Green Impact Excellence Project Report

To be completed before 5 May 2023

This update is an opportunity for you to celebrate your hard work and achievements in Excellence. We hope that a lot of your projects will continue after the submission deadline, but you should aim to summarise your work so far, as well as any work due to be completed. Please ensure your project update doesn't exceed 2,500 words.

Name of Team: **Jeffrey Cheah Biomedical Centre**
Excellence Submission Title: **Increasing sustainable practice and energy efficiency in ultra-low temperature (ULT) freezers at the Jeffrey Cheah Biomedical Centre**

A summary of your project's achievements

In brief, we reached out to the three departments in the building about changing the running temperature of ULT freezers from -80°C to -70°C. We contacted all available research groups either directly or through the facilities teams and were able to have 6 units changed, with a further 4 agreeing to change but not yet actioning it. When these are switched over, these will save the building 7665 kWh/year (see evidence section). We also produced a concise, informative guide on how to be more energy efficient with ULT freezers, and a video showing best practice when using the freezer (both also uploaded), and shared these with the facilities teams of all three departments.

Objective A) ***Reach out to research groups to bring awareness to ULT freezer efficiency***

Objective B) Increase the number ULT freezers that are set at -70°C that were previously at -80°C

In this project we contacted the three departments in the building – Cambridge Stem Cell Institute (CSCI), Milner Therapeutic Institute (MTI) and Cambridge Institute for Therapeutic Immunology and Infectious Disease (CITIID). As CSCI are the largest department with the most ULT freezers, they were prioritized at first.

CSCI

We first contacted the CSCI director (Bertie Göttgens) and the facilities manager (Steph Hall) to discuss the project. Both were supportive and Bertie agreed to raise the point of running freezers at -70°C in the February PI meeting. After the meeting, the feedback was that generally all group leaders agreed with the concept, though some were hesitant depending on the specific samples they had stored in the freezers. From here we reached out to all group leaders by email to ask if they would be comfortable changing at least one of their ULT freezers to run at -70°C. As of writing, 6 units from 4 groups have made the change, and an additional 3 freezers from 4 groups (includes one unit shared by two groups) have agreed to make the change but have not yet actioned (fig. 1,2). A further 9 freezers from 5 groups declined change with the following reasons:

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- Wanted feedback from other groups/building that already run at -70 to hear their experience
    - We contacted the facilities manager at the Cambridge Institute for Medical Research (CIMR) as we had been told this department had previously worked on switching freezers to -70°C. We received two contacts – Victoria Barratt (Lab Manager, Rubinsztein lab) and Professor Michael Weekes (Group Leader). We also contacted Komal Nayak, lab manager of the Zilbauer lab at CSCI, for feedback as they were the first group to change their freezers to -70°C. All feedback is seen below and was shared to the PI who raised this point.
- Concerned increasing the temperature reduces the time the units stay cold in the case of a power failure. This is notable as the building experienced a system failure last year during the summer heatwave whereby the freezer room overheated and tripped lots of the freezer alarms
    - This concern came from the facilities team and meant that they unfortunately were not willing to lead by example. Steph said she would rather wait until after the summer to revisit the topic, so they can ensure the new system changes could in fact deal with any heatwaves.
- Wanted assurance that the alarm system is fully functional and that this enough spare freezer space in the case of a unit failure
    - We contacted the facilities team and had assurance that there are multiple 'emergency' freezers and that the T-scan alarm system is fully functional, but groups could test this by changing the alarm thresholds to intentionally trigger it.
- Would be more inclined to switch if the University or even funding bodies like UKRI had guidelines on this.
    - There is no such feedback as of yet, but Ed Bullmore (Dept. Head of the School of Clinical Medicine) has said that this may be something the School may be enforcing in the near future.

