2eq/year) are known (values from before the Corona pandemic).

2.3 Measures and Guidelines

2.3.1 Improving the Recording of CO_2 Emissions of the Department

- **M2.1** (Responsible: dean's office, sustainability group, building officer) The department **compiles and publishes a statistic on its CO_2 emissions.** In addition to the CO_2 emissions that can be directly determined from electricity and heating energy consumption, **all other CO_2 emissions should also be determined** – as far as possible – in particular those from mobility (including business trips, commuting) and goods and services (including laboratory equipment, furniture, consumables, fresh water/waste water). The statistics are updated annually to track the development over time. They are compiled centrally at the department. The person/unit in charge for the compilation of the statistics and the (efficient) methodology that will be used is still being clarified between the dean's office, the sustainability group and the building officer. The Sustainability & Energy Unit will be involved in determining the method of the CO_2 emissions assessment.[6]

2.3.2 Participating in the 'Scientific CO_2nduct' Initiative

- **L2.1** (Responsible: members of the department) It is recommended that all members of the department participate in the **'Scientific CO2nduct' initiative.** This does not directly avoid emissions, plus it means extra work and there are still open questions in the implementation. But publishing the emissions associated with a paper is very well suited for raising awareness about one's role and thus stimulating discussion in the scientific community.
- **M2.2** (Responsible: sustainability group) In order to reduce the hurdle for staff in the experimental physics working groups to assess the CO_2 emissions of publications – and thus enable them to participate in the 'Scientific CO2nduct' initiative – the sustainability group will present an **example of the assessment of an experimental physics publication** based on the model of a theoretical physics publication.

[6] In some areas, the compilation of statistics is relatively simple, such as energy consumption, fresh water/waste water and business trips. The emissions data can be easily calculated with the help of a CO_2 calculator – for example atmosfair (www.atmosfair.de) or myclimate (co2.myclimate.org). However, a way still needs to be found to collect the data centrally.
In some areas, especially in the purchase of office supplies, FU-central efforts have already been made to collect such emissions data. The department could therefore resort to this data if necessary. In other areas, however, it will hardly be possible to collect such data in the foreseeable future, for example when purchasing laboratory equipment.

3 Purchase and Sharing of Equipment and Materials

3.1 Goals

When purchasing materials and (large) equipment, sustainability – for example a low carbon footprint as well as the possibility to return defective/old appliances – should be established as a criterion. Among other things, this serves the goal of a circular economy or a circular value chain. In order to conserve resources and reduce CO_2 emissions, the working groups should also share as much (large) equipment, materials and tools as possible.

3.2 Status quo

The precision engineering workshop is open to all working groups: The working groups can have precision mechanical components constructed for a fee. This avoids duplication in the purchase of equipment or machines and reduces the carbon footprint. The same holds for the Electronics Workshop. Furthermore, the Electronics Workshop and the IT Unit (ZEDV) collect old equipment that can be reused if necessary.

For some large-scale experimental equipment (confocal microscope, electron microscope, BESSY), measurement times can be "rented". Experience shows that for a successful sharing of complex equipment, at least one permanent employee is normally required to ensure a proper operation (measuring/processing, analysis, post-processing).

Up to now, a low purchase price has been the decisive criterion when buying equipment. In principle, it is possible to include the associated CO_2 emissions as a criterion when purchasing larger appliances.

3.3 Measures, Guidelines and Ideas

- **L3.1** (Responsible: working groups, Purchasing Department, Sustainability & Energy Unit) It should be possible to conclude a **service guarantee for 10, 15 or more years.** Appliances/equipment with such service guarantees should be favoured when deciding on a purchase. Likewise, companies with a **recycling guarantee** should be preferred.
- **L3.2** (Responsible: dean's office, working groups, Purchasing Department) We support efforts to determine the **carbon footprint for the production and operation of (large) equipment.** If reliably possible, this footprint should be established as an important decision criterion when purchasing an appliance. Where applicable, a low carbon footprint should be more decisive than a low purchase price: the overall ecological and economic balance is decisive.
- **L3.3** (Responsible: working groups) Before buying a new appliance, one should first ask the **FU Recycling Exchange** whether an adequate appliance is available.
- **M3.1** (Responsible: working groups, IT Unit, Purchasing Department) Only **computer monitors with low energy consumption** are to be purchased (for a desktop computer, the monitor often consumes the most energy).

- **M3.2** (Responsible: working groups, departmental administration, building officer) A central **list of equipment and materials is compiled in a timely manner and continuously updated** in order to promote equipment and material sharing. Each working group records its equipment in this list, which is divided into the following categories:
  - A: Equipment that can be used independently by each person without any introduction, only with the help of a short written instruction.
  - B: Equipment that can be used independently after a short introduction by the supplying/lending work group.
  - C: Equipment that can only be used with the know-how of a person from the supplying/lending working group.
  - D: Equipment that can be used by cooperating groups.

4 Business Travel

4.1 Goals

Business travel is responsible for a large part of the CO_2 emissions of the Freie Universität. Reducing these CO_2 emissions is not only important for the FU to reach climate neutrality by 2025 at the latest. The FU is also under pressure to take responsibility for society as a whole. A new business travel policy with CO_2 pricing and its own climate protection budget is nearing completion.

The Physics Department supports the FU's new business travel policy and is examining new tools to meet, and possibly exceed the FU's planned targets for reducing greenhouse gas emissions (caused by business travel) by 50%.

4.2 Status quo

Business travel accounts for about one third of all (recorded[7]) CO_2 emissions at the Freie Universität. Over 95% of these emissions have so far been due to air travel, especially long-distance flights. For the most part, they were not compensated or could not be compensated if the air travel was financed from third-party funds. This has changed since January 2020: anyone who has to board a plane for a business trip can offset the resulting CO_2 emissions with the FU's Travel Costs Division.

