

# Carbon Footprint Estimations of Research Project Activities

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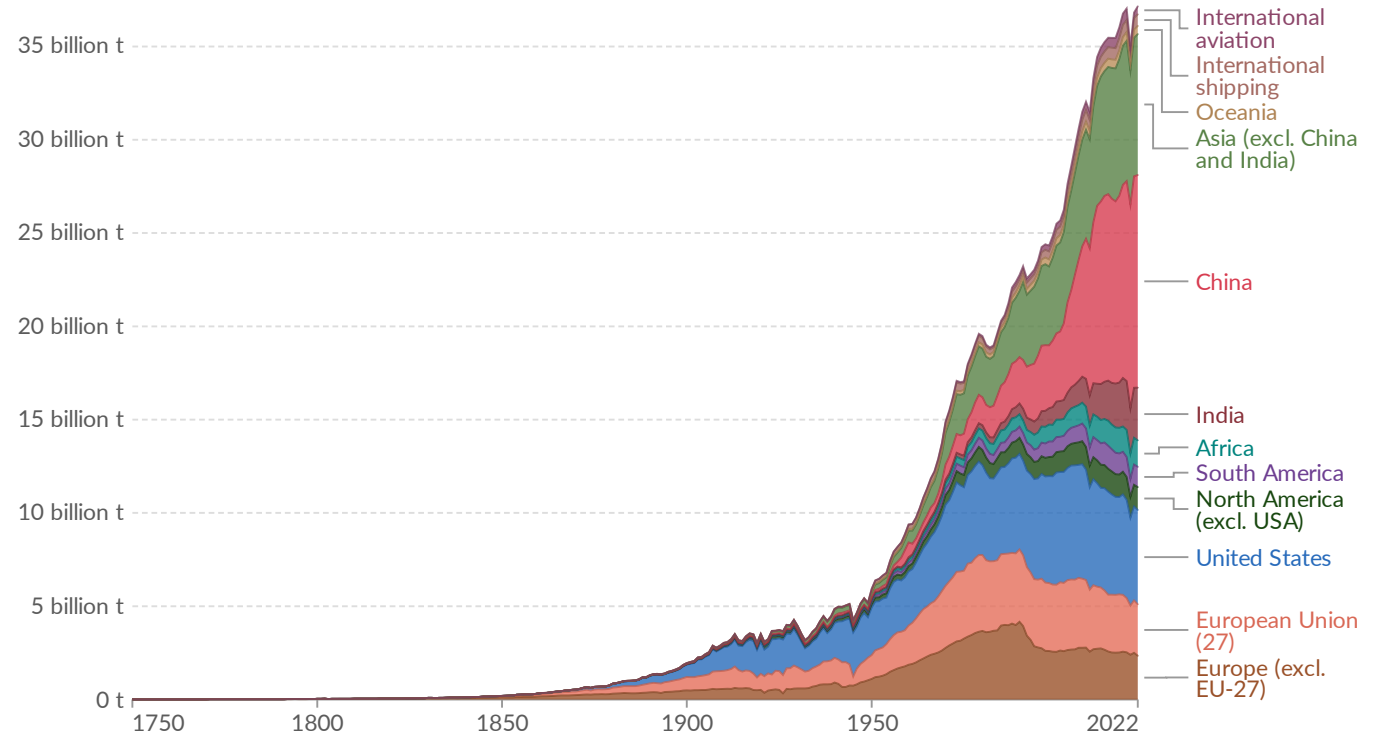


# Outline

- 1. Setting the scene**
- 2. Environmental impact of medical scientific research**
- 3. Key areas of carbon emissions**
- 4. Carbon footprint reduction strategies**
- 5. Resources for environmental sustainability**

# Annual CO<sub>2</sub> emissions by world region

Emissions from fossil fuels and industry<sup>1</sup> are included, but not land-use change emissions. International aviation and shipping are included as separate entities, as they are not included in any country's emissions.



Data source: Global Carbon Budget (2023)

OurWorldInData.org/co2-and-greenhouse-gas-emissions | CC BY

1. Fossil emissions: Fossil emissions measure the quantity of carbon dioxide (CO<sub>2</sub>) emitted from the burning of fossil fuels, and directly from industrial processes such as cement and steel production. Fossil CO<sub>2</sub> includes emissions from coal, oil, gas, flaring, cement, steel, and other industrial processes. Fossil emissions do not include land use change, deforestation, soils, or vegetation.



