Energy consumption

Author	Role	Version	Issue date
Jenna Lowe	Laboratory Sustainability Officer	2.0	January 2024

1. Purpose

This document provides information about how much energy common items of laboratory equipment use and steps that can laboratory users can take to reduce this energy consumption. This document also supports the University to achieve objectives set out in the Environmental Policy and maintain compliance with the ISO 14001:2015 environmental management system.

2. Scope

This document is relevant to all laboratory users.

3. Procedure

40% of global CO2 emissions come from generating electricity and since laboratories consume 10 times more energy than a typical office building they are one of the most energy intensive industries.

The following offers some guidance on changes that can be made in the laboratory to reduce the energy consumption.

3.1. Ultra-Low Temperature (ULT) Freezers

ULT freezers make up over 66% of energy used by laboratories and if set to -80°C can use the same energy as 1 UK household per year. Increasing the temperature to -70°C can reduce energy consumption by 30%.

Many institutions have already made the switch and have shown that there is no effect on the samples in the freezer, more information can be found here.

Good freezer management and organisation will help with energy consumption and will minimise the risk of exposing samples to fluctuating temperatures. For every minute a freezer door is open it takes around 10 minutes for the freezer to recover its temperature.

- Use racking to maximise storage space.
- Standardise recording and labelling of samples.
- Create freezer inventories and update them when items are added or removed.

Good freezer maintenance can save up to £250 in energy costs per year and prolong the life of the freezer.

- Regularly clean the filters and remove any ice build-up from the seals.
- Completely defrost once a year.
- Fill any empty freezer space with polystyrene boxes.

The University of Edinburgh carried out a cold storage sustainability project, the details can be found here.

3.2. Air circulation units

Air-circulation in laboratories also contributes to their high energy consumption. This consists of fume hoods, laminar flow cabinets, biosafety cabinets and general air conditioning.

3.2.1. Fume hoods

Fume hoods use the same energy as 2-3 UK households per year when running.

Follow these rules when using a fume hood to increase its energy efficiency:

- Keep the sash as low as possible when working and lower the sash during breaks in work and when it is not in use.
- Do not use for excess storage as this can impede the air flow and make the fume hood work harder.
- Move arms in and out of the fume hood slowly and avoid unnecessary movement in front of the hood.
- Work at least 15cm inside the hood.
- Only bring the items you need into the fume hood and make sure items are placed at least 20cm behind the sash, 10cm from the sides and nothing is blocking the back.
- If it is safe to do so turn the fume hood off when not in use.

All this can reduce energy consumption by 30-50%.

3.2.2. Safety cabinets

Ducted safety cabinets can use as much energy as fume hoods, although better recirculating Safety cabinets can still use as much energy as half a house.

Like with fume hoods correct use of safety cabinets can be applied to reduce the energy consumption:

- Switch off the cabinet when it is not in use.
- Do not use for excess storage.
- Move arms in and out of the cabinet slowly and avoid unnecessary movement in front of the hood.
- Work at least 15cm inside the hood.

- Only bring the items you need into the cabinet and make sure all items are stored in the centre and not blocking any vents.
- If using UV make sure this in not used for longer than required. Check local guidance but 20-30 minutes is usually sufficient.

3.3. Smaller items of equipment

Smaller items of equipment are also very energy intensive. A heat block at 90°C can consume as much energy as one and a half -20°C freezers and a 10-12L water bath at 37°C can consume as much energy as 2 small fridges.

One way to reduce energy consumption is to measure how long equipment takes to heat up and cool down. For example, how long does it take a heat block to reach 95°C or a centrifuge to cool down to 4°C. By knowing this we can significantly reduce the amount of time equipment is switched on before it is required, this information can easily be captured and written on a label stuck to the equipment.

3.4. Turning off equipment

Turning off equipment can reduce energy consumption directly as well an indirectly. Equipment that is on can heat up the laboratory causing the air conditioning and also cold storage units to work harder and consume more energy. Therefore, by turning off all equipment when it is not in use it will have a positive impact and help to reduce energy consumption aswell as wear and tear on the equipment.

Laboratories have reported a 50% reduction in energy consumption simply by switching off small items of equipment that are not in use.

3.4.1. Sticker up

Using these stickers on equipment can help users to identify what equipment can be switched off and what needs to be left on. Stickers are available from the laboratory sustainability officer (jenna.lowe@liverpool.ac.uk)

3.4.2. Booking sheets

Most large pieces of communal equipment such as safety cabinets, fume hoods and PCR machines will have booking sheets available for users to book timeslots to use the equipment.

It is important to consider using this practise for other items such as centrifuges, heat blocks and other small items.

Placing booking sheets on these smaller items can prevent accidental switch off by users who may think that the item has been left on by mistake. This is especially important when it comes to items that require time to heat up or cool down.

Users can book their time allowing for heat up/cool down times. This can also help other laboratory users identify equipment that may have been left on by mistake and switch it off or contact the last user to see if it is still required.

The following is an example that can be printed and laminated for continual use:

4. Changes to the procedure

Version	Reason for change	Date
1.0		November 2023
2.0	Change to purpose, scope and section 3.4.1	January 2024