

## **My Green Lab**

Emory University is dedicated to integrating sustainability into our laboratories. To support this mission, we have partnered with [My Green Lab](#), an organization that promotes sustainable practices in scientific research. Below, you'll find comprehensive resources provided by My Green Lab to help you incorporate sustainability into your lab operations.

### ***Smart Labs Toolkit and Program***

**Overview:** The [Smart Labs Toolkit and Program](#), developed by the Department of Energy (DOE) in collaboration with the International Institute for Sustainable Laboratories (I2SL), builds on the success of the University of California Irvine program. This free toolkit provides a roadmap for improving laboratory ventilation to achieve significant energy savings and safety enhancements. It includes a section on scientist engagement, emphasizing the importance of involving researchers in sustainability efforts.

#### **Features:**

- **Roadmap for Ventilation Improvement:** Offers guidance on optimizing laboratory ventilation systems for energy efficiency and safety.
- **Scientist Engagement:** Provides strategies for involving scientists in sustainability initiatives, fostering a culture of collaboration and innovation.

**Additional Resources:** Explore further resources at the [University of California Irvine website](#).

### ***ACT, The Environmental Impact Factor Label***

**What is ACT?:** The [ACT Label](#) (Accountability, Consistency, Transparency) helps laboratories choose sustainable products by evaluating the environmental impact of manufacturing, energy and water use, packaging, and end-of-life disposal. Products with the ACT label are independently audited by [SMS Collaborative, LLC](#) to ensure their sustainability claims are accurate.

**Why ACT Matters:** Choosing products with the ACT label ensures you are making environmentally responsible purchasing decisions. This helps reduce the overall environmental footprint of your lab.

**Learn More:** Visit the [ACT Label website](#) for detailed information on the criteria and certified products.

### ***My Green Lab Ambassador Program***

**Overview:** The [My Green Lab Ambassador Program](#) is designed for scientists and lab professionals who want to promote sustainability in their labs. This free, online learning program provides a quick introduction to lab sustainability and offers practical ideas for implementing sustainable actions in your organization.

**Program Content:** The program includes four Smart Science training videos covering Energy, Waste, Water, and Green Chemistry & Community. These videos follow a lab's journey toward sustainable research practices.

**Networking:** Ambassadors can connect with other participants and My Green Lab staff through a dedicated Microsoft Teams channel and monthly virtual discussions.

**Benefits:** Ambassadors receive a certificate, insights into sustainable practices, and preparation for the more in-depth My Green Lab Accredited Professional (AP) Program.

**Join the Program:** [Become a My Green Lab Ambassador](#).

### ***Million Advocates for Sustainable Science***

**Campaign Goal:** This campaign aims to demonstrate support for systemic changes in global science funding systems to encourage environmentally sustainable practices in research laboratories.

**Current Issues:** Existing funding structures often do not incentivize sustainability. The campaign seeks action from research funders to set expectations for efficiency, resiliency, and sustainability.

#### **Get Involved:**

- [Learn more and support the campaign](#).
- [How Can I Write A Letter to My Country's Main Science Funders and Get it Included in Million Advocates for Sustainable Science?](#)

### ***How to Green Lab?***

**Monthly Tips:** My Green Lab shares useful tips and hacks to help laboratories become more sustainable through their '[How To Green Lab](#)' series. Follow My Green Lab on [X](#) and [LinkedIn](#) to receive monthly #HowToGreenLab tips.

### ***Center for Energy Efficient Laboratories (CEEL)***

**Energy Efficiency Research:** [CEEL](#) works with scientists, lab equipment manufacturers, facility managers, and utility companies to identify energy efficiency opportunities in laboratories.

#### **Notable Studies:**

1. [Market Assessment of Energy Efficiency Opportunities in Laboratories](#) (2015): The first comprehensive study on laboratory plug loads in California, estimating consumption from 12 different pieces of lab equipment at 1-3 TWh/year.

2. [Ultra-Low Temperature Freezers: Opening the Door to Energy Savings in Laboratories](#) (2016): Testing energy consumption and performance of ULT freezers, leading to the establishment of an ENERGY STAR standard.
3. [In Search of Energy Efficiency Opportunities for Laboratory-Grade Freezers](#)(2019): Evaluating energy consumption to identify efficiency opportunities.

## **Green Chemistry**

**Principles:** Green chemistry involves selecting less hazardous, more sustainable chemicals and designing chemical products or processes that reduce or eliminate the use or generation of hazardous substances.

