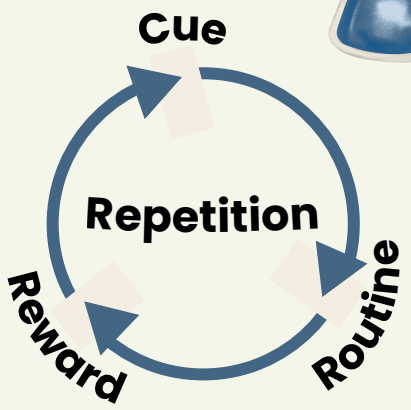
JANUARY

NEW YEAR, *New Habits*

How are Habits Formed? [2]

- **Cue:** The trigger which encites the response. It can be a person, place, time, object or event.
- **Routine:** The actions performed in response to the cue.
- **Reward:** The outcome reinforces the behavior to make it more likely to recur.
- **Repetition** strengthens the association across the cycle, with the cue, routine, and reward.

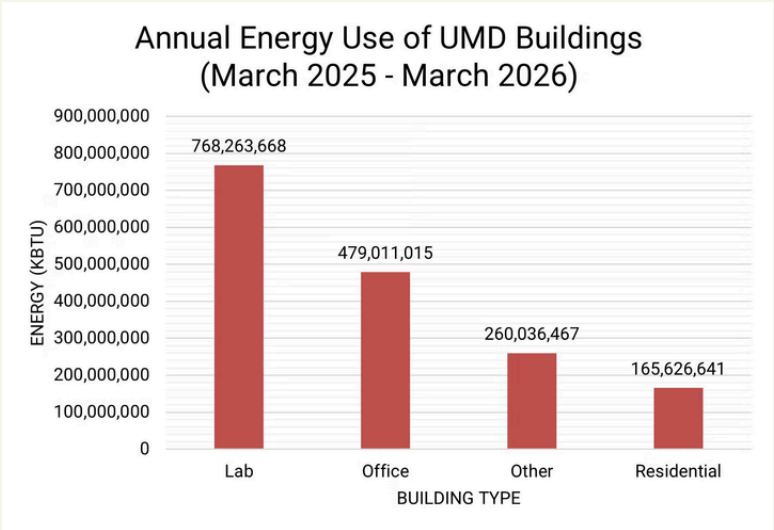


To break a habit, disrupt the cycle!

Let's Try it Out!

Let's say your lab finishes experiment, and they leave their computers on for the next time they need to use it, for convenience. Let's disrupt the flow!

CUE	ROUTINE	ROUTINE	NEW REWARD
Finsinhing up analysis on the computer	Leaving the computer/ monitors on	Powering off computers before leaving for the day	Whoever shuts down their PC the most consistently in a week gets a shoutout at the lab meeting



Why Focus on Labs?

Lab buidlings use more energy and resources per square foot than other buildings on campus. This is largely due to: continuous operations, high ventilation demands & specialized equipment. UMD's labs consume **~60% more energy** than office buildings and over **4.5x** as much as residential facilities. [1]

1. *Green Labs | SustainableUMD.* (2024). SustainableUMD. https://sustainability.umd.edu/green-labs
2. University of North Carolina at Chapel Hill. (n.d.). *Changing habits.* The Learning Center. https://learningcenter.unc.edu/tips-and-tools/changing-habits/

FEBRUARY

FREEZER MANAGEMENT & Cold Storage

Did You Know?

Ultra-low temperature (ULT) freezers are one of the most energy intensive pieces of equipment in research labs. Most ULT freezers lose energy efficiency over time as a result of frost buildup, dirty condenser filters, and worn door seals. According the University of Edinburgh, operating ULT freezers at -70°C versus -80°C saves 28% more energy and preserves the integrity of samples just as well. [2]



