



my green lab  
certification.

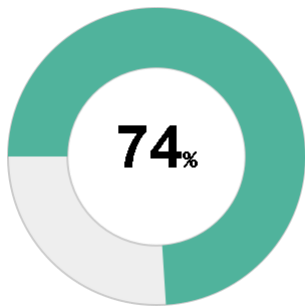
## Certification Feedback Report

Chemistry Lab

TU Dublin

Monday, December 12, 2022

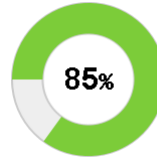
## Your Certification Score:



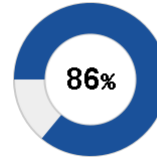
(100% (3 people) of your lab responded to the survey)



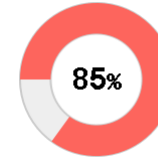
Community



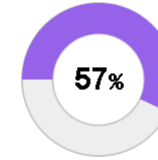
Recycling & Waste  
Reduction



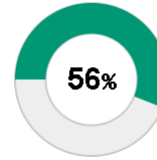
Resource  
Management



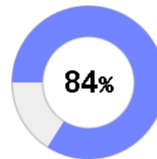
Purchasing



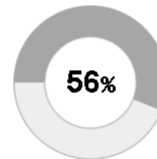
Green Chemistry  
& Green Biologics



Water



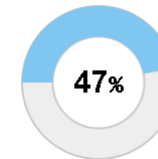
Plug Load



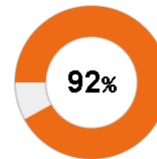
Fume Hoods



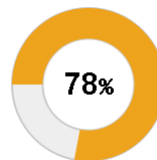
Cold Storage



Large Equipment



Infrastructure  
Energy



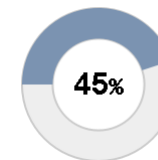
Field Work



Animal Research



Travel



# Welcome to the Green Labs Community!

Dear Chemistry Lab,

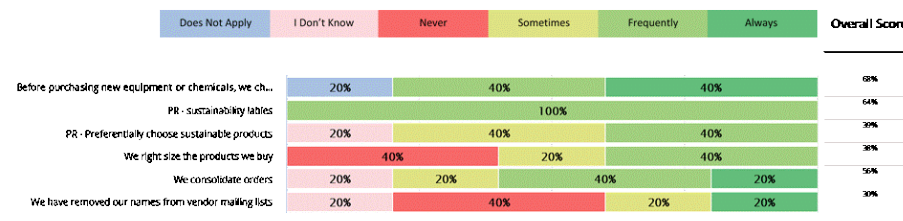
Thank you for completing the certification assessment for the My Green Lab Certification. All of us at My Green Lab are pleased to welcome you into a global community of scientists and laboratory professionals that are actively working to reduce the environmental impact of their laboratory operations. We look forward to supporting you through the certification process and beyond as you explore what you can do to advance sustainability in your lab.

## How to Use This Report

In the questionnaire you were asked about your lab's current sustainable practices in a variety of topic areas. Ideally at least 50% of your lab responded. This report shows how your lab answered these questions and provides recommendations for making change. Use this report to have a discussion with your lab about the different topic areas covered in the assessment. Congratulate yourself where your lab scored highly and discuss the sustainable actions your lab already does to ensure everyone is aware. Then move on to explore changes you'd like to make, as discussed below.

The report is divided into sections for the topic areas you answered. Each section begins with a "Learning Center" where we give key information to help you understand the importance of this topic and provide links and references if you want to deepen your knowledge. As you share these results with the lab, use the Learning Center to help provide context and talk to the lab about why this topic is important.

Each section will also show a chart detailing how the lab answered the questions about that topic:



Questions where there are a lot of "I don't know" answers are learning opportunities. Take the time to learn about what your lab or organization is doing on the topic and how you can be involved. Raising your level of awareness about lab sustainability practices helps you develop a mindset of sustainability and makes it easier to see new opportunities for change. Questions where people selected "frequently", "sometimes", or "never" are behavior change opportunities. Take the time to discuss why this activity isn't done all the time and discuss what solutions would help your lab with that change. At the end of the report we have collected comments and ideas from your colleagues. Be sure to review these in your discussion about each topic.

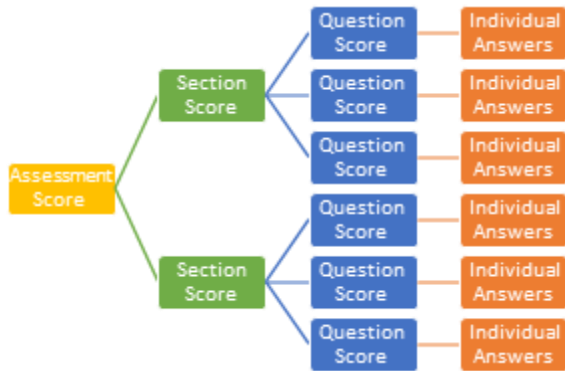
In the "Strategies to Improve" sections below, My Green Lab has made recommendations on what your lab could improve upon, and provided links to additional resources to help you explore those solutions. This will include poster templates, worksheets, discussion guides and references. To learn more about sharing your results with the lab, please watch [this short video](#). If you like, use our [Green Lab Action Tracker](#) to take note of the specific activities you will do and who will be responsible for them.

## Resources to Help You Out

Throughout this report you will see links to worksheets, case studies, articles and more. You can access all these documents and [more through our SharePoint site here](#).

## How Scoring Works

In this report, higher percentage scores correspond to questions where more of your colleagues answered that an activity is always done. You are only scored on sections of our assessment that are applicable to your lab, as determined by your lab members. For any questions where your entire lab selected “not applicable”, that will appear as a score of zero percent (0%), and those questions do not factor into your scores. To learn more about how scoring works, please watch [this short video](#).



## Teamwork Makes the Dream Work

Be aware that you may need to consult a variety of professionals at your institution to implement some of our recommended best practices. You may need to involve your green team, health & safety, building operations, procurement and more. Involving these groups in your green lab efforts will help build a culture of sustainability at your organization. And My Green Lab and the green lab community are part of your team too! If you need additional support from My Green Lab, send us an email at [programs@mygreenlab.org](mailto:programs@mygreenlab.org). You can also connect with the green lab community through our free [Ambassador Program](#).

## Become an Advocate

You have already started your green lab journey but there are many who haven't. Share your experience with your community and with My Green Lab and let others know about solutions worked or didn't work for you. This will help more scientists accelerate their efforts and broadens your impact. You can also be part of the [Million Advocates for Sustainable Science](#) campaign and let funding agencies know that sustainable science is an important topic that should be fundamental to the research enterprise.



The My Green Lab Team

# Why These Topics Were Included



## PLUG LOAD

This topic covers all the equipment plugged into outlets in your lab, which accounts for 20-25% of the energy used in a lab. We encourage you to think about whether all equipment needs to be on and plugged in 100% of the time, and strategies for handling equipment differently.



## FUME HOODS

In most cases, fume hoods are the most energy consumptive equipment in your lab. They also contribute to increased energy load on your lab building's ventilation system if fume hood sashes are left open.



## LARGE EQUIPMENT

We ask specific questions about incubators, vacuum pumps, computers, tissue culture hoods, and glove boxes in this section because these equipment types have unique energy efficiency considerations.



## COLD STORAGE

This section covers refrigerators, freezers, and cold rooms, which after fume hoods are usually the most energy consumptive equipment category in the lab. Your lab can have 10% greater energy efficiency by doing routine maintenance on your units, or save up to 30% by changing your ultra-low temperature freezer's setpoint to -70 °C.



## INFRASTRUCTURE ENERGY

In a typical lab, at least half of the energy consumption is related to the air handling system which maintains air quality and temperature, and another 15% of the energy consumed is from lighting. Being aware of the energy use of your building's infrastructure, and how to work within it, is positive for your institution's energy reduction goals.



## WATER

Laboratories consume around 4 times more water than office spaces, with 25% used in lab processes. Being judicious with fresh water is positive for everyone, as fresh water is a finite resource on our planet.



## WASTE REDUCTION AND RECYCLING

Labs tend to generate a large amount of waste, especially plastic waste, which has been estimated at almost 2% of global plastic production. This section encourages labs to think about alternatives to single-use items, and strategies for tackling the many different types of waste generated by your lab.



## RESOURCE MANAGEMENT

Save resources, time, and money by managing your lab's materials effectively. Keeping inventories, maintaining lab systems, sharing resources when possible, and implementing positive lab policies can go a long way to your lab being more sustainable in this area.



