Manual of sustainable good practices

In the labs and in the offices

2023

IDBAPS

Intro

Research brings about great benefits to human health and society, however, at the same time, unintentionally, it leaves behind an important environmental footprint[1]. Laboratories are highly resource-intensive facilities with relevant carbon footprints. As examples, academic research alone is producing an estimated 5.5 million tonnes of plastic waste every year, and life science research is causing significant carbon emissions through the consumption of reagents, chemicals, materials and equipment[2].

The present manual is a living document for all IDIBAPS employees, collaborators and visitors to contribute to the institute's sustainability and reduce our environmental impact. Listed recommendations are based on existing literature as well as on other manuals and charters developed by national and international research institutions, such as the **MSCA Green Charter**[3] and the **BIST Sustainability Handbook**.

It is possible to reduce the environmental impact of laboratories and offices without compromising the integrity of our research and management activities thanks to our individual and institutional contributions.

If you have further suggestions, ideas, questions or doubts you can write to: **sustainability@recerca.clinic.cat**.

[1] Towards climate sustainability of the academic system in Europe and beyond. 2022. DOI: 10.26356/climate-sust-acad.
[2] Achieving sustainable transformation in science – green grassroots groups need nurturing from the top. 2022. DOI: 10.1242/jcs.259645.
[3] Marie Sklodowska-Curie Actions Green Charter. 2021. Available: https://marie-sklodowska-curie-actions.ec.europa.eu/accessible/green-charter.

Good practices in the labs and offices

1 Supplies

Resource-conscious designs: sustainability starts at the drawing board.

Seek products that are designed to minimize use of-and exposure to-hazardous materials, and buy them from manufacturers who consider the entire life cycle of lab supplies in their design process.

Look for sustainable suppliers that are providing data about their environmental claims through the ACT (Accountability, Consistency, and Transparency) label or other green product markings.

Look for sustainably manufactured products. This process may include efforts to reduce material consumption, minimizing the use of hazardous chemicals, and reducing energy usage. By selecting an environmentally-minded supplier, you are choosing to reduce your lab's environmental impact on the world.

2 Energy

Experimental and computational laboratories consume very large amounts of energy. On-site energy use (electricity and heating) can represent up to 45% of the estimated greenhouse gas emission of an academic institute[4].

For example, ultra-low temperature freezers can use as much energy as an average household every day (as estimated by the Environmental Protection Agency), small water baths can consume as much energy as a dishwasher every hour and a fume hood left wide open consumes energy equivalent to 10 households. Heated or refrigerated equipment, such as incubators, centrifuges or PCR machines, are some of the most energy-intensive machines in the lab.

Turning these machines off when not in use or changing their set-point temperature when they are can save a lot of energy.

In order to reduce our energy consumption, be more efficient and environmentally friendly, the following good practices are recommended.

[4] An Astronomical Institute's Perspective on Meeting the Challenges of the Climate Crisis. 2020. DOI: 10.1038/s41550-020-1202-4.

2.1 In the lab

Set up ultra-low temperature freezers to -70ºC and back-up ones to -60ºC. This measure can reduce energy consumption by 30-40% and increase the equipment lifespan. In most cases, samples are not damaged if stored at -70ºC[5]. In the case of a freezer failure, most freezers are protected by an alarm system that provides early warning.

Keep samples at -20ºC, when you can. Many samples, such as DNA, are preserved indefinitely at -20ºC and do not need to be kept in an ultra-low temperature freezer. Fewer samples means fewer fridges, which means less energy.

Eliminate periodically unneeded samples from the freezers. Follow the cleaning and maintenance instructions provided by the lab managers to optimize freezers´ performance and be more sustainable.

Keep open the freezers as shortly as possible. Moreover, remove the ice accumulated on the doors at least once per month; make sure that the doors fit well and that there are no boxes that hinder their closure; avoid using super-absorbent underpads during cleaning (there are special boxes for this purpose).

Shut the sash of fume hoods. Closing fume hood sashes when not in use can dramatically reduce energy usage and operational costs. The Harvard Shut the Sash program - a researcher-driven behavioral initiative that aims to minimize the energy consumption of Harvard's variable air volume fume hoods - leads to annual reductions of more than 300 metric tonnes of greenhouse gas emissions[6].

Avoid using lab equipment overnight, such as thermocyclers (both for PCR and qPCR). If it is necessary, remember that in the majority of applications, the last PCR step can be set to 15ºC instead of 4ºC.