With the new business travel policy of the Freie Universität,[8] FU employees are encouraged to travel by train whenever possible.

4.3 Measures, Guidelines and Ideas

- **M4.1** (Responsible: dean's office) The goal is to allow **mobile working from abroad as well.** So far, for example, the following problem has arisen: if two conferences are held outside Europe in quick succession, one has to return to Berlin after the first conference and then travel long distance again for the second conference if there is more than a week between the two conferences.
- **M4.2** (Responsible: departmental council, working groups, departmental administration) **The CO_2 emissions from air travel are determined for each working group and published within the department** (the total number of flights and the CO_2 emissions in tonnes, separately for each working group). A distinction is made between CO_2 emissions from conference trips, workshops and retreats on the one hand and measurement trips and work stays abroad lasting several weeks on the other hand. This data is discussed annually in the departmental council with regards to the reduction targets of the Freie Universität and possible measures. The listing of air

[7] FU Sustainability Report 2022: https://www.fu-berlin.de/sites/nachhaltigkeit/_media/stabsstelle/NHB22_web.pdf, table on page 55. (so far, the FU has only recorded CO_2 emissions from campus-related electricity and heat consumption, the vehicle fleet and flight emissions).

[8] The Business Travel Policy of the Freie Universität will be published soon; https://www.fu-berlin.de/sites/nachhaltigkeit/handlungsfelder/campus/energie_klimaschutz/Nachhaltigkeit-im-Arbeitsalltag/Rund-um-die-berufliche-Mobilitaet1/Dienstfahrten-oder--Reisen-klimafreundlich-gestalten.html

travel and the corresponding CO_2 emissions (determined e.g. via https://CO2.myclimate.org/de/flight_calculators/new) is done either in the individual working groups or centrally in the departmental administration; this will be clarified in due course.

- **M4.3** (Responsible: dean's office) The department is examining **the extent to which the CO_2 emissions caused by air travel by members of the department can be offset from the department's budget.** However, avoiding CO_2 emissions is still better than offsetting them.
- **I4.1** (Responsible: dean's office) The **CO_2 emissions of travel for conferences, workshops and retreats could be included in the performance-based allocation of funds:** working groups that travel less (by air) would get extra points. Measurement trips and work stays of several weeks would be excluded from these measures.
- **I4.2** (Responsible: FU Central Administration) The **travel bookings could be made by trained staff.** This could pay off especially for long rail journeys abroad, which are often very confusing to plan and difficult to book.
- **I4.3** (Responsible: FU Central Administration, dean's office) Consideration should be given to whether a more friendly flexitime arrangement or compensation for weekend rail travel would be possible. **Travel time should be recorded and credited as working time.**
- **L4.1** (Responsible: sustainability group) The sustainability group develops **guidelines that go beyond those of the FU's business travel policy.**
  Example 1: The distance and duration of the flight should be in reasonable proportion to the duration of the stay abroad. For example, if the flight time for the outward flight is 10 hours, one should spend at least 10 days at the destination. (Notwithstanding this, short-haul flights should generally be avoided).
  Example 2: The CO_2 emissions of air travel can vary greatly from one provider to another for the same destination. This is due, among other things, to the different aircraft models. This should be taken into account when booking flights, in addition to the price. The non-governmental organisation atmosfair, for example, carries out a corresponding assessment of airlines:
  https://www.atmosfair.de/en/air_travel_and_climate/atmosfair_airline_index/

5 New Conference and Communication Formats

5.1 Goals

If one wants to save CO_2 emissions in the area of mobility, it is inevitable that online formats for meetings and events will be increasingly offered and used. Online and hybrid formats should be further improved in order to come as close as possible to a "live feeling". One item that has a very high impact on CO_2 emissions is flights to meetings outside Europe. The FU's new business travel policy aims to halve the number of flight-related CO_2 emissions. The Physics Department is adopting this goal and is striving to reduce these emissions by even more than 50%.

5.2 Status quo

Due to the pandemic, some new communication formats have been established for conferences and teaching.

5.2.1 Examples of Online Meetings

Example 1 – Online meeting with videos sent in advance: Four weeks before the conference, videos were submitted that could be viewed asynchronously by all participants. The conference itself consisted of short sessions with a 5-minute summary. This way, many more presentations and topics could be presented than at a face-to-face conference.

Example 2 – Hybrid conference: speakers from Europe gave live presentations and speakers from other continents were connected via video. After the presentation, questions from the audience were answered first, followed by questions from the chat. Good camera work was important in the implementation: the camera was always directed at the chairperson or the speaker. This reinforced the feeling of being there live. The use of two screens was particularly positive, with one always showing the lecture and the other the person giving the lecture.

5.2.2 Tools for Virtual Events

In addition to the usual programmes for video conferences, there are numerous tools that can be used to create virtual interactions that are very similar to face-to-face events. Well-known tools are, for example, Mozilla Hub (3D), Gathertown (2D), Work adventure (2D).