### **Resources:**

- **ACS Solvent Selection Tool:** The ACS Solvent Selection Tool is an interactive resource that helps scientists select solvents based on their physical properties and environmental impact. By utilizing Principal Component Analysis (PCA), the tool allows users to evaluate solvents on various criteria such as boiling point, density, and toxicity. This helps in choosing the most suitable and environmentally friendly solvent for a specific application.
- **MilliporeSigma DOZN:** MilliporeSigma DOZN is an online tool designed to help researchers identify green chemistry alternatives for both individual chemicals and entire chemical processes. It evaluates the environmental impact of chemicals based on 12 principles of green chemistry, providing a DOZN score that reflects the overall sustainability of a substance or process.
- **OSHA's Transition to Safer Chemicals:** The OSHA Transitioning to Safer Chemicals methodology provides a systematic approach for identifying and implementing safer chemical alternatives in the workplace. This framework helps organizations evaluate current chemical usage, identify potential hazards, and select less harmful substances without compromising functionality.
- **Michigan Green Chemistry Clearinghouse:** The Michigan Green Chemistry Clearinghouse is a comprehensive repository of resources aimed at promoting the adoption of green chemistry practices. It offers a wide range of tools, including databases for identifying hazardous materials, information on safer chemical alternatives, and guidelines for implementing green chemistry in various settings.

## **Virtual Green Chemistry Lab Resources**

**Overview:** [Beyond Benign](#) and the Green Chemistry Community have put together [a list of resources](#) for organizing virtual or remote green chemistry labs, including the [DOZN™ 2.0 guide](#) providing an overview of DOZN™ 2.0, rules for using the tool in academic settings, a template worksheet for students, and select reactions with DOZN™ 2.0 scoring.

## **Chemical Inventory**

**Importance:** Managing chemical inventories prevents duplicate purchases and the possession of expired chemicals. Sharing inventories across departments can reduce waste and save money. Access a good example of a [Chemical Inventory Form](#).

### ***BETR Grants***

**Description:** The BETR (Bringing Efficiency to Research) Grants Movement aims to revolutionize resource utilization and spending in US research institutions. By promoting efficient practices and facilities, BETR Grants seek to reduce the cost of research while minimizing the environmental, social, and fiscal footprint. This initiative aims to alleviate pressure in the competitive funding environment, allowing for increased funding allocation to scientific endeavors.

#### **Scope:**

- BETR Grants focus on four key areas: Promoting Shared Research Equipment: Encourages collaboration and resource sharing among research institutions to maximize equipment utilization and minimize redundancy. See examples from a [report by FASEB](#) and [CU Boulder](#).
- **Advancing Energy and Water-Efficient Equipment:** Supports the adoption of sustainable procurement practices, with emphasis on energy and water-efficient laboratory equipment.
- **Integrating Efficiency Discussions:** Advocates for the inclusion of efficiency discussions within ethics courses for graduate students receiving federal funding, fostering a culture of sustainability in academia.

**Global Impact:** Similar initiatives are underway worldwide to promote efficiency and sustainability in research practices. For more information, contact [info@mygreenlab.org](mailto:info@mygreenlab.org) or visit the [BETR Grants website](#).

### ***Green Chemistry Challenge Awards***

**Overview:** Green chemistry focuses on designing chemical products and processes that minimize or eliminate the generation of hazardous substances, thereby reducing environmental impact. The [Green Chemistry Challenge Awards](#) recognize and celebrate innovations in green chemistry, highlighting the environmental and economic benefits of developing and utilizing novel green chemistry solutions.

**Impact:** By promoting green chemistry, these awards contribute to a more sustainable future by reducing pollution, conserving resources, and improving human health and safety.

**Participation:** Scientists, researchers, industry professionals, and organizations involved in green chemistry innovation are eligible to apply or nominate candidates for the awards.

### **International Institute for Sustainable Laboratories (I2SL)**

[I2SL](#) is a global leader in promoting sustainable laboratory design, construction, and operation. Their innovative solutions and best practices are based on extensive research and real-world

implementation with tools that support Emory's mission to integrate sustainable practices into our lab operations

The International Institute for Sustainable Laboratories (I2SL) provides a wealth of resources for enhancing the sustainability and efficiency of laboratory operations. These guides and technical bulletins offer practical, proven strategies based on real-world implementations.