Avoid leaving the lab equipment switched on without using them, such as thermoblocks, baths or electrophoresis current power. Keep also your eyes open and periodically check equipment in your lab: shut down whatever is not needed, someone might have forgotten to switch off the equipment.

Use the equipment during the minimum time needed, such as UV light that is efficient after 5 minutes. Set the timer to remind you to switch off the equipment just after your experiment.

Be aware of the energy cost of your calculations[7] and incorporate these considerations when making decisions about your computing equipment purchases or the scale and depth of your computational analyses[8].

Adapt your computing hardware to your needs: avoid buying the most powerful computer in the market, if your calculations do not need that power.

Consider optimizing the code of your most heavily utilized software to minimize the energy consumption of your calculations.

[5] -70 is the new -80. Available: https://www.mygreenlab.org/-70-is-the-new--80.html.
[6] Harvard Shut the Sash Programme. Available: https://green.harvard.edu/programs/green-labs/shut-sash-program.
[7] Green algorithms. Available: https://green-algorithms.org/.
[8] Ten simple rules to make your computing more environmentally sustainable. 2021. DOI: 10.1371/journal.pcbi.1009324.

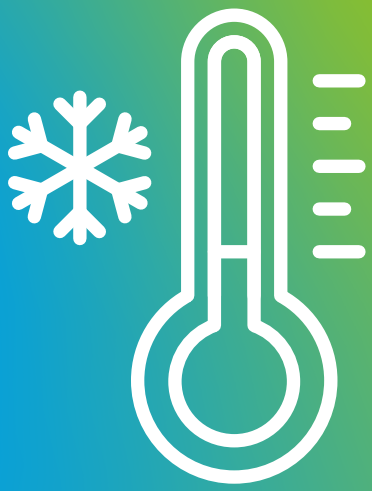
2.2 In the labs and in the offices

Avoid "night" phantom consumption: switch off and/or disconnect lab equipment, as well as mobile chargers, coffee makers, computers, computer screens and printers, etc., and turn it on again in the morning, when necessary. Office 365 now allows you to access your folders and files, from everywhere, without the need to leave your computer turned on.

Turn off the webcam, when not necessary. Sometimes, it is important to see each other during videoconferences. Other times, for example, when watching someone else giving a presentation or seminar, you can switch it off. The environmental impact of web streaming is significant: turning off the webcam can reduce energy use by a stunning 96%.

Turn-off the lights of your office, lab or other common rooms when you leave. You can also consider turning off the lights when daylight is adequate.

Adjust air conditioning and heating temperature in office spaces in compliance to the Spanish law, RDL 14/2022 (19ºC - 27ºC).



3 Waste

Research facilities produce important quantities of waste: plastic, paper, packaging, glass, biological and chemical waste, among others. Scientific research was estimated in 2015 to be responsible for 1.8% of total global plastic waste[9]. It is estimated that every year the plastic waste from laboratories could cover an area 23 times the size of Manhattan, ankle deep[10].

Good practices can reduce waste, promote recycling and re-use in the labs and in the offices.

3.1 In the lab

Share resources. This includes equipment, reagents, chemicals and consumables. Lab managers regularly inform all research groups about resources available (extra chemicals, consumables, equipment, etc.) and people in need.

Recycle porexpan boxes and ice-packs. Lab managers have reached a negotiation with AttendBio Research S.L.: the delivery material is kept in the laboratory and the company collects them fortnightly to re-use them. There is a collection point at each floor.

Save bubble wrap, envelopes, and boxes for reuse in future shipments by the group. Set-up a specific place in the lab where these materials can be stored and are accessible to everybody.

[9] Lab should cut plastic too. 2015. DOI: 10.1038/528479c.
[10] My green lab - waste. Available: https://www.mygreenlab.org/waste.html.

Dispose waste correctly. For example, in the culture room do not throw standard plastic or paper waste (e.g. from pipettes/plates packaging) to the biological waste bins. Hazardous waste bins are not for general waste. Plastic packaging and disposable plastic material, such as tubes, which have only been used for nontoxic reagents, such as buffers or sterile growth medium, should not go into biological waste bins, and can often be recycled.

Whenever it is possible, switch to reusable materials. Instead of single-use plastics, such as falcon tubes, use glassware, such as glass bottles to store solutions.

Reduce the use of plastic bags, having only one bin for plastic, and another for paper.

Promote low-impact packaging and shipping: in the lab, think about your role in consolidating shipping options and opt to place orders together with your labmates to reduce the number of boxes being shipped.