MTI

The MTI is a much smaller department in the building with only 3 ULT freezers, one belonging to a larger group (FGC), one to shared by all other research groups, and one as an emergency back up. The FGC were contracted directly and declined to change for the time being as there were concerns over sensitive viral stocks and the freezers frequency of use. All other research group were contacted through the MTI facilities team, though not all groups agreed to the change thus far. The MTI facilities team agreed that they were happy to change the emergency freezer to run at -70°C though this is yet to be actioned.

CITIID

We contacted CITIID through the facilities manager Michal Blaszczyk as we currently have no representatives from CITIID on the Green Impact Team. He was very supportive of the idea and informed us that CITIID went through the campaign of switching to -70°C a few years ago, and that many had agreed to change. However, upon checking the status of the CITIID freezers, we were informed that only 4 are running at -70°C. Michal has said he is liaising with lab managers in the department to action further changes.

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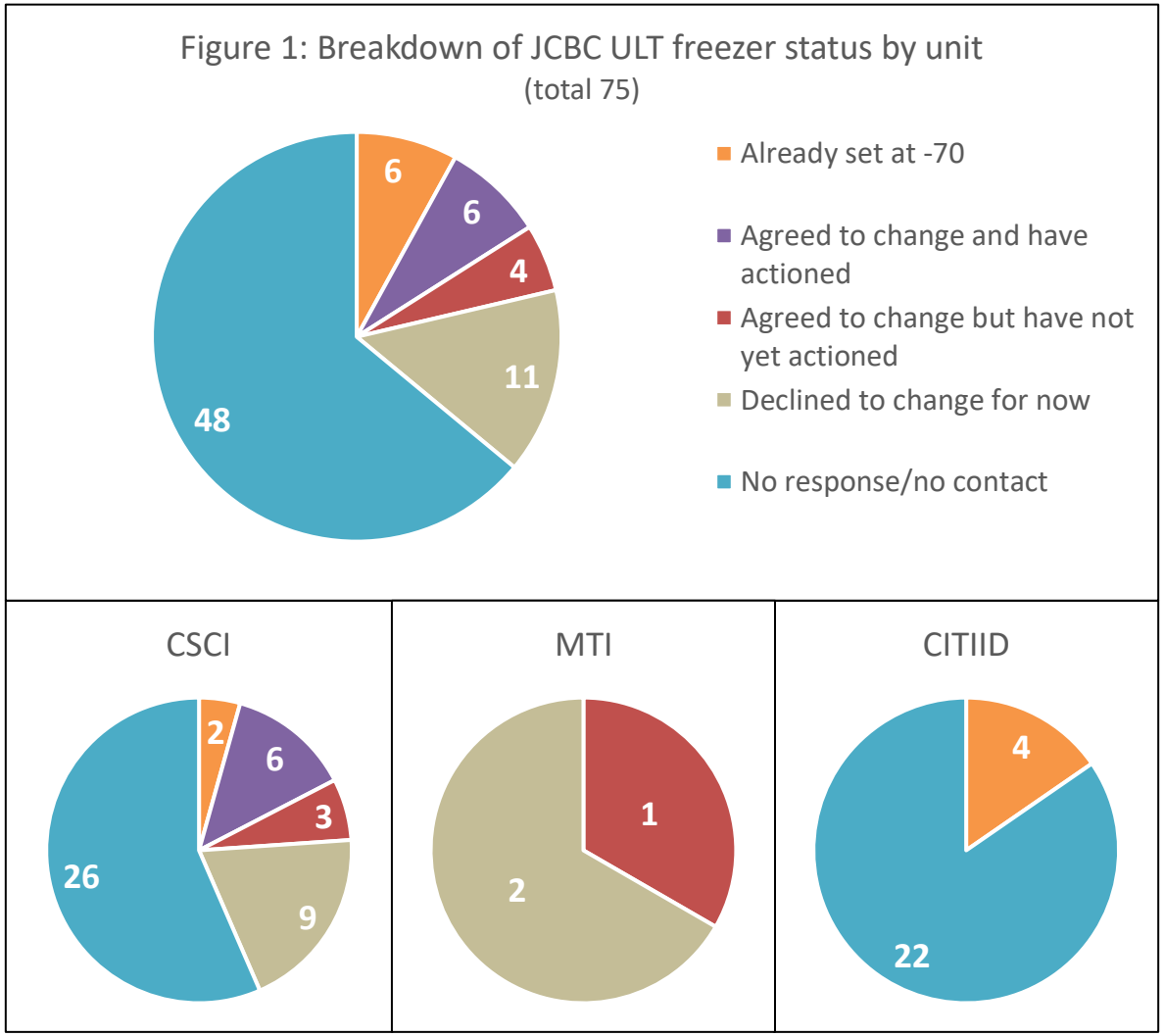