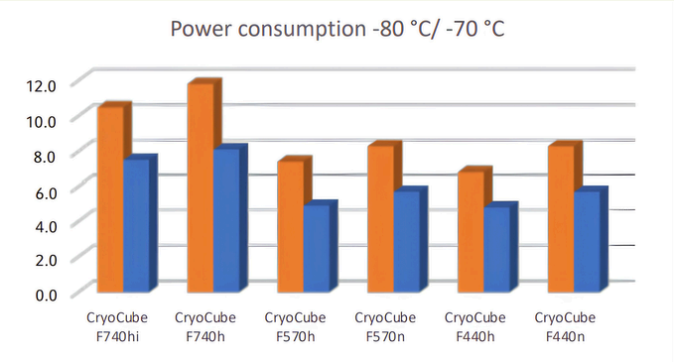


Figure 1: Average energy savings in kWh/day when changing the set-point of an Eppendorf ULT freezer from -80 °C to -70 °C. [1] Overall, raising the remperature by 10 degrees reduced energy consumption by about 30%, with the highest energy reduction saving around 3.5 kWh/day with the CryoCube F740h. [1]

Racking Reduces Temperature Gradient

Opening the door of a ULT results in a rapid rise in its interior temperature, with the top shelf experiencing the greatest temperature rise, while the bottom shelf remains more stable. **Racking** can minimize this effect and help reduce sample temperature variation. [2]

Racking is adding extra shelves like these in the freezer!



1. Bebermeier, Jan-Hendrik, and Kate Meola. "How Sustainable is My URL Freezer?" *Eppendorf*, 2022, https://www.eppendorf.com/product-media/doc/en/5059229/Sustainability_White-Paper_074_Sustainability_ULT-Freezers_CryoCube_How-Sustainable-is-my-ULT-Freezer.pdf?srsltid=AfmBOoouDVExriz7hC2pyRfojDQ7ufz1agoZ_monGDK3z3sS8MSKomT-
2. Martin Farley, Brian McTeir, Andrew Arnott, & Andy Evans. (2015). An Investigation of ULT Freezer Energy and Temperature Dynamics [Technical report]. University of Edinburgh, Social Responsibility and Sustainability. https://sustainability.ed.ac.uk/sites/default/files/2024-10/Efficient%20ULT%20freezer%20storage%3A%20An%20investigation%20of%20ULT%20freezer%20energy%20and%20temperature%20dynamics.pdf

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MARCH

RECYCLING *in Labs*

Labs Produce a Lot of Waste! [1]

2.5k (thousand)

In science education at universities, students consume, on average, 7 pipette tips every day, or 2,555 tips annually.

8.4k (thousand)

These same students consume on average 23 pairs of gloves every day, or 8,395 pairs annually.

5.5M tonnes

Laboratory research produces an estimated 5.5 million tons of (single-use) plastic waste annually.

Plastics4Purpose

Plastics4Purpose is a program offered through UMD's Green Labs that enables research labs to recycle biologically contaminated plastic materials, which are processed into durable plastic lumber products.



Shredded regulated plastic waste

Regulated plastic is shredded and treated to remove contamination.



Raised garden bed using recycled plastic lumber

The shredded plastic is melted, extruded into molds, and converted into plastic lumber.

Get involved with UMD's Contaminated Lab Plastics Recycling Program!

230

pounds diverted from incineration with Plastics4Purpose (as of October 2026)

Case Study: Pipette Tips [2]



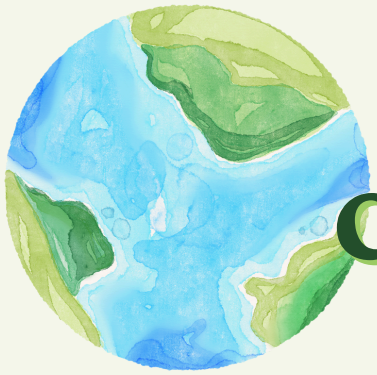
Producing a single 96-rack of polypropylene pipette tips requires approximately **0.304 kilograms of CO_2 equivalent** (CO_2e) and **6.6 liters of water**.

Validation studies from the NIH and CDC demonstrate that washed tips are the same quality as new tips, with no evidence of contamination. The CDC implemented a Grenova tip washer in their own lab and concluded that using cleaned pipette tips can save over $24,000 annually, even with the purchase of the tip washer.