5.3 Measures, Guidelines and Ideas

- **M5.1** (Responsible: dean's office, respective organisers) The following events at the department should preferably take place in hybrid format as soon as the technical possibilities have been installed – provided there is demand:
  - Conferences,
  - Colloquia,
  - Workshops,
  - Appointment procedures (presence mode remains the standard mode, but attending online is made possible for external members of the appointment committee and for audience wishing to attend the teaching samples),
  - inFUtage (study information days for pupils)

- **L5.1** (Responsible: dean's office) **Dissertation defences should also be able to take place in hybrid format** (subject to legal review). However, defences in presence are favoured. Furthermore, online-only defences should also be possible in exceptional cases, even after the end of the Corona pandemic.
- **M5.2** (Responsible: dean's office) For the successful implementation of the hybrid format, one person (and one deputy) should be responsible for the technical operation. The department should have about **five mobile, easy-to-use hybrid devices** with which the lecture and the speaker can be transmitted online on two screens. It would also be nice to have a hybrid conference room (e.g. the large lecture hall, the BoB or a room outside the department) in which there is a permanently installed, well-functioning system for hybrid conferences and streaming options.
- **L5.2** (Responsible: dean's office, all travellers) It should always be checked whether a conference trip outside Europe is really necessary. In particular, short conference trips should be critically examined. **The amount of CO_2 emissions caused by conference trips outside Europe by members of the department should, on average, be (at least) halved.** Preference should be given to conference trips by young researchers, especially when establishing collaborations. Established scientists should accordingly reduce long-distance travelling above average. The working group leaders will pursue the implementation of these goals.
- **M5.3** (Responsible: dean's office, FU Central Administration) The department works towards **formal review meetings (e.g. ERC status meetings) being conducted entirely online.** As there are no on-site (informal) discussions and no 'networking' for status reports, there is no advantage in appearing on-site. Other meetings, such as SFB reviews, should continue to be held preferably in presence.
- **I5.1** (Responsible: dean's office, FU Central Administration) There should be opportunities **to try out innovative software for new communication formats** (such as Gather Town or Quiz Academy), as this avoids travelling. The sustainability goals of the department should not be thwarted by centrally imposed restrictions or prohibitions on the acquisition of licences.
- **L5.3** (Responsible: dean's office) The department is **open to alternative concepts for online events.** Model projects are financially supported. Examples: asynchronous online meeting formats at international conferences or the concept of "hubs" (conference participants meet physically at different locations around the world – for example, one hub in the USA, another in Europe, another in Japan –; these hubs are then connected online).

6 Commuting to University

6.1 Goals

Road traffic in Germany accounts for about 20% of the greenhouse gas emissions.[9] If the FU wants to become climate-neutral by 2025 (see introduction), it must become active in the area of mobility. For the Physics Department, this means that it should create (even) better conditions so that more students and staff come to the university by (electric) bike. Support for electric mobility would also be desirable, although public transport and cycling are of course the better options.

6.2 Status quo

The department is well connected to public transportation. While the semester ticket seems to be useful for students, the job ticket for FU employees is rarely purchased – by about 500 employees only, https://www.fu-berlin.de/sites/nachhaltigkeit/handlungsfelder/campus/mobilitaet/). The job ticket is somewhat cheaper than a normal monthly ticket, but has the disadvantage that it is not transferable.

The department is relatively easy to reach **by bike.** The last stretch to Arnimallee (no matter where you come from) is very bike-unfriendly (cobblestones).

There are **covered bicycle parking spaces** ('Kreuzberger Bügel') next to the main entrances. However, these are often all occupied during the lecture period. There have been isolated cases of theft, so some staff prefer to leave their bikes in the "cage" (a barred area for bikes in the underground car park) or in their office.

There are **no charging stations for electric bikes.**

There are **only few shower facilities.** Some staff members have access to the showers of the precision engineering workshop.

Those coming by car can park in the underground car park or in Arnimallee and Takustraße.

6.3 Measures

6.3.1 Bicycle Parking Opportunities

- **M6.1** (Responsible: dean's office, Technische Abteilung) The department is examining **various options for the provision of additional bicycle parking spaces** and is initiating appropriate measures for implementation.

[9] Source: https://www.umweltbundesamt.de/sites/default/files/medien/361/dokumente/2022_01_12_em_entwicklung_in_d_trendtabelle_thg_v1.0.xlsx

6.3.2 Shower Facilities

- **M6.2** (Responsible: dean's office, Technische Abteilung) All employees of the department should have the possibility to **shower at work** to avoid having to go to work sweaty after long bike rides. By rebuilding the room with the showers, more shower facilities could be made available. To avoid overcrowding, time slots could be created for different groups of people (e.g. members of the precision engineering workshop early in the morning and at the end of work in the afternoon). Before this measure is implemented, a survey should be conducted to determine the need for additional shower facilities.

6.3.3 More Bicycle-friendly Paths and Further Measures

- **M6.3** (Responsible: dean's office, Technische Abteilung) It will be **examined whether public and private streets** in the vicinity of Arnimallee 14 can be **made more bicycle-friendly.** Example: The short section of Takustraße between Königin-Luise-Straße and Lansstraße, which is currently a one-way street, should be opened to cyclists in both directions.
- **M6.4** (Responsible: Sustainability & Energy Unit) The **exchange** with the people dealing with **mobility in the Sustainability & Energy Unit** is to be continued in order to stimulate the above-mentioned measures and to discuss further, university-wide measures – such as safe-cycling seminars, carpooling app, parking space management.

7 Waste Management

7.1 Goals

Systematic and correct waste separation contributes to circular economy and ultimately to saving energy and raw materials. It fulfils the UN Sustainable Development Goals 11 (Sustainable Cities and Communities) and 12 (Sustainable Consumption and Production). The department pursues the goal of achieving better and thus more sustainable waste separation.

7.2 Status quo

The Berliner Stadtreinigung (BSR) is responsible for collecting the waste at the department. The capacity of the central waste containers in the courtyard near the goods reception (Warenannahme) is calculated according to the building's surface. The containers are usually not crammed.

Large containers in the courtyard near the goods reception allow separating paper/cardboard, plastic/packaging and residual waste. In addition, there are numerous bins placed all over the department – in groups of three in order to separate paper, plastic and residual waste. No one has to walk more than 50 metres to throw their plastic packaging into the right bin. Some offices also have smaller bins (one for paper and one for residual waste).