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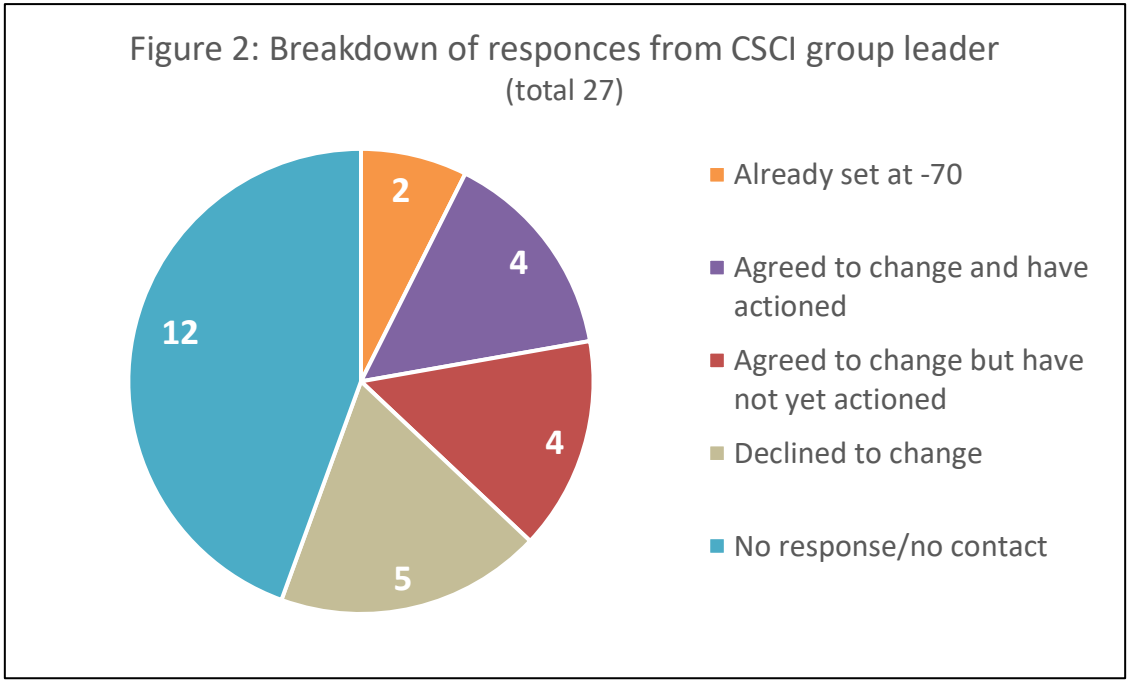

Feedback from groups about -70 freezer change:

Prof. Michael Weekes:

"We use our freezer at -70°C along with the majority of the building. All of the freezers in our freezer room are now -70°C (these are for longer term storage so opened infrequently). I think the only real reason to use -80°C is if the freezer is opened very frequently so the temperature warms up too much (although notably the new freezers are good at cooling down quickly). For valuable samples of ours (virus aliquots) that we want not to be subject even to minor temp fluctuations, we store at the back of the freezer - so they still remain completely cold even if the drawer they are stored in is partially out of the freezer.
I agree there is a theoretical risk of lower durability of cell lines - our rule of thumb is that they last up to a year in the -70/-80°C - so we only store working stocks in the freezer and longer term in liquid nitrogen. I think it's difficult to know if increasing to -70°C has had any effect on durability - it may have done a small amount but difficult to tell - would be interesting to look to see if anyone has done a formal controlled comparison. We store glycerol stocks at -20°C so I don't think these should be affected.
The energy saving from turning up to -70°C is huge - about the same as that used by the average household in a year"

