



FORSE GROUP



Sustainability Guide 2024

Chemistry
Sustainability






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Why is sustainability important to us

The [Royal Society of Chemistry](#) states that

“The chemical sciences will play a pivotal role in solving the challenges associated with sustainability.”



As a research group that focuses on understanding materials that can reduce greenhouse gases and tackle the climate-change crisis, this statement is of great relevance to us. We therefore strongly believe in working in a sustainable way that aligns with the goals of our research outcomes.

Sustainability, in all aspects of our work is therefore one of our group's [core values](#).



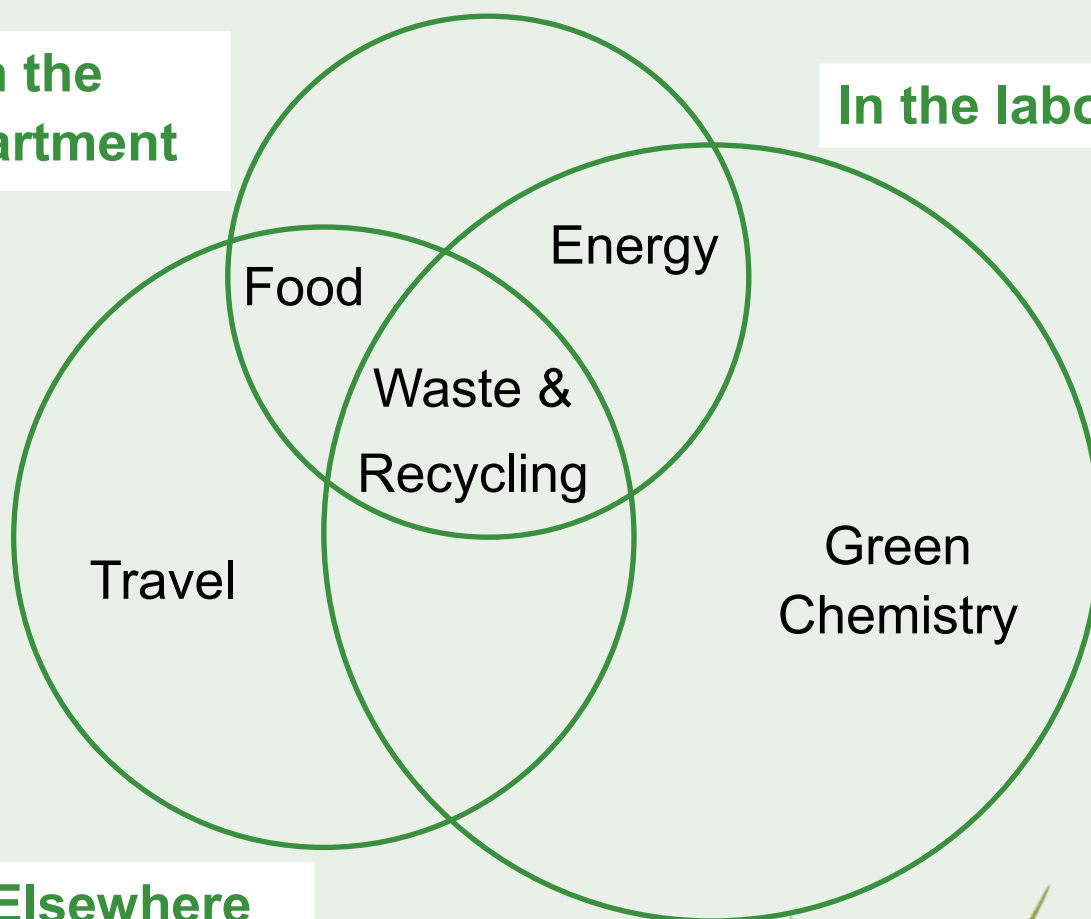


What can we do

The ways our group can practice sustainability fall into three key categories and this guide aims to simultaneously give guidance on best practice in all three of these scenarios.