For other types of waste, there are additional waste containers. The following waste categories are separated:

a. **Batteries, fluorescent tubes, metals (separated by type of metal), electrical scrap, waste oil, drilling emulsion** – a separate container for each waste category (in the goods reception area, in the corridor between the courtyard and the metal workshop, in the metal workshop).
b. Paper/cardboard – the BSR classifies paper and cardboard as raw materials and pays 300 euros per tonne to the department, minus disposal fees.
c. **Plastic/packaging material** – is collected free of charge.
d. **Residual waste** – which includes glass and organic waste.
   The containers for residual waste make up roughly 40% of the total waste containers in terms of volume.

In addition, there is a FU-central special waste disposal (e.g. for IT components). The respective form has to be completed, see https://www.fu-berlin.de/en/sites/nachhaltigkeit/handlungsfelder/campus/verwertung_entsorgung/sonderentsorgung/.

Random samples at the central waste containers have shown that waste is often very poorly separated. This makes the whole concept of waste separation very inefficient and unsustainable.

7.3 Measures, Guidelines and Ideas

- **M7.1** (Responsible: precision engineering workshop) The **containers** for metals, fluorescent tubes, batteries and waste oil **are not easy to find.** Notices should be placed in the yard of the goods reception indicating where these less frequently used waste containers are located.
- **M7.2** (Responsible: precision engineering workshop) The **containers must be better labeled** – in German and in English. Signs should also be put up indicating exactly what may and may not be put into the respective containers.

- **M7.3** (Responsible: building officer, internal communication) The **waste concept must be better communicated** (in German and English). There is a waste ABC from the Sustainability & Energy Unit:
  - in German: https://www.fu-berlin.de/sites/nachhaltigkeit/handlungsfelder/campus/verwertung_entsorgung/abfall_dokumente/Trennkonzept-Entwurf_Aushang_Version-5_final.pdf
  - in English: https://www.fu-berlin.de/en/sites/nachhaltigkeit/handlungsfelder/campus/verwertung_entsorgung/abfall_dokumente/Abfall_Trennkonzept_Aushang_en.pdf

  The waste ABC is to be hung up by all waste bins in the corridors.
- **L7.1** (Responsible: working groups, sustainability group together with the dean's office) The **members of the department are informed about the department's waste management concept** and are encouraged to act within the framework of the concept. For example, working groups could give their new staff members a leaflet explaining what is disposed of where.
  The Sustainability & Energy Unit also offers lectures on waste disposal and energy saving. The department motivates the technical staff to take part in these events.
- **L7.2** (Responsible: dean's office, Technische Abteilung) The **department's waste separation concept** should be better communicated to the **cleaning staff.** According to information from the FU administration, this is an FU-wide problem, but also a sensitive issue, as the employees of the cleaning companies usually receive low wages and work under time pressure. Perhaps the employees should be given more time for their work. This issue is probably also relevant to sustainable waste management across the FU.
- **M7.4** (Responsible: dean's office, FU waste management officer) Glass cannot currently be disposed separately at the department. The department will check whether there is a need for a glass container and, if so, commissions the Technische Abteilung to **initiate the installation of glass containers at the Physics Department.**
- **I7.1** (Responsible: dean's office, building officer) Offices often produce little waste. To make the cleaning staff's work easier and save on bin liners, office occupants could, for example, voluntarily put **a sticker on the door signalling that emptying the bins is not necessary.**
- **I7.2** (Responsible: dean's office, FU waste management officer, building officer, volunteers) To enable separate disposal or recycling of organic waste, an **organic waste bin** will be installed. Consideration should also be given to whether a **departmental compost** is a viable option for the disposal of organic waste.

8 Sustainability Topics in Studies and Teaching

8.1 Goals

Renewable energies and climate protection are socially, scientifically and technologically highly relevant topics for shaping the (global) future. Prospective physicists should be enabled to participate competently in social discourse in these areas and to help shape future developments. Furthermore, students are to be taught the diverse options for future professional activities in the field of sustainability and supported in entering the corresponding fields of activity.

8.2 Status quo

Students are informed about sustainability-related courses every semester before they choose their courses: https://www.physik.fu-berlin.de/fachbereich/arbeitskreise/nachhaltigkeit/Lehrveranstaltungen/

The range of courses offered at the Physics Department is rather small and fluctuates significantly from semester to semester.

The Sustainability & Energy Unit regularly offers modules on sustainability for Bachelor students of all subjects. These are therefore also open to physics students; they are recognised as “ABV modules”. In this attractive offer consisting of a lecture series and project group work, the natural science basics are, however, usually left out or are not a central topic. The project group work with the focus on "Investigating Sustainability" is an exception. With 10 ABV credit points, the compatibility of this project group work with the physics students course planning is problematic.

Sustainability topics in the natural sciences are often interdisciplinary topics. Interdisciplinary courses on sustainability topics with a natural science focus are currently lacking. The Institute of Chemistry is, however, interested in a joint course; details and the integration into curricula have not yet been clarified.

8.3 Measures, Guidelines and Ideas

8.3.1 Survey of Students and Lecturers

- I8.1 (Responsible: FSI) The FSI (student council initiative) – supported by the sustainability group – is **conducting a survey to find out whether students are informed about the current course offerings connected with sustainability, how they evaluate them and what suggestions/wishes they have for future development.** If the students are interested in further general or specific sustainability topics, they should name them as specifically as possible.
- M8.1 (Responsible: dean of studies, lecturers at the department, education commission) The **lecturers in the department are initiating a discussion process on whether and how sustainability topics can be more strongly anchored in the courses offered.** During this process, it is also examined to what extent lecturers see themselves in a position to realise courses on sustainability topics beyond their specific field of research. The Education Commission will develop proposals for the discussion process.