## PURCHASING

What your lab or organization chooses to spend money on directly influences the laboratory product market, and contributes to the energy, water, and materials that your lab consumes. Smart purchases with an eye on resource efficiency ensures that you support greener manufacturers and reduce your environmental footprint.



## GREEN CHEMISTRY

Chemical use is unavoidable in scientific research, but we can critically examine our usage by applying the 12 principles of green chemistry to our lab protocols. This helps uncover how to reduce, swap out, and properly design the use of chemicals for experiments and manufacturing.



## COMMUNITY AND ENGAGEMENT

Sharing your experiences, methods, tips and ideas with your colleagues is one of the most important ways to keep the Green Labs movement going strong, while also building a stronger culture of sustainability within your lab.



## TRAVEL

Whether you're attending a conference or choosing how to get to work, there are important decisions you can make to reduce your carbon footprint.

# Community



85%

## Maintain the energy on your sustainability efforts!

- Share responsibility for sustainability across lab members and staff
- Revisit topics regularly to help train new people and explore new innovations
- Designate a point person in the lab to represent your lab group on a broader green team at your organization

Motivating the entire lab team to make sustainable changes in their day-to-day practices can take a little time and effort. A common strategy to motivate behavior change, which is what this Green Lab Certification is all about, is rooted in **understanding the barriers that your lab faces to making changes and attempting to remove those barriers through specific strategies.** One school of thought is called [Community-Based Social Marketing](#), which is rooted in the science of social psychology. This can work both in a single lab and for broader green labs programs.

## CONVENIENCE



**Your lab will be more likely to succeed in starting sustainable practices if those new actions are convenient to do.** For example, if you're hoping colleagues will put the autoclave in standby mode after a cycle is done, put instructions for doing that on the autoclave itself - or better yet, pre-program it.

## SOCIAL NORMING



People pay attention to what their peers do, especially friends, family, coworkers, and neighbors. **Create norming behavior in your lab** and within your building by advertising what your lab group is trying to do to be more sustainable. And lead by example!

## COMMITMENTS



The probability is greater that someone will try a sustainable action **if a peer asks them to make a commitment to do so**, and it is even better if the commitment is made in writing and is public. Could you ask your lab to sign a pledge you all create to focus on practicing three new sustainable behaviors in the lab over the next month?

## PROMPTS



Use prompts in the lab to remind your colleagues what to do, such as turning equipment off overnight, turning off the lights in the lab, or reminding them to be conservative with ultrapure water use. Try using bold colors but avoid cluttering the lab with too many prompts at once.

# Community



85%

## Answer Distributions

	Does Not Apply	I Don't Know	Never / No	Sometimes	Frequently	Always / Yes	Overall Score
We have nominated a point person for sustainability i...						100%	100%
We have roles and responsibilities for our sustainabili...			100%				5%
We have a process to ensure sustainability measures ...						100%	100%
We provide training on lab sustainability best practice...						100%	100%
We use reusable kitchenware in lunchrooms or shared...						100%	100%
We participate in a Green Team						100%	100%
Personnel using common equipment or spaces are trai...						100%	100%
We have engaged groups outside the lab in our sustain...				100%			40%
I know and understand my organizations sustainability...						100%	100%
I understand things I can do to support my organizatio...						100%	100%

## Strategies To Improve

Great start with building a community of sustainability in science, but there are probably a few more best practices you could try in this topic area.

- Ensuring that everyone in the lab is responsible for making sure that some aspect of the lab's sustainability efforts are maintained is key to the long-term success of your efforts. Consider dividing up the duties according to topic (like energy, water, waste) or by activity (like purchasing, shutting down equipment, maintaining cold storage). Writing the roles and responsibilities into a document or on a poster can help ensure that those activities are maintained as new lab members take them over. Make sure everyone in the lab is aware of how duties are divided up and what their responsibilities are. Spend some time in a lab group meeting to determine roles and responsibilities for lasting success.
- Great job ensuring that reusable mug, utensils, and dishes are being used.
- Great job setting up a Green Labs Team! Recruit additional members and share your knowledge with other team members to get them excited about the great work you're doing!
- Great job training personnel the best sustainability practices on using common equipment!
- It often takes a team to make lab sustainability a reality at research institutions. As relevant, engage Environmental Health & Safety, Purchasing, your Store Room, Building Maintenance/Operations, the Office of Sustainability, and administrators in your department or institute to assist with the sustainable best practices you wish to see in your lab and at your institution. What starts as a passion or interest of a few individuals can grow into wide culture change across a research institution.
- It's great to see that you have a good handle on your organization's sustainability goals and how to support them!

# Waste Reduction and Recycling



86%

Labs produce many types of waste, and a lot of it, so this category is typically a high priority in greening your research. **Recycling and waste management will always depend on local regulations, organizational standards and more** – but there are simple steps that most labs can take to reduce impact.

The foremost tactic in the battle against waste is **REDUCTION**. A holistic approach of **smart purchasing, organization, planning, and communication** will ensure that your lab doesn't acquire or incorporate unnecessary waste in your research.

## HAZARDOUS AND CHEMICAL WASTE

Chemical, biological and other hazardous wastes are much more prevalent in research industries, and unfortunately disposing of them is an energy intensive and often unsafe process.

- ✓ Properly segregate your waste
- ✓ Utilize Green Chemistry
- ✓ Avoid over-purchasing of reagents and chemicals

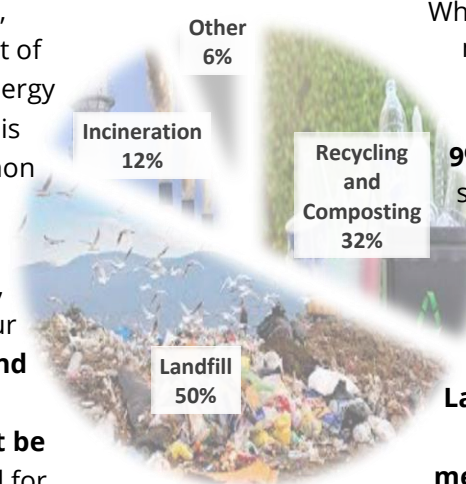
## PLASTICS

In 2018, **plastics in labs became even harder to recycle** due to China's new import regulation which limited allowable contamination in materials sent there for recycling. Labs produce over 5 million tonnes of plastic annually! **How can we minimize plastic consumption?**

- ✓ **Swap** glass for plastic (vials, large pipettors, petri dishes, etc.)
- ✓ **Reuse plastic items** – check out this [guide from University of Bristol](#)
- ✓ **Choose vendors** with reusable containers & take back options
- ✓ Look for **compostable** plastic
- ✓ **Consolidate** orders – 30% of all plastic resins worldwide are used in packaging
- ✓ Perform a [waste audit](#) to identify targets for reduction

## Where does our waste go?

Incineration, often as part of Waste-to-Energy technology, is more common in areas like Europe. Additionally, much of your **chemical and hazardous waste must be incinerated** for proper disposal.



While this number may seem high, consider that globally **only 9% of materials** sent to recovery centers are estimated to be actually recycled!

**Landfills are still the disposal method of choice for most of the world.**

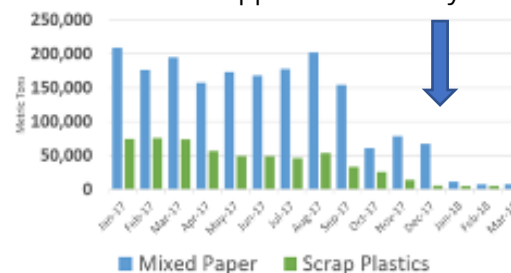
Data from 2017 EPA estimations

When tackling waste, a few key stakeholders should always be involved:

- Environment, Health and Safety
- Facilities/Building Operations
- Waste Management

These are your local experts and will ensure that your waste management plans and goals are a success.

Materials accepted by China for recycling dropped dramatically after 2018



Want to take a deeper dive? Check out **MGL's Accredited Professional course!**



# Waste Reduction and Recycling



86%

## Answer Distributions

	Does Not Apply	I Don't Know	Never / No	Sometimes	Frequently	Always / Yes	Overall Score
We have recycling bins for our lab materials				100%			100%
We know what materials can be recycled in the lab an...				100%			100%
We take advantage of product/material return progra...			100%				5%
We use take back programs for packaging in our labs	100%						0%
We preferentially select suppliers who offer product a...	100%						0%
We recycle gloves when feasible	100%						0%
We have conducted a waste audit to identify our wast...				100%			100%
We have implemented solutions to minimize the lab's ...				100%			100%
We recycle batteries that can be recycled				100%			100%
We use a reusable alternative to ice or dry ice				100%			40%
We recycle solvents when possible	100%						0%
We repurpose, surplus, or donate equipment, supplies ...				100%			100%
We reuse disposable plastic and glass items and mini...				100%			70%
We understand the labeling requirements for the diffe...				100%			100%
We throw only biohazardous waste into the biohazard...				100%			100%
We have guidelines for separating chemical waste streams.				100%			100%
We have guidelines for separating hazardous waste fr...				100%			100%

## Strategies To Improve

Congratulate yourself for a great start in a difficult category - waste and recycling is often confusing and frustrating, but with a little effort and the suggestions below your lab will be earning top marks.

