Environmental impacts of computing in health & life sciences research

Tuesday 7th November 2023

Programme

10:00-11:20	Session 1 - The Big Picture
Opening remarks: Why the environmental impact of computing matters for health & life scientists Charlotte Rae, *University of Sussex*	
How the environmental impacts of research are currently being addressed (the role of funders and institutions) Gabrielle Samuel, *King's College London*	
Advancing environmentally sustainable research at Wellcome Talia Caplan, *Wellcome*	
Addressing environmental impacts in the lab Martin Farley, *GreenLab Associates; University College London*	
11:20-11:40	**Tea & coffee break**
11:40-13:00	**Session 2 - The Technical Side**
The carbon footprint of high-performance computing Loïc Lannelongue, *University of Cambridge*	
The UKRI Net Zero Digital Research Infrastructure (DRI) scoping project Miranda MacFarlane, *King's College London*	
Reducing the carbon footprint of digital pipelines: A case study from MRI Nick Souter, *University of Sussex*	
The benefits of efficient programming Lincoln Colling, *University of Sussex; Software Sustainability Institute*	

Programme

13:00-14:00	**Meat-free lunch**
14:00-15:00	**Session 3 - Breakout Discussion**
Separate moderated group discussions concerning steps you can take in your own work to reduce the carbon footprint of your computing, as well as barriers and potential solutions.	
15:00-15:30	**Tea & coffee break**
15:30-16:00	**Session 4 - Feedback**
Feedback from group discussions summarised by a member of each group, followed by closing remarks.	