8.3.2 More and Better Overview of Sustainability-related Events

- **I8.2** (Responsible: professors in Physics, Chemistry, Biology) Within the framework of a **lecture series,** scientists could provide (interdisciplinary) insights into the scientific foundations of climate change and sustainable energy use from the perspective of physics, chemistry and biology.

- **I8.3** (Responsible: dean's office) Each semester, one **date of the Friday Colloquium** is reserved for a lecture or information event related to sustainability.

- **I8.4** (Responsible: FSI) The FSI could compile an **overview of external events for students interested in sustainability** (such as the "Fridays for Future public climate school").

- **M8.2** (Responsible: officer for studies and teaching, dean of studies) The **bundled overview of sustainability-related courses should be continued.** The overview should also list ABV modules and lecture series (e.g. "Transforming Our World: Political and Social Ways out of the Climate Crisis" by the Sustainability & Energy Unit). The offer should be published timely at the beginning of the semester so that students can include the courses in their study planning.

- **L8.1** (Responsible: officer for studies and teaching, dean of studies) **The sustainability topic should be integrated into existing modules,** including practical courses and exercises.

9 Research with a Focus on Sustainability

9.1 Goals

The Physics Department is aware of its responsibility towards society as a whole and promotes research on topics related to sustainability. This orientation also increases the attractiveness of the department for young scientists. The department pursues the goal of enabling students to deepen their studies in the area of sustainability, for example by specifically advertising and supporting corresponding final Bachelor and Master theses.

9.2 Status quo

Currently, a number of working groups in the department is carrying out research on topics related to sustainability, be it renewable energies and fuels or materials that can contribute to energy saving:

- WG Behrends: Organic radical batteries, organic solar cells
- WG Bittl: Use of EPR spectroscopy to explore the functioning of solar cells
- WG Dau: Catalysts for the production of non-fossil fuels, artificial photosynthesis
- WG Heyne: Light-induced hydrogen production 'SunHy'
- WG Lips (HZB): Semiconductors and organic materials for solar energy conversion and storage
- WG Roldán-Cuenya (FHI): Development of electrocatalysts for the production of fuels and materials from water and CO_2

9.3 Measures and Guidelines

- **L9.1 (Responsible: dean's office, departmental council)** The department encourages its members to conduct **research on topics related to sustainability** – especially research on **potential solutions to limit global warming.** The freedom of research remains unaffected, other research topics are also appreciated.
- **L9.2 (Responsible: departmental council)** The department **welcomes theses related to sustainability,** both at the department itself and in cooperation with other departments/institutes (e.g. Biology, Chemistry) or other research institutions (e.g. Fritz Haber Institute, Helmholtz Centre Berlin, Potsdam Institute for Climate Impact Research).
- **L9.3 (Responsible: dean's office, departmental council, appointment committee)** In the next few years, **several professors conducting sustainability related research will leave the department.** Sustainability-related research should be an asset for new appointments so that the topic is well represented at the department.
- **M9.1 (Responsible: dean's office, departmental council)** The department aims to **establish an additional interdisciplinary sustainability professorship** (for example in cooperation with the Institutes for Biology, Chemistry, Computer science and/or the Potsdam Institute for Climate Impact Research) that conducts interdisciplinary research on one or more aspects of sustainability and can comprehensively teach the topic.

10 Communication

10.1 Goals

The Physics Department offers numerous events for students, schools and the wide public that focus not only on physics but also on sustainability. The department should communicate its focus on sustainability even better and expand its range of sustainability-related events.

10.2 Status quo

10.2.1 Wide Public

The topics of energy transition and climate protection have been addressed by two working groups at the Long Night of Sciences (Lange Nacht der Wissenschaften) for many years: The Dau working group focuses on artificial photosynthesis and solar energy. The Nordmeier working group uses science education to give young people an understanding of the greenhouse effect, energy networks, the energy transition and climate protection. The content is usually conveyed through one or more lectures and experiments at various stations.

10.2.2 Students

Since the winter semester 2020/21, the sustainability working group has served as an exchange forum on sustainability topics and is open to all physics students. More student participation would be appreciated.

Since the winter semester 2020/21, courses with a focus on sustainability have been compiled and communicated separately – via the department's website (https://www.physik.fu-berlin.de/fachbereich/arbeitskreise/nachhaltigkeit/) and by e-mail.

The online event series “Pathways in Physics” regularly presents career prospects in the field of sustainability. Lecturers are physics alumni working on “green innovations” (https://www.physik.fu-berlin.de/fachbereich/veranstaltungen/pathways-in-physics/).

10.2.3 Schools

In addition to the Long Night of Sciences, the Physics Department offers students opportunities to understand the causes and consequences of climate change and to acquire knowledge on the topic, for example in the context of the SommerUNI or in the teaching-learning-laboratory seminar on “Climate change in physics classes at school”.

The Pupils' University Sustainability & Climate Protection (5th-6th grade, https://www.fu-berlin.de/sites/schueleruni) also offers a very broad range of sustainability topics in cooperation with external partners. So far, the Physics Department has only participated sporadically in the Pupils' University.

Professor Wöste (senior professorship) lends experimental equipment suited for schools – for example, a cloud chamber that can be used to demonstrate basic processes in cloud and aerosol formation as well as other processes in the atmosphere (https://www.physik.fu-berlin.de/physlab/koffer/).

Pupils can also find out what contribution the department’s physicists make to climate protection and sustainable development. The information events and webinars for upper secondary school “Studying Physics at Freie Universität” explain how bio-physicists work on the foundations of green energy sources. Secondary school students are also invited to the “Pathways in Physics”.

