The environmental impact of...

Experimental research resources

Where we are

Laboratory equipment and consumables represent 6 % of UNIL's impact on CO_2eq. This refers only to the inbuilt carbon (production and disposal), and not to its electricity usage. At Biophore level, laboratory equipment and consumables constitute 19% of total CO_2eq.

Figure 1: Proportion of emissions due to laboratory equipment and resources in Biophore in 2024

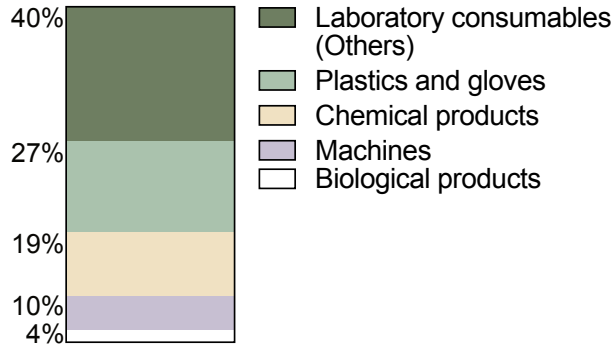
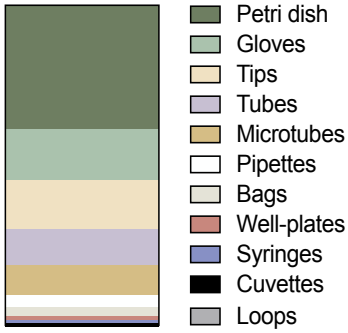
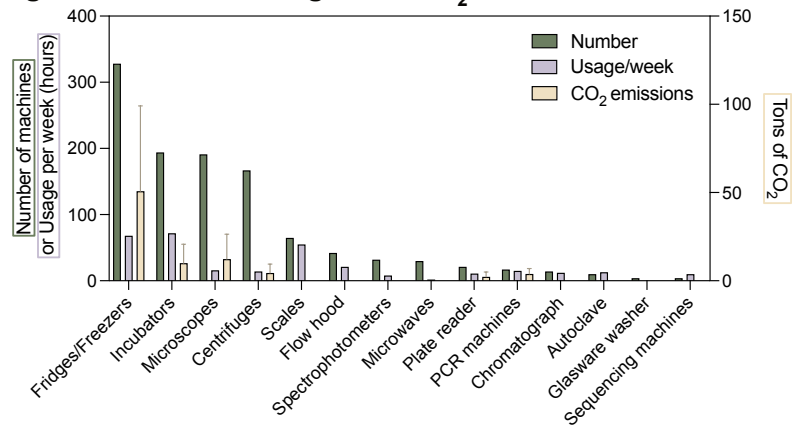


Figure 2: Tons of CO_2 eq of plastic consumables (DMF 2024)



A bottom-up estimate for DMF Plastic found that it generates 18t CO_2eq. The top-down estimate by CCD for Biophore is 109 t CO_2eq and thus, assuming a uniform consumption between departments, this would mean 39 tCO_2eq for DMF: about twice the bottom-up estimate. The discrepancy is likely due to errors in estimating the weight of plastic items in the bottom-up approach.

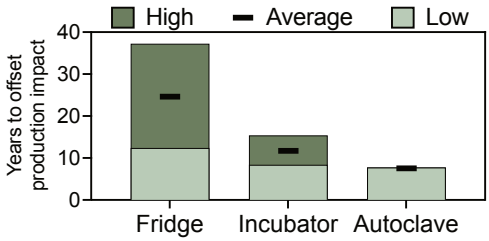
Figure 3: Number, usage and CO_2 emissions of machines



Source: Inventory work done by students with Paul Majcherczyk 2023-2024 for the Biophore building.

Limitations to the current estimates on laboratory equipment:
- *We lack a centralized inventory of all purchases*
- *Estimates are based on money spent in equipment based on catalogue price, but real expense often profits from big discounts (up to 50%)*

Figure 4: Nb of years needed to offset production emissions with usage emissions, for laboratory machines



These numbers are obtained by dividing the CO_2eq due to production by the CO_2eq due to usage. Note that for machines that require more energy for usage, such as ultra low freezers, the number of year to offset production cost might be much lower than the numbers shown in this graph.