**Climate change: university researchers feel powerless to take action – survey**

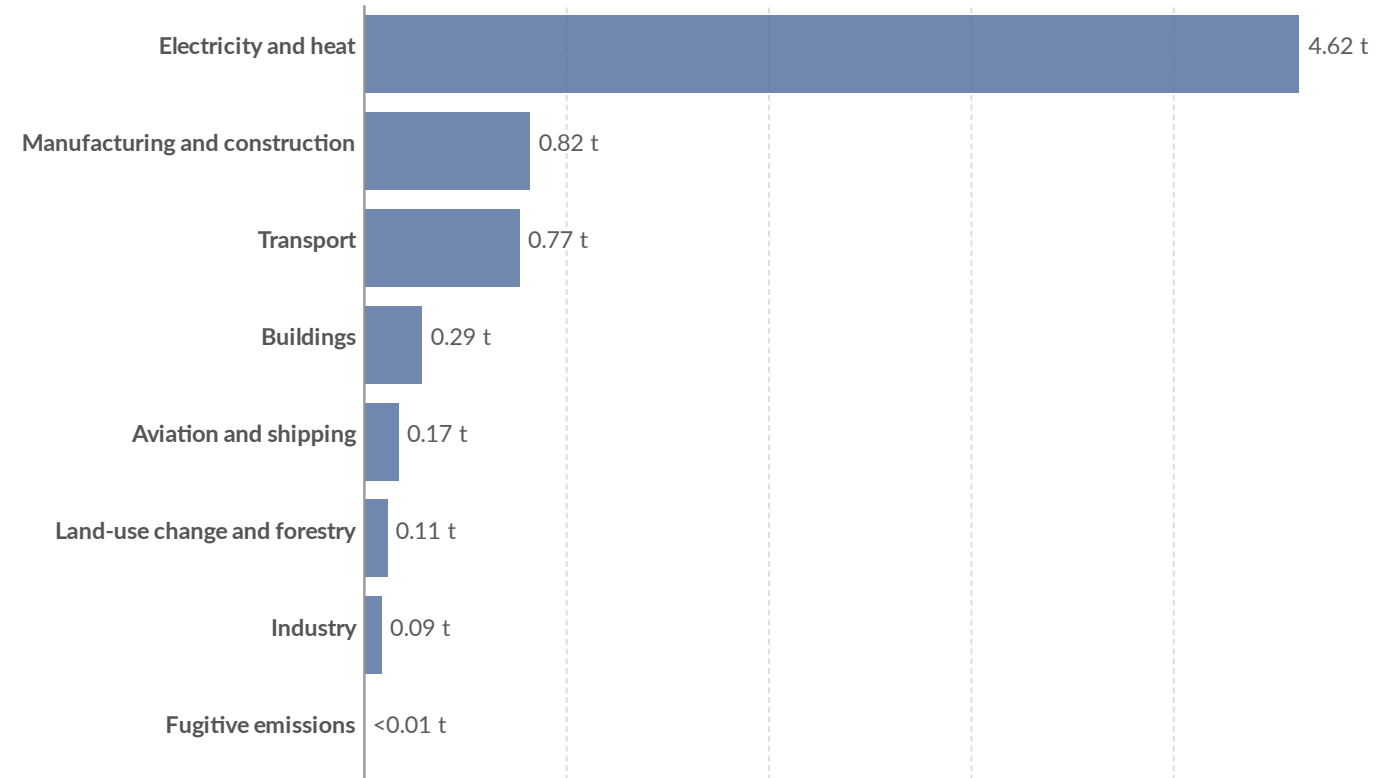
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**"In the UK, 108 institutions have made a commitment to divest from fossil fuels. Yet almost half of researchers think their universities are not doing enough and some are concerned universities are only paying lip service to the climate crisis"**



## Per capita CO<sub>2</sub> emissions by sector, South Africa, 2020

Our World  
in Data



Data source: Climate Watch (2023); Population based on various sources (2023)  
[OurWorldInData.org/co2-and-greenhouse-gas-emissions](https://OurWorldInData.org/co2-and-greenhouse-gas-emissions) | CC BY