Why the environmental impact of computing matters for health & life scientists

Dr Charlotte Rae

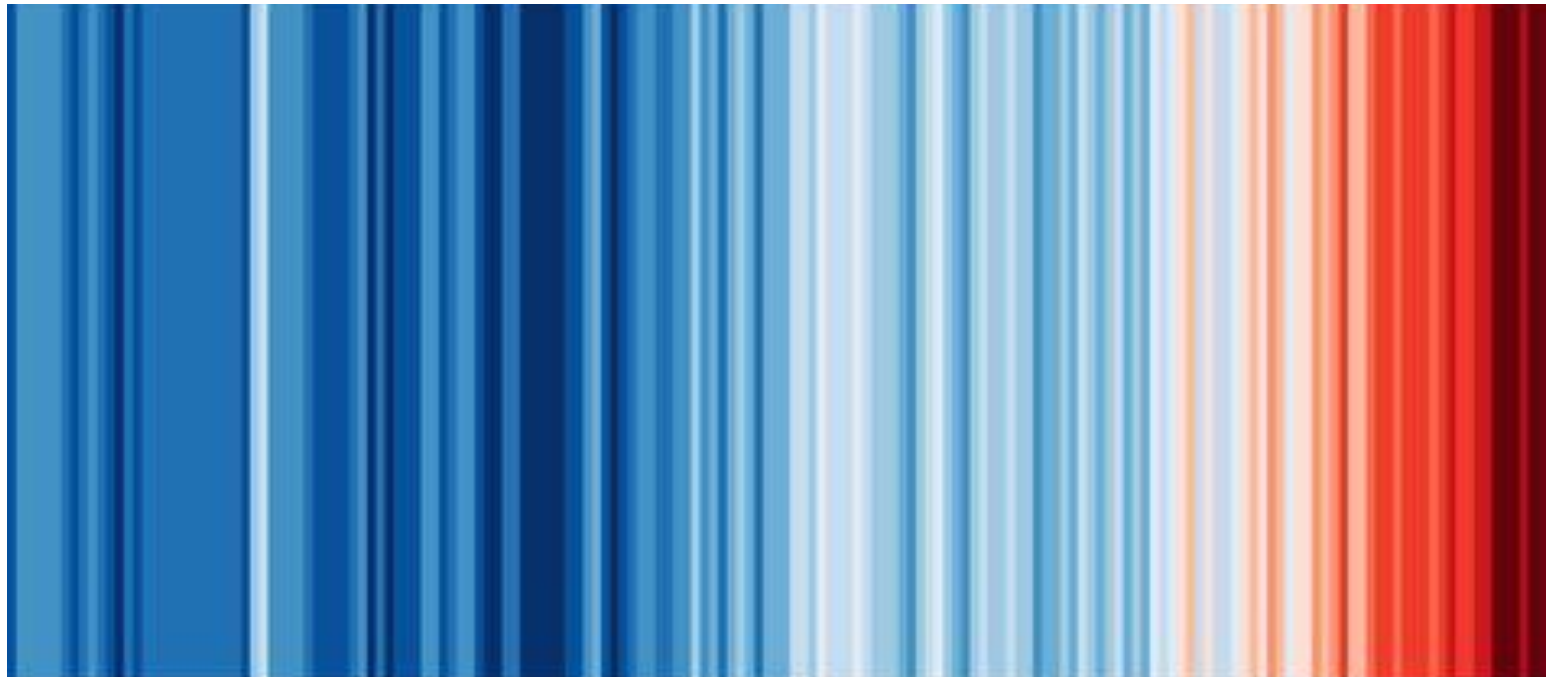
School of Psychology

University of Sussex, UK

www.sussex.ac.uk/psychology-abc-lab