Items from which we were not able to estimate a bottom-up footprint:
- Chemicals
- Laboratory equipment & machines (order of magnitude: 20-200 tCO_2/year for items listed in the DMF calendar, big equipment only)
- Outsourced services (order of magnitude: 1-2.5 tCO_2/year for Sanger Sequencing in DMF only)
- Glassware

Where we need to go

1) Reduce volume of purchased laboratory consumables by 20%*
2) Reduce volume of purchased laboratory equipment by 40%*
*compared with 2019

CAP 2037

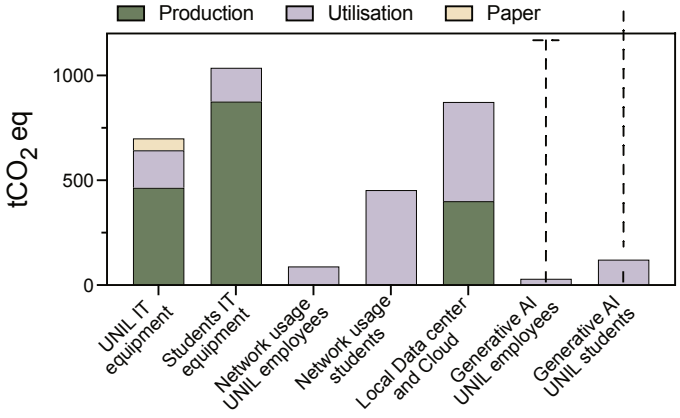
The environmental impact of...

Computational research resources

Where we are

Computational research impacts the environment because of production of equipment and electricity consumption for its use. While IT and electronic equipment itself represents a moderate share of UNIL's CO_2eq. emissions (4%), it represents a huge share of UNIL's impact on global biodiversity (30%), due to the extraction of rare earths and metals [UNIL donut 2019]. At Biophore level, the electricity consumption due to cluster use + data storage, and the purchase of IT equipment are responsible for 5% and 6% of its CO_2 eq emissions, respectively.

Figure 1: Digital carbon footprint at UNIL (2023)



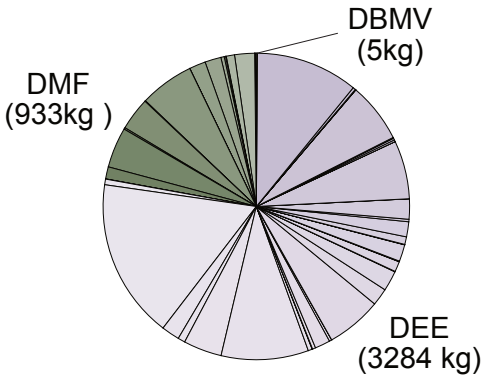
Carbon emissions of digital technologies at UNIL in 2023. More accurate estimates for each category are underway.
Courtesy of Johann Recordon, CCD.

The amount of data stored in UNIL servers grew from 2.5 to 10 PetaBytes between 2019 and 2023, of which about 80% is research data (of which 85% is FBM data).

For basic IT equipment (laptops, desktops), production is more impactful than usage.

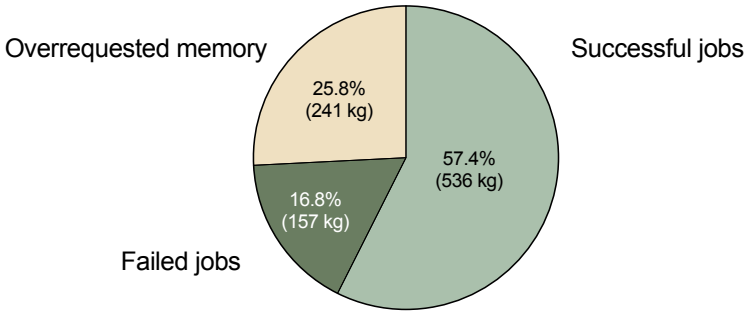
The impact of generative AI is very uncertain due to lack of data: on the one hand, providers do not disclose the consumption of their models, on the other hand we have no estimates on the rate of usage of AI for research activities. The emissions linked to the usage of Datacenters contain both cluster computing and data storage, and it is hard to disentangle the two parts.