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Victoria Barratt (Lab Manager, Rubinsztein Lab)

"We were asked to reduce the temperature of our ULT freezers but found that the integrity of some samples reduced at the higher temperature. Some people found issues with their glycerol stocks, and those naughty people who don't move their cell samples to LN2 also experienced issues. The freezer has a lot of usage, and the temperature was increasing too much when the door was opened so I asked to have the temperature reduced. I think our lab is one of the few that uses -80°C rather than -70°C"

Komal Nayak (Lab Manager, Zilbauer Lab)

"During our time in Paediatrics and Department of Medicine (2012-2022), we stored all our samples at -70°C instead of -80°C. We generate and store various kinds of samples in our group- whole blood, plasma, serum, fixed biopsies, snap-frozen biopsies, biopsies in RNALater, DNA, RNA. We have never had any problems with the quality of any of these samples and we have processed these for single cell sequencing, transcriptional profiling, methylome profiling, whole exome sequencing etc. When we moved to CSCI we were happy to continue to maintain our freezers at -70°C."

Objective C) Generate a guide for staff on how to increase efficiency when using ULT freezers

As the last part of our project we worked on creating a guide to help staff be more efficient when using their ULT freezers. The CSCI facilities team were met with to discuss the freezer efficiency guide and the shared their SOP on de-icing and defrosting ULT freezers, which was incorporated into the guide. By the end this guide took the form of a concise, informative poster on how to increase freezer efficiency, and a video showing best practice when using the freezer. These were shared with the facilities teams of all three departments as a resource that they can direct users to. We also put the poster guide on the wall in the freezer room so it can be seen to reference (see photos).

KPI Delivery Update

Please refer back to the KPIs you stated in your project plan and report the progress made. If you didn't quite meet your targets, you can make reference to any challenges in a later section. The most important thing here is to check you've been able to accurately measure your KPIs. Please also mention your target KPIs alongside your actual figures. The table below may be helpful

KPIs (as in project plan)	Revised KPIs (If applicable)	Actual outcomes
Number of lab groups directly contacted		CSCI: 26 MTI: 2 (1 group contacted directly, all others through MIT facilities) CITIID: 0 (contact was through CITIID facilities)
Number of freezers switched from -80°C to -70°C		6 have been changed, with a further 4 agreeing to change but have not actioned as of writing
Number of freezers defrosted		0 defrosts. This became less of a priority during the project.

