A Green Recovery: How to make Laboratories more Environmentally Sustainable

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Introduction

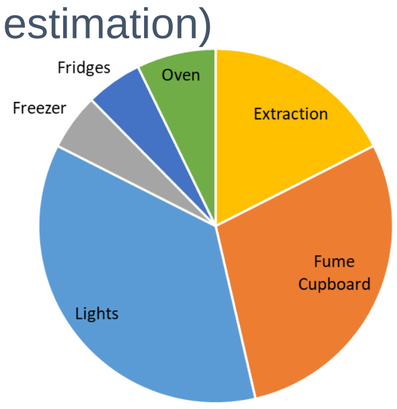
- The UK Government has set out plans to reach net zero carbon emissions by 2050, backed by the drive for a "green recovery" post COVID-19 lockdowns
- Laboratories are large carbon consumers between high energy usage and single-use product waste
- Need to champion "greener" practices and policies in lab spaces as we return to in-person work

Areas of Concern

- Need to focus on what we can control within the lab itself
- Energy Consumption
  - 65% of energy usage in universities is attributed to lab spaces (Farley, 2022)
  - Lab spaces use 4-5x the energy of other commercial spaces (My Green Lab)
- Waste Management
  - Recycling plastics is energy intensive and varies by type of plastic
  - Not all cellulosic products used in labs can be recycled
  - Hazardous waste issues
- Procurement
  - Embodied carbon of chemicals derived from petrochemicals
  - 1.8% of global plastic production is attributed to labs (Farley, 2022)

What can we control?

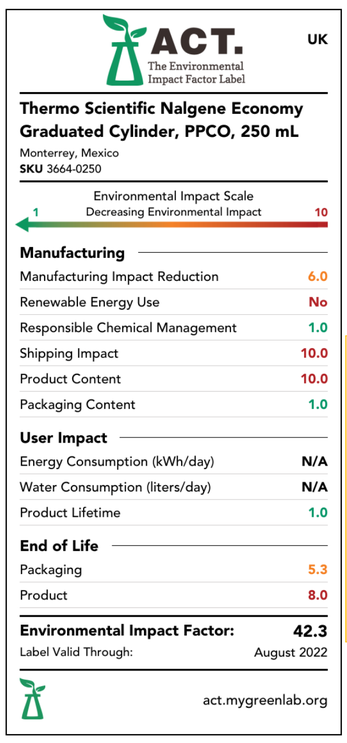
- Energy Usage
  - Energy Auditing
    - What uses the most energy in the lab? (Rough estimation)



  - Fume Hoods/Extraction Systems
    - Air is constantly pulled through using fans, creating a negative pressurized environment
    - Fume hoods consume 1-3.5x the energy of the average US household
- Waste Management
  - Waste Audits
    - What do we throw away most?
  - What can be reused?
- Procurement
  - Push for Life Cycle Analysis
    - Understanding that carbon emissions do not begin with usage

Via: https://commons.wikimedia.org/wiki/File:Life_Cycle_Thinking_Product_System.jpg

  - Green Chemistry
    - CO_2 emissions from refining petrochemicals into ethylene, methanol, etc.



"Any chemical with more than 8 letters is probably bad for the environment" (AIC Sustainability Committee)

My Green Lab has created "ACT" to demonstrate the environmental impact of different products and materials used in all laboratories

Via: https://actdatabase.mygreenlab.org/products/9b8f453c-87b1-4cd1-bd98-0fbee1cad95d

Conclusions

Top Five Tips for Environmental Sustainability in Labs

- Close fume hoods when not in active use
- Increase temperatures of ultra-low temp freezers to -70C
- Turn off and unplug equipment when not in use
- Push for embodied carbon analysis and life-cycle analysis from suppliers
- Reuse and Reduce waste first, then recycle what's left

- Labs need to focus on what they can control easily
  - Particularly energy and waste in order to limit carbon emissions
  - We can pursue low budget solutions and changes to daily behavior to help limit the carbon consumption of lab settings
- The transition to more carbon neutral practices needs to be apparent in all sectors.
- If scientists are not limiting their own emissions, how can we expect anyone else to?

Next step— We must consider alternative materials that can be used in lab spaces that demonstrate less embodied carbon.

- Requires funding in order to research materials and their effectiveness
- Requires a high enough demand for new materials to push innovation
  - Packing materials
  - Gloves

Literature Cited

Farley, M. (2022). *Interested in Making Your Heritage Science Laboratory or Conservation Studio More sustainable?* [Zoom] Available at: https://www.icon.org.uk/events/esn-hsg-sustainability-in-science-labs-and-beyond.html
Macleod, R. (2021). *How the Petrochemicals Industry Can Reduce Its Carbon Footprint*. [online] World Economic Forum. Available at: https://www.weforum.org/agenda/2021/10/how-petrochemicals industry-can-reduce-its-carbon-footprint/
My Green Lab (2021a). *Thermo Scientific Nalgene Economy Graduated Cylinder ACT Label*. [online actdatabase.mygreenlab.org. Available at: https://actdatabase.mygreenlab.org/products/9b8f453c-87b1-4cd1-bd98-0fbee1cad95d
My Green Lab. (2021b). *Tips for Managing Energy Consumption in the Lab*. [online] Available at: https://www.mygreenlab.org/blog-beaker/tips-for-managing-energy-consumption-in-the-lab.
Sustainability Committee (2018). *Sustainability and Chemicals*. [online] www.conservation-wiki.com. Available at: https://www.conservation-wiki.com/wiki/Sustainability_and_Chemicals
Thompson, K. (2009). *LifeCycle Graphic*. [online] National Institute of Standards and Technology. Available at: https://www.nist.gov/el/systems-integration-division-73400/lifecycle-graphic

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CMAS Conservation & Museum Advisory Service