- **[Energy Recovery in Laboratory Facilities](#)**: A guide for lab owners, operators, builders, architects, and engineers to consider various types of energy recovery systems to improve efficiency in heating and cooling laboratories.
- **[An Introduction to Low-Energy Laboratory Design](#)**: This guide tracks the history and evolution of energy efficiency standards in the U.S., emphasizing efforts such as Architecture 2030 and the DOE's Better Buildings Smart Labs Accelerator. It outlines specific strategies for improving lab energy efficiency, addressing both general building practices and lab-specific needs while giving a holistic view of how enhancing lab energy efficiency can significantly improve overall building energy consumption.
- **[Benchmarking Energy Efficiency in Laboratories](#)**: This guide serves laboratory owners from universities to federal agencies, helping them meet energy efficiency and greenhouse gas reduction targets. The guide emphasizes the importance of specifying and tracking quantitative energy efficiency metrics throughout a lab's lifecycle—from design and construction to operations and renovations. It offers practical steps for integrating these metrics into both new and existing facilities and points readers to I2SL resources for additional strategies and technologies.
- **[Daylighting in Laboratories](#)**: This daylighting guide, part of I2SL's best practices series for laboratories, updates a previous version by Labs21. It provides comprehensive information for architects, engineers, designers, owners, and facility managers on integrating daylighting into lab design and operations. The guide emphasizes the benefits of natural light, including energy savings, improved occupant well-being, and enhanced productivity. It covers daylighting's role in the design process, performance metrics, and relevant energy codes, offering strategies for both new and existing lab buildings. By leveraging daylighting, labs can create environments that support research and innovation, while also attracting and retaining top talent.
- **[Decarbonizing Laboratories: A Primer](#)**: As the urgency to combat climate change intensifies, governments across the United States are enacting building performance standards aimed at reducing energy consumption and greenhouse gas emissions. This guide is designed to assist laboratory owners, operators, and designers in navigating the evolving landscape of building decarbonization. With a focus on operational energy use, the guide presents essential concepts and strategies for achieving significant reductions in carbon emissions within laboratory facilities.
- **[Designing and Operating Sustainable Laboratory Exhaust Systems](#)**: This guide offers invaluable insights into the design and operation of laboratory exhaust systems, focusing on mitigating the adverse re-entrainment of effluent at critical surrounding locations.

Recognizing the critical link between indoor air quality and the health and productivity of building occupants, the guide presents various quantitative approaches, including dispersion modeling, to determine expected concentration levels resulting from exhaust system emissions. Additionally, it delves into methodologies for operating laboratory exhaust systems safely and efficiently through the utilization of variable air volume (VAV) technology.

- **Energy Efficiency Projects and Principal Investigators:** Laboratory facilities play a crucial role in facilitating cutting-edge research, but retrofit projects aimed at improving safety, efficiency, and control can often disrupt scientific work if not executed with careful consideration of occupants' needs. This guide, offers strategies for facilities staff to navigate lab retrofit projects smoothly, ensuring the satisfaction of both engineers and scientists alike.
- **Energy Savings with Demand-Based Control:** Laboratory research facilities and vivaria, crucial for scientific endeavors, often demand high energy consumption due to the substantial amounts of outside air required to maintain safe and healthy indoor environments. With increasing concerns about energy costs, carbon emissions, and indoor air quality, reducing energy expenses in laboratory facilities has become imperative. This guide addresses this challenge by discussing demand based control (DBC), a form of demand control ventilation (DCV), as a solution to minimize energy usage while ensuring optimal indoor environmental quality.
- **Financing Options for Energy Efficiency and Renewable Energy Projects:** From the urgency of climate action to the staggering financial investments projected by the International Energy Agency (IEA), the guide explores the landscape of financing options available for energy projects. It sheds light on the limitations of utility incentives and the emerging trend of building performance standards (BPS) that penalize non-compliance, prompting a shift from incentives to regulatory enforcement. Through insightful discussions and real-world examples, the guide equips readers with the knowledge and strategies needed to navigate the complexities of financing energy efficiency and renewable energy projects. It underscores the importance of speaking the language of finance and articulating compelling business cases to secure buy-in from organizational leaders.
- **Laboratory Resilience:** This guide explores the application of resilience principles to laboratory facilities, focusing on both operational and physical aspects necessary for maintaining continuity in the face of disruptions. It defines resilience for labs, examines its impact on planning, design, operation, and funding, and identifies emerging challenges. The guide offers practical insights and case studies to illustrate resilience strategies in action, catering to a diverse audience including lab owners, operators, funders, and design professionals.
- **Low-Pressure-Drop HVAC Design for Laboratories:** Description: This guide focuses on optimizing laboratory ventilation systems to enhance performance and reduce energy consumption. Laboratory ventilation systems are crucial for maintaining controlled environments and safeguarding occupants working with hazardous airborne materials. However, the high-flow exhaust systems commonly employed in these systems, coupled

with conditioned outside air supply, often result in significant energy usage. The guide emphasizes the importance of scrutinizing both the design and operation of ventilation systems to identify opportunities for improvement. It highlights the substantial impact of fan energy on electricity consumption in laboratories, with ventilation fans alone contributing over a quarter of total electricity consumption. By implementing low-pressure-drop design strategies, particularly in the early stages of design, laboratories can significantly reduce energy costs over the lifespan of their HVAC systems. The guide offers insights and strategies to achieve this goal, aiming to support more sustainable and efficient laboratory operations.

