

Sustainable Ultra-Low Temperature Freezer Resources



According to the Department of Energy, **conventional Ultra-Low-Temperature Freezers can consume up to 20 kWh of energy per day** – as much as a single US household. Ensuring proper maintenance on a ULT freezer not only has the potential to improve its lifespan and performance, but can also widely decrease energy consumption. In a high energy demand world, freezer maintenance can help save both costs and the climate.

UCLA Sustainability encourages laboratories to improve their energy efficiency through regular freezer maintenance and necessary upgrades. This document provides a brief overview of best practice resources for ULT Freezers that will guide labs on a path to sustainable practices.

Action Category 1: General Maintenance

Overview:

Category 1 represents the most simple and important ways to reduce energy consumption and optimize freezer efficiency. Regular maintenance schedules should be implemented and proper ventilation should be provided for all freezer units.

Importance:

These general maintenance practices **decrease energy consumption by eliminating debris buildup and interference** with freezer performance, ultimately increasing unit longevity and efficiency.



Action Items:

Place all freezer units on an annual defrosting schedule.

- Frequency may be increased depending on usage

Place all freezer units on a monthly maintenance schedule

- Remove frost from freezer interior
- Remove dust from intake and coils
- Check filters to ensure proper working condition
- Check seals and gaskets to ensure proper working condition



Keep surrounding area of all freezer units well ventilated to avoid heat accumulation

- Allow for clear space behind and above all freezer units



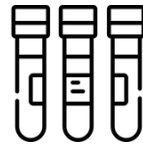
Action Category 2: Temperatures and Samples

Overview:

Category 2 represents temperature-based and organizational methods for improving freezer efficiency, which includes altering freezer conditions and everyday laboratory practice. Freezer temperatures should be permanently increased, or “chilled-up”, and samples should be organized in order to increase working efficiency.

Importance:

Well-organized and chilled-up freezers increase efficiency by increasing storage capacity and reducing temperature fluctuations that require excess energy to restore the freezer to its ultra-low temperatures. By implementing these practices, the freezer will also increase operational longevity while reducing energy consumption by more than 30%.



Action Items:

Set freezer temperature to -70°C rather than -80°C

- Maintains sample integrity while reducing energy consumption

Optimize sample organization within freezer

- Clearly label samples and maintain inventory with previous temperature and usage records
- Place more highly used samples towards front of freezer
- Minimizes open-door time

Fill empty spaces with polystyrene ice; avoid large, empty spaces in freezer

- Polystyrene ice acts as insulation

Implement high-density storage and vertical rack systems

- Use 13x13 dividers and/or smaller tubes to increase storage capacity
- Reduces empty space (provides insulation) and increases unit capacity

Each month, clear out unneeded samples

- Increases unit capacity

Action Category 3: Gold Star Practices

Overview:

Category 3 represents final additional measures that can be taken to maximize freezer efficiency in conjunction with actions from Categories 1 and 2, though not all may be applicable based upon your lab's freezer model. Steps include retiring unused freezers, upgrading to more energy-efficient models, and utilizing advanced, cutting-edge practices.

Importance:

Freezer retirement and upgrades ensures that freezers are running to the best of their ability and that unneeded freezers are not wasting energy, thereby improving efficiency and reducing emissions.



Action Items:

Unplug unneeded or unused freezer units

- Reduces total energy consumption of the lab

Implement a barcode inventory system

- Assists in sample tracking

Implement room temperature sample storage (RTSS) for applicable samples

- RTSS can apply to DNA, RNA, plasmids, reagents, and diagnostic kits
- Increases storage capacity for other samples

Share cold storage space with another lab if possible

- Optimizes unit space usage throughout UCLA

Additional Resources

Action Category 1

Preventative maintenance and management

[National Institutes of Health User Level Freezer Preventative Maintenance Video \(2018\)](#)

[ULT Freezer Maintenance - Eppendorf, 2019](#)

[Maintaining a Healthy and Efficient Ultra-Low Temperature Freezer Fleet - ThermoFisher Scientific, 2020](#)

[Everything You Wanted to Know about Running an Ultra Low Temperature \(ULT\) Freezer Efficiently but Were Afraid to Ask - Store Smart, 2013](#)

[ULT Freezer Resource Library - ThermoFisher Scientific](#)

Action Category 2

Temperatures

[Temperature Minimum for Energy Efficiency - My Green Lab](#)

[Researched best-temperatures for storing samples efficiently - Energy Transition Coordinating Council, 2016](#)

Sample Management and Loading

[Sample Storage Practices - ThermoFisher Scientific, 2019](#)

[Storing for Energy Efficiency - Mississippi State University, 2024](#)

Action Category 3

Retirement and Upgrades

[Energy efficiency and upgrading resources - Freezer Challenge](#)

[The Future of Cooling Liquids in ULT Freezers - Eppendorf, 2018](#)