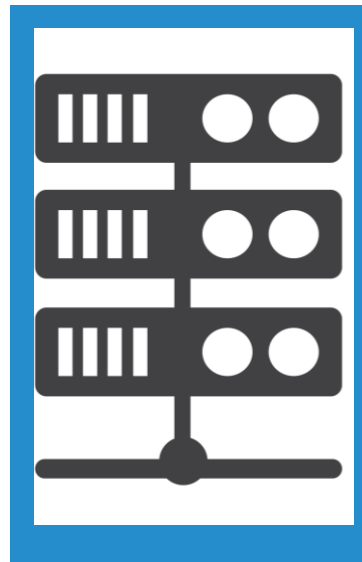
**Health researchers must lead by example, tackling our own emissions and driving global reduction efforts.**

# Environmental impacts of scientific research

Laboratories contribute **2%** of global plastic waste and consume **3-10** times more energy per square meter than a typical office.



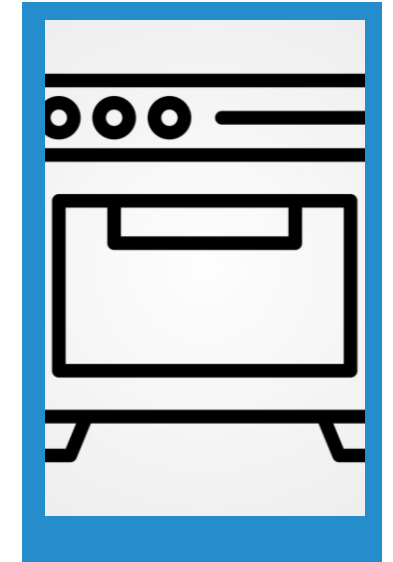
Lighting consumes **10-28%** of laboratory electricity.



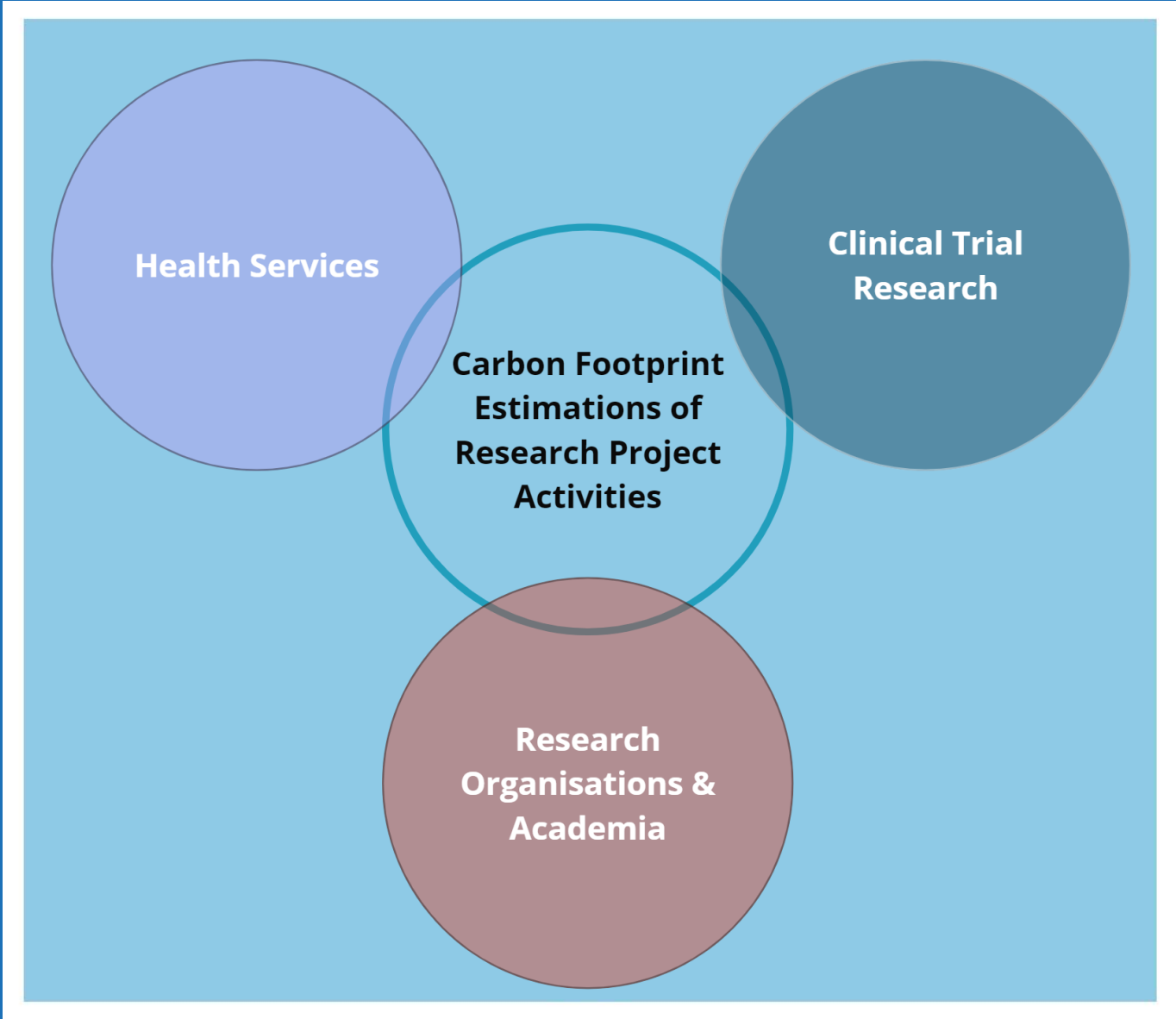
Large AI model training can emit almost **five times** the lifetime emissions of the average car.