- It's great to see that your team has a good handle on what items can be recycled and how to sort them. So that all team members are aware make posters, hold a meeting, or send an email to ensure that your group is aware of the items that can be recycled and where they are to be collected in your lab.
- Use manufacturer 'take back' programs, such as those for pipette tip boxes, as well as programs which accept used packaging. [Corning](#) will take plastic packaging, [Sigma Aldrich](#) and [NEB](#) reuse polystyrene containers, and some sales reps will locally collect pipette tip boxes and cartridges.



- Great to see that your lab has conducted a waste audit to identify your biggest waste streams, and are researching options to divert/minimize them!
- Great to see that your lab has implemented solutions to minimize the lab's largest waste streams or divert them to the most environmentally friendly solution!
- Amazing job implementing solutions to minimize the lab's largest waste streams!
- Outstanding job recycling batteries when possible!
- Look into alternatives for ice or dry ice, such as Lab Armor beads, freezable tube holders, or ever reusing gel packs!
- Amazing job repurposing or donating equipment, supplies and/or chemicals.
- Reuse plastic and glass items that are meant for single use when you can, such as centrifuge tubes or HPLC vials.
- It's very important to understand the guidelines for sorting all waste in your lab, but especially hazardous and chemical items. Ensure that you only dispose of hazardous waste in the biohazard/burn bin, as improper sorting leads to more resources and energy being used to separate and dispose of materials and chemicals downstream.

# Resource Management



85%

In this section, we asked you questions about **how you manage the reagents, chemicals, consumables and equipment** in the lab in order to minimize waste and keep materials out of the landfill or away from incineration.

## WHY IS THIS IMPORTANT?

Once you bring materials into the lab it's imperative that they are used efficiently and discarded correctly. - [Millipore Sigma reports](#) that 5% of goods in labs each year are disposed of before they are used due to expiration! It is also important to make an effort to repurpose unused materials or equipment, rather than dispose of them.

- ✓ Sustainable resource management best practices also **overlap with general cost-efficiency**, which is extremely helpful when trying to maximize the funding dollars that you have available.
- ✓ A good **inventory management system** is necessary for most of the best practices mentioned in this section. **These systems can save the lab time and money**, while also preventing any unnecessary waste. Look into options such as Quartzly, Rheaply, LabNotebook, and more.

### Benefits of managed, shared equipment



## High Purity Solvents

These solvents typically require additional distillation and filtration steps to purify, greatly adding to the environmental footprint. Not only that, but they are generally more expensive!

## Gas Lines

Proper gas line maintenance is necessary as all gases take considerable energy to isolate and bottle, and some gases, like helium, are in limited supply. Close lines when not in use and check tanks and hoses regularly for leaks.

## Sharing Equipment

Check out this list from the University of Colorado Boulder on why **sharing equipment** benefits the lab. Reasons include space utilization, energy efficiency and safety.

## Sharing Supplies

One example of successful supply sharing comes from the University of Michigan at Ann Arbor, which saw massive **savings of more than \$250,000 a year** from implementing a campus-wide recycling and reuse program for chemicals, equipment and materials

# Resource Management



85%

## Answer Distributions

	Does Not Apply	I Don't Know	Never / No	Sometimes	Frequently	Always / Yes	Overall Score
We maintain an inventory						100%	100%
We check our inventory before making purchases to pr...						100%	100%
We notify other colleagues when we have excess mate...						100%	100%
We use materials in a "first in/first out" policy						100%	40%
Materials that can expire are well-labeled						100%	40%
We share equipment rather than purchasing duplicate						100%	100%
We use a shared supply of common reagents, chemical...						100%	100%
We only use high-purity solvents when necessary						100%	70%
We only have gas supplies open when gas lines are in use						100%	100%
We maintain gas lines and regularly check for leaks						100%	100%
We have added additional insulation to our large dry i...						100%	0%

## Strategies To Improve

The lab has some good behaviors in place when it comes to Resource Management, yet there is still room for improvement. See below for opportunities to reduce unnecessary waste of chemicals, supplies and equipment.

- Continue to check your inventory before making purchases to prevent over-purchasing.
- Continue to notify your colleagues when you have excess materials to share.
- Use your oldest chemicals/reagents first to decrease the amount of wasted lab materials.
- Label your materials that can expire with the date of arrival to aid in following a first in/first out policy. If needed, look for opportunities to make this easier like hanging a marker in your storeroom.
- Only use high purity solvents when necessary, as these reagents typically require additional distillation and filtration steps which increases their environmental footprint.
- Work with site operations to keep gas lines maintained and regularly checked for leaks.

# Purchasing



57%

Sustainable purchasing is the procurement of **products and supplies that have a reduced impact on the environment** when compared to similar options. These products can differ from each other in several areas, such as raw material usage, production, manufacturing, packaging, reuse, and disposal.

Key phrases used for sustainable products or supplies can include **“made from recycled content, environmentally preferable, bio-based, energy efficient, & eco-friendly”**. In the lab, these products range from energy-efficient freezers to lab supplies with reduced packaging materials.

## Why focus on sustainability during the purchasing process?

- ✓ Start sustainability choices "upstream" of the laboratory
- ✓ Prevent the need for more work down the line to achieve sustainability goals
- ✓ Influence market demand for greener products and supplies
- ✓ Improve lab member safety and health
- ✓ Reduce lab-generated waste



### Market Influence

Preferentially purchasing greener products helps vendors understand their importance to consumers and encourages them to design more.



### Advocacy at Your Institution

Even if another person or department at your institution manages purchasing, **you can push for better products and practices**. This curbs the flow of waste before it enters the lab and reduces transportation emissions.



### Right Sizing

Purchasing products in a **volume that is appropriate** for the usage rate of the lab ensures that materials are not left on a shelf to expire or be discarded later

## HOW TO USE THE ACT LABEL DATABASE

The ACT label provides **clear, third-party verified information** about the environmental impact of laboratory products.

All ACT labeled products can be found [here](#). This database is **searchable and filterable** so that you can find the products you need quickly.

Label criteria is broken up into 12 categories, which combine to give the label its **Environmental Impact Factor (EIF)**. Learn more [here](#).

ACT. The Environmental Impact Factor Label		US
<b>Product Name</b>		
Product Location SKU 0000		
Environmental Impact Scale Decreasing Environmental Impact		
1		10
<b>Manufacturing</b>		
Manufacturing Impact Reduction 3		
Renewable Energy Use Yes		
Responsible Chemical Management 5		
Shipping Impact 9		
Product Content 1		
Packaging Content 5		
<b>User Impact</b>		
Energy Consumption (kWh/day) 2.5		
Water Consumption (gallons/day) 13.1		
Product Lifetime 4		
<b>End of Life</b>		
Packaging 5		
Product 1		
<b>Innovation</b>		
Innovative Practices -1		
<b>Environmental Impact Factor: 50.1</b>		
Label Valid Through: January 2021		

Want to take a deeper dive?  
Check out **MGL's Accredited Professional course!**



# Purchasing



57%

## Answer Distributions

	Does Not Apply	I Don't Know	Never / No	Sometimes	Frequently	Always / Yes	Overall Score
Before purchasing new equipment or chemicals, we ch...				100%			100%
We check for sustainability labels such as ENERGY STA...				100%			40%
We use sustainability labels to help us make more inf...			100%				5%
We preferentially purchase products with energy, wate...			33%		67%		28%
We preferentially purchase products with reduced toxi...				100%			40%
We right size the products we buy				100%			70%
We consolidate orders				100%			70%
We have removed our names from vendor mailing lists				100%			100%

## Strategies To Improve

Keep working to ensure that the lab is making sustainable purchasing decisions. The suggestions below will help the lab decrease unnecessary waste and prioritize low environmental impact products.

