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Caroline Giuglaris was inspired by student demonstrations around the world against climate change.

## A GREEN LAB IN THE MAKING

Leading a drive to lower our carbon footprint is tough. Celebrating small successes is important. **By Caroline Giuglaris**

**A**fter starting my PhD in biophysics at the Curie Institute in Paris in October 2020, I was startled by the amount of waste that comes out of a laboratory: sterile packaging, excess chemicals that can't be reused and all kinds of plastic containers. And I became more aware of this issue thanks to the School Strike for Climate, in which secondary-school students, inspired by Swedish climate activist Greta Thunberg, skipped Friday classes to participate in demonstrations demanding climate action.

In 2020, my department (130 scientists across 13 teams) launched an internal

sustainability initiative called the Green Physics Lab, which I asked to join. I decided to deepen my knowledge of academia's environmental impact. The more I dug into the topic of sustainable research, the more passionate I became. I started to realize that the waste that my lab produced was only one small part of its carbon emissions – a concept that the initiative had not yet addressed. All those pipette tips were just the tip of the iceberg.

In 2021, I discovered the work of Labos 1Point5, an international academic collective that aims to reduce the environmental impact of research. This group gathers resources and

develops tools to help scientists to reduce their carbon footprints. As a result, I decided to take on a challenge with Jean de Seze, a labmate in my PhD programme. Could we measure our department's carbon footprint and set our lab on a trajectory that was compliant with targets set out in the 2018 Intergovernmental Panel on Climate Change report, which describes the impact of global warming of 1.5 °C above pre-industrial levels?

We are not experts in carbon accounting and have not yet investigated other environmental impacts such as biodiversity pressures, pollution or water use from our lab activities,

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but we did our best to follow the Greenhouse Gas Protocol, a tool that has been adopted by many governments and industries, with our limited resources. You can do it too. Here is an overview.

### Start by assessing your carbon footprint ...

I started by collecting information about our existing footprint by looking at energy consumption, a list of lab purchases and travel details. I then converted these data into a standardized metric, known as carbon dioxide equivalents.

The first tranche of data collection was difficult, because we had no idea who had access to the numbers or who was willing to help. For instance, it took us a few months and help from our department director before the facility-services office gave us heat- and electricity-bill data. And we had to earn the trust of the head lab manager before we could access the database containing information on purchases and travel. There were many discussions on how to analyse travel data while complying with data-protection regulations. Since we first collected those data, we've gained our colleagues' confidence and now know who to contact for help, which makes things easier.

To estimate the lab's final footprint, I multiplied consumption by CO<sub>2</sub> conversion factors that I found in the literature (J. Mariette *et al. Environ. Res. Infrastruct. Sustain.* **2**, 035008; 2022) and in the Labos 1Point5 database (M. De Paepe *et al.* Preprint at bioRxiv <https://doi.org/krf5>; 2023) for emissions of purchases. This can be done using a spreadsheet. Another useful option is entering all the data into Labos 1Point5's open-source online tool. We found that our department released into the atmosphere the equivalent of 4 tonnes of CO<sub>2</sub> for each person per year.

### ... but don't dwell too much on the details

Refining a carbon-footprint estimate is very time-consuming. We first focused on obtaining a rough assessment for our team. We then shared our results with our colleagues and broadened our analysis to include the whole department.

We identified key elements that contributed greatly to our footprint, and started thinking about how to reduce their impact. In most labs, the main emissions are related to purchases (especially biochemical reagents), energy consumption and air travel. We found that, in 2021, consumables accounted for 44% of the department's emissions (total purchases made up 69%), heating and electricity accounted for 20% and air travel accounted for 6% – at that time, travel for international conferences was still curtailed owing to the COVID-19 pandemic. Our first recommendations were to encourage teams to share chemicals and

stocks to reduce purchases, and to raise the freezer temperatures to reduce electricity consumption.

### Broaden your base

To deepen our impact, we needed to make our results known to the department. Our first discussions with the lab director last January were broadly positive.

Those on the leadership team helped us when they could, but they warned us that some of our proposals would be hard to implement. Indeed, current institutional policies (which are changing) usually do not take carbon emissions into consideration. For example, they might favour the cheapest option for longer travel, which is often by air.

After several months of gathering and analysing data, we presented our results at our department's weekly seminar. The response was overwhelmingly positive, especially from the younger people. After that seminar, we reached a critical mass of 25 volunteers, whom we organized into four working groups: electricity and information technology, travel, purchases and plastic and waste. Each group had two tasks: to improve the estimate of our

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current carbon footprint, and to propose rules to reduce it in the future.

There is also a communications group that works with the department to facilitate guideline implementation. Jean and I now lead the Green Physics Lab. We have monthly meetings at which we share our hurdles and progress and debate ideas, and I have integrated the working groups' results into the bigger picture.

### Get into action

For the first steps you take, you don't need to reinvent the wheel. There are many resources online to help you, including Labos 1Point5, My Green Lab and the Laboratory Efficiency Assessment Framework. In our lab, we aim to reduce our use of consumables by testing the suitability of reusable glassware for common items, and we use tubes made of plastics constructed from renewable biomass materials. We have also reduced our use of sterile plastic for non-sterile tasks. The department's largest suppliers now deliver orders twice per week for everyone, instead of several times per day for each team. Each month, volunteers run a bike-repair workshop to encourage people to reduce carbon emissions on their commute by cycling to work. With the department director, the Green Physics Lab members agreed on a lab policy to encourage people to raise

freezer temperatures from –80 °C to –70 °C. A few teams in the department, as well as others at the institute, are testing this.

This side project is not part of my PhD work, and in 2021, it was mainly a weekend task. But I am now fortunate to be funded by my lab for the extra work, equivalent to two days per month entirely dedicated to the Green Physics Lab, on top of my PhD grant.

### Set a target

Quantifying your current carbon emissions is good, but how will this translate into the future? Set short- and long-term goals, and assess your progress often. We proposed an ambitious plan to halve our emissions between 2021 and 2030. We also wrote a 'green statement', which was debated and voted on by the lab council, to formally acknowledge the need for an environmental transition in our workplace. We can now refer to this statement when we advocate concrete actions.

For instance, one proposal that we are debating is using trains instead of planes to travel in France. We aim to implement this policy by 2025, and hope to put more stringent rules into place between 2025 and 2030.

### Communicate, communicate, communicate

I try to update our department members on our progress frequently, to keep the buzz on sustainability in their heads. We also organize sustainability challenges and workshops and share interesting articles on the subject. We will hold our first symposium on sustainable research in October.

We know that some of our proposals, such as reducing air travel and switching –80 °C freezers to –70 °C, are, understandably, not popular. Having an open discussion on the pros, cons, feasibility and constraints can help to reach an agreement. And we found that having senior researchers in the group on our side helped us to convince others to get on board.

Finally, external communication is paramount. Since we have started this journey, we have realized that many labs are further along in this process than we are, but information on their carbon footprints, data usage and the initiatives that they have adopted can be hard to find. I try to promote our work at conferences and seminars – even when they are unrelated to sustainability – with posters and talks.

### Celebrate small successes

You will probably meet a lot of resistance, refusal or, worse, deadly silence, during this journey. Celebrate every bit of progress that you make. Don't be too hard on yourself if the world is not ready for your green ambitions.

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