Figure 2: eqCO_2 emissions of Curnagl usage (per project)



Each sector is a single project. Some groups have several projects
A limited amount of projects has a very significant footprint.

Figure 3: eqCO_2 emissions of Curnagl usage (DMF only)



Optimizing cluster usage (by avoiding overrequesting memory and testing new scripts on small datasets) can save up to 40% CO_2 emissions

Where we need to go

Reduce the volume of goods purchased for IT and electronics by at least 40% compared with 2019.

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The environmental impact of...

Energy and spaces

Where we are

Electricity consumption and Heating/Cooling represent, respectively, 7% and 14% of the CO_2eq emissions at the University level (source: Unil donut 2023). At the Biophore level, they account for approximately 25% and 27% of the CO_2eq emissions (source: Biophore donut, Cecilia Matasci's talk). In 2024, the total energy consumption of Biophore was 2.2 Million kWh, corresponding to 282 tonnes of CO_2eq. Construction material represented 13% of CO_2eq emissions at the University level in 2023, due to the construction works for the extension of Unithèque.

Fig. 1 Carbon footprint of Biophore (2024)

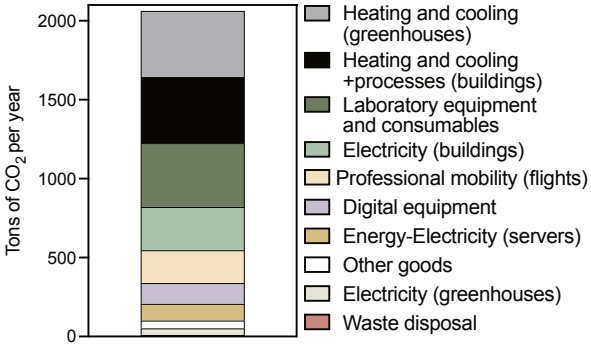
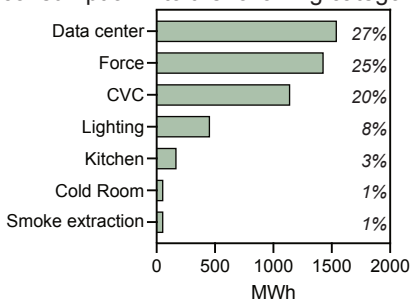


Fig. 2 Electricity consumption contributions at Géopolis level

For Géopolis in 2022 it was possible to decompose electricity consumption into the following categories



Electricity consumption in the Géopolis building in 2022, per category. Force= everything that is plugged in the power grid, CVC=ventilation, Kitchen=kitchens of canteens, Smoke extraction=system to remove smoke in case of fire.

Fig.3 Biophore electricity consumption (2010 to 2025)

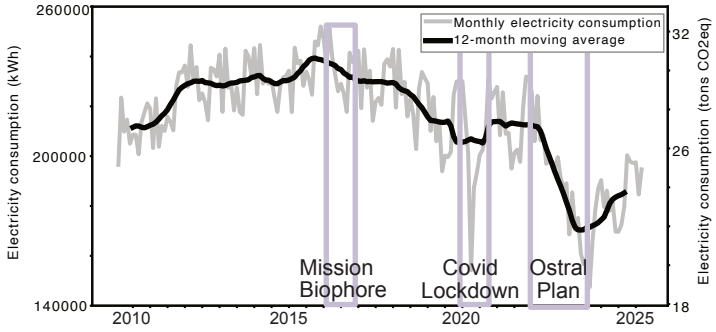
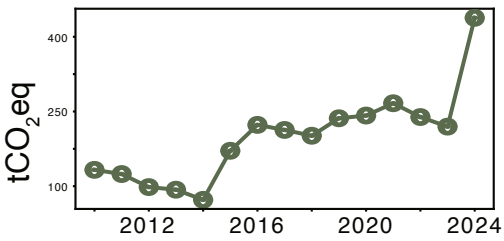