- Use the [ACT label database](#) to make informed decisions about what you are buying and using in the lab. Use [ENERGY STAR](#) certified products to find energy efficient cold storage units, as these are the only lab products that currently have ENERGY STAR certification.
- Discuss with your colleagues or purchasing office if more sustainable product options have been explored recently. If not, create a plan to talk with your vendors about sustainable alternatives for the products that you buy today.
- To start right-sizing, look at things that you purchase a lot of and evaluate if you could order them in a different a size. Also look at items where you are throwing away expired materials (e.g. ethers) to see if you can buy them in a smaller volume.
- Start consolidating orders first with small orders and seeing how you can combine those. Keep track of how often and when you order from your suppliers to see if you can create a reasonable ordering schedule.

# Green Chemistry



56%

After decades of global environmental disasters, human health crises and toxic spill events, scientists in the late 20<sup>th</sup> century conceived the concept of Green Chemistry – defined as “**the design of chemical products and processes that reduce and/or eliminate the use or generation of hazardous substances**”.

The 12 Principles of Green Chemistry provide a framework for evaluating and minimizing the life cycle impacts of a product or process.

- |                             |                            |
|-----------------------------|----------------------------|
| 1. Pollution Prevention     | 2. Atom Economy            |
| 3. Less Hazardous Synthesis | 4. Design Safer Chemicals  |
| 5. Safer Solvents           | 6. Energy Efficiency       |
| 7. Renewable Feedstocks     | 8. Reduce Derivatives      |
| 9. Catalysis                | 10. Design for Degradation |
| 11. Real-Time analysis      | 12. Accident Prevention    |

## Take it a step further!

- ✓ [Beyond Benign](#) – nonprofit group focusing on educational resources
- ✓ [ACS: Industry Roundtables](#) – convenes global companies to advance the implementation of green and sustainable chemistry and engineering
- ✓ Check out Green Chemistry/Engineering programs at these [institutions worldwide](#)
- ✓ Sign up to use [Millipore Sigma's DOZN tool](#), which will help to effectively plan your synthesis and other experiments sustainably
- ✓ Share your green chemistry solutions with us – send us your ideas to [programs@mygreenlab.org](mailto:programs@mygreenlab.org)



## Swap toxic items for less toxic

Exchanging mercury thermometers and discontinuing ethidium bromide use for gels are just a start to the ways your lab can cut back on harmful chemicals, reagents and precursors.



## Substitute and Recycle Solvents

Our best practices [guide](#) breaks down available selection tools to help choose greener solvents. Many solvents (Acetone, Acetonitrile, and more) can be efficiently distilled back to + 99% purity using solvent recyclers and vendors.



## Share Chemicals and Reagents

Many labs contain chemicals which are unused that could be valuable to others. Talk to your organization about hosting a chemical share/swap event, to ensure these valuable items are utilized by your peers.



## Stay Informed and Engaged

Keep talking to your lab mates, managers, PIs, EHS personnel and more about your desire to incorporate Green Chemistry principles into your lab. Use our [discussion guide](#) as starting point!

*Want to take a deeper dive?  
Check out **MGL's Accredited  
Professional course!***



# Green Chemistry



56%

## Answer Distributions

	Does Not Apply	I Don't Know	Never / No	Sometimes	Frequently	Always / Yes	Overall Score
We have had a group discussion about how green che...				33%	67%		83%
We use greener alternative tools or guides				100%			70%
We use greener chemicals in the lab				67%	33%		50%
We use an alternative to ethidium bromide	67%				33%		100%
We avoid acutely hazardous materials				100%			70%
We seek ways to minimize chemical or reagent use				100%			70%
We use E-factor or process mass intensity to measure ...		67%			33%		14%
We use atom economy to identify more efficient reactions		67%			33%		14%
We use solvent-free chemistries or separations				100%			0%
We have switched to ambient conditions for reactions ...	33%	33%	33%				3%
We use chemicals and reagents sourced from renewab...				100%			0%
We use an alternative to radioisotopes for labeling				100%			0%
We have exchanged mercury-containing devices from t...				100%			100%

## Strategies To Improve

While you may be taking steps to reduce hazardous and environmental impacts of chemicals in your lab, it's important to take the suggestions below and ensure that your group members all know the ways to incorporate green chemistry into your research.

- Have a group discussion regarding the principles of Green Chemistry, and how your lab can incorporate best practices or make changes to abide by them. MGL has a [guide presentation](#) to help you!
- Green alternative tools, such as the [Solvent Selection tool from ACS](#), can help your lab mates make smart choices that minimize waste and hazards in your lab.
- Try out 'greener' chemicals in lab. If you need guidance, [Sigma Aldrich's DOZN](#) tool will help you to plan your experiment in a sustainable way. You can also ask your suppliers about less hazardous or greener alternatives. Examples could be heptanes instead of hexanes, 2-Me-THF instead of THF, or Cyrene instead of DMF or NMP. [Here](#) and [here](#) are examples of greener biological reagents.
- Excellent work on using an alternative to ethidium bromide. Make sure new members are aware that this is what you use in the lab and why.
- Avoid acutely hazardous materials unless absolutely required by your research. Make sure everyone in the lab knows what hazards you have in the lab and work with safety and your lab to minimize or eliminate them.

- Conduct microscale experiments if possible, to reduce waste and minimize impact.
- E-factor is a process other than yield to measure the efficiency of a reaction, which helps to pre-identify waste and consider ways to minimize it. Learn more [here](#) and use [this](#) article to help you evaluate other metrics.
- Atom economy helps ensure that as many starting materials as possible end up in the final product. Talk with the lab about how you might use atom economy, and learn more [here](#).
- Using methods that don't require heating, cooling, or non-ambient pressures use less energy and reduce risk of accidents related to failure of the apparatus. Evaluate which experiments you run today that require non-ambient conditions and use the literature to evaluate if there are any known alternatives.



# Water



84%

Water is often overlooked by scientists when it comes to resources use in our labs – even though labs use a whopping 4 times as much as a standard office building!

## Never use single-pass cooling!

When cooling chemical reactions, use technology such as waterless cooling (Findenser or Asynt are good choices) to ensure that running water isn't used to cool your experiment. You can even use a fish pump in an ice bucket to create a recirculating water system in-house!

## Use Faucet Aerators

These simple, cost-effective mesh inserts can reduce water flow at your lab sink by 60% while maintaining pressure – talk to facilities to ensure you have them.



## Always use the correct quality water

Reverse Osmosis (RO), Deionized (DI), ultrapure – which do you need? Using the correct water not only has consequences on your research, but the energy and excess water used in production varies as well - **It takes 3L of tap water to make 1L of DI water.** [Labconco's guide](#) can help you think about the right water for your task.

## Always consolidate

When running glassware washers, dishwashers, animal cage washers, or autoclaves, always ensure that you've **maximized the load** – don't run an autoclave for just one flask. Try using a [schedule like the one here](#) to make sure your team is aligned.

## Mind the Tap

Be on the lookout for leaky faucets – one drip per second wastes more than 11,000L per year!

## Autoclaves/Steam Sterilizers

These are a staple of most biological labs, as the combination of **heat, steam and pressure are used to sterilize materials** such as media, instrumentation, flasks, and more.

Full-sized, front-loading autoclaves can use **up to 60 gal of water per cycle**, mainly due to two features:

- Steam jackets: Many models are designed with a “jacket” of steam around the main vessel, to aid in temperature uniformity. Filling this secondary area uses additional water and heat.
  - Tempering water: Cold water must be added to the effluent hot steam/water to protect your building's plumbing. Often, this tempering water is left running constantly, and can consume up to 15,000 gallons a week.
- ✓ Talk to your facilities/building personnel about **purchasing non-jacketed autoclaves** and installing devices to **control and limit tempering water**.
  - ✓ Limit the use of drying and cooling time on your cycles – they should only be necessary if you are running many loads per day, back-to-back.
  - ✓ If you have low throughput needs, purchase a **benchtop or top-loading** autoclave for your lab, as they use far less water and energy to operate.

# Water



84%

## Laboratory Water

84%

### Answer Distributions

	Does Not Apply	I Don't Know	Never / No	Sometimes	Frequently	Always / Yes	Overall Score
We turn off the faucets / taps when they are no...				100%			100%
Our faucets/taps have low-flow aerators	33%		67%				5%
We promptly report all water leaks				100%			100%
We have replaced water-vacuum aspirators wit...				100%			100%
We do not use single-pass cooling for distillatio...				100%			70%
We dont use single-pass cooling on equipment				100%			40%
We have had a group discussion about minimiz...				100%			100%
We do not let water sources run longer than ne...				100%			100%
We understand which quality water to use for e...				100%			100%
We check the efficiency of purified water systems				100%			100%
We only run glassware washers when full				67%		33%	80%

### Strategies To Improve

Great start, but there's room for improvement with your lab's water usage. Implement other water-saving devices and practices to conserve this precious resource.