1. Freese, T., Elzinga, N., Heinemann, M., Lerch, M. M., & Feringa, B. L. (2024). The relevance of sustainable laboratory practices. RSC Sustainability, 2(5), 1300–1336. https://doi.org/10.1039/d4su00056k
2. Harclerode, C. (2024, August 20). Cutting laboratory plastic waste: The power of reusable consumables. My Green Lab. https://mygreenlab.org/the-beaker-blog/cutting-laboratory-plastic-waste-the-power-of-reusable-consumables

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APRIL

CLIMATE ACTION & Earth Day



Climate change is a problem that requires collective and collaborative action. Yet, climate research is often separated in individual labs. According to the World Association of Industrial and Technological Research Organizations, "this fragmentation means breakthrough technologies stay in laboratories while urgent climate challenges demand immediate, coordinated action. The solution lies in fostering **collaborative networks** that connect researchers across borders and disciplines, enabling rapid knowledge sharing and accelerating the deployment of innovations." [1]



Structural change is needed, but requires people to act together and demand it.

Climate Action in Labs [1]

Innovation Engines: Labs create cutting-edge technology, provide science to support policy decisions and practical solutions, and train the next generation of climate scientists.

Neutral Ground: Interdisciplinary teams can help influence international climate agreements through research partnerships and connections.

Climate Education and Public Engagement: Labs communicate scientific findings to the general public. This is through publications, conferences, and advisory roles.

UMD's Response to the Climate Crisis [2]

UMD has been ranked #1 globally for sustainability research.[3]

$30 Million Institutional investments to support projects that address enduring societal issues.

>23 Research centers focused on solutions to environmental problems.

50 Climate projects funded through Grand Challenges Grants.

1. Reinertz, D. (2026, May 11). How do research organizations contribute to climate action? WAITRO. https://waitro.org/blog/how-do-research-organizations-contribute-to-climate-action/
2. University of Maryland. (n.d.). *Climate research.* Office of Sustainability. https://sustainingprogress.umd.edu/climate-research
3. The Association for the Advancement of Sustainability in Higher Education. *2026 Sustainable Campus Index*. aashe.org/resources/sustainable-campus-index/

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MAY

REGULATED *Materials*

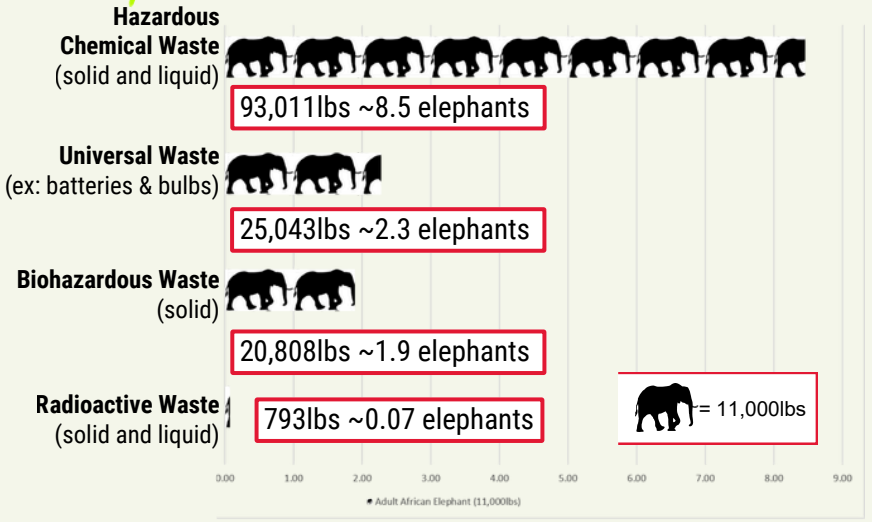


Figure 1: Amount of regulated waste generated by UMD in 2025 [3]

UMD's Regulated Waste

UMD generates huge quantities of regulated waste, with the majority being hazardous chemical waste (67% in 2025). It is important to correctly store and label regulated to avoid costly and dangerous unknowns from occuring.

Scan here to view UMD's disposal guidelines

Four Tiers of Waste Minimization[4]

The main principle governing prudent handling of laboratory waste is that no activity should begin unless a plan for the disposal of nonhazardous and hazardous waste has been formulated.

Restoration (last resort)

- **Disposal through incineration, treatment, or land burial.**
- **Treatment or recycling of materials within waste.**
- **Reuse or redistribution of unwanted, surplus materials.**

Prevention (first option)

- **Pollution prevention and source reduction.**

Unknowns are Costly!