Twitter/X @NeuroRae

We know what the problem is



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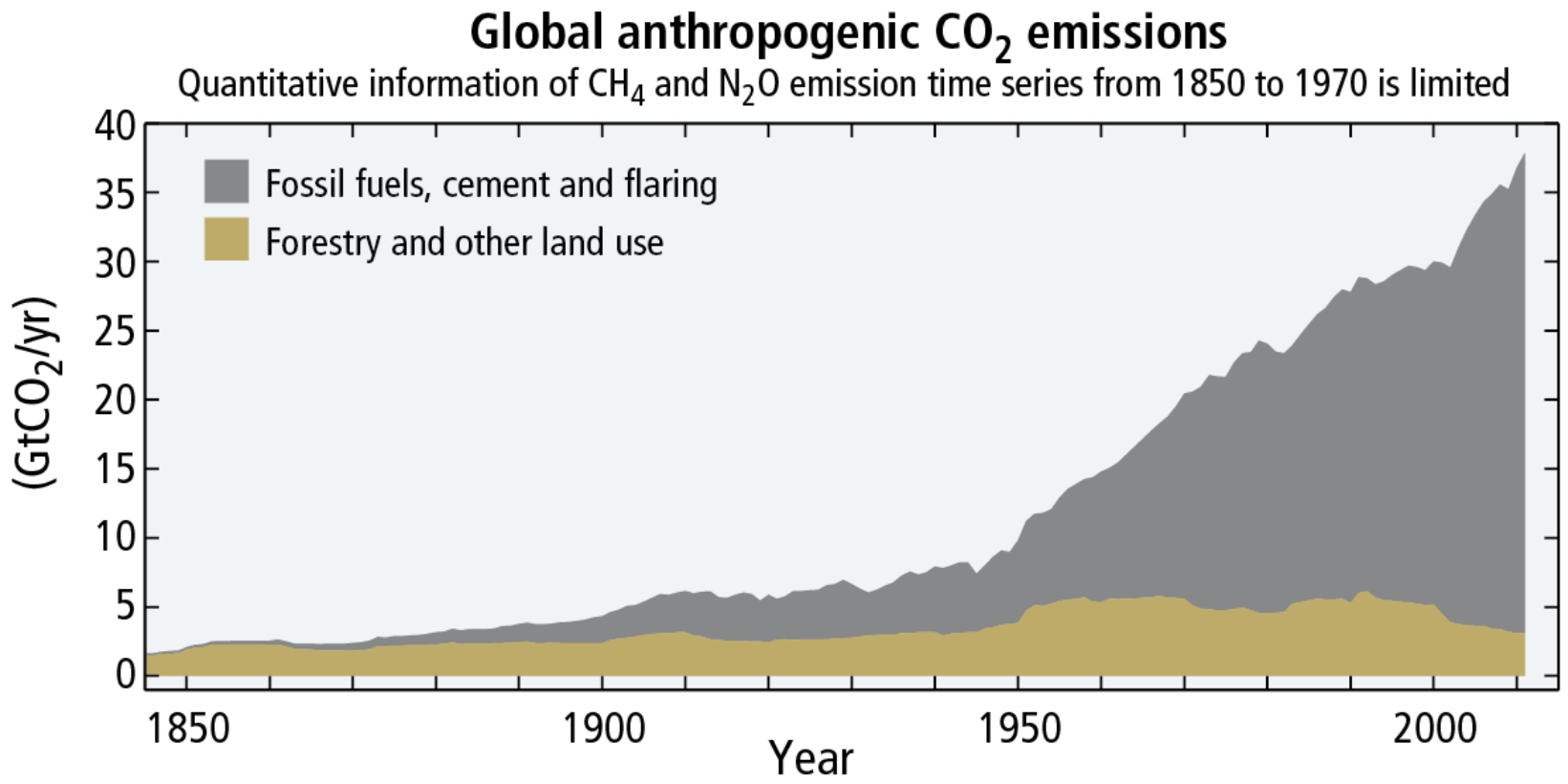
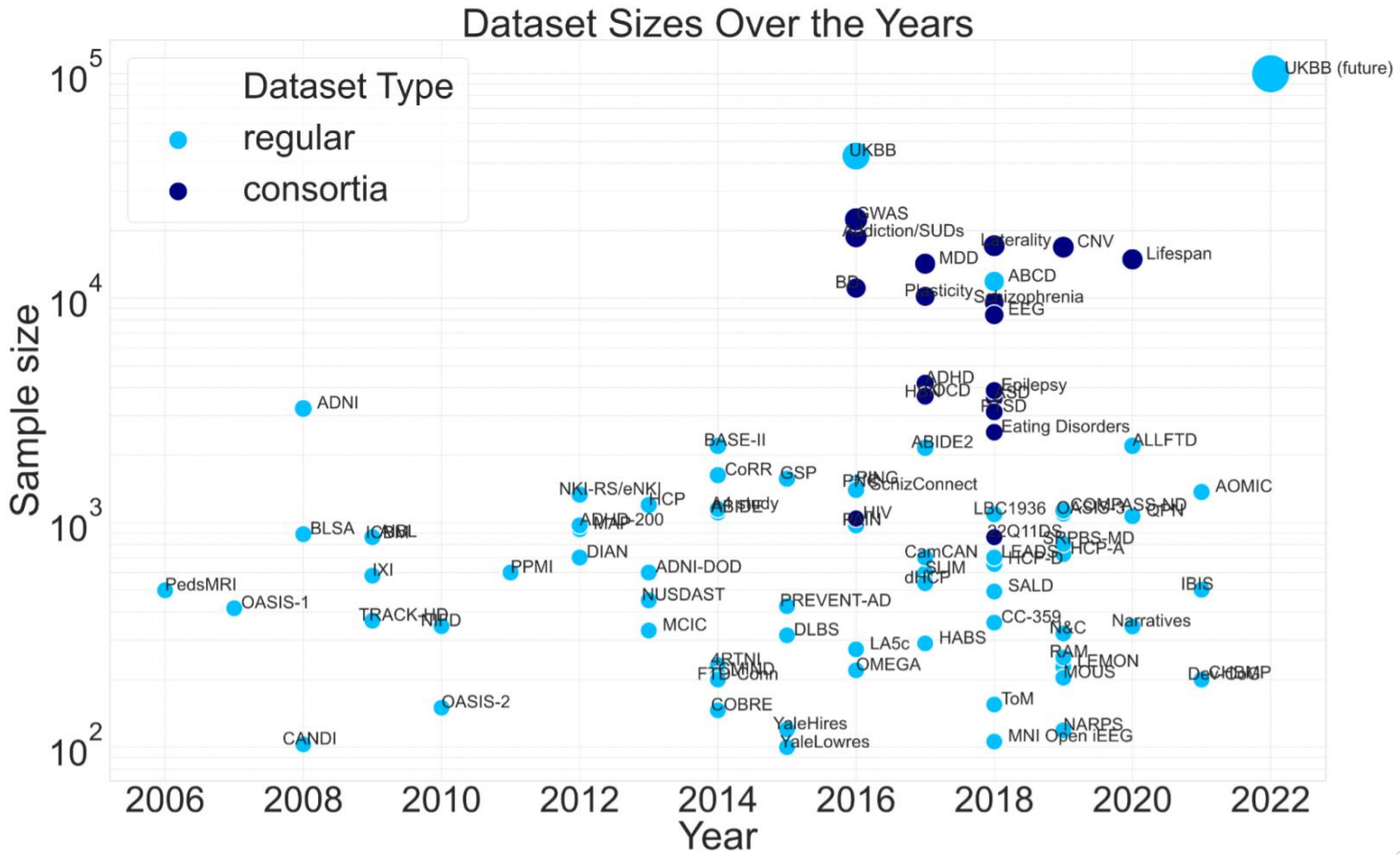


