



Sustainability in the research laboratory.

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- Although scientific research generally contributes to the progression of humanity in some form, we should be aware of the disproportional environmental footprint of our research.



Lab work is resource intense



CO_2





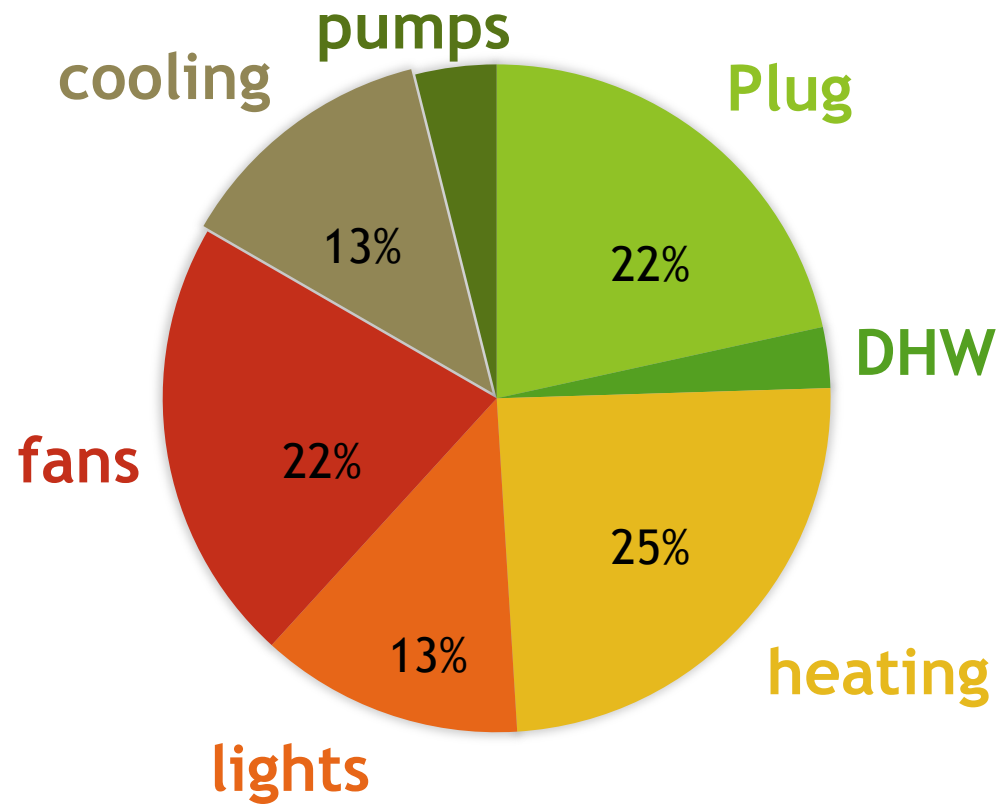
Annually, Rutgers emits about 470,000 tons of carbon dioxide.

How to reduce your lab footprint



- ▶ **Energy**
- ▶ **Waste**
- ▶ **Water**
- ▶ **Microchemistry**

Energy consumption in a common laboratory



Every Step counts!

- Disconnect equipment that is not in use.
- Use electrical timers.
- Turn off lights in empty rooms.
- Maximize the use of natural light.



Did you know?

Fume Hood



3 Homes/day

ULT Freezer



1 Home/day

Small Water Bath



Dishwasher/hr

Heat Block



50" TV/hr

Factors affecting the performance, energy consumption, and carbon footprint for ultra low temperature freezers: case study at the National Institutes of Health

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- **Ambient temperature**
- **Age**
- **Capacity**
- **Set Point temperature**
- **Spacing between units**
- **Dust on the filter**
- **Ice**
- **Performance**

Sustainable cold storage.

- Remove ice regularly.
- Minimize sample size.
- Keep a good inventory.
- Clean out unneeded samples.
- Switch from -80° to -70° (up to 30% reduction in energy use).



Temperature tuning rationale

- ▶ ULT-freezers used to be set at -65°C or -70°C .
- ▶ Only in the 1980s-1990s producers of ULT freezers start to advertise lower temperatures of -80°C or even -86°C .
- ▶ Although this 10°C lower temperature comes at a considerable cost (**up to 30% higher energy use**), no evidence was provided that lower temperatures improved sample stability or recovery.
- ▶ The crystallization (freezing) point of water (0°C), the 1st re-crystallization (-60 to -63°C) and 2nd re-crystallization point (-130 to -135°C) are critical temperatures for long-term storage of samples; -80°C , however, is not a critical temperature.