Properly label your lab waste to avoid extra fees. At UMD, the Department of Environmental Safety, Sustainability & Risk (ESSR) handles unknown on-campus waste, but the generating department must pay for the mandatory identification testing. In 2025 alone, 178 unknown lab waste items required this costly testing.[2]

$110 *per bottle fee for all solid and liquid unknown wastes.*[1]

$2000 *per cylinder fee for unknown cylinders.*[1]

1. Department of Environmental Safety, Sustainability & Risk. (2004, April). *Hazardous and regulated waste procedures manual* [Procedures Manual]. University of Maryland. https://essr.umd.edu/sites/default/files/2021-11/HazardousAndRegulatedWasteProceduresManual.pdf
2. Department of Environmental Safety, Sustainability & Risk. (2025). 2024-2025 *Annual Report*. University of Maryland. https://essr.umd.edu/sites/default/files/2025-10/ESSRAnnualReport2025.pdf
3. University of Maryland (2026). *Regulated Hazardous Waste Training v5* [PowerPoint Slides].
4. National Research Council (US) Committee on Prudent Practices in the Laboratory. (2011). Management of waste. In *Prudent practices in the laboratory: Handling and management of chemical hazards* (Updated version, Chapter 8). National Academies Press (US). https://www.ncbi.nlm.nih.gov/books/NBK55885/

JUNE

ENERGY Efficiency

Laboratories have the highest average heating and electricity consumption at institutions, consuming at least **5-10x** more energy than an office building of equivalent size, and being responsible for **60–65%** of the whole university's total energy consumption.[1]

To better understand energy consumption in the lab, Stanford University conducted a **plug load equipment inventory** throughout 220 buildings. They found the top three contributors to lab energy consumption were **(1) lab freezers, (2) incubators, and (3) water baths.**[2] Knowing what takes up the most energy in your lab can help with targeted efforts to address them.

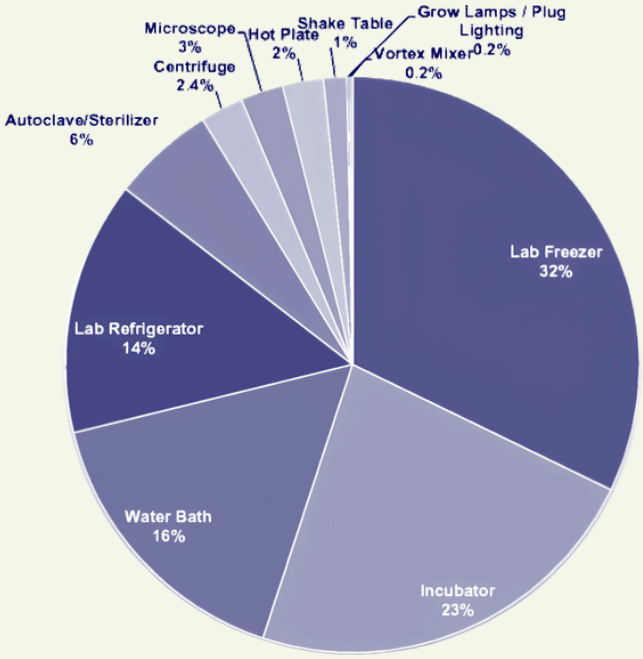


Figure 1. The energy usage of various lab equipment. Lab Freezer (32%), Incubator (23%), Water Bath (16%), Lab Refrigerator (14%) Autoclave/Sterilizer(6%), Other(9%)[2]

CASE STUDY: FUME HOODS [3]

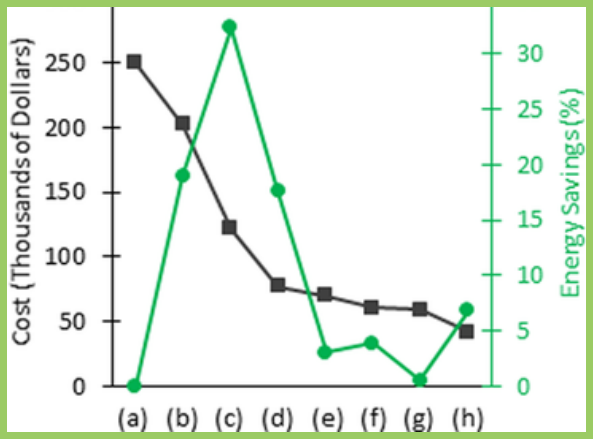


Figure 2. Energy strategies applied with the least expensive strategies applied first. (a) is the status quo.