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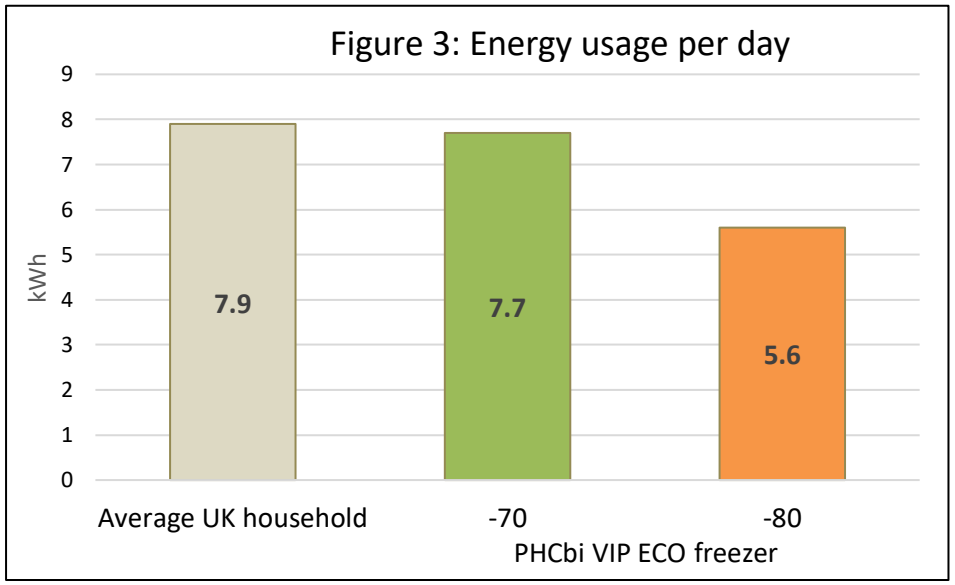
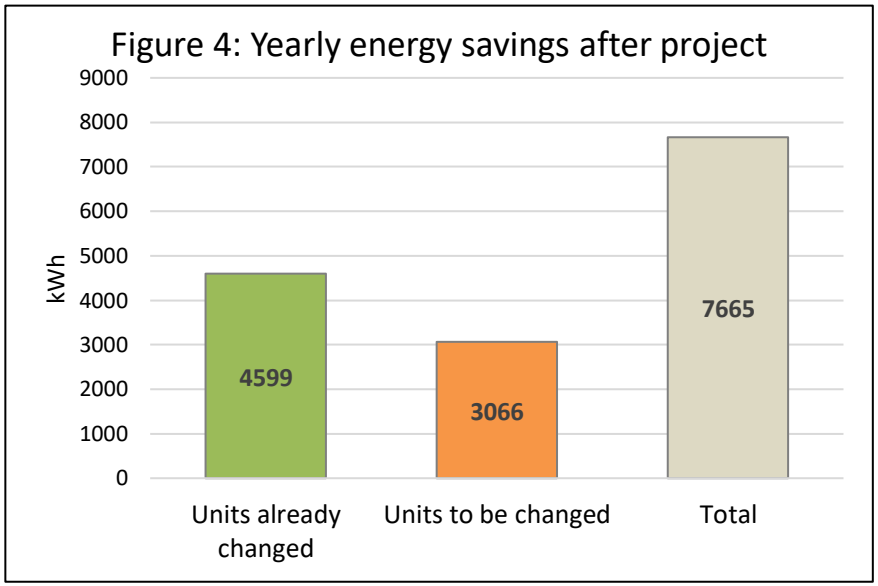
Evaluating the impact of your project

How can you evidence the success of your project, other than through the KPIs above? Qualitative data is as useful as quantitative data so you can add anecdotal evidence here on the overall result of your project. You may wish to refer back to the 'action plan template' that you submitted in your project plan in December. Are there any things that resulted from the project that you can't easily measure? What were your team members', colleagues' and senior management's views on the project?

We can quantify the energy savings from our actions based on the energy cost of running the units at -70°C vs -80°C. As >90% of the ULT freezers in JCBC are PHCbi VIP ECO freezers (Cat. No. MDF-DU702VH-PE), we have used the energy consumption of this model (shared by a PHCbi rep) for all calculations (though it is important to highlight that this model of freezer is very efficient and so energy savings from changing older, less efficient models would likely be greater). As such, changing the running temperature from -80°C to –70°C saves 2.1 kWh/day per unit (fig. 3). From the 6 units that were changed to -70°C since starting the project, we will be saving 4599 kWh/year (fig. 4). If we include the other 4 units that have groups have agreed to changing but as of writing have not actioned, this increases to 7665 kWh/year. That means the yearly monetary savings for the building is ~£2480 (assuming 32.36p/kWh based on government energy price guarantee in East of England). Though saving money is not the primary reason for pursuing this project, it is noteworthy given the recent cost of living crisis. It also helps with stakeholder engagement to highlight the additional positives that sustainable actions such as this have.