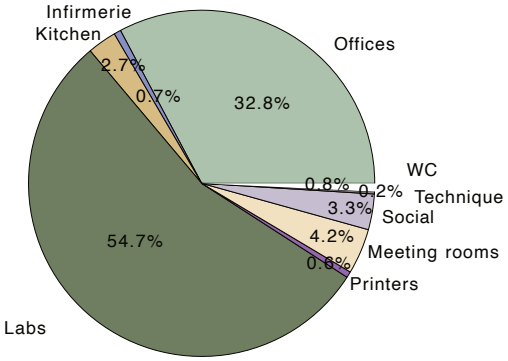
Fig.4 : CO_2 emissions due to heating of greenhouses



Several initiatives over the last 10 years succeeded in reducing the energy consumption of Biophore. Some significant measures implemented in these initiatives were:

- -80°C freezers consume ~3300-5500 kWh/year. Increasing to -70°C saves 30% of energy.
- Switching off unused equipment, replacing old machines with more efficient ones, and increasing temperature of freezers to -70 °C made DEE save 17% of energy in 2023 compared to 2022.
- **Mission Biophore** (2016) reduced energy consumption focusing only on behavioural changes (management of heating and cooling, optimization of equipment usage.)
- **The Ostral plan** was enforced at National level to save energy during the invasion of Ukraine. The Ostral plan managed to reduce up to 20% of electricity in summer 2023 compared winter 2021-2022.

Fig.5 : Space usage in DMF



Biophore spaces are mainly occupied by Laboratories, followed by offices. The per-capita surface for DMF employees is 24m². The per-capita office space for DMF (excluding PIs, secretaries and nccr employees) is 5-6 m². PI office space is instead 18m².

Where we need to go

- Reduce the thermal and electrical energy consumed by building operations by 50% compared with 2019.
- Reduce the electrical energy consumed by experimental research activities by 20% compared with 2019.
- Reduce the average gross floor area built per person by at least 20% compared with 2019

CAP 2037

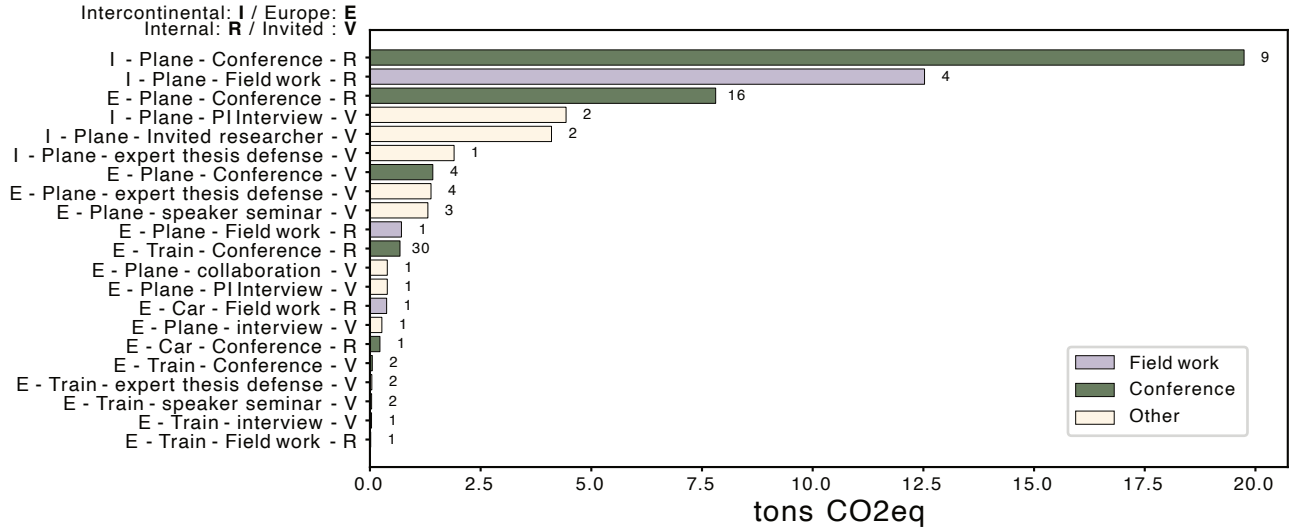
The environmental impact of...