An ultra-low temperature (ULT) freezer can consume between **5840 and 8030 kWh per year**.



A drying oven's energy use is estimated at **1932 kWh per year**.



ISSUES IN PUBLIC HEALTH

**Tackling the climate targets set by the Paris Agreement (COP 21): Green leadership empowers public hospitals to overcome obstacles and challenges in a resource-constrained environment**

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**Groote Schuur Hospital implemented initiatives to be more sustainable.**



**Green leadership engaged staff at all at all levels.**

**Table 1. Reduction in water and coal consumption at GSH**

	2011	2012	2013	2014	2015	%
Coal (tons)	3 433	3 469	3 163	2 214	1 885	-45.1
Water (kL)	652 424	532 088	503 860	420 782	371 705	-43.0
Electricity (kW)		4 256 750	4 256 255	4 269 498	4 016 333	-5.7
Recycling (tons)				110.7	144.0	+23.0

Global Green and Healthy Hospitals Initiative [www.greenhospitals.net](http://www.greenhospitals.net)

These measures showcase the success of resource-efficient practices in healthcare.



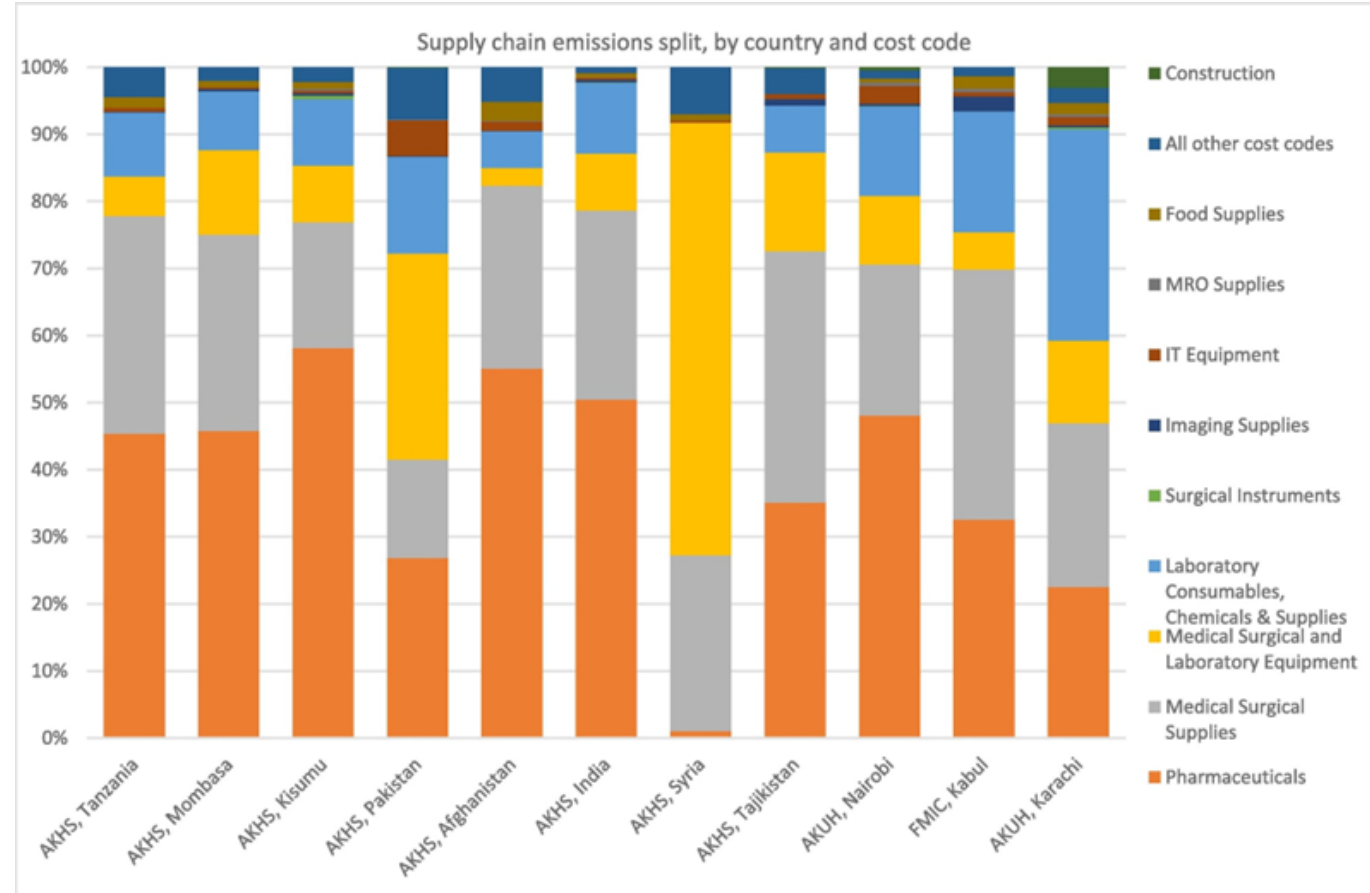
# Carbon footprint in LMICs

The Aga Khan Development Network's (AKDN) approach to supply chain carbon footprinting for healthcare providers

Jerome Baddley<sup>a</sup>, Fawzia N. Rasheed<sup>b</sup>

## Key Findings

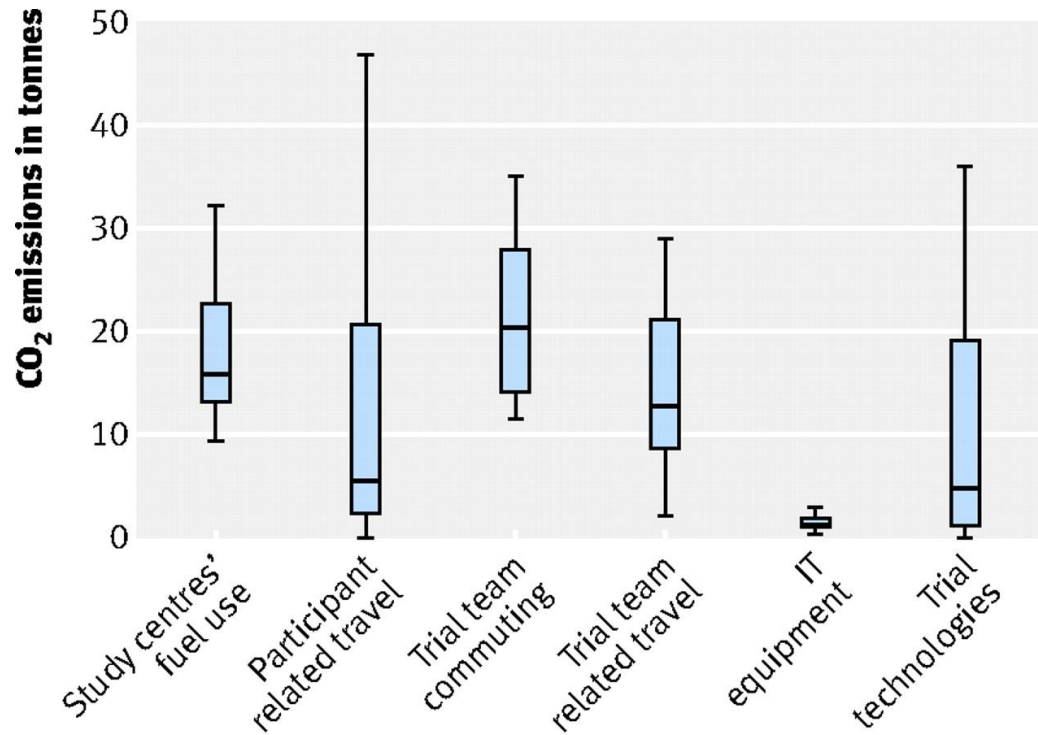
- LMICs show higher carbon intensity per healthcare expenditure.