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Project Difficulties and Opportunities

What were the barriers (if any) to your project's success and how did you overcome these? Has the project raised any opportunities? If so, how does your team plan to take advantage of them? This is an ideal place to make reference to any unexpected issues or barriers that may have come up during your excellence project. If your project plan didn't progress as planned, please explain why and what you did instead.

One main difficulty when approaching group leaders about -70°C freezers was the response rate. As shown in Figure 2, 12 group leaders are yet to respond in CSCI out of 27. This number was originally higher, but we approached some individuals face-to-face too which was successful. This leads to the point that group leaders may miss emails from us due to their busy work schedules and that speaking to them in person (where possible) and contacting their lab managers could be a solution in the future.

Another key issue was the lack of strong evidence to support our campaign to change to -70°C. It is widely accepted that -80°C only became the standard in the scientific community because manufacturers started making freezers capable of -80°C, and marketed them very well to convince users this was better. There is little evidence to say that samples are more stable at -80°C vs -70°C, but equally little to show -70°C is as good as -80°C. People in science will follow the evidence and this is where we are lacking. The best evidence we have available is referencing groups that are already operating at -70°C, sharing what sample types they are storing, and hope this is convincing enough for others. We would have liked to apply for funding to construct our own project to test sample integrity (including DNA, RNA, bacteria, protein, primary tissue, cells, organoids, bacteria and viruses) over time up to one year, but we were directed by Martin Howes to the University of Edinburgh's Long-Term Cold Storage Study in which they are doing exactly this but over 5 or 10 years. Martin informed us that they are wrapping up the 5 year outcome so we hope this data will be released soon so we can distribute it more widely. We have contacted Rachael Barton in department of Social Responsibility and Sustainability at the University of Edinburgh to learn more.

Value added benefits

Please outline what the value added benefits of completing an Excellence project were. These are anything that arose from the project that wasn't planned, or any additional benefits outside of your original KPIs and objectives. Examples could be building community bridges, strategic community partnerships, engaging hard to reach students, helping to widen participation in sustainability issues, building a stronger Green Impact community etc.

This project has definitely increased the Green Impact Team's visibility in the building through the act of contacting many groups either directly or indirectly about this topic. This project has been discussed with all facilities teams, raised in PI meetings and lab meetings, and has been a topic of conversation at our other unrelated Green Impact events. Regardless of groups agreeing to switch or not, it has been excellent exposure for us in a building of ~900 staff, and hopefully has raised more awareness of sustainability in research more generally.

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Legacy

Please outline where you hope to take the project next and what the legacy effects of your Excellence submission are. For instance, will the project continue? Will the project result in any lasting change? Do you plan to share the results with others or is there scope for others to adopt a similar project? What would your recommendation be to others wishing to carry out a similar project?

We believe this project is just getting started. With only 12/75 freezers now set at -70°C we continue to aim for more. Considering this project only began 5 months ago and the hard part of raising awareness across the building has already happened, we are aiming for >30 units at -70°C by the end of the year. We hope that some data from the previously mentioned Long-Term Cold Storage Study becomes available too to help in this.

We plan to display the figures from this project on the building monitors and would be happy to share more widely with other buildings that are undertaking similar work. We also would like to share our Freezer Efficiency Guide and hope that Susie and the Sustainability Team can help to promote this.

In terms of legacy effects, the main one is the energy savings that come from both -70°C switching and increased efficiency when using the freezers. At a minimum we are saving the building 4599 kWh/year (soon to be 7665 kWh/year) which is crucial as our research building is one of the highest in terms of energy demand in the School of Clinical Medicine. The efficiency guide has been shared and posted up, and we hope the departments will use this and the best practice video when inducting new staff. The University's ambitious goal of absolute carbon zero by 2048 is only going to be possible with meaningful actions like this one, and we hope to continue to progress further.

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Photograph

Please include a photograph (or photographs) relating to your project – you can provide captions for these in this section.

Pictures show all 6 ULT freezers that were changed to run at -70 degrees

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Evidence of our freezer efficiency guide on the walls in the freezer room