A 2020 case study examined different strategies for reducing energy use in laboratories through fume hood use, comparing the strategies based on cost and energy efficiency.

Fume hood energy use can be reduced substantially through relatively low-cost strategies. A combination of reducing hood size, face velocity, and sash opening cut exhaust energy use by 69%, reducing costs from $250,000 to $77,500 annually for 20 hoods.

1. Freese, T., et al. (2024). The relevance of sustainable laboratory practices. *RSC Sustainability*, 2(5), 1300–1336. https://doi.org/10.1039/d4su00056
2. Hafer, M. (2017). Quantity and electricity consumption of plug load equipment on a university campus. *Energy Efficiency*, 10(4), 1013–1039. https://doi.org/10.1007/s12053-016-9503-2.
3. Haugen, R. K. (2020). Laboratory hood energy savings: The low-hanging fruit. *ACS Chemical Health & Safety*, 27(2), 125–128. https://doi.org/10.1021/acs.chas.9b00013

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JULY

WASTE *Reduction*

Did You Know?

Laboratories generate up to 5.5 million metric tons (5.5 billion kg) of plastic waste each year, nearly 2% of the global total. That laboratory waste could cover 57 square kilometers— 23x the area of Manhattan—ankle deep! [2]

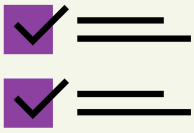
Although much of this waste is hazardous, a significant portion isn't and could have a different end-of-life.



Waste Audits [1]

A **Waste Audit** is a period check that waste is being sorted properly, and that all lab members are aware of the disposal locations of commonly used items. Consider conducting an audit with new students for familiarity! Key items to note during a waste audit include:

- Collection bin locations
- Recycling signage
- Volume of waste
- Categories of waste
- High-frequency items
- Improper disposal
- Contaminants
- Overflowing bins





Case Study: University of Alabama, Birmingham [3]



UAB has the largest campus-wide Green Lab program in the world, with 78 labs certified since 2017, and 79 certifications currently in progress in 2023. Since the program's start in 2016, they've been able to reduce their waste by 75,000 lbs. They have also recycled 20,000 lbs of pipette tip packaging.

1. How to kickstart your waste reduction journey. (2026). My Green Lab - Education. https://mygreenlab.org/the-beaker-blog/how-to-kickstart-your-waste-reduction-journey/
2. Laboratory Waste Solutions for Sustainable Research Practices. (2025). My Green Lab - Education. https://mygreenlab.org/resources/waste/
3. University of Alabama, Birmingham. (2023). My green lab case study: University of Alabama - Birmingham. https://mygreenlab.org/wp-content/uploads/2025/08/UAB-case-study.pdf

AUGUST

WATER Conservation

Labs Use a Lot of Water [2]

4x
More water consumed by labs than equivalent office spaces.

3
Gallons of water to make 1 gallon of deionized (DI) water.

13K
Gallons of water used annually by a single-pass cooling system.

60
Gallons of water used per autoclave cycle.

Water Assessment

A **water assessment** is an audit of a location's water usage. Well-managed facilities can usually account for **85% to 95%** of the water they purchase.[3] Water assessments help to:

- ***Establish*** annual water use
- ***Collect*** detailed information on major water-using equipment and processes
- ***Create*** a facility water balance of water inputs and outputs
- ***Identify*** implementable water conservation measures

Technology for Water Efficiency [1]

Waterless Condensers
Their shape increases contact of vapor molecules with the glassware by up to 5x, thereby increasing the rate of heat transfer and cooling the vapor.



Water-Miser for Autoclaves
Without a water miser, an autoclave can consume 45-50 gallons of water per minute, 24 hours a day, seven days a week.



Low-Flow Aerators
Affixing a low-flow aerator to your sink's faucet can reduce water flow to 1 or 1.5 gallons per minute instead of 2 or 3 gallons per minute.



