



# Sustainable Lab Guide

Best Practice Guidance for a Greener Lab



## Why green labs are important...

EMBL is a centre of scientific excellence recognised worldwide for the quality and innovation of its research. Unfortunately, scientific research is also extremely resource-intensive and comes at a very large environmental cost.

Life science laboratories are energy intense by the nature of the work they do. Particularly energy intensive activities of a laboratory include year-round cooling, ventilation, and ultra-low temperature freezers as well as the use of highly specialised energy-intensive equipment like microscopes and structural biology beamlines.

The carbon footprint of the energy used in our Heidelberg and Hinxton sites in 2019 was 13,711 tonnes. It would take 220,000 tree seedlings 10 years to remove the annual carbon dioxide emissions from those two sites.

EMBL's operations, like all scientific laboratories, produce significant volumes of hazardous and non-hazardous waste. In 2019, we generated 215 tonnes of waste, including nine tonnes of hazardous or contaminated waste. We also use significant amounts of single-use plastic. For example, in 2019 we used more than two million non-filtered pipette tips. And it is not solely the tips themselves, as the 23 thousand racks they are stored in and the associated packaging all end up in our waste stream.

Along with the downstream impact of waste treatment, there are upstream impacts from our consumption of materials as well. Items we bought and discarded in 2019 are estimated as the second highest carbon impact we had in that year. At 20,500 tonnes of CO<sub>2</sub>e, it was the same carbon footprint as our energy use and flight emissions combined.

We are glad you are reading this guide. It shows that you care about this vitally important issue. So is it possible for your lab to be more sustainable and efficient? **YES!**

Here are some practical steps to make your lab "greener".

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# Energy Use



## TURN OFF EQUIPMENT

When equipment is not being used it always saves energy to turn it off, so do this where possible and safe, particularly at nights and weekends. Any equipment which heats or cools is particularly energy hungry so pay close attention to them.

- Use our “traffic light system” of [colour-coded stickers](#) to label what can and cannot be switched off.



- Engage your colleagues using our [superhero stickers](#) to remind them to switch-off equipment and lights



Ask the [SIM team](#) to carry out a Laboratory Energy Audit where they will give you advice on saving energy and set your lab up with switches, multi-plugs and timers to make switching-off easy. Read more about their work [here](#).

## SHUT THE SASH

When open, a single fume hood can consume as much energy as 3-3.5 houses. Closing the sash can reduce the energy consumption of a fume cupboard up to 40%. Therefore, it is important to always close the fume hood sash when not in use.

[Energy use and savings potential for laboratory fume hoods](#) 😊

- [‘Shut the Sash’ posters](#) are available and can be put up next to the fume hood as a reminder.

## KEEP FREEZERS CLEAN AND WELL ORGANISED

Freezers use a lot of energy and there are over six hundred of them across the EMBL sites. Remember to:

- Vacuum the filters to remove any dust.
- Avoid storing items on top of freezers, as it reduces the air circulation that they need to work efficiently.
- Regularly check the seals and remove any ice that would impede their correct closure.
- Plan at least one full defrost a year to remove the accumulated ice and to check the samples stored (a freezer runs about 10% more efficiently after a full defrost).
- Report any issues like heavy icing, broken seals or dirty filters to the lab manager or the person responsible for it.
- Organise sample storage to minimise opening times.



Ask the SIM team for advice on freezer maintenance if you have any concerns.

Consider using a database system to record your samples' information and location (always, but especially when stored inside freezers), to avoid keeping the freezer door open for long periods of time. This is not only safer for your stored samples and a good laboratory practice, but it also reduces the workload of the freezer, resulting in lower energy consumption and increased lifespan of the machine.

## RAISE FREEZERS TEMPERATURE

A single ultra-low temperature freezer (ULTs) consumes on average as much energy as a single-family house. Raising the temperature of ULTs from -80 °C to -70 °C can save up to 30% of energy used. Many groups across EMBL are setting their ULT Freezers to -70 - all Hamburg, Rome and Barcelona and 65% of Heidelberg ULT freezers - Can your samples be stored at -70 too?

 [Efficient ULT freezers storage](#) 😊

**!!! Also, don't leave the freezer door open longer than necessary !!!**

## RUN EQUIPMENT WHEN FULL

Drying ovens and incubators are very energy-intensive. Where possible, try to run any equipment only when full and switch them off when not in use.

## ENGAGE WITH FACILITIES MANAGEMENT

If you notice anything about our buildings which seem wasteful, such as temperatures are too cold in the summer or lights are always on, inform the [Facilities Department](#) who can investigate and change the building settings.

## OPTIMISE IT WORK

Only run codes that are needed and optimise them so that they run faster with fewer resources. Make sure you only store data as long as it is needed and in a way that fits access requirements (don't keep in the primary server data that is only accessed once every few years or archived). Also, lowering the screen brightness and the sleep timer reduces the energy associated with computer usage.