Professional mobility

Where we are

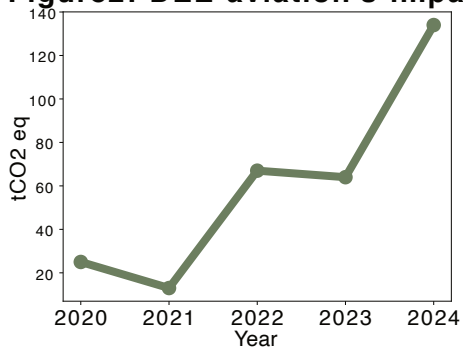
Professional mobility represents 33% of the CO_2eq (with 26% due to aviation) emissions at the University level (source: Unil donut 2023), and approximately 12.5% at the Biophore level (source: Biophore donut, Cecilia Matasci's talk), which is equivalent to 250 tonnes of CO_2. The marked inconsistency is due to differences in the calculation methodology, which is based on indirect estimates from expenses for the UNIL level, and on direct estimates from reimbursement forms for the Biophore level. Nevertheless, this is probably an underestimate, due to the limitations of the current data collection method. Trips refunded from entities other than UNIL (other funding sources or other Universities), some student field trips and privately paid trips are not captured by the reimbursement form system. It is still unclear why the impact of professional mobility at the Biophore level is proportionally lower than the one at Unil level.

Figure1: Professional mobility emissionsin DMF in 2023



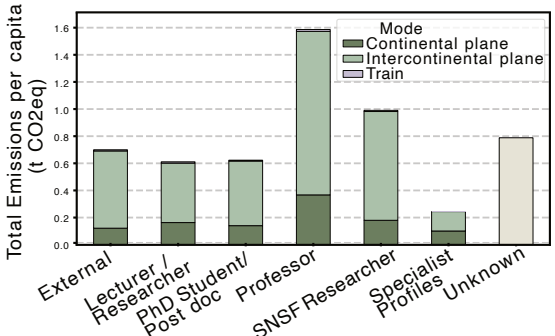
- DMF emissions linked to professional mobility in 2023 were approximately 58 tonnes CO_2eq, of which 97.5% were due to flights.
- Few intercontinental air trips represented more than half of the total emissions. At UNIL level, the 10% longest trips generate 80% of the total emissions (source: air travel working group).
- For DMF in 2023, trips to conferences outweighed emissions of trips for field work.

Figure2: DEE aviation's impact



DEE emissions linked to professional mobility varied significantly across the recent years, with a marked increase after the post-pandemic period. (source: DEE air travel working group)

Figure3: Yearly emissions per capita (UNIL)



Per capita emissions are grouped by employee status and color coded with travel mode.
Courtesy of N. Chesaux, HEC ; M. Albisetti, EPFL ; Prof. S. Houde, HEC (academic travel working group).

Where we need to go

Reduce CO_2eq. emissions from business travel by air by at least 60%, compared to 2019.

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The environmental impact of...

Beyond research ... food and commuting

Where we are

Food sold in cafeterias and bought by departments, represents 5% of the CO_2eq emissions at the University level. in 2019 it was estimated that about 1/3 of people bought their food in cafeterias. In 2023, the volume of purchased foods on campus was about 2/3 of 2019.
Compared to 2019, the impact of food on the environment has halved, this was mainly due to a reduction in total volume, and to a smaller extent to the introduction of a vegetarian day per week, that reduced the kgCO_2eq/kg of food from 3.5 to 3.2.

Fig. 1 Kilograms of food consumed in Unil cafeterias in 2019 and 2023, divided by category.

