Greener initiatives at the Geoscience laboratories

PREFACE

Denmark focuses on two of the UN sustainable development goals: “Responsible consumption and production” (no. 12) and “Climate action” (no. 13). Changing habits in research laboratories can make a difference in both areas, we hereby invite you to join us by implementing more sustainable solutions at the department. 

Examples of green procedures and initiatives in laboratories:

- Reduce energy consumption.
- Reduce plastic/packaging, reuse and recycle.
- Use return systems (some companies offer to pick up plastic bags or cardboard boxes to reuse).
- Optimize temperatures when shipping and storing.
- Optimize protocols, this includes trying to get the most data out of sample material as well as reviewing your method to minimize the use of consumables and optimize infrastructure usage.
- Use green chemicals (note that Danish law requires substitution of hazardous materials).

Why consider greener solutions:

- Some initiatives are directly life-prolonging for lab equipment, which turns out to be more cost-efficient by reducing time and money spent on repairs.
- When critically evaluating lab procedures, you may improve working time, quality, reproducibility and sustainability.
- Lab work leaves an imprint on the planet that is significant: It is estimated that the impact from laboratories is 3-10 times more than from a single person. The four main areas are:
    1. Electricity (power for instruments, computers, ventilation, cooling systems etc.).
    2. Water (used for cooling purposes, dilutions, washing and generally water is an essential component in many laboratory processes).
    3. Consumables and equipment (unfortunately often based on non-green manufacturing processes, long distance transportation and excessive packaging of the products).
    4. Waste (often plastic), the biggest influence of all.

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No initiative should be implemented if safety or quality of the process is compromised. If you replace a product or a process with a greener alternative: Conduct thorough tests and evaluate to ensure the effect is as expected before proceeding.

1. ELECTRICITY

Ventilation:

Reduce ventilation for fume hoods, flexible arms and general room ventilation by:

- Minimizing the opening when using a fume hood (keep the front sash as low as possible).
- In most labs you can turn off the ventilation on the flexible arm when finished working.
- Close doors to laboratories (this also benefit the safety when you work by optimizing the air flow).

Fact: A fume hood running at max. capacity (open front sash) uses 3.5 times the amount of energy of a normal household. Even when the front sash is down a fume hood will use 2 times the amount of energy of a normal household.

Cold storage:

- Consider what temperature is really needed: Don't use a freezer if you could use a cold room etc.
- Check the actual running temperature (not the set temperature): Some appliances are colder than you think and the set temperature can be raised without compromising the quality of the storage.
- Organize: Often a list of content for a freezer will not only help the user find what is needed quicker, but also minimize the time that the door is open. If possible, fill up refrigerators and freezers instead of having several running that each contain less items.
- Defrost regularly: A freezer full of ice may indicate that it is broken, and/or that the door is not sealed.

Fact: A freezer running at -28 degrees Celsius will use 50% more energy than at -20 degrees Celsius.

Lights, monitors, generally all equipment:

- Most accessories in a lab should be turned off when not in use:
    - If you turn off a computer, also turn off its monitor.
    - Make it a habit to turn off the lights when you leave a room.
- Fill up when using water baths, ovens, centrifuges, heating cabinets etc. instead of running small batches.
- Consider using timers for equipment that otherwise would sit idle after running a batch. Also consider if standby for a while is necessary or you should turn off the equipment instead.

Dry labs and IT:

Modelling and simulating data as well as machine learning all use a lot of electricity to power and cool local or cloud-based hardware. Check how green your computations are at http://green-algorithms.org/

- Minimize unnecessary computations.
- If more elaborate data analysis is needed: Test the analysis on a small dataset first.

Check out the https://www.electricitymap.org/map

2. WATER

Reduce water consumption:

- Often it is possible to use less water when washing, rinsing, wet sieving etc. Consider installing foot pedals to better control the water flow when needed.
- Use taps that have water-saving aerators installed.
- Use appropriate water quality for a specific job: Don't select the best/cleanest water just because it is available.
- If you need Ohm-18 water of high quality, don't purify more than you need for the day (this type of water is not suitable for storage and should be used within the same working day).
- Use normal tap water to clean sinks etc. after use, not deionized water.
- Immediately report water leaks or dripping from taps, toilets etc. to NAT-BYG.
- Do not use single-pass cooling systems, opt for closed system cooling.
- Only run equipment that uses water when full (an example is a dishwasher for glassware).
- If you purchase new cooling equipment, select products that use limited water supply.
- Use proper sized equipment that fits the job to avoid using extra water:
    - Use a small water bath when having tiny containers.
    - Use a small centrifuge when having small volumes.

Fact: Making purified water requires about 3 liters of normal tap water to make 1 liter of deionized water.

3. CONSUMABLES AND EQUIPMENT

Sharing prevents spill:

- If you only need a small amount of a chemical or consumable, check the department list of chemicals (available from this page https://geo.au.dk/en/research/faciliteter/laboratories/introduction/) and/or ask around to borrow what you need from another lab.
- Reduce the number of shipments by combining several orders into one.

Procurement:

- Buy products that are greener in one or more ways: Have less packaging, are transported a shorter distance and/or are produced by a company that uses green energy etc.
- Only buy what you need: Resist buying multi-buy offers.
- Purchase the volume/size that you need.
- If you participate in a tender, make sure to consider energy efficiency, life span, carbon print etc. as important parameters to evaluate.
- When purchasing products for the laboratories, insist that the supplier use and handle their products in a sustainable manner: You can ask them to change something, e.g. reduce and/or remove excess packaging.
- Some companies have a sustainability policy, check it out and make an impact by talking to the manufacturer or vendor about your needs for sustainable products.
- Be vocal, speak to the AU procurement unit or your shopping partner about the need for sustainable products.

Paper and cardboard:

- When using printing paper opt for recycled paper. Note that the alternative to paper (data storage) may be less sustainable: Paper is already one of the most recycled products in the world, often harvested using certified sustainable practices and easy to dispose of.
- Limit the use of tissues used to wipe surfaces or hands, instead use washable cloths.
- If you receive consumables packed in much larger cardboard boxes than needed: Complain to the company that shipped it.

End of life:

- When buying instruments: An expensive product with a longer lifetime may turn out to be greener and cheaper than a product with a shorter lifespan.
- Consider a product's full life cycle: The carbon print may not make it feasible to repair old equipment that has a high energy consumption.
- Often you can return specialized equipment hardware to be reused or resold as replacement parts.

4. WASTE

What you can do to limit and handle waste:

- Buy less and buy smaller quantities.
- Plan your work to reduce waste products.
- Sort all waste into appropriate categories.

What about plastic?

Most plastic isn't recyclable and plastic is difficult to sort correctly. The most efficient green impact is to limit the use of plastic or (if possible) avoid it entirely:

- Substitute plastic for other materials such as glassware.
- Reuse plastic items that are normally considered onetime use only. Some tubes, beakers etc. may be used repeatedly.
- Sort your plastic (see "Types of plastic" below), use the bins in the basement of 1674.

Fact: 5.5 million tons plastic waste is produced by academic biological research labs (excluding industrial research labs) worldwide.