Intergovernmental Panel on Climate Change (IPCC) 2014 report https://www.ipcc.ch/report/ar5/syr/summary-for-policymakers/

…and health & life sciences computing is contributing to it



MRI brain scanning

OHBM SEA-SIG Neuroimaging Pipelines Working Group https://neuropipelines.github.io/10carbon

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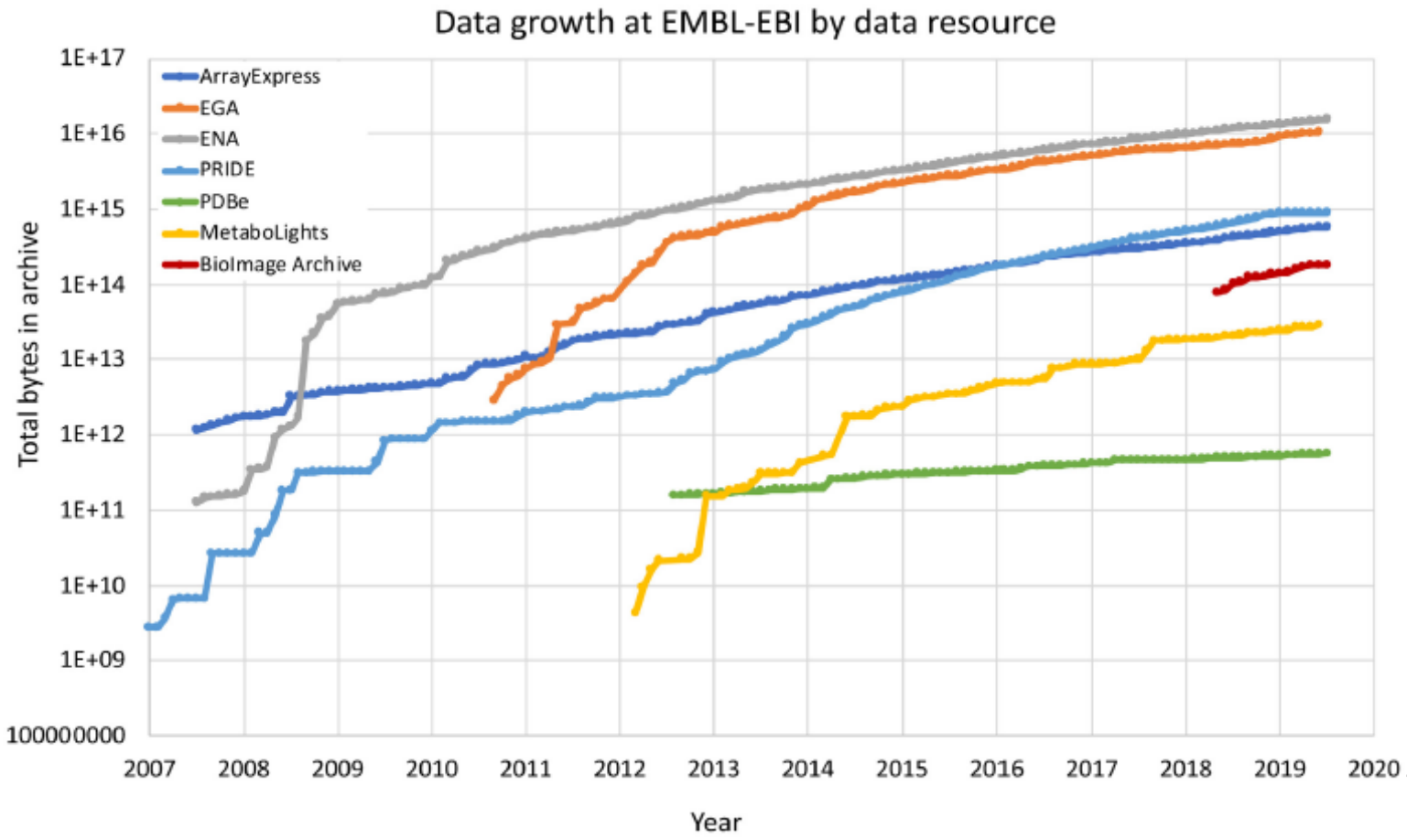