In the department

In the laboratory



Elsewhere





12 Principles of Green Chemistry

During the planning of experiments, keep in mind the 12 Principles of Green Chemistry:

Real-time pollution prevention



Accident Prevention by risk assessment and precautions



Prevent waste of chemicals and resources

Design for Degradation



Atom Economy
choose the most efficient reaction



Catalysis



Safer synthesis
Avoid hazardous chemicals and waste



Reduce derivatives



Safer chemical design



Use of renewable feedstocks



Energy Efficiency



Safer Solvents minimise solvent quantities; use greener solvents





Reducing single-use items

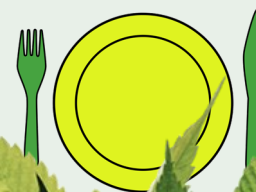
A great deal of **non-recyclable single-use waste is avoidable** - read this [Nature article](#) for an inspiring tale on how labs can reduce it! **Plastic** is the biggest problem, but even biodegradable single-use items are problematic as these usually end up in general waste.

In the lab:

- ◇ *Rinse & re-use glass vials*
- ◇ *Re-use clean weighing boats from e.g. films*
- ◇ *Use re-useable glass syringes rather than plastic*
- ◇ *Re-use glass pipettes attached to fume cupboard for water and ethanol*

Outside the lab:

- ◇ Bring your own travel *mug* and *water bottle* to the department
This will avoid the surplus charge on **disposable cups**; there is a sink in the office to wash up, you can take it home or the cyber café dishwasher may be used
- ◇ Use metal cutlery in cyber café
- ◇ At social events, bring your own cutlery, plate and cup





Lab Recycling

Where items cannot be **re-used**, and waste not **reduced**, the next best efforts are in **recycling responsibly**. Our lab was the first in the department to recycle nitrile gloves!

Recovery Stream:

Almost everything ends up here!
non-hazardous & dry waste
(carbon & small solvent contamination fine)

◇ Carboard: flattened

Consider if cardboard boxes and packaging can be re-used

◇ Paper, metal, plastic etc.

Soaked paper towels:

If **damp**, put in **recovery stream**

If **soaked**, put into **food/contaminated waste** (see office)

Non-Recyclables:

Glass: Should be rinsed and placed in glass bin

Needles: Sharps bin

Hazardous Contaminated Chemical Waste: e.g. paper towels/filters with MOFs—see **chemical waste**

Nitrile Glove Bins:

Uncontaminated nitrile gloves: not visibly contaminated gloves or those that have been in contact with very hazardous chemicals





Office Recycling

General Recycling:

Recycling should be clean & dry

- ◇ Carboard & Paper
- ◇ Plastic (including wrapping)
- ◇ Tins & Cans etc.

Food & Contaminated:

This waste stream goes for

[anaerobic digestion](#)

- ◇ Food
- ◇ Wet/soiled/dirty packaging

Soft Plastic / Mixed Foil:

Bag in Office 137

Bring from lunch or home!

- ◇ Crisp Packets
- ◇ Sweet/chocolate/biscuit

Notes on “compostable”

Biodegradable coffee cups, cutlery etc. are **home compostable only** and cannot be recycled into food waste or recycling. It is better to **avoid single-use items!**

Other Recycling:

Batteries: see [here](#) for details

Printer Cartridges: return to stores





Chemical selection

In accordance with the 12 Principles of Green Chemistry, where possible aim to do the following:

- ◇ To **replace hazardous routes** with alternatives where possible
- ◇ **Maximise yield** and reaction **efficiency**
- ◇ Use **minimal reagents** and solvents
- ◇ Use **Greener Solvents**: see Solvent Selection Guides for help
- ◇ Share equipment (e.g. vacuum line, oven) to improve energy efficiency

Before buying new chemicals

1. Check the chemical inventory
2. If using a small amount, consider borrowing off another group

Chemical waste

Dispose of chemicals into the appropriate waste:

- ◇ Aqueous, organic (non-chlorinated), organic (chlorinated) solutions
- ◇ Solid chemical waste: For hazardous contaminated and chemical waste
- ◇ Coin-cells: aqueous & organic collection jars in 288





Energy Use

Did you know a fumehood uses 3-4 times an average U.S. household's annual energy? Harvard University reports fumehoods are responsible for 44% of their lab's energy consumption!

What you can do:

- ◇ **Shut the fume-hood sash!**
- ◇ Remember to ***switch off equipment*** when not in use (including portable potentiostats)
- ◇ Improve Computational efficiency
- ◇ **Share equipment** (vacuum lines, glovebox, oven...) if possible
- ◇ The department's **biggest direct fossil fuel consumption** is on the **gas heating** so:
If the windows are open in the room, don't use air conditioning
turn the thermostat down a few degrees and wear an extra layer
- ◇ **Turn off the lights** when leaving





COMPUTATIONAL Efficiency

High-performance computing requires a great deal in both electricity, and cost. It is worth considering how to **optimise** the computational credits of the lab.