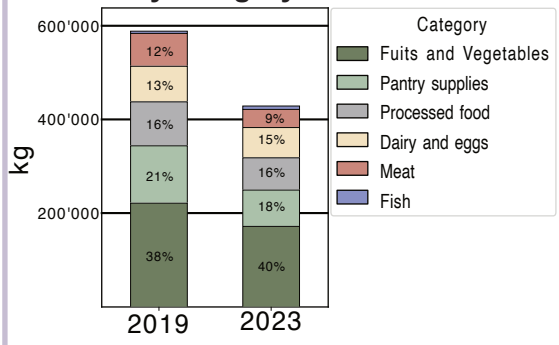


Fig. 2 The proportion of CO_2 emissions

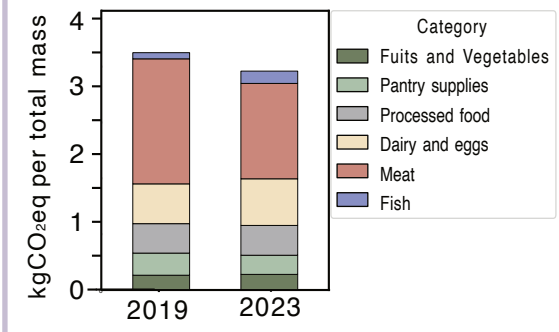
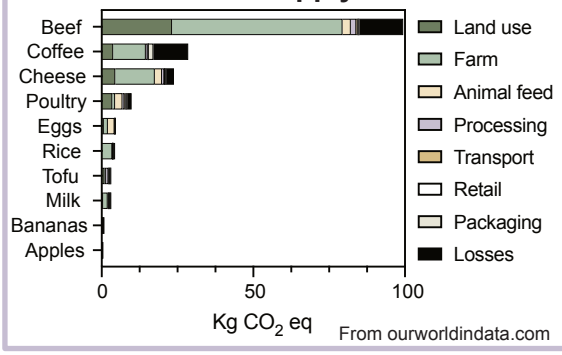
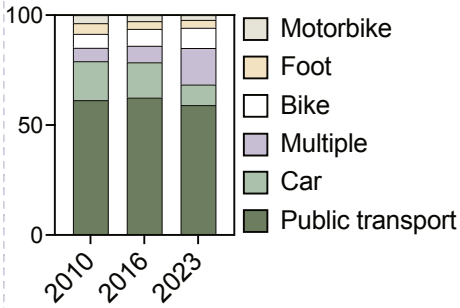


Fig. 3 CO_2 emissions of different food items across the supply chain.



From ourworldindata.com

Fig. 4 Proportion of Unil members using different means of transport to commute (2010-2023)



Commuting to work represents 15% of CO_2eq emissions at the University level. Over the years, Car usage has decreased in favor of "Multiple means of transport" and "Bike".

Not all means of transport produce the same amount of CO_2eq. Fig. 5, shows the impact on CO_2eq of each means of transport, considering the average distance covered with each of them for the commute to Unil.

Fig. 5 CO_2 emissions per means of transport

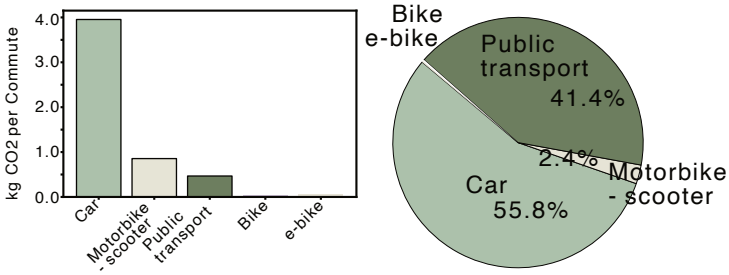
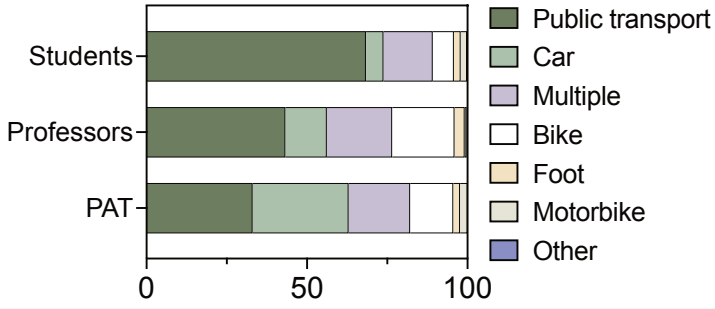


Fig. 6 Choice of mode of transport, per type of Unil community member (2023)



Where we need to go

1) Increase the proportion (by mass) of plant-based foods offered in cafeterias by at least 30%*.
2) Increase the proportion (by mass) of Swiss food products by at least 50%*.
3) At least triple the amount (in mass) of products labelled bio*.
4) Reduce the proportion of commuting by motorised individual transport by 50%*.
5) Double the proportion of commuters by bike and on foot*.

*compared to 2019

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