- Great job ensuring that faucets and taps are turned off when not in use!
- Low flow aerators can reduce water flow from your lab sink by 50%, which prevents annoying splashing but also has the benefit of saving this precious resource. Talk with your institution's building manager, or whoever is responsible for operating your laboratory building about whether there is funding available to support your lab in purchasing low flow aerators for lab faucets.
- Great job promptly reporting all water leaks. A leaking faucet can waste liters of water each day.
- Great job replacing water-vacuum aspirators with sources of vacuum that are waterless. This saves a great deal of this precious resource.
- Transition away from single-pass cooling, as this is a method that uses significant quantities of tap water. Other options for cooling synthesis/distillations are waterless condensers, recirculating water baths with a pump, and connecting to the processed chilled water at your fume hood (requires specialized equipment).

- Using tap water to cool laboratory equipment, like lasers, microscopes, etc., is extremely water consumptive. Ensure that if you have any water-cooled equipment, that it is on a recirculating water system instead of a single-use or "once-through" cooling system. You will likely need to consult with your institution's Facilities or Operations team to make this transition.
- Great job having a group discussion about minimizing water usage in the lab.
- Great job ensuring that you don't let water sources run any longer than required.
- Great job ensuring that the team understands which quality water to use for each task.
- Glassware washers can save a good amount of water, especially when you run them full! Hand washing 30 pieces of glassware takes about 20 gallons (76 liters) of tap water, whereas glassware washers use less than 14 gallons (53 liters) of water to wash the same amount of glassware. If you aren't running them full, you decrease this benefit! As a next step, check that your system can adjust the water supply for the load size, provides rinse cycle options, and recycles the rinse water in the next cycle.

# Autoclaves

85%

## Answer Distributions

	Does Not Apply	I Don't Know	Never / No	Sometimes	Frequently	Always / Yes	Overall Score
We only run the autoclave when full				100%			70%
We put autoclaves in standby mode or turn the...				100%			100%
We have replaced autoclaves with more efficie...	100%						0%

## Strategies To Improve

You're off to an excellent start with efficient autoclave use, but could you implement any further sustainable best practices? Explore.

- Autoclaves can be large consumers of energy and water - especially the larger steam-jacketed or medical-grade autoclaves, which can use around 80kWh of energy and over 3,000 liters of water each day (though on these units, water usage is not correlated to the number of runs, but energy usage is). Continue to coordinate amongst your lab group and neighboring colleagues to try and run the fullest autoclave loads as possible, while still allowing the space necessary for sterilization.
- Great job putting autoclaves in standby mode or turn them off when not in use!

# Plug Load



56%

When academic research institutions have assessed the effect of laboratories on their campus' energy usage, they find that labs have a seriously outsized impact. The energy used by equipment you plug into your wall is the 'plug load' and can typically **account for 10-20% of the total energy your lab space uses.**

Stanford University published a [white paper](#) in 2015, revealing that **lab equipment comprises 50% of the total estimated plug load energy consumption** on Stanford's campus - this equates to 11% of total campus electricity consumption and 71% of total plug load energy use in lab buildings. Regardless of how you slice it, laboratory plug loads are drivers of energy consumption at research institutions.

Potential  
kWh/yr:



Drying  
Ovens  
**2,500**



Incubators  
**3,700**



Thermal-  
cyclers  
**3,800**



Rotovaps  
**5,100**



Biosafety  
Cabinets  
**3,300**

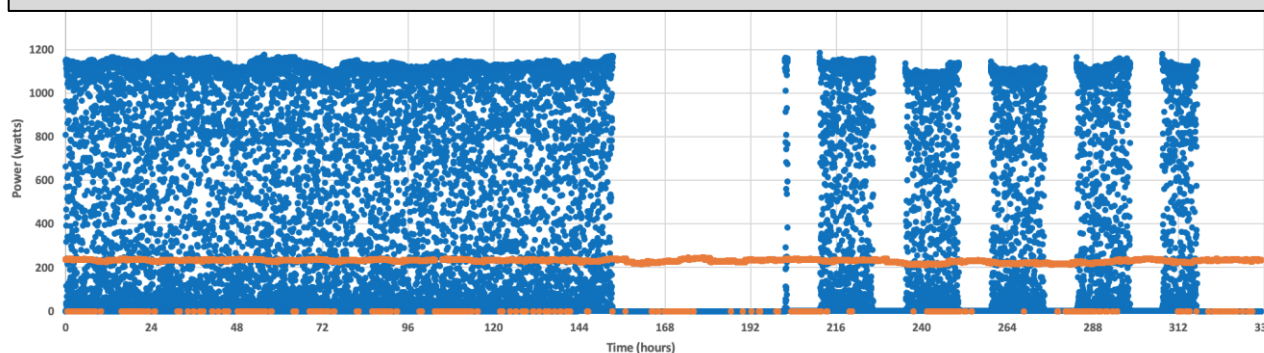


Kitchen  
Fridges  
**1,500**

## STRATEGIES FOR REDUCING LABORATORY PLUG LOADS:

- ✓ **Share equipment** within your laboratory - and if possible, with other lab groups too
- ✓ Use prompts such as **stickers (use ours if you like!) or labels** to remind lab members to turn off certain equipment at night, over the weekend, or leave off until the equipment it is needed
- ✓ **Run a competition** in your lab to see if you and your colleagues can make it a habit to keep equipment off on a pre-determined schedule
- ✓ Try **outlet timers** to automatically power down some equipment overnight. Some versions which work as **energy monitors** can also tell you the amount of energy being used by the equipment and show you what you save when turning it off or changing the temperature. Check out our [Plug Load Guide](#) for more info!
- ✓ If you have equipment in your lab that you're not sure anybody ever uses, **have a group discussion** to clarify its use. If no one is currently using the instrument, opt to turn it off and unplug it

This is metering data from **MIT** (below), visualizing the potential savings from turning off equipment. Turning off the drying oven (**blue**) at night saved 1350 kWh/year. For comparison, a vacuum pump (**orange**) that was left on all the time, was metered as using 1825 kWh/year.



# Plug Load



56%

## Answer Distributions

	Does Not Apply	I Don't Know	Never / No	Sometimes	Frequently	Always / Yes	Overall Score
We have discussed what equipment can be turned off				100%			100%
We turn off equipment when it is not in use				33%		67%	90%
We have checked for and utilize energy saving modes ...			33%		67%		28%
We have optimized the number of pieces of equipmen...				33%		67%	60%
We have investigated the energy consumption of equi...			100%				5%
We replace equipment with more energy efficient options				67%		33%	50%

## Strategies To Improve

You've clearly already implemented some plug load best practices in your lab, but we have some suggestions you may not have considered yet. Explore further ideas for improvement below.

- Checking for and utilizing energy saving modes on your existing lab equipment can lead to greater energy efficiency. Look for built-in timer features, "eco-modes", low power modes, automatic sleep functions, etc. Look to user manuals for your equipment or ask your sales representatives from the product manufacturing company about what energy saving features are present on their equipment.
- Laboratories should be looking to achieve a "happy medium" when it comes to equipment. You don't want too few pieces of equipment, which results in lab members operating inefficiently, and you also don't want too many pieces of equipment so much of the equipment is plugged in but idle, and taking up significant lab space. Work to achieve this middle road by sharing or donating excess equipment with other labs. This is applicable to all types of lab equipment: fume hoods, cold storage, microscopes, biosafety cabinets, drying ovens, water baths, etc.
- You can use a variety of strategies to better understand the energy consumption of your lab's equipment, including metering the equipment yourself or with assistance from your organization, referring to the variety of white papers and databases we have linked to on [SharePoint](#), or by asking the equipment manufacturers about the energy consumption of their equipment. In general, unless your lab has a data center, high-powered lasers, or highly sophisticated microscopes, the largest energy consumers in your lab are likely to be your fume hoods, your ultra-low temperature freezers, and other equipment that requires heating or cooling or that generates vacuum. Use knowledge of the largest energy consumers in your lab to prioritize which equipment could be replaced with a more energy efficient option.
- When purchasing new lab equipment or upgrading equipment, your lab should consider energy efficiency as a factor contributing to your lab's decision. Consider that the equipment you buy may be plugged in and used for five, ten, or even twenty years. That is years of utility costs for your institution! If you afford it, even if an energy efficient unit costs slightly more, consider buying energy efficient equipment.

# Fume Hoods



100%

Fume hoods (or fume cabinets) exist to **keep researchers safe as they work with hazardous substances**. They are often also used for temporary storage of hazardous waste, to contain experiments with high heat loads or particulate emissions, and more.