1. Lab Efforts | Water. *(n.d.). University of Colorado Boulder.* https://www.colorado.edu/ecenter/programs/cu-green-labs-program/lab-efforts-water
2. *Laboratory Water Conservation: Reducing Your Lab's Hidden Footprint.* (2025). My Green Lab - Education. https://mygreenlab.org/resources/water/
3. U.S. Environmental Protection Agency. (2022). *Best Practices Guide: Water Efficiency in Laboratories* [Technical report]. https://www.epa.gov/system/files/documents/2022-06/ws-I2SL-Laboratory-Water-Efficiency-Guide.pdf



SEPTEMBER

SHUT *the Sash*



20 six-feet fume hoods will use approximately $250,000 per year in energy when run full open at 100 ft/min (FPM) face velocity. That is **$12,500/ year per hood.**[1] Closing the sashes of a fume hood can, in addition to being safer, **reduce their energy consumption by 40%** or more.[2] If your fume hood type and experimental procedures permit, use these strategies to make shutting the sash a habit.

Case Study: MIT [2]

A study at MIT demonstrates the effectiveness of reminders for shutting the sash. MIT created a **Motion and Sash Height (MASH) alarm** system. Hoods with a MASH alarm installed exhibited a decrease in average sash heights of over 75%. Additionally, the hoods in the influenced group, co-located in labs with MASH alarms present but without MASH alarms installed, experienced a decrease in average sash height of over 70%.

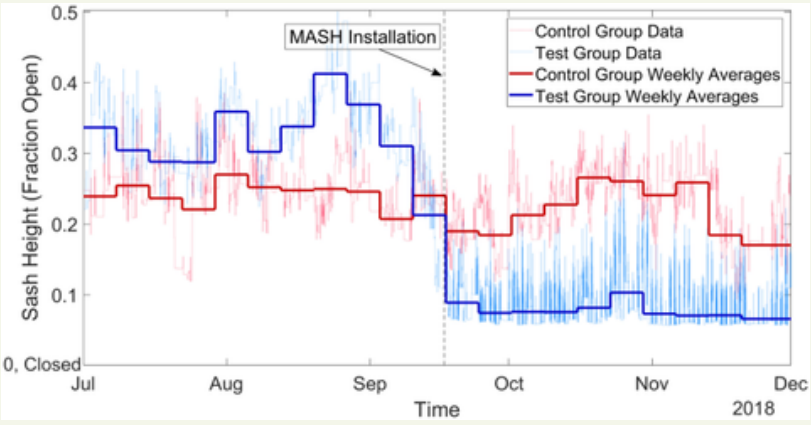


Figure 2. Average sash heights of control (no alarm) and test (with alarm) groups over time. The group with MASH alarms showed a significant drop in average sash heights.

Case Study: UMD [4]

UMD conducted a study in 4 labs (16 fume hoods total) to analyze the relative impact of two "Shut the Sash" strategies: (1) **Shut the Sash stickers** and (2) a **Shut the Sash competition** with gift cards awards for the lab who could reduce their average fume hood height the most. Stickers alone resulted in a 10% decrease in average fume hood height. The competition resulted in closer to 30% decrease in average fume hood height. Replicating these competition results across 120 lab hoods would save the university $150,000 annually.

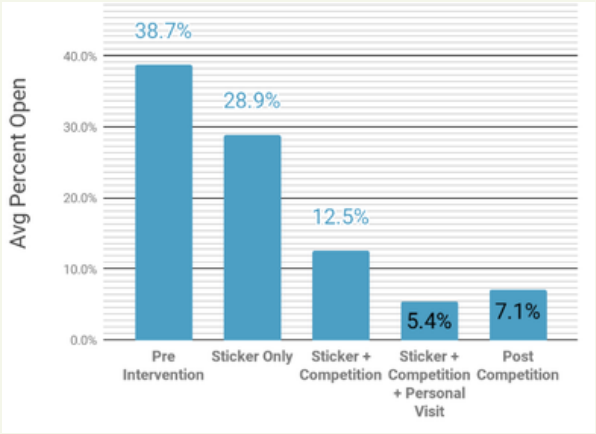


Figure 1. Impact of Various Interventions on Fume Hood Openness. The lowest average percentage of open hoods was achieved through a combined approach of reminders, stickers, and a competition.