10.3 Measures, Guidelines and Ideas

10.3.1 Wide Public

- **L10.1** (Responsible: PhysLab and scientist of the department) The **range of sustainability topics on offer at the Long Night of Sciences** should be maintained and further expanded in terms of quality and quantity. Offers for younger children should also be developed.
- **I10.1** (Responsible: coordination unit „Offener Hörsaal“) The “Offener Hörsaal” (Open Lecture Hall) could offer **a lecture series with a focus on sustainability.** The topics should be presented from a scientific perspective.
- **I10.2** (Responsible: volunteers and one person for supervision) The **inner garden** in wing 3, ground floor (opposite the BoB) and/or the inner garden between wing 1 and wing 2; ground floor, **could be landscaped and made into an inviting place to stay and hold events.** The redesign could run as an action with student participation. The “Garden of Physics” could serve as a meeting place for various groups that are committed to environmental protection and sustainability – for example, local Fridays for Future groups. This would position the Physics Department as a place for discussions on sustainability issues. The greening of an indoor garden would also contribute to increasing biodiversity.
- **M10.1** (Responsible: respective organisers) The department offers a **sufficient, equivalent vegan option at all its events where food is offered** (e.g. summer party, Long Night of Sciences). The sustainability group is available to advise on the selection of tasty vegetarian/vegan dishes on request. If meat is offered, it should be from species-appropriate/sustainable animal farming. In addition, the use of disposable cutlery and crockery is avoided/minimised.

10.3.2 Students

- **M10.2** (Responsible: public relations) **Interviews with students and professors who are committed to sustainability** should address future issues and explain or increase the motivation for their commitment. The interviews could be disseminated as text and video contributions via the physics homepage and via Instagram.

10.3.3 Schools

- **L10.2** (Responsible: PhysLab, scientists of the department) The **programme of the SommerUNI should continue to offer workshops on sustainability topics** and, if possible, **expand** the range of offerings.
- **L10.3** (Responsible: Physics education) The subject areas of climate change and sustainability should play an important role in the training of student teachers. The **climate change teaching-learning laboratory** should become a permanent part of teacher training.
- **I10.3** (Responsible: dedicated scientists) The department could again **contribute to the programme of the Pupils' University Sustainability & Climate Protection.**

- **l10.4** (Responsible: Professor Wöste, volunteers) The **experimental kit** with the cloud chamber should cover **sustainability aspects** in addition to the teaching materials about basic physical knowledge.

11 Sustainability – Organisational Anchoring within the Department

11.1 Goals

Sustainability is a cross-cutting issue that will also be solidly anchored organisationally at the department in the long term. It is important to prevent that the sustainability agenda leads to only short-term activity.

11.2 Status quo

The sustainability group has been meeting regularly since its inception on 1 July 2020. The working group is open and invites all interested parties from all status groups to participate. The organisational and content-related work of the working group is coordinated by a student assistant (currently Benjamin Ünzelmann), who is financed from departmental funds. This has worked out well.

11.3 Measures and Ideas

- **M11.1** (Responsible: sustainability group) The **sustainability group continues its work and cordially invites further participants.** The working group continues to be **supported by a student assistant,** who is also available as a contact person.
- **M11.2** (Responsible: dean's office, building officer) **Sustainability in the operation of the department's buildings falls explicitly within the responsibility of the Physics Department's building officer,** who also takes an active role in implementing **corresponding measures of the sustainability agenda.** This includes monitoring energy consumption and CO_2 emissions. The corresponding data and information are published on the department's website.
- **M11.3** (Responsible: officer for studies and teaching, dean of studies) The officer for studies and teaching, together with the dean of studies, **collects information on the courses offered on sustainability topics.** Furthermore, the officer for studies and teaching and the dean of studies strive to initiate steps to strengthen the teaching offer.
- **M11.4** (Responsible: study marketing and public relations) Potential **new students are informed about activities and specialisation options related to sustainability.** Students are given an insight into career prospects in the field of sustainability, for example through the "Pathways in Physics" series of events. The corresponding measures are initiated and coordinated by the student marketing and public relations officer.
- **M11.5** (Responsible: sustainability group, departmental council) Once a year, the **sustainability group discusses the status of the implementation of the sustainability agenda and other sustainability topics in the departmental council.**
- **M11.6** (Responsible: sustainability group, departmental council) **Every two years, an updated version of the sustainability agenda is discussed in the departmental council** and, after modifications if necessary, adopted by resolution.
- **M11.7** (Responsible: dean's office) **Sustainability aspects are regularly addressed in the target agreements** between the dean's office and the FU Presidential Board.

- **I11.1** (Responsible: dean's office, sustainability group) The Physics Department **regularly (once a year) holds a sustainability day,** including workshops on sustainability topics that are tailored to the interests of the students. No competing courses take place on this day. It is organised by the sustainability group together with the student council initiative (FSI) and with the support of the dean's office.
- **I11.2** (Responsible: sustainability group) **Suggestions for improving sustainability in the department can be sent to** mehr-nachhaltigkeit@physik.fu-berlin.de.