European Bioinformatics Institute

Cook et al (2020) *Nucleic Acids Research*

…and health & life sciences computing is contributing to it

Machine learning (ML) models

Sevilla et al (2022) *arXiv* https://doi.org/10.48550/arXiv.2202.05924

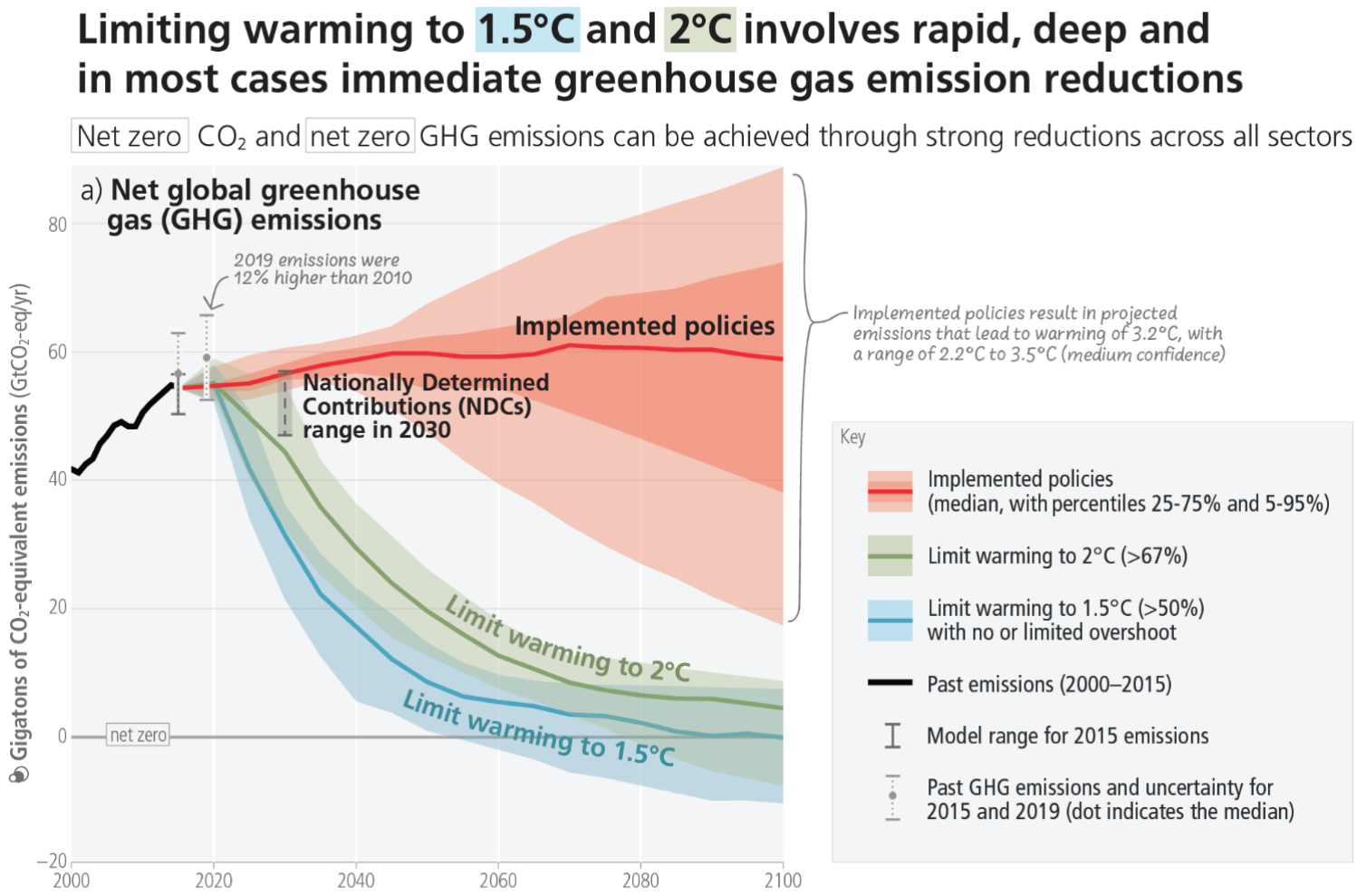
What happens when you run a project?