1. Submit non-urgent jobs with **low-level priority**
2. Optimise parameters at lower parameter values
3. **Read up** on how to optimise your calculations: e.g.




Parallel Efficiency and Parametric Optimization in CASTEP

Parallel in CASTEP - for **CASTEP**:

- ◇ Number of CPU's should be equal to number of k-points; if this is not possible, have a high common factor between them
- ◇ Choose the least number of nodes with sufficient memory; avoid cross-node parallel calculation
- ◇ Supercells with cubic symmetry recommended for better convergence and less memory usage

Increasing number of CPU's and nodes does not necessarily improve efficiency!

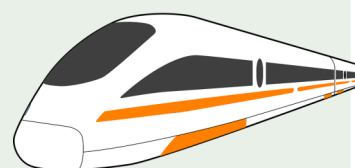




Travel

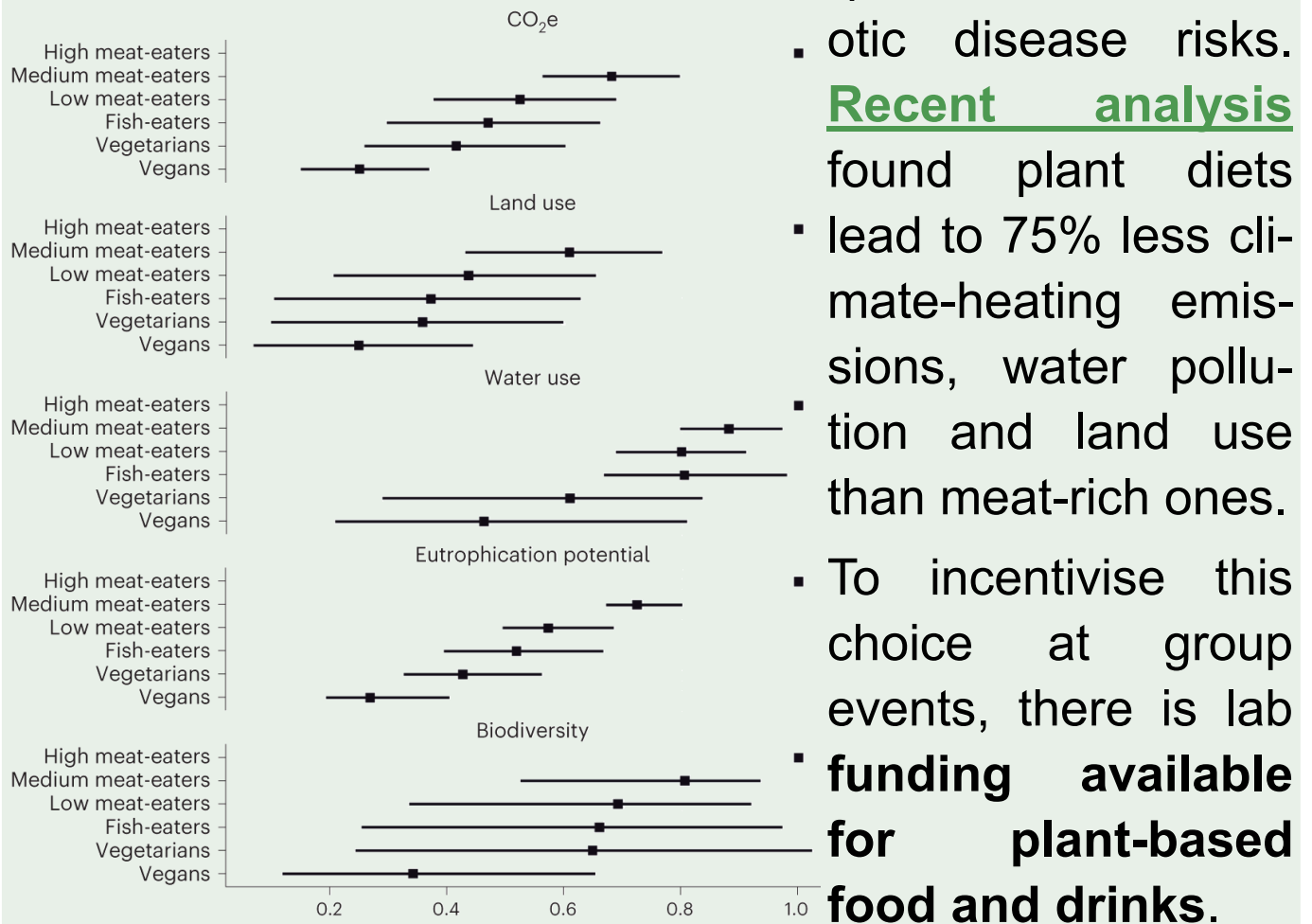
The **greatest source of emissions** from the chemistry department comes from **conference travel**. By far the most emissions intensive travel is flying, so we should aim to reduce, and/or replace, this as far as practicably possible. In the Forse group (see our **Sustainable Travel Policy** for details)