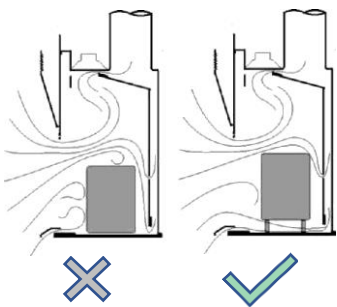
While their benefits are undeniable, the energy costs associated with fume hoods continue to be a top target for lab sustainability professionals. **An inefficient fume hood which is improperly operated can consume as much energy as 3.5 houses per year!**



It's estimated that there are over 1 million fume hoods in more than 10,000 North American labs, **consuming in excess of \$5 billion in energy each year.**

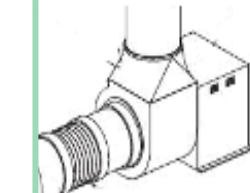
It's important to **follow best practices.**

Keeping equipment towards the front, and elevated if possible, ensures that **air flows safely** away from the user.



## KNOW YOUR HOOD

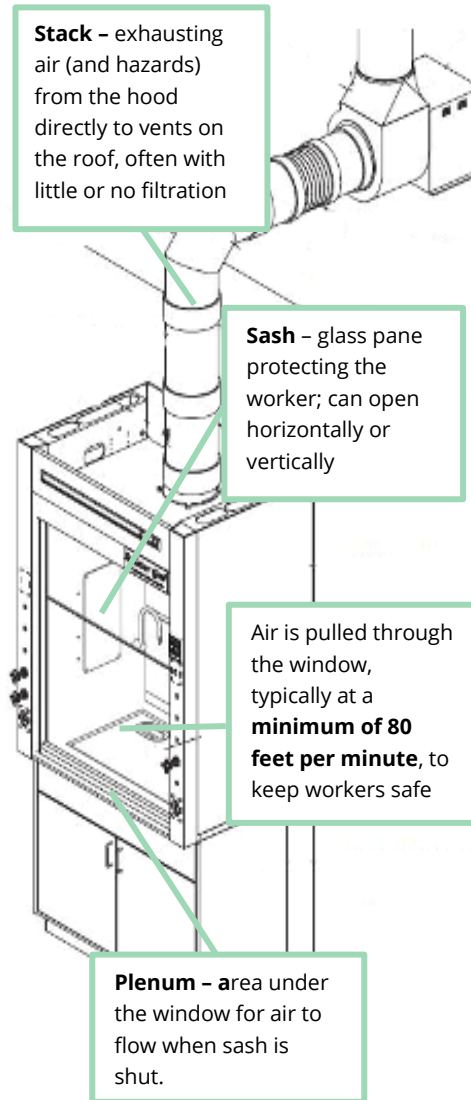
**Stack** – exhausting air (and hazards) from the hood directly to vents on the roof, often with little or no filtration



**Sash** – glass pane protecting the worker; can open horizontally or vertically

Air is pulled through the window, typically at a **minimum of 80 feet per minute**, to keep workers safe

**Plenum** – area under the window for air to flow when sash is shut.



## Variable or Constant Air Volume?

Variable Air Volume (VAV) hoods are preferred in modern laboratories for most applications, as they can save over 40% of the energy of Constant Air Volume (CAV) hoods. They do this by **employing valves and building control systems which lower the flow rate through the stack when the sash is lowered**, ensuring that the face velocity remains high enough for safety purposes.

## ALTERNATIVES TO CONSIDER

### High Performance Hoods

Also known as “reduced flow” or “low-velocity” fume hoods, they **operate safely at reduced face velocities** due to their superior aerodynamic features.

### Ductless Fume Hoods

Lower risk experiments can often be performed in hoods that do not connect to the building's ventilation, and instead **use HEPA filtration** to keep researchers safe, much like a biosafety cabinet. Talk to your lab and your EHS dept about making the switch!

### Shutting the Sash: Sustainable and Safe!

Remember – keeping your fume hood sash low or closed isn't just saving energy, **it is primarily keeping you and your lab mates safe** from chemical exposures or even physical explosions.

**Try a sticker to remind your lab, or go a step further and start a SHUT THE SASH competition like Harvard!**

# Fume Hoods



100%

## Answer Distributions

	Does Not Apply	I Don't Know	Never / No	Sometimes	Frequently	Always / Yes	Overall Score
We keep fume hood sashes closed						100%	100%
We don't work in the fume hood with the sash all the ...						100%	100%
We dont store chemicals inside the hood						100%	100%
We avoid using the fume hood to evaporate chemicals...						100%	100%
We turn off the lights in the fume hoods						100%	100%
We have replaced old fume hoods with energy-efficien...	100%						0%
We remove excess equipment from fume hoods						100%	100%
Our organization checks the air flow of the fume hood...						100%	100%

## Strategies to Improve

Well done here, team. High scores in the Fume Hoods section mean that your lab is not only sustainable, but safe.

- Always ensure that fume hood sashes are closed when not actively working in them
- Continue to avoid working in the fume hood with the sash all the way up.



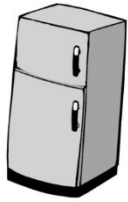
# Cold Storage



47%

After fume hoods, **cold storage units can be the most energy intensive group of equipment** in your lab space. Ultra-Low Temperature (ULT) freezers are especially energy consumptive and are often set as low as  $-96^{\circ}\text{C}$ , and Ultra Ultra low freezers can reach temperatures of  $-200^{\circ}\text{C}$  and below.

Refrigerators



1-3 kWh/day

-20 °C Freezers



1-5 kWh/day

ULT Freezers



10-30 kWh/day

A Single Family Home



25 kWh/day

One ULT freezer can use more energy than an entire house!

## Cold Storage Best Practices:

- Conduct routine preventative maintenance, as you would on a car to keep refrigerators and freezers running efficiently
- Because cold storage units **reject a lot of heat**, place them in areas with sufficient cooling and ventilation capabilities for greater efficiency
- Take steps to reduce the need to purchase additional cold storage units – consolidate your samples, clean out regularly, and share space!
- When you need to purchase a new unit, be sure it is energy efficient!



Any preventative maintenance recommended for your cold storage units is either detailed in the user manual or can be found on the manufacturer's website.

Some resources are gathered [here](#) regarding **preventative maintenance best practices**. Maintaining your cold storage units can result in 10% energy savings!

## “Chill Up” your Freezer!

Thousands of ULT freezers around the world are now **set to  $-70^{\circ}\text{C}$  instead of the usual  $-80^{\circ}\text{C}$** . We call this “chilling up” your freezer!

This setpoint change can result in a **30% energy savings** for your ULT freezer and puts less strain on your unit.

Be sure to get permission from your lab before changing your freezer set-point. [Check out these resources](#) we have gathered about storing scientific samples at  $-70^{\circ}\text{C}$ .

## Join the Freezer Challenge!

The [International Laboratory Freezer Challenge](#) is a **competition designed**



**freezer challenge**

**to promote best practices**

in cold storage management. Winning labs and organizations receive their **photo in Nature** and are recognized at the International Institute for Sustainable Laboratories conference each fall.

# Cold Storage



47%

## Cold Storage Maintenance

21%

### Answer Distributions

	Does Not Apply	I Don't Know	Never / No	Sometimes	Frequently	Always / Yes	Overall Score
We check door seals and replace them in a tim...			100%				5%
We clean or replace the filters at least once per...			100%				5%
We defrost and remove ice at least once per year			33%		67%		68%
We clean the condenser area and condenser c...			33%		67%		4%

### Strategies To Improve

Take control of your lab's cold storage maintenance by focusing on a few recommendations in this area.

- Cold storage that is properly maintained uses about 10% less energy than equipment that is not maintained. Ensure a cold storage maintenance plan has been developed for your lab that includes regularly checking door seals, cleaning or replacing filters, regularly defrosting units, and cleaning the condenser coils. Establish a schedule for keeping all units maintained, and ensure all lab members know how they can help. View a collection of preventative maintenance resources on [Sharepoint](#).

# Sample Management

75%

## Answer Distributions

	Does Not Apply	I Don't Know	Never / No	Sometimes	Frequently	Always / Yes	Overall Score
We maintain a record of cold samples				100%			100%
We periodically eliminate unneeded materials f...				100%			70%
We have evaluated whether we can share our c...			67%			33%	100%
We do not store samples or reagents in colder ...				67%		33%	50%

## Strategies To Improve

It's clear you are already considering your sample management practices and wish to do well here - great start, but where can you still improve?