3.2 In the labs and in the offices

Read on screen and share electronically. The first best thing is not to print, and use your screen to read documents. There are software packages that allow you to make notes. When you hold a meeting, do not print multiple copies of a document for each participant; you can send the electronic version before the meeting or show the document on the screen.

Switch to recycled and unbleached paper. Use white paper only when necessary.

Print responsibly. If you need to print, ensure that your computer has the default printing set-up with double-sided, black and white printing options. Do not print unnecessary pages, take a moment to check that you print only the pages you need.

Recycle the capsules of the coffee machines. In the CEK, on every floor and in the Cellex, Còrsega 176 and Còrsega 180, a container for these capsules has been placed next to the coffee machine and staff members volunteer to take them to a recycling point.

Use your own cup/glass, glass cups or single-use paper cups and plates for celebrations. Several coffee places around IDIBAPS and Barcelona Clínic accept to fill in your own cup/glass for coffee.

When organizing a catering, **ask the provider to avoid plastic bottles, cups and/or plates**.

Reduce electronic waste by keeping, repairing and reusing computing devices. Do you really need to buy that new, flashy laptop?

4 Water

Laboratories can also consume high amounts of water, therefore negatively impacting the environment. Cage washers, autoclaves, purified water, all contribute to substantial water requirements of many research facilities.

While ensuring water quality and purity is crucial for precise and reproducible experiments, researchers must select the appropriate water type according to their specific requirements. Ultrapure water purification systems are highly inefficient, with nearly 6 liters of water required to make 1 liter of pure water. Using water with an unnecessarily high purity level for a particular application has a high cost in terms of water and energy consumption that could be avoided.

Good practices can reduce water waste.

4.1 In the lab

Sterilization service. Establish efficient labware washing practices. Run dishwashers, autoclaves, and stoves only when they are full, and turn off these pieces of equipment or put them into standby mode when you are not using them.

Use the correct water type for each application. Water types are classified according to their purity: Type I (Ultrapure/Reagent grade), Type II (Pure/Analytical grade) and Type III (Pure/Laboratory grade). Use Type I/Ultrapure water responsibly, only for ultrasensitive applications (HPLC, LC-MS, molecular biology...), and not regularly as a substitute for tap water or deionized water. Type II water can be safely used in standard lab applications, such as culture media preparation, ELISA buffers, Western Blot buffers, etc. Use Type III water for basic lab needs, such as filling water baths, washing lab material or autoclaves. To identify the right tap corresponding to the water type you need, you can ask your lab manager.

Do not store ultrapure water. Ultrapure water is highly reactive when exposed to the laboratory atmosphere and becomes contaminated by ions such as ammonia and atmospheric CO_2, as well as by the container itself, in less than 24 hours. Only dispense the volume of water required for its immediate use.

4.2 In the lab and in the offices

Turn off taps while not in use. Leaving the tap running for just 15 seconds can waste up to 4 liters of water.

Report any water leaks immediately.

Toilets are not a bin. A single toilet flush can consume a significant amount of water, ranging from 6 to 10 liters.

5 Travel and mobility

Researchers travel around the world for multiple reasons, attending conferences, giving seminars, visiting other researchers and facilities. While these trips facilitate developing a successful career, building connections and collaborations, these benefits need to be weighed against a significant carbon footprint.

A return flight from London to New York (11,000 km), for example, releases around 2 tonnes of CO_2 - roughly the same as that produced, on average, by a year's car usage in Europe[11]. Many trips might be avoidable or unnecessary, and the impact for many more can be lessened with some careful planning.

Reduce flights to attend the congresses, whenever possible, and avoid trips that are not absolutely necessary. During the COVID-19 pandemics, we have learnt that online meetings can also be effective.

If you travel, consider doing more with less travel. Sometimes conferences are organized at similar times, or you can combine a meeting with an invited talk or a visit to a nearby institute.

Check for more sustainable traveling options, such as trains, especially when trips are less than 1.000 km. Use websites such as raileurope.com to identify routes and set alerts for cheap tickets.

Walk, bike or take public transport to come to work, whenever possible. The following travel decision tree tool can help you to reflect on your travel plans, identify sustainable travel alternatives and maximize the benefit of your travel emissions:

If cycling or public transport are impractical for you, see if anyone else working on your site lives in your area and if you can share lifts to reduce traffic.

At work, take the stairs instead of the elevators.

[11] Seven steps to make travel to scientific conferences more sustainable, 2019. DOI: 10.1038/d41586-019-02747-6.

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