- **Manifolding Laboratory Exhaust Systems:** Geared towards architects, engineers, and facilities managers, this guide provides practical insights into designing and operating laboratory exhaust systems. It emphasizes the importance of considering locally applicable codes and existing system configurations during the design process. It explains how such systems save energy by reducing fan power, providing adjustable airflow, and increasing energy recovery opportunities. Additionally, it discusses the synergy of manifolded systems with other design best practices, such as variable air volume fume hoods and variable speed drives, to further enhance efficiency in laboratory operations.
- **Predictive Maintenance Using Automatic Fault Detection and Diagnostics:** This guide explores the evolution and applications of automated building analytics in laboratory facilities, emphasizing its potential beyond energy savings. Introduced two decades ago, automated building analytics has advanced significantly, offering lab owners and operators opportunities to enhance energy efficiency and facilitate predictive maintenance. Predictive maintenance aims to increase equipment life, reliability, and lower labor costs by continuously analyzing equipment performance to identify faults before they become critical. By implementing predictive maintenance, lab facilities can achieve leaner and more efficient operations, eliminating energy-wasting faults while reallocating funds and labor for other sustainability improvements.
- **Principles for Building Automation Systems in Laboratory Facilities:** This guide explores best practices to ensure that building automation systems (BAS) in life science and laboratory environments perform correctly and continue to perform that way, including monitoring for safety, performance, pressurization, and ventilation rates.
- **Water Efficiency in Laboratories:** Developed in collaboration with the U.S. Environmental Protection Agency's (EPA's) WaterSense® program, this document is one of a series of best practices guides the International Institute for Sustainable Laboratories (I2SL) published to provide information about technologies and practices to use in designing, constructing, and operating safe, sustainable, high-performance laboratories. This guide highlights best practices for laboratory water management in particular and potable water use reduction in general, including:
  - Water management and monitoring
  - Understanding and targeting efficiency in specialized laboratory equipment

- Designing for efficiency
- Minimizing cooling demand and optimizing cooling tower and boiler operations
- Improving efficiency within other building water systems
- Reusing water or identifying alternative sources.
- **[Retro-Commissioning Laboratories for Energy Efficiency](#)**: This technical bulletin delves into the specialized process of retro-commissioning (RCx) as it relates to laboratories, highlighting unique steps and energy-performance issues specific to these environments. It identifies three key areas crucial for optimizing energy performance in laboratories: fume hoods or exhaust devices, laboratory spaces or modules, and HVAC systems serving laboratory spaces. The bulletin emphasizes the importance of airflow, pressure, and temperature control within laboratory spaces for energy efficiency while outlining the basic RCx process steps while focusing on lab-specific considerations. Additionally, it distinguishes between retro-commissioning as a one-time effort and monitoring-based commissioning (MBCx) as a continuous process for sustaining and enhancing building performance over time.

The LabSavers campaign encourages lab owners, managers, and researchers to conduct annual clean-outs and space assessments to improve efficiency and sustainability.

*Why conduct a lab clean-out and space assessment?*

- Inventory, consolidate, and properly store lab supplies
- Dispose of (or reuse) excess chemicals safely
- Repurpose old or unwanted equipment where needed
- Evaluate lab space and storage and optimize for better research efficiency

I2SL's [LabSavers tool kit](#) consists of guidelines for conducting a lab clean-out and space evaluation at a research institution, sample materials to promote the campaign in a building or across a campus, and a how-to guide for implementation.

This program is meant to provide suggestions and templates, but facility managers, green labs professionals, EHS staff, and research or student leaders should tailor the program and customize the materials to fit their buildings and participants.

Looking for an **example** of a lab clean-out and space evaluation? Watch this [talk](#) presented by Suzann Staal and Ethan Carter of the University of Colorado Anschutz Medical Campus during I2SL's 2024 Education Week.

Developed by the Department of Energy (DOE) and I2SL, the [Smart Labs Toolkit](#) offers a comprehensive guide for implementing Smart Labs programs.

This free, online resource provides a step-by-step guide to assist laboratory owners and users when implementing their own Smart Labs program through 4 main phases:



1. *Plan: Establish objectives and goals for lab efficiency and safety.*
2. *Assess: Evaluate current lab conditions and identify areas for improvement.*
3. *Optimize: Implement strategies to enhance lab operations.*
4. *Manage: Continuously monitor and adjust practices for sustained efficiency.*

The Labs2Zero initiative focuses on decarbonizing laboratories by improving energy efficiency and reducing emissions. Find the Quick Start Guide [here](#).

- Lab Benchmarking Tool (LBT): Benchmark your lab's energy performance and emissions.
- Energy Score: Evaluate and compare your lab's energy use against similar facilities.
- Operational Emissions Score: Assess and reduce greenhouse gas emissions from lab operations.
- Embodied Carbon Benchmarking Tool: Compare the embodied carbon in construction materials used in lab buildings.

*For further assistance or to request more information, please contact us at [greenlabs@emory.edu](mailto:greenlabs@emory.edu).*