1. Haugen, R. K. (2020). Laboratory hood energy savings: The low-hanging fruit. ACS Chem. Health Saf., 27(2), 125–128. https://doi.org/10.1021/acs.chas.9b00013
2. Kongoletos, J., Munden, E., Ballew, J., & Preston, D. J. (2021). Motion and sash height (MASH) alarms for efficient fume hood use. Scientific Reports, 11(1). https://doi.org/10.1038/s41598-021-00772-y
3. Royal Society of Chemistry. (2023). RSC sustainable laboratories report.
4. Wolf, V. E. (2018, December 20). Energy & Carbon Reductions in research labs through competition: A reproducible case study. Visualizing Informatics. https://emerywolf.wordpress.com/2018/12/20/energy-carbon-reductions-in-research-labs-through-competition-a-reproducible-case-study/

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OCTOBER

CULTURE of Sustainability



Figure 1. United Nations Sustainable Development Goals (UN SDGs) [1]

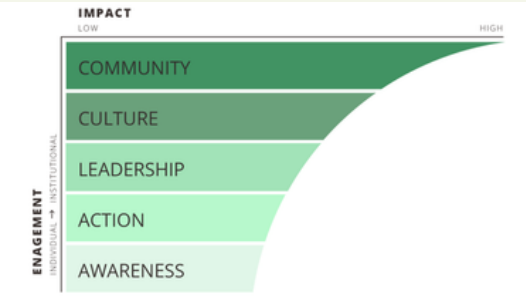


Figure 2. Green Lab Theory of Change [3]

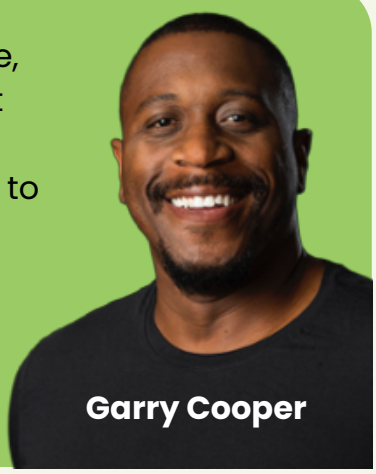
Awareness Changes Culture

Culture change is essential to improving sustainability. For **133** of the 169 SDG targets (79%), which cover each of the 17 SDGs and the three sustainability pillars, there is evidence that culture has an influence on their achievement.[2]

Creating a culture of sustainability begins with awareness. One study in a biochemistry lab measured the effectiveness of a sustainability training program. Before the training program, participants were asked the following question: "What is sustainability?" and approximately 59% of respondents answered correctly. After completing the training program, the number of correct responses significantly increased to about 90%.[1] Beyond adopting sustainable practices, leaders must actively engage stakeholders and garner awareness so that everyone feels empowered to contribute to positive change.

Sharing is Caring: Rheaply

Rheaply is an online platform where scientists can buy, sell, trade, or donate surplus supplies. Owner Garry Cooper launched a pilot program at Northwestern University. In its first 6 months, around 300 university researchers created Rheaply accounts. According to Cooper, who remains a visiting scholar at Northwestern, users collectively posted around 200 items, ranging from pipettes and glassware to chemicals and biological probes. At least 55 items were passed on, saving labs across the campus more than $25,000 and keeping resources out of landfills.[4]


Garry Cooper

1. Aykal, G., Kılıç, K. K., Yıldız, G., & Hamit Yaşar, E. (2025). Building a sustainable laboratory culture: The power of awareness and strategic training programs. Clinical Biochemistry, 137, 110924. https://doi.org/10.1016/j.clinbiochem.2025.110924
2. Zheng, X., Wang, R., Hoekstra, A. Y., Krol, M. S., Zhang, Y., Guo, K., Sanwal, M., Sun, Z., Zhu, J., Zhang, J., Lounsbury, A., Pan, X., Guan, D., Hertwich, E. G., & Wang, C. (2021). Consideration of culture is vital if we are to achieve the Sustainable Development Goals. One Earth, 4(2), 307–319. Sciencedirect. https://doi.org/10.1016/j.oneear.2021.01.012
3. *Five Strategies to Empower Laboratories for a Greener Tomorrow.* (2024). My Green Lab - Education. https://mygreenlab.org/the-beaker-blog/five-strategies-to-empower-laboratories-for-a-greener-tomorrow/
4. Dolgin, E. (2018, February 7). How going green can raise cash for your lab. *Nature,* 554(7691), 265–267. https://doi.org/10.1038/d41586-018-01601-5

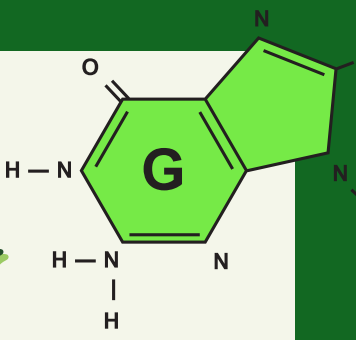
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NOVEMBER

The 12 Principles of GREEN CHEMISTRY





1. **Prevent Waste**
   It is better to prevent waste than to treat or clean up waste after it has been created.