 [10 Steps to make computing more environmentally responsible](#) 😊

 [GREENER principles for environmentally sustainable computational science](#) 😊

## Resource Use



## SHARING IS CARING (FOR THE ENVIRONMENT)

Purchasing of lab equipment and reagents is one of the main factors responsible for the large carbon footprint of labs. Wherever possible:

- Be aware of the recommended storing conditions for samples and reagents.
- Keep a database to record sample storage location.
- Regularly dispose of samples and reagents that are old and/or no longer needed to optimise the use of fridges and freezers and lab space.
- Share equipment, and make good use of the core facilities services available at EMBL.
- Make your reagents list available to other labs within your unit/site.
- Before placing an order, check what items are available on the [EMBL Freecycle Database](#). And if you have spare items to donate, add them using the EMBL Freecycle Database [form](#).
- Consolidate orders: try to order all products from one manufacturer in a single order to minimise the number of shipments and reduce transportation-related emissions

## STORE SAMPLES & REAGENTS CORRECTLY

Having samples and reagents well organised and properly stored ensures reproducibility and saves time and resources. Remember to:

- Clearly label all samples, including expiry date if relevant.
- Consider keeping a database to record sample storage location.
- Be aware of the recommended storing conditions for samples and reagents.

- Regularly dispose of samples and reagents that are old and/or no longer needed to optimise the use of fridges and freezers and lab space.
- Make sure pipettes and other instruments are calibrated regularly.
- Be mindful of the reagents used:
  - Reduce your chemical waste to a minimum
  - Opt for less toxic alternatives where available
  - Deactivate toxic chemicals to make them less harmful or innocuous before disposal.
  - Follow the [12 Principles of Green Chemistry](#)

For an all-in-one application you can use EMBL's in-house solution STOCKS. It can be used to easily manage and share your lab consumables (antibodies, plasmids, ...), specimens (fly lines, strains, viruses...), equipment (microscopes, sequencers ...) and storage (fridges, freezers...). It can also be used as an electronic lab book, SOP database for protocols, archiving data (e.g. Sequencing & Images), listing chemicals/antibodies and for booking rooms. At the moment, H&S requires that the labs record all chemicals onto the Toxolution software.

An alternative option for keeping track of reagents/antibodies and reagents as well as the most recent ordering of the above is Quartz. Tools like Benchling can be used to upload plasmid sequences and DNA alignments and also share protocols and lab books.

## PLAN AHEAD FOR EXPERIMENTS

Planning experiments ahead of time avoids unnecessary repeats and saves time and resources. Remember to:

- Be conscious of what you use and why.
- Consider what's available in the lab before buying something new. Ask around for small aliquots and spare items to avoid unnecessary purchases.
- Order only as much as you need.
- Use appropriate amounts of samples and reagents.
- Think about reducing the size of your experiment and individual sample volume e.g. run it in 96-well plates rather than 24-well plates.

## PURCHASE ENERGY-EFFICIENT EQUIPMENT

Even though energy-efficient models may be more expensive, the energy savings will compensate for the higher buying costs.

- Look out for energy labelling on electrical equipment and aim for A+ ratings.



Speak to the SIM Team before ordering new equipment as they will be able to advise on energy efficiency as well as recommend products which are reliable, can be easily maintained and repaired if needed.

## REDUCE, REUSE, RECYCLE

Follow the principle of the '3 Rs' (Reduce, Reuse, Recycle) in that order, to lower the amount of lab waste, particularly single-use plastic. Where possible, try to:

- Substitute single-use plastic for glass.
- Choose the smallest plastic possible for the required volume.
- Prepare master mixes and carefully plan the order of reagents to add to reduce the number of pipette tips required.
- Buy in bulk when large quantities are needed, to reduce the amount of packaging.
- Reuse single-use plastic where possible (sometimes a rinse is enough and PP is even autoclavable)
- Use the recycling schemes available at EMBL. Contact us to get more information.



 [Re-use of laboratory utensils reduces CO2 equivalent footprint and running costs](#) 

Do you know you can:

- Reuse cell culture flasks and plates when splitting cells instead of using new ones each time.
- For bacterial work, you can replace single-use plastic cell spreaders with autoclavable glass beads. and avoid wasting pipette tips for colony picking. Instead, use autoclavable toothpicks or metal handles that can be sterilised on the flame after each use. You can as well grow your miniprep cultures in glass tubes provided by the lab kitchen.

## PIPETTE TIP USER'S GUIDE

- Whenever possible use non-filter tips provided by the lab kitchens or use stackable refill racks.
- Minimise the amount of tips used by planning experiments in advance.
- Consider using pipette tip boxes with the least amount of plastic or made from recycled plastic.
- Reuse boxes as incubator chambers, or boxes to autoclave other materials such as microcentrifuge tubes.
- Make use of tip box recycling bins (Heidelberg & Grenoble) or supplier return schemes.



Speak to the Lab Kitchens to see what assistance they can offer in terms of cleaning glassware and plastics, providing reagents and mixes and even refilling tip boxes. Read about their work [here](#).





# Laboratory Efficiency Assessment Framework



Don't forget to sign up to LEAF (**L**aboratory **E**fficiency **A**ssessment **F**ramework). Successful teams will receive a Bronze, Silver or Gold award.

- Find more resources on our [intranet LEAF Support page](#), including free stickers, posters and videos.



We're here to help!

Contact the environmental sustainability team

[sustainability@embl.org](mailto:sustainability@embl.org)

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