Pharmaceuticals constitute the largest share of supply chain emissions across regions.



# Emissions in clinical trial research



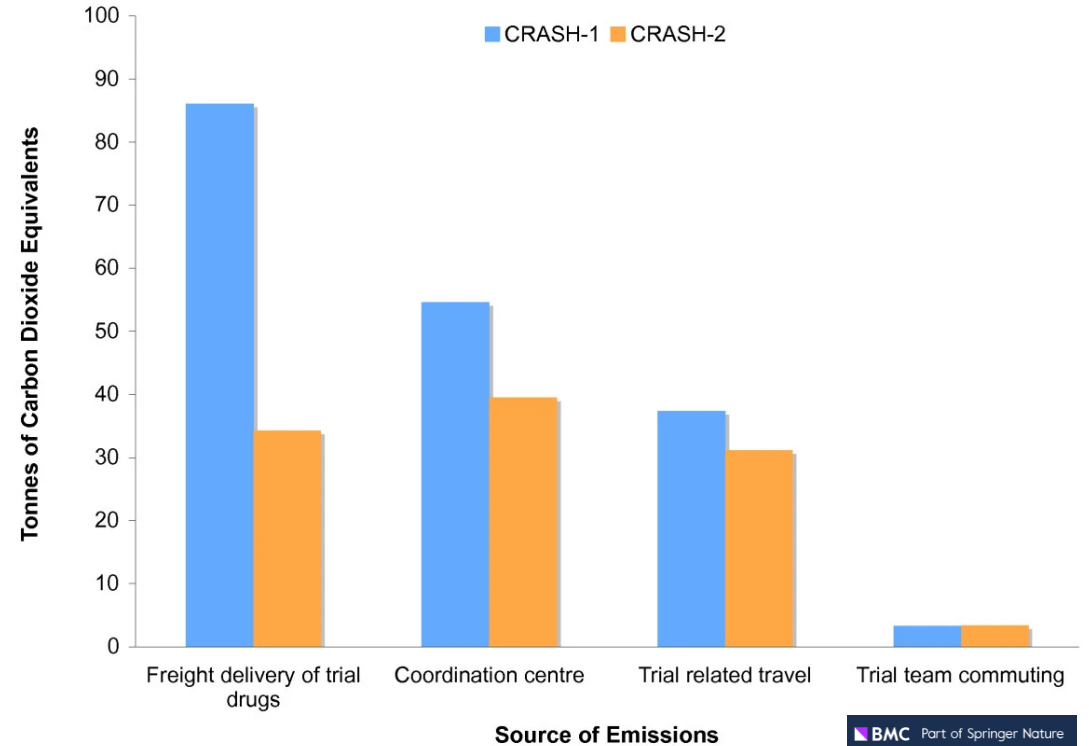
BMJ Research

Carbon cost of pragmatic randomised controlled trials: retrospective analysis of sample of trials

BMJ 2009 ; 339 doi: <https://doi.org/10.1136/bmj.b4187> (Published 30 October 2009)

Cite this as: BMJ 2009;339:b4187

Total carbon consumption of approximately **27.5 million tonnes of CO<sub>2</sub>** across all registered trials.