2. **Maximize Incorporation of Materials**
   Synthetic methods should be designed to maximize the incorporation of all materials used in the process into the final product.

3. **Use and Generate Less Toxic Materials**
   Wherever practicable, synthetic methods should be designed to use and generate substances that possess little or no toxicity to human health and the environment.

4. **Safer Chemicals**
   Chemical products should be designed to preserve efficacy of function while reducing toxicity.

5. **Safer Solvents and Auxiliaries**
   The use of auxiliary substances (e.g., solvents, separation agents, etc.) should be made unnecessary wherever possible and, innocuous when used.

6. **Design for Energy Efficiency**
   Energy requirements should be recognized for their environmental and economic impacts and should be minimized. Synthetic methods should be conducted at ambient temperature and pressure.

7. **Use of Renewable Feedstocks**
   A raw material or feedstock should be renewable rather than depleting whenever technically and economically practicable.

8. **Derivatives**
   Unnecessary derivatization (use of blocking groups, protection/deprotection, temporary modification of physical/chemical processes) should be minimized or avoided if possible because such steps require additional reagents and can generate waste.

9. **Use Catalysts**
   Catalytic reagents (as selective as possible) are superior to stoichiometric reagents.

10. **Design for Degradation**
    Chemical products should be designed so that at the end of their function they break down into innocuous degradation products and do not persist in the environment.

11. **Real Time Pollution Prevention**
    Analytical methodologies need to be further developed to allow for real-time, in-process monitoring and control prior to the formation of hazardous substances.

12. **Accident Prevention**
    Substances and the form of a substance used in a chemical process should be chosen to minimize the potential for chemical accidents, including releases, explosions, and fires.

American Chemical Society. 12 Principles of Green Chemistry. https://www.acs.org/green-chemistry-sustainability/principles/12-principles-of-green-chemistry.html

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DECEMBER

HOLIDAY *Powerdown*

Switch Off!

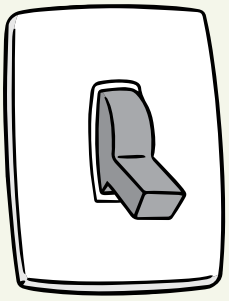
Lighting can account for up to **28%** of energy use in labs.[3] This can be easily reduced by simply switching off lights at the end of the day, or during the day if possible. Small LED task lights or installing motion sensor controls use considerably less energy. The same applies to computers and other equipment. Switching these off, or adjusting settings and using timers so they are only used when necessary, can result in big savings. Simple things, like stickers to remind people to 'switch off' can also help establish good habits.

Season's Cleanings [1]

Annual cleanings, inventory reduction, and maintenance can be easier to complete during the holiday season because:

- Fewer people in the work place = fewer distractions and risk
- Remediation or maintenance work won't come at the expense of productivity
- More gets done. An extended dormant period allows more to be completed in one sitting.

Full Switch Off Checklist [2]



Turn off (don't just leave on standby) and only where safe to do so	Done? (✓)
Lights	
Monitors, computers and laptops	
Ovens/autoclaves and drying cabinets	
Centrifuges	
Gas Chromatographs	
Lasers	
X-ray machines	
Extractor fans (where this is safe to do so)	
Incubators	
Sterilisers/dishwashers	
Orbital shaker	
Microscopes	
Fume cupboards and biosafety cabinets (close sash, turn off if feasible)	
Radios/hi-fis	
MRI scanners	
Diffusion pumps	
Reserve osmosis units	
Ice machines/Cryostat	

1. Benson, M. (2023, December 5). Season's Cleanings: How To Maximize Your Holiday Shutdown and Lab Hibernation. Triumvirate.Com; Triumvirate Environmental. https://www.triumvirate.com/blog/seasons-cleanings-5-ways-to-maximize-shutdown
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