acquire | store | analyse | share

- Impacts on **ecosystems** from server manufacture & disposal
- Energy required to store & share, because servers need **air conditioning**
- Most of all: increasingly **heavy compute** required for health & life sciences data

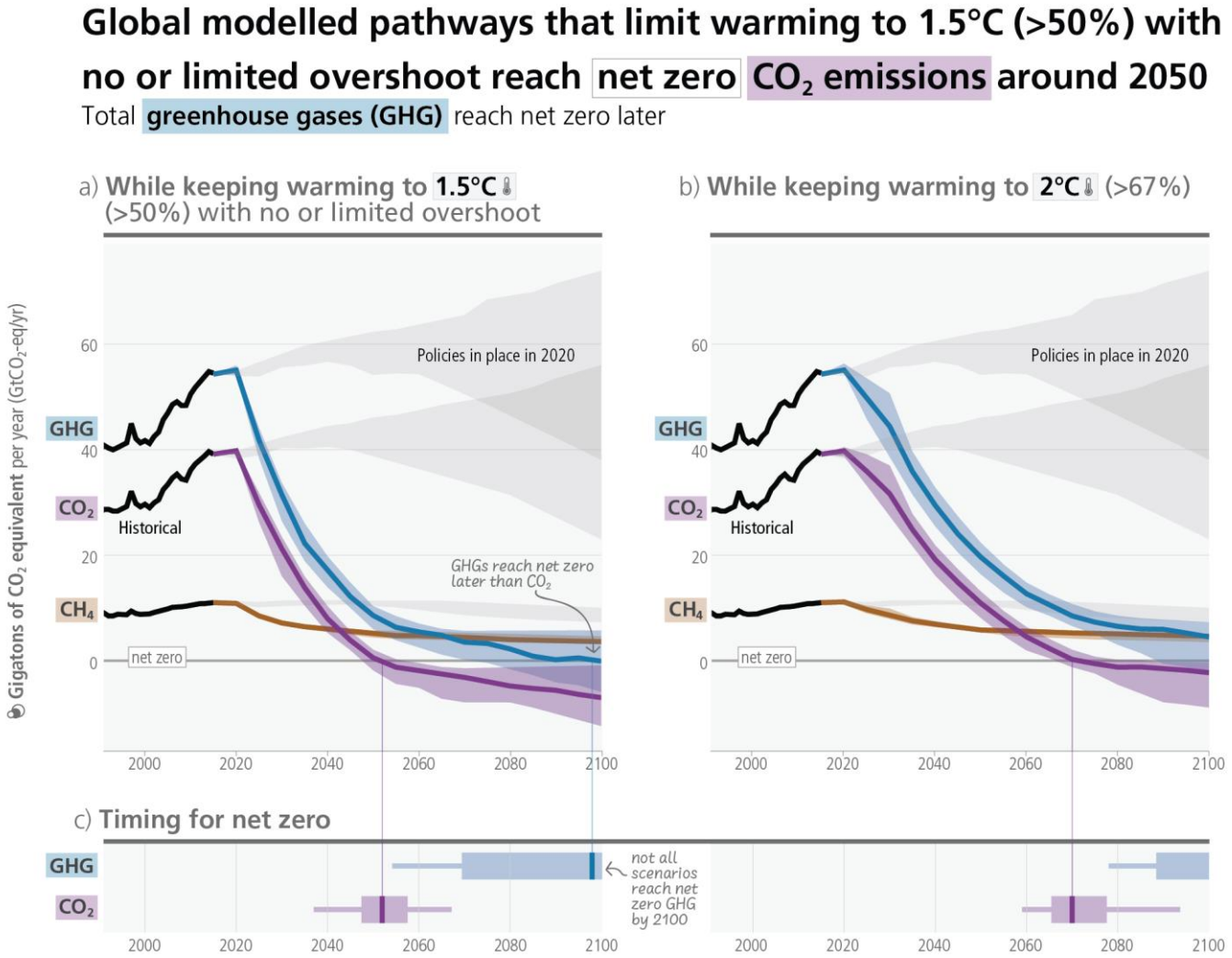
- Every time we press ‘Go’ on an analysis, we are **burning fossil fuels**
- Every time we press ‘Go’ on an analysis, we are **heating the planet**
- Every time we press ‘Go’ on an analysis, we are **reducing our future ability to conduct science**, because we are making our planet & human society unstable

