GREEN CHAMPIONS

-70°C IS THE NEW -80°C

Clinical laboratories use ultra-low temperature (ULT) storage to preserve temperature-sensitive biological samples and reagents, ensuring their long-term viability and integrity for research, clinical studies and other applications. This process is incredibly energy intensive, with freezers set to -80°C shown to use 16-22 kWh per day. To put this into context, the average daily electricity use of a standard home is only 8-10 kWh. Numerous publications suggest that increasing the temperature of ULT freezers from -80°C to -70°C significantly reduces energy consumption and increases freezer lifespan, whilst still safeguarding the long-term integrity of clinical samples and other materials.

CALLUM GOOLDEN

Clinical scientist (virology) – Manchester Medical Microbiology Partnership (MMMP); and Association for Laboratory Medicine Green Champion

The Freezer Challenge

"The Freezer Challenge" is a free international competition co-ordinated by not-for-profit organisations MyGreenLab and the International Institute for Sustainable Laboratories (I2SL) with the aim of promoting best practice in cold storage management. The competition runs from January to July 2025 and claims to have resulted in 76.5 million kWh of energy savings since its conception in 2017. Both academic and clinical labs are encouraged to sign up and are provided with a selection of carefully crafted resources to assist laboratory teams to optimise their practices. Results of the programme are uploaded via an online score sheet, with points awarded for various actions. Select laboratories demonstrating the greatest efficiency saving are eligible for prizes.

Infographic of Freezer challenge components.
Image from http://freezerchallenge.mygreenlab.org/

Our experience

As a large tertiary referral centre, MMMP Virology receives and processes a vast number of clinical samples for both virological diagnoses and public health surveillance. This volume of specimens necessitates substantial ULT storage capacity which is a major contributor to the overall energy consumption of the service.

After reviewing the large body of published evidence and obtaining consensus agreement, the decision was made to evaluate the potential switch of all ULT freezers to -70°C. As part of this small project, the annual electrical efficiency, financial cost and greenhouse gas savings would be estimated.

The electrical consumption of select freezers was measured at -70°C vs -80°C for seven days using a plug-in power meter. The obtained value was extrapolated to estimate annual electrical consumption and efficiency savings over a 12-month period. Annual cost savings were calculated using the local electricity tariff. The potential carbon savings were estimated using the UK Government GHG Reporting Conversion Factors.

By switching 19 freezers from -80°C to -70°C we were able to demonstrate potential electricity savings of 13,728 kWh (19.6%), a cost saving of £3,020 and an annual CO_2e saving of 2842.49 kg CO_2e (equivalent to 12,291 road miles in a small petrol car).

Conclusion

It is clear that the vast majority of clinical laboratories still have huge work to do to ensure the environmental sustainability of their services. One relatively minor, but significant change labs can make is to optimise their ULT storage to reduce energy use. Resources are readily available via the Freezer Challenge website to help guide those unsure what practices to adopt or how to implement them. The Freezer Challenge website also houses a repository of evidence which provides assurance that the change in practice will not negatively affect the integrity of high-value clinical specimens and laboratory reagents.

Darren Livsey, virology equipment officer next to one of the freezers we have successfully adjusted to -70

Our findings at MMMP align well with published data and will hopefully provide the impetus for other departments within the Division of Laboratory Medicine, and perhaps readers of this article, to adopt similar changes in their cold storage.

References

1 The Freezer Challenge. Available at: http://freezerchallenge.mygreenlab.org/

2 -70°C database. Available at: https://freezerchallenge.mygreenlab.org/resources?showResource=negative-seventy-c-database

Plug-in power meter. These devices are simple to operate and can be cheaply purchased from popular online marketplaces.