Reducing the environmental impact of trials: a comparison of the carbon footprint of the CRASH-1 and CRASH-2 clinical trials

Saleena Subaiya, Euan Hogg & Ian Roberts

Trials 12, Article number: 31 (2011) | [Cite this article](#)

Optimizing patient recruitment, utilizing lighter materials, and implementing web-based data management. Commuting and energy usage are the most significant contributors to the carbon footprint in trials.

# Carbon reduction in research

● Conduct carbon footprint measurements

● Develop carbon reduction strategies

● Evaluate strategy impact and refine approaches

● Identify major emission sources and reduction opportunities

● Implement optimized carbon reduction practices



# Carbon footprint reduction strategies

## Renewable Energy

Transition to renewable energy sources like solar, wind, or geothermal.

## Green Procurement

Implement policies favouring sustainable lab equipment and supplies.

## Waste Minimization

Develop policies to reduce, reuse, and recycle lab waste.

## Virtual Collaboration

Encourage remote conferencing to reduce travel-related emissions.

## Energy Monitoring

Install systems to optimize lab energy use in real-time.

# Carbon reduction incentives and divestment

Invest

Transparency

Pr

DIVEST FOR THE FUTURE OP-ED

The bucks stop here – let's stop investing in firms that fuel the climate crisis

Divestment

Commur

Grants & awards

Exchange








# Examples of initiatives supporting the environmental sustainability of research

Initiative	Description	Website
Beyond Benign	Promotes green chemistry and sustainable science, offering educational resources for the community.	<a href="#">Beyond Benign</a>
Code Carbon	An open-source tool that tracks emissions from code execution, supporting sustainable software development practices.	<a href="#">Code Carbon</a>
GES 1point5	An open-source web application for calculating the carbon footprint of French public research, promoting transparency and sustainability.	<a href="#">GES 1point5</a>
Green Impact	Provides a framework for organizations, including research institutions, to become more environmentally sustainable.	<a href="#">Green Impact</a>
International Institute for Sustainable Laboratories (I2SL)	Engages in promoting safety and sustainability in laboratories across various research fields.	<a href="#">I2SL</a>
International Sustainable Campus Network (ISCN)	Offers a platform for universities and research institutions to share and promote sustainable practices.	<a href="#">ISCN</a>
Labconscious	Focuses on sustainability in the life sciences, providing resources for waste reduction and eco-friendly lab practices.	<a href="#">Labconscious</a>
LEAF (Laboratory Efficiency Assessment Framework)	Developed by University College London to enhance sustainability in laboratories through practical measures.	<a href="#">LEAF</a>
My Green Lab®	A certification program and resource hub for laboratories to adopt sustainability practices.	<a href="#">My Green Lab</a>
S-Lab	Aims at improving laboratory efficiency and effectiveness, with a focus on sustainability in the academic and research sectors.	<a href="#">S-Lab</a>

Royal Society. (2023). *Sustainable Laboratories Report: Exploring Environmental Impacts and Initiatives*. Retrieved from <https://www.royalsociety.org/sustainable-laboratories-report>

Practical open-source tools enable research labs to reduce carbon emissions.

CATEGORY	Bronze	Silver	Gold
 <b>Waste</b>	Provide recycling bins in the lab	Single-use plastic waste has been reduced (guidance provided)	Recycling rates have been increased, or overall waste produced has been decreased
 <b>People</b>	Samples owned by departing staff are cleared or tracked	The lab has engaged other labs on LEAF and sustainability	One action to reduce travel has been implemented
 <b>Sample &amp; Chemical Management</b>	Labels are legible, and there's a common labeling system in place	Procedures are in place in case cold storage equipment breaks down	At least 80% of all samples and/or chemicals are clearly catalogued
 <b>Equipment</b>	Equipment is turned off when not in use	There is a system in place for communal equipment booking	Excess equipment is repaired, sold, and/or donated
 <b>Ventilation</b>	There is a clear reporting system for building issues	Fume cupboard sashes are kept closed when not in use	Solvent vapours are condensed and disposed and not released into the atmosphere

# References and further reading

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# Acknowledgements

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# Questions

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