- The most affordable laboratory refrigerator or freezer is the one you don't have to buy in the first place. Schedule time each year for regular sample cleanouts, so unneeded samples can be discarded to make room for new ones. Focus on samples that are duplicate of others, expired, have illegible labels, or are no longer useful to keep stored.
- Could any of the samples your lab currently stores at in refrigerators and freezers instead be stored at room temperature? Evaluate room temperature sample storage feasibility for your lab.

# Additional Cold Storage Practices

52%

## Answer Distributions

	Does Not Apply	I Don't Know	Never / No	Sometimes	Frequently	Always / Yes	Overall Score
We joined the Freezer Challenge in the last two...		33%	67%				4%
We have evaluated the best placement of our c...				100%			100%
We have set ULT freezers to -70 or higher				100%			0%
We have replaced or retrofitted cold storage ro...				100%			0%

## Strategies To Improve

Great start, but there's room for improvement here. How can you further incorporate sustainability into your lab's cold storage habits?

- The [International Laboratory Freezer Challenge](#) is an annual competition that can help labs focus in on implementing best practices (like those mentioned in this assessment) with their cold storage. This free competition can support your lab to dedicate time and collaborate as a team to be more efficient with your laboratory refrigerators and freezers. Discuss participating in the next annual Freezer Challenge with your lab.

# Large Equipment



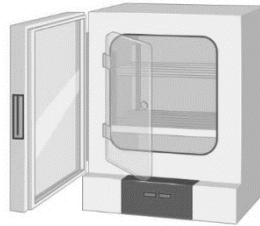
92%

**In general, equipment that has a heating or cooling element or pulls a vacuum consumes a larger amount of energy than other types of laboratory equipment.**

Depending on what you use in the lab, in this section we might have asked you about incubators, gloveboxes, tissue culture hoods/biosafety cabinets, vacuum pumps, or computers.

## Incubators

- Incubators consume between 1 and 10 kWh/day.
- Even on the low end, turning incubators off would be equivalent to reducing emissions associated with driving over 1000km; on the high end it's equivalent to half a home's worth of electricity use for the year.



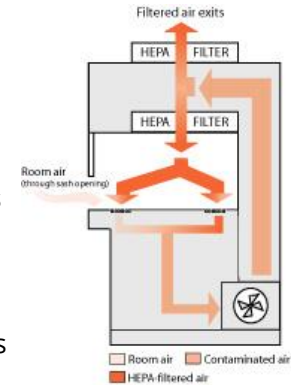
## Computers

- Putting computers to sleep can save up to \$75 a year per computer!
- Limiting paper use and using paper with recycled content are two ways the lab can decrease their impact on forest resources
- Chlorine-free paper is an alternative that prevents harmful chemicals from negatively impacting aquatic environments.



## Biosafety Cabinets / TC Hoods

- A tissue culture hood or biosafety cabinet can consume nearly 1400 kWh a year - the equivalent of driving over 3800 km in your car.
- **Avoid using UV lights to sterilize surfaces** in biosafety cabinets and tissue culture hoods, as the UV lights lose their intensity over time and become ineffective at sterilizing. Furthermore, UV light exposure is hazardous to scientists' health. Read more [here](#).
- For more information, see our [BSC guide!](#)



## Gloveboxes

- Employing best practices such as leak prevention, pump maintenance, shutting off the lights and coordinated antechamber use all will help the lab save energy and reduce waste related to glovebox use.



## Vacuum Pumps

- A poorly maintained vacuum pump and/or improper use of a cold trap will eventually lead to pump failure and require a rebuild.
- If your pump usually runs 24/7, you could save the greenhouse gas emission equivalent of driving over 1,800 miles (or 2,900 kilometers) per year just by turning your pump off overnight.

# Large Equipment



92%

## Computers

95%

### Answer Distributions

	Does Not Apply	I Don't Know	Never / No	Sometimes	Frequently	Always / Yes	Overall Score
Computers and monitors are shut down or put i...				100%			100%
We utilize a shared printer				100%			100%
The printers in our lab are set to default double...				100%			100%
We only print when necessary				100%			100%
We purchase paper that is chlorine free and co...			67%			33%	1%
We recycle ink and toner cartridges or use refill...			67%			33%	100%

### Strategies To Improve

Your lab has strong best practices in place when it comes to computers, great job!

- Work with your purchasing office and your suppliers to find paper options made with post-consumer recycled content and that are chlorine-free. These options lessen pollution, energy consumption, and impacts on forest resources. Here are the number of people in the lab that think the group are already acting on these sustainable paper purchasing guidelines:
  - 0 - chlorine-free
  - 0 - contains recycled content

# Vacuum Pumps

90%

## Answer Distributions

	Does Not Apply	I Don't Know	Never / No	Sometimes	Frequently	Always / Yes	Overall Score
We check the function of our pumps regularly				100%			100%
We use a cold trap in line to prevent volatiles fr...				33%	67%		60%
We turn off vacuum pumps when they are not i...				100%			100%
We have exchanged the oil pumps with oil-free ...				100%			100%

## Strategies To Improve

Your lab has strong best practices in place when it comes to vacuum pumps, great job!

- Use a cold trap in-line to prevent volatiles from entering your vacuum pump and make sure everyone in the lab is trained on how to use the trap.

# Infrastructure Energy



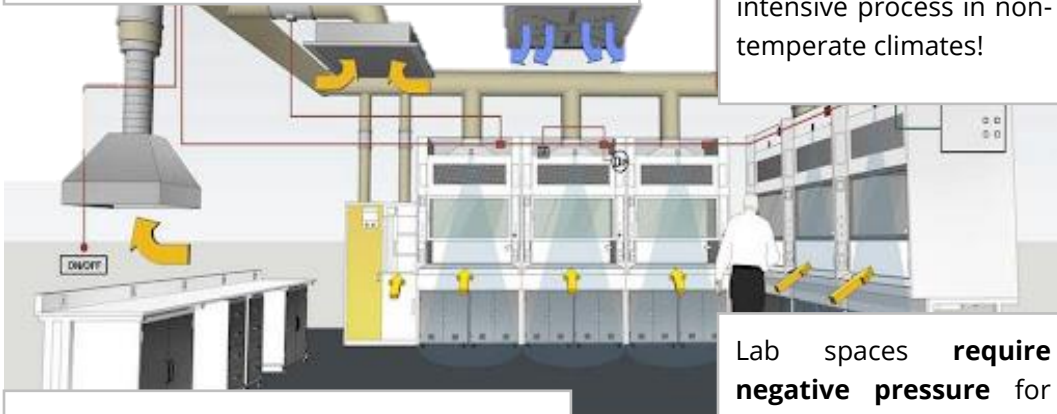
78%

## HVAC (Heating, Ventilation and Air Conditioning)

The air that moves through your laboratory, while invisible to the eye, is typically [responsible for over 50% of the energy](#) used by any lab building – that could be up to **10 million kWh/year**, or **as much as 850 homes!** Research spaces are heavily regulated by groups such as ANSI and ASHRAE in order to maintain safe environments, and therefore must conform to standards in ventilation and air conditioning. **Here are just some of the ways that labs use extra energy to move and condition air in ways that office spaces usually do not:**

The minimum rate for lab ventilation is generally **6 air changes per hour (ACH)** but can go as high as 20 or more. Talk to your organization to ensure your rates are correctly calibrated for your lab space – many will allow for **lower flows overnight/unoccupied, or in situations with fewer hazards present.**

In most labs, the air coming in must be **100% outside air**, meaning it must be heated/cooled, humidified and filtered before entering your space – a very energy intensive process in non-temperate climates!



Heat emitted from large equipment such as ULTs, ovens and more results in more air intake to maintain temperature in the lab space.

Lab spaces **require negative pressure** for safety, which ensures that the air will not flow into hallways in the event of a spill.

## LIGHTING

Keeping our labs brightly lit can account from **8 to 25% of the energy used** in your lab, depending on the bulb type:

- **Fluorescent** - Commonly seen in labs, these are usually the tubular lights in your ceiling, and produce 60-100 lumens per watt consumed. Compact Fluorescent (CFL) bulbs use fluorescent technology but are designed to fit in a standard bulb socket.
- **LED** - Light Emitting Diodes have been steadily growing in for decades, understandably since they use 75% less energy and last 25 times longer than their incandescent predecessors.
- **Incandescent and Halogen** bulbs are rarely seen in labs nowadays, due to the increasing popularity of more efficient bulb types.