Overview of Measures, Guidelines and Ideas

	Measures	Responsible
1 Energy Consumption of the Department		
M1.1	Optimisation of the operation of the heating system	Dean's office, Technische Abteilung, facility managers
M1.2	Improve the window insulation	Dean's office, Technische Abteilung, facility managers
M1.3	Replace incandescent lamps and fluorescent tubes by LED lighting	Dean's office, Technische Abteilung, facility managers
M1.4	Install motion detectors where appropriate	Dean's office, Technische Abteilung, facility managers
M1.5	Training to optimize energy consumption for technical staff (facility managers, control technology)	Technische Abteilung, Sustainability & Energy Unit
M1.6	Annual compilation and internal publication of the energy consumption/CO_2 emissions of large appliances	Building officer
M1.7	Start of a pilot project to measure electricity consumption in the department - in cooperation with the Sustainability & Energy Unit	Dean's office, working groups, Sustainability & Energy Unit, building officer
M1.8	When planning the new building or the renovation of the current department building, measures for energy efficiency and emission minimization should be taken into account at an early stage.	Dean's office, Technische Abteilung
M1.9	Strive to install additional photovoltaic systems on buildings associated with the department	Dean's office, Technische Abteilung
M1.10	Reduction of helium losses in the department	Liquid hydrogen and helium supply, working groups
2 Assessing CO_2 Emissions and 'Scientific CO2nduct'		
M2.1	The department compiles and publishes statistics on its CO_2 emissions.	Dean's office, sustainability group, building officer
M2.2	Using the instructions from the 'Scientific CO2nduct' initiative, an example for the emissions of a publication by an experimental physics group is calculated.	Sustainability group

3 Purchase and Sharing of Equipment and Materials		
M3.1	When purchasing computer screens, pay attention to low energy consumption.	Working groups, IT Unit, Purchasing Department
M3.2	Keep a central equipment and material list and share it with other working groups	Working groups, departmental administration, building officer
4 Business Travel		
M4.1	Mobile working should also be possible from abroad.	Dean's office
M4.2	Air travel is compiled at working group level and CO_2 emissions are calculated.	Departmental council, working groups, departmental administration
M4.3	The department examines to what extent the CO_2 emissions caused by flights by members of the department can be offset from budget funds.	Dean's office
5 New Conference and Communication Formats		
M5.1	Some events of the department should, if there is demand, preferably be offered in a hybrid format.	Dean's office, respective organisers
M5.2	Acquisition and provision of mobile devices for hybrid format events	Dean's office
M5.3	The department works to ensure that review meetings on the status of projects are held online.	Dean's office, FU Central Administration
6 Commuting to University		
M6.1	Provision of additional bicycle parking spaces	Dean's office, Technische Abteilung
M6.2	Expand shower facilities in the department	Dean's office, Technische Abteilung
M6.3	Check the possibility of making the streets leading to Arnimallee 14 more bicycle-friendly	Dean's office, Technische Abteilung
M6.4	Exchange with the Mobility team of the Sustainability & Energy Unit on further measures	Sustainability & Energy Unit
7 Waste Management		
M7.1	Better findability of the containers for special types of waste (metals, fluorescent tubes, ...)	Precision engineering workshop
M7.2	Label the containers for special types of waste in two languages + precise instructions on what (does not) belong in them.	Precision engineering workshop
M7.3	Better communication of the waste concept (especially waste separation)	Building officer, internal communication
M7.4	Needs assessment and, if sensible, installation of glass containers	Dean's office, FU waste management officer

8 Sustainability Topics in Studies and Teaching		
M8.1	Discussion process on expanding the range of sustainability-related study modules	Dean of studies, lecturers at the department, Education Commission
M8.2	Continuation of the bundled overview of sustainability-related courses	Officer for studies and teaching, dean of studies
9 Research with a Focus on Sustainability		
M9.1	The establishment of an additional cross-departmental sustainability professorship is being sought.	Dean's office, departmental council
10 Communication		
M10.1	The department offers a vegan alternative at events where food is available.	Respective organisers
M10.2	Interviews with students and professors to raise awareness for the issue of sustainability	Public relations
11 Sustainability – Organisational Anchoring within the Department		
M11.1	Continuation of the work of the sustainability group; support by a student assistant	Sustainability group
M11.2	Building officer is responsible for sustainability in the operation of the department's buildings; he/she becomes active in implementing appropriate measures.	Dean's office, building officer
M11.3	Gathering information on the range of courses on sustainability issues	Officer for studies and teaching, dean of studies
M11.4	Potential new students are informed about activities and specialisation options related to sustainability.	Study marketing and public relations
M11.5	Sustainability group discusses the status of the implementation of the sustainability agenda in the departmental council once a year.	Sustainability group, departmental council
M11.6	Every two years, an updated version of the sustainability agenda is adopted by the departmental council.	Sustainability group, departmental council
M11.7	The sustainability aspects are regularly addressed in the target agreements.	Dean's office

	Guidelines	Responsible
1 Energy Consumption of the Department		
L1.1	In air-conditioned rooms, the air-conditioning system and the waste heat from electrical appliances should not work against each other → increase the temperature setpoint of the air-conditioning system.	Working groups
2 Assessing CO2 Emissions and 'Scientific CO2nduct'		
L2.1	Participate in the 'Scientific CO_2nduct' initiative	Members of the department
3 Purchase and Sharing of Equipment and Materials		
L3.1	It should be possible to conclude a service guarantee for 10, 15 or more years; companies with a recycling guarantee are preferred.	Working groups, Purchasing Department, Sustainability & Energy Unit
L3.2	Support efforts to determine the carbon footprint of (large-scale) equipment and establish it as a decision-making criterion	Dean's office, working groups, Purchasing Department
L3.3	Before purchasing an appliance, check with the FU Recycling Exchange to see if it is available there.	Working groups
4 Business Travel		
L4.1	Development of business travel guidelines that go beyond the FU's business travel policy	Sustainability group
5 New Conference and Communication Formats		
L5.1	Making hybrid format dissertation defences possible	Dean's office
L5.2	(More than) halve the number of flight-related CO2 emissions from conference trips	Dean's office, all travellers
L5.3	The department is open to alternative concepts for online events.	Dean's office
7 Waste Management		
L7.1	Inform (new) members of the department about waste separation options	Working groups, sustainability group together with the dean's office
L7.2	Communicate waste separation concept to cleaning company	Dean's office, Technische Abteilung
8 Sustainability Topics in Studies and Teaching		
L8.1	Integration of sustainability issues into existing modules	Officer for studies and teaching, dean of studies

