

ULT Freezer Fact Sheet

Public Sector Lab
Working Group
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“28.6% energy savings associated with operating at -70 °C instead of at -80 °C” (Farley et al. 2015)

Improve energy efficiency of public sector buildings

50%
by 2030



Reduce emissions from the public sector by

30%
by 2030

The Big Picture

By David Wilson

All Public Sector Organisations have been set the target of improving energy efficiency by 33% by the end of 2020, when compared to a base line year of 2009.

The emphasis has now turned to the 2030 targets and the 50% improvement in efficiency being set for the Public Sector along with a 30% total emissions reduction.

With the 2020 targets much of the low hanging efficiency reduction projects have been undertaken, and in most cases little emphasis put on the opportunities to conserve and optimise energy within our labs. Thankfully there are vast numbers of options available within our labs where energy, resources, time and money can be saved.

For energy conservation and optimisation projects to achieve sustained results there is a need for staff involvement and leadership - without which projects will never come close to achieving their full potential.

In this first in a series of Fact Sheets we will look at the opportunities available for the optimisation of freezer use with special focus placed on the energy saving opportunities when moving operating temperatures of ULT freezers from -80°C to -70°C.

International Laboratory Freezer Challenge

The International Laboratory Freezer Challenge is a competition designed to promote best practices in cold storage management. The Freezer Challenge covers all forms of cold storage, including refrigerators, freezers, and cold rooms.

This challenge is designed to encourage all laboratories to recognize the benefits of good cold storage management, such as:

- Removal of unneeded, unwanted, or non-viable samples from refrigeration units
- Reduced costs associated with maintaining refrigeration units.
- Improved researcher access to laboratory samples and reagents.
- Development of ongoing cold storage management practices that support efficiency and maximize space utility.

Things we can do

By David Wilson

- **Freezer Operating Temperature** - not all samples need to be stored at -80°C and it's only in the last 15 - 20 years that freezers have even been able to achieve temperatures of -80°C . The University of Colorado and University of California have carried out long term research and have developed an inventory of hundreds of different sample types stored at -70°C and warmer.

“Investigations at the National Institutes of Health in the United States of America have indicated that for every year of a ULT freezer's life its energy consumption increases by 3%” Gumapas & Simons, (2013)

- **Inventory of Samples** - knowing what samples are in your freezer and their location allows you reduce door opening time when retrieving samples. Studies show that door opening time directly affect sample storage temperature and energy requirements to reinstate set point temperature.

- **Freezer Management** - do samples need to be stored at ULT Temperatures? Are the samples still required? You can save significant costs from purchasing and running ULT freezers by regularly removing samples no longer required.

“ULT freezer storage, of course, does not stop sample degradation - it merely slows it down - so those samples you have been holding onto for years and years may not even be of any scientific use to you if you did decide to use them again.” University of Edinburgh (2018)

- **Defrost and cleaning ice build-up** - frost build up reduces usable internal space and also increases the energy consumption, a 16% increase in consumption was seen in the operation of a heavily iced-up freezer (DO NOT USE HAMMERS OR OTHER BLUNT OR SHARP TOOLS ALLOW THE FREEZER DEFROST NATURALLY)

If operating an empty backup ULT freezer a stand-by temperature of -60°C will suffice as the prolonged period door opening time associated with sample transfer will result in a significant temperature increase in all cases. There is a 42% energy saving when operating at -60°C instead of -80°C

- **Clean Filters Regularly** - Freezers draw air through filters and across condensers and heat exchangers as part of the refrigeration cycle. A buildup of dust and debris means that freezers need to work harder using more energy to achieve the set point temperatures. If maintenance is sub-contracted, ensure these works are included in all further tendered works as saving of 12-14% have been reported for well-maintained machines.

- **Give Room** - ULT freezers need room to allow heat to dissipate from the cooling process; don't place boxes or equipment on top or adjacent to units.

References

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