- Where other means of travel are possible within **10 hours**, these should be taken instead
- In usual circumstances, students attend a **maximum of one international conference a year**
- Where a flight is required, consideration of **online attendance** is encouraged.
- **Supported in taking additional time** away from Cambridge and can work remotely to travel by a sustainable means, and with the **necessary financial** resources



FOOD

It is widely established that **plant-based food has the lowest carbon footprint**, as well as being associated with lower land-use, water-use, eutrophication and zoonotic disease risks.





SOCIAL EVENTS

The Forse group actively promotes a **healthy work-life balance** with regular group social events. The **environmental and ethical impacts** of these events are carefully considered.


As such events :

- ◇ Are as **local** as possible, with **public transport** used as necessary
- ◇ **Minimise waste**: food and single-use items
- ◇ Often **support local businesses**
- ◇ Follow our [sustainable food policy](#)



Recent social events:

Suggestions always welcome!

- ◇ A **zero-waste potluck** in Darwin College Gardens
 - ◇ Visits to the [Botanic Garden](#), punting and picnic in **Grantchester** and a [board games café trip](#)
 - ◇ Christmas meals at plant-based venues [Stem and Glory](#) & [Thrive](#)
- 



Lab Achievements and targets

We have already inspired the department by our progress in sustainability with initiatives such as:

- ◇ Introducing the role of **sustainability officer**
- ◇ The first group to begin **nitrile-glove recycling**
- ◇ Producing this guide as a **sustainability induction** to members
- ◇ Receiving Green Impact funding for Fumehood stickers
- ◇ Achieving a **Silver LEAF award** in our first Sustainability Audit
- ◇ Adopting problems and challenges into our research presentations
- ◇ Apply for a Royal Society of Chemistry Grant for Sustainable Chemistry
- ◇ Created leading sustainable travel & food policies



Targets for the coming year include:

- ◇ Achieve a **Gold LEAF award** in the 2024 Sustainability Audit
- ◇ Investigate the potential of **Polystyrene packaging recycling**
- ◇ **Create a database for excess samples**





Climate Anxiety and Mental Health

It is essential in a demanding academic environment to take time to **take care of yourself**, and this also applies when thinking about sustainability.

Climate anxiety is defined as “a chronic fear of environmental doom” and is experienced by over 2/3 of young people.

Chemistry is undoubtedly a challenging environment to tackle sustainability in. As such the Forse group aims to promote sustainability in a positive way and support each other with its practice. Whilst we endeavour to make our collective impact as positive as possible, many changes are slow. It's important to be kind to yourself, remember the bigger picture and take some time in nature (e.g. the botanic gardens) to disconnect. You are not alone - join a **climate group** to speak to other people or consult Cambridge Climate Therapists.





want to do more

After reading this guide, why not challenge yourself to **making one positive change** for sustainability whilst working in the department?

Contact sustainability@ch.cam.ac.uk to join the [departmental sustainability committee](#)

You could also join a **climate society**, apply to be your college **green officer** and make changes within your college or a **personal commitment** to your own lifestyle.

If you would like to do more, help the lab meet its targets or have any questions or suggestions please contact:

- ◇ Chloe (Sustainability Officer): cjb266@cam.ac.uk
- ◇ Dr Alexander Forse (PI): acf50@cam.ac.uk

For general reading see the Chemistry World Article:

[How to run a sustainable chemistry lab](#)

Thank you