One of the best ways to conserve energy in lighting is to **turn off overhead lights** when they aren't needed. As seen here, sunlight is by far our most efficient light source, and many activities in lab can be completed with **task lighting** or simply **ambient natural light.**

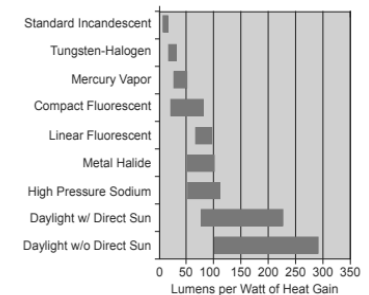


Figure 8. Luminous efficacy of various light sources.

Installing occupancy sensors in your lab can **control the lights, air change rates, and temperature when you're gone**—check out this [SmartLabs case study at Emory University!](#)



# Infrastructure Energy



78%

## Lighting

83%

### Answer Distributions

	Does Not Apply	I Don't Know	Never / No	Sometimes	Frequently	Always / Yes	Overall Score
We turn off the lights when the lab is not in use.				100%			100%
We turn off lights in support rooms when not in ...				100%			100%
We turn off overhead lighting when daylight is s...				33%	67%		90%
We have upgraded to LED lighting				100%			40%

### Strategies To Improve

You are off to a good start with lighting but there is some room for improvement. Here are some ways that you can improve your lighting best practices.

- Upgrading your space to LED lighting will save energy, and it's important to let your facilities teams know that your lab is on board for these installations and upgrades.

# Ventilation

73%

## Answer Distributions

	Does Not Apply	I Don't Know	Never / No	Sometimes	Frequently	Always / Yes	Overall Score
We have optimized the ventilation of the lab ba...				100%			100%
Our organization has reduced air changes whe...	100%						0%
We keep the windows in the lab closed				33%	67%		60%
Thermostats are not blocked	100%						0%
Our organization has optimized the temperatur...			67%			33%	5%
In our lab, temperatures are set back when the ...	100%						0%

## Strategies To Improve

Lab ventilation should be properly managed and understood in order to keep you safe and save energy. You're off to a good start, just make sure you follow the tips below.

- Keep lab windows shut, even if it's nice outside!
- Optimizing the temperature of your lab for comfort and energy savings is another great conversation to have with your organization - let them know you want to talk!

# Travel



45%

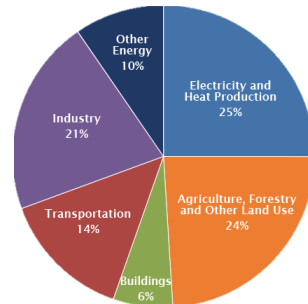
Travel, and more specifically road travel, is **one of the main sources of carbon dioxide (CO<sub>2</sub>) emissions**. With CO<sub>2</sub> being one of the largest contributors to global warming, reducing travel-based CO<sub>2</sub> emissions is crucial in the fight against climate change.

Moving away from car travel toward alternative transportation options like walking, biking, and public transit is the best option to achieve the necessary reductions in emissions. Though travel may not affect how you work in the lab, it is an inextricable element of how you get to work as well as meet with and engage with the broader scientific community.

## GLOBAL IMPACT OF TRAVEL

**Road transport (cars, buses, taxis, etc.) accounts for 17% of global CO<sub>2</sub> emissions.**

**Flying accounts for 2.5% of global CO<sub>2</sub> emissions, and 12% of the United States' transportation-based CO<sub>2</sub> emissions**



Global Greenhouse Gas Emissions by Economic Sector

## UNDERSTANDING YOUR TRAVEL

A travel-focused carbon footprint calculator like [this one](#) can be used to first understand the impact of your own commute to work. You can then look for options that help lower the impact of your weekly commute.



### Biking and Walking

Biking and walking **eliminate carbon emissions** and other pollution from your commute while also providing numerous health benefits. See these [biking](#) and [walking](#) to work guides for some helpful tips to get you started.

### Public Transit

Public transportation is any bus, train, or other form of transportation that runs on a fixed route and is publicly available. Riding light rail produces 62% less carbon emissions per passenger mile while **buses produce 33% less carbon emissions.**



### Teleconferencing/Videoconferencing

These technologies provide face-to-face meetings from our homes or workplaces. This **cuts down on flights** that otherwise would be contributing to CO<sub>2</sub> emissions. And while aviation's share of global carbon emissions aren't shockingly high, flying is still the most damaging form of travel for the climate.



### Carpooling

Carpooling may not be as impactful as public transit, but it's a good option if access to other options is restricted. Carpooling reduces the number of vehicles on the road and the total number of miles traveled, which decreases emissions and improves air quality.



# Travel



45%

## Answer Distributions

	Does Not Apply	I Don't Know	Never / No	Sometimes	Frequently	Always / Yes	Overall Score
We have posted information on alternative transporta...		67%	33%				2%
We use alternative transportation to go to work			33%	67%			28%
We use alternative transportation around or near the ...				67%	33%		50%
We use alternative transportation when traveling for work				33%	67%		90%
We use teleconferencing instead of flying to meet with...	67%				33%		70%

## Strategies To Improve

Good start! It looks like the lab already has some good behaviors in place for sustainable travel. Here are some additional recommendations to keep the ball rolling.

- Guide people to a more sustainable transit choice by providing information on the available options for alternative transportation in your area. This could include details on biking/walking paths or public transit options. Post this information where everyone can find it - like a shared web folder or a bulletin board. Include any information on public transit incentives offered by your organization, such as discounted transit passes.
- Find an alternative transportation option that works for you and start by using that option one day per week, then go from there! Or if you're already using an alternative transportation option share this with the lab!
- Look through your upcoming meetings or collaborations that require flying and consider whether these meetings could be arranged virtually. You can send materials through the mail or work on shared manuscripts using a file sharing platform.

# Lab Comments

<b>Community</b>	<ul style="list-style-type: none"> <li>• There is a plan to extend the current sustainability practices to other labs within the campus - Respondent</li> <li>• we will liaise with our colleagues with sustainability rollout - Respondent</li> </ul>
<b>Waste Reduction and Recycling</b>	<ul style="list-style-type: none"> <li>• University's purchasing rules restricts the suppliers that we are allowed to purchase from, it is not clear whether or not sustainability and buy back schemes are applied by the selected suppliers. - Respondent</li> </ul>
<b>Resource Management</b>	<ul style="list-style-type: none"> <li>• Purchasing is dependant on price and allowable suppliers by the University. - Respondent</li> </ul>
<b>Purchasing</b>	<ul style="list-style-type: none"> <li>• University policies dictate how we purchase and it largely comes down to price, so it is very difficult to make changes without a university wide policy change - Respondent</li> <li>• Purchasing is determined by University policy, it is difficult to make changes in this regard. - Respondent</li> </ul>
<b>Green Chemistry and Green Biologics</b>	
<b>Water</b>	<ul style="list-style-type: none"> <li>• Lab has applied for funding for additional chiller units for use with rotary evaporators - Respondent</li> </ul>
<b>Plug Load</b>	<ul style="list-style-type: none"> <li>• Price is the determining factor when purchasing equipment. - Respondent</li> </ul>

<b>Fume Hoods</b>	<ul style="list-style-type: none"> <li>• Air flow meters are in the process of being upgraded. - Respondent</li> <li>• new air flow monitors are being upgraded on the fumehoods - Respondent</li> </ul>
<b>Cold Storage</b>	
<b>Large Equipment</b>	
<b>Incubators</b>	
<b>Computers</b>	<ul style="list-style-type: none"> <li>• Paper is purchased University wide. We don't purchase our own paper. - Respondent</li> </ul>
<b>Biosafety Cabinets</b>	
<b>Gloveboxes</b>	
<b>Vacuum Pumps</b>	<ul style="list-style-type: none"> <li>• Funding for chiller units for use with the vacuum pumps has been applied for - Respondent</li> </ul>
<b>Infrastructure Energy</b>	<ul style="list-style-type: none"> <li>• Lab has radiators, not thermostats - rads are not blocked. Windows are left open in the lab when deemed necessary - Respondent</li> <li>• lab heating works off a central system, its difficult for us to regulate it, also, Windows can open and are opened when required - Respondent</li> </ul>
<b>Field Work</b>	

<b>Animal Research</b>	
<b>Travel</b>	

## Thank You

Congratulations on completing your green lab assessment! We are excited to be working with you and helping you find solutions to reduce the environmental impact of your laboratory operations.

If you need additional support or have questions, please visit the My Green Lab website at [mygreenlab.org](http://mygreenlab.org) or you can email us at [programs@mygreenlab.org](mailto:programs@mygreenlab.org). Thank you for becoming part of the Green Labs Community!

Best Regards,



The My Green Lab Team