Temperature tuning concerns

- That freezers may become more prone to freeze-thaw in case of power-cuts.
19 h 10 minutes (-70 °C) vs 19 h 45 min (-80 °C) to reach -20 °C.
- The temperature impact of opening doors is similar between freezers set at -80 °C or -70 °C .
- Freezer content organization is critical for temperature stability; a partially empty freezer heats up considerably faster than one at capacity.

Temperature Tuning concerns

Sample integrity

- ▶ Genomic DNA is stable at -20°C or -70°C .
- ▶ Similar stability and viability of fungal isolates was achieved after 8-year storage at -70°C and -130°C .
- ▶ No differences were observed in a series of assessments of serum antioxidant status when samples were stored for 1 year at -20°C , -70°C or -196°C .
- ▶ Plasma antibodies against HIV, HCV and HbsAg were stable for over 15 years at -20°C ,
- ▶ Cardiac troponin T plasma concentrations are stable for over 8 years when stored at -70°C .

mygreenlab.org

Waste Managing

Reduce

Replace

Recycle



Reduce

Avoid extra packaging and plastic.

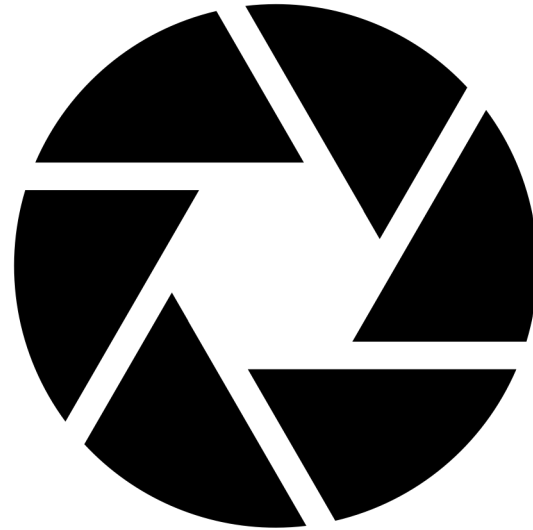


These tubes* are made with at least 90% biobased plastic.

Reduce

Introducing Rheaplay

- ▶ Asset management and exchange platform.
- ▶ It allows Rutgers members to share equipment and supplies across campus to scale circular economy efforts.
- ▶ Rheaply helps save money, reduce emissions and landfill waste.
- ▶ <https://research.rutgers.edu/researcher-support/core-services/rheaply>



Replace

Disposable for
reusable



Recycle

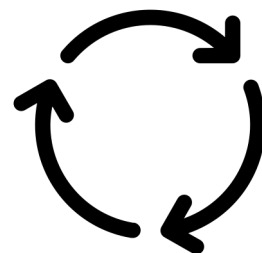


Bottles, cans
and paper



Pipette tip refill racks (USA)
and boxes (Corning, Falcon,
Axygen, ART, Olympus)

Recycle



Recycle

Packaging materials



Corning, Falcon, Axygen

<https://corning.mailthisback.com/>



Sigma-Millipore

Water

- It takes **3 gallons** of water to make 1 gallon of deionized (DI) water.
- Single-pass cooling systems can easily lead to 1 lab using **more than 13,000 gallons of water each year.**
- Autoclaves can use as much as **60 gallons of water per cycle.** And if the autoclave is >10 years old, chances are it uses up to 90 gallons per cycle.



Microchemistry

Waste Disposal

Request for Hazardous Waste Pick-up

To request hazardous waste disposal, please complete the Request for Hazardous Waste Disposal form by:

- Completing the online form: <http://halflife.rutgers.edu/forms/hazwaste.php> or
- Faxing a hardcopy form to REHS: <https://ipo.rutgers.edu/sites/default/files/Haz-Wast-Req-Form.pdf>

Hazardous Waste Minimization

Rutgers has the following components in the Waste Minimization Program:

Chemical Reuse - Unused and unopened chemicals should be redistributed within your department or can be given to REHS for storage and re-disbursement. [Check out the cataloged list of available chemicals.](#)

Microscaling - Microscale chemistry is a pollution prevention method that decreases the amount of chemical waste generated during laboratory experiments. This method reduces waste generated, laboratory chemical costs, the time necessary complete experiments, and chemical storage.

Inventory Control - When inventories are controlled, this can drastically reduce unnecessary purchase and disposal of chemicals.

Substitution - In some instances, chemicals that are more environmentally friendly may be substituted for traditionally used chemicals. [See some Substitution examples here!](#)

Small collective efforts make the difference



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Additional Resources

- ▶ My Green Lab: mygreenlab.org
- ▶ The Green lab Group: Marcela Rodriguez: rodrigg2@njms.rugers.edu
- ▶ Rutgers OCA:
<https://climateaction.rutgers.edu/campus-resources/sustainability-tips/#>