What do we need to do?



Intergovernmental Panel on Climate Change (IPCC) 2023 report https://www.ipcc.ch/report/sixth-assessment-report-cycle/

“Net zero”



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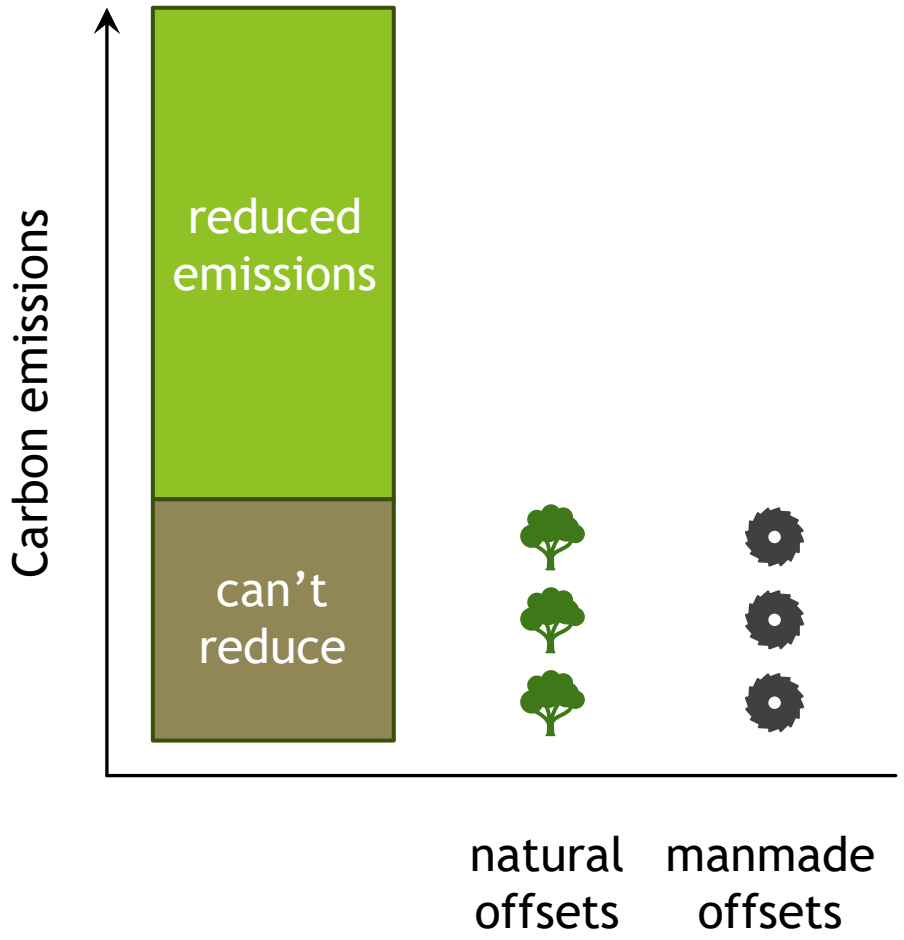


However…

- Insufficient land for natural offsets: 200,000 trees for OHBM2019*
- Some industries aren’t planning to decarbonise, and intend to rely entirely on offsets e.g. aviation
- Manmade offsets (‘Negative Emissions Technologies’) don’t exist yet

- We **cannot rely on offsetting**, and **must reduce energy in real-time**

*Epp et al (2023) *Aperture Neuro*

Renewable energy will be limited