9 Research with a Focus on Sustainability		
L9.1	Research related to sustainability is particularly encouraged by the department.	Dean's office, departmental council
L9.2	Theses with a reference to sustainability are welcomed.	Departmental council
L9.3	Sustainability orientation is a plus when appointing new professors.	Dean's office, departmental council, Appointment Committee
10 Communication		
L10.1	Maintaining or expanding the range of sustainability topics offered at the Long Night of Sciences	PhysLab and scientists of the department
L10.2	Continue to offer sustainability-related lectures as part of the SommerUNI; if possible, expand offer	PhysLab and scientists of the department
L10.3	Continuation of the climate change teaching-learning laboratory	Physics Education

	Ideas	Responsible
1 Energy Consumption of the Department		
I1.1	Aim for a pilot project on the combined use of photovoltaics, fuel cells and H_2 storage	Dean's office, Technische Abteilung
4 Business Travel		
I4.1	CO_2 emissions from travel to conferences, workshops and retreats could be included in the performance-based funding allocation.	Dean's office
I4.2	Trained staff for booking rail travel abroad	FU Central Administration
I4.3	Flexitime regulation or compensation for business trips on weekends: travel time = working time	FU Central Administration, dean's office
5 New Conference and Communication Formats		
I5.1	Opportunity to try out innovative software for new communication formats	Dean's office, FU Central Administration

7 Waste Management		
I7.1	(Voluntary) affixing of stickers "no emptying of rubbish bins necessary".	Dean's office, building officer
I7.2	Installation of a bio-waste bin and creation of a departmental composting area	Dean's office, FU waste management officer, building officer, volunteers
8 Sustainability Topics in Studies and Teaching		
I8.1	FSI survey on the level of information and additional wishes of students with regard to the topic of sustainability	FSI
I8.2	Conducting a lecture series on the basics of climate change and sustainable energy use	Professors in Physics, Chemistry and Biology
I8.3	Once a semester, reserve a date of the Friday Colloquium for a lecture or information event related to sustainability	Dean's office
I8.4	Compilation of an overview of external events with sustainability relevance	FSI
10 Communication		
I10.1	Lecture series with a focus on sustainability as part of the Open Lecture Hall	Coordination unit "Offener Hörsaal"
I10.2	Greening of one of the inner gardens; use as a "sustainable meeting place".	Volunteers and one person for supervision
I10.3	Contribution of the Physics Department to the People's University Sustainability & Climate Protection	Dedicated scientists
I10.4	Expanding the teaching materials of the experimental kit with regard to sustainability aspects	Professor Wöste, volunteers
11 Sustainability – Organisational Anchoring within the Department		
I11.1	A sustainability day is held once a year.	Dean's office, sustainability group
I11.2	Write suggestions for improving sustainability to: mailto:mehr-nachhaltigkeit@physik.fu-berlin.de	Sustainability group

Link Collection

Waste ABC of the Sustainability & Energy Unit
- in German: https://www.fu-berlin.de/sites/nachhaltigkeit/handlungsfelder/campus/verwertung_entsorgung/abfall_dokumente/Trennkonzept-Entwurf_Aushang_Version-5_final.pdf
- in English: https://www.fu-berlin.de/en/sites/nachhaltigkeit/handlungsfelder/campus/verwertung_entsorgung/abfall_dokumente/Abfall_Trennkonzept_Aushang_en.pdf

Sustainability group of the Physics Department:
https://www.physik.fu-berlin.de/en/fachbereich/arbeitskreise/nachhaltigkeit/

atmosfair Airline Index 2018
https://www.atmosfair.de/en/air_travel_and_climate/atmosfair_airline_index/

CO_2 calculator of myclimate
https://CO_2.myclimate.org/en/flight_calculators/new

deZem measuring case of the Sustainability & Energy Unit
https://www.dezem.de/en/mobile-metering-case/

Experimental kit for Physics classes (Prof. Wöste)
https://www.physik.fu-berlin.de/physlab/koffer/

FU form for the disposal of special waste
https://www.fu-berlin.de/en/sites/nachhaltigkeit/handlungsfelder/campus/verwertung_entsorgung/sonderentsorgung/

Climate emergency declaration of the FU:
https://www.fu-berlin.de/en/sites/nachhaltigkeit/commitment/klimanotstand/

Courses addressing sustainability at the Physics Department:
https://www.physik.fu-berlin.de/en/fachbereich/arbeitskreise/nachhaltigkeit/lehrveranstaltungen/

FU Sustainability Report 2022
https://www.fu-berlin.de/sites/nachhaltigkeit/_media/stabsstelle/NHB22_web.pdf

Pathways in Physics
https://www.physik.fu-berlin.de/en/fachbereich/veranstaltungen/pathways-in-physics

Schools@University for Sustainability + Climate Protection
https://www.fu-berlin.de/en/sites/schueleruni

'Scientific CO2nduct'
https://scientific-conduct.github.io/

Sustainability & Energy Unit – Mobility
https://www.fu-berlin.de/en/sites/nachhaltigkeit/handlungsfelder/campus/mobilitaet

Sustainable Development Goals (SDG) of the United Nations
https://sdgs.un.org/goals

Transparent reporting of research-related greenhouse gas emissions through the scientific CO_2nduct initiative
Ryan Sweke, Paul Boes, Nelly Ng, Carlo Sparaciari, Jens Eisert & Marcel Goihl,
Commun Phys 5, 150 (2022): https://doi.org/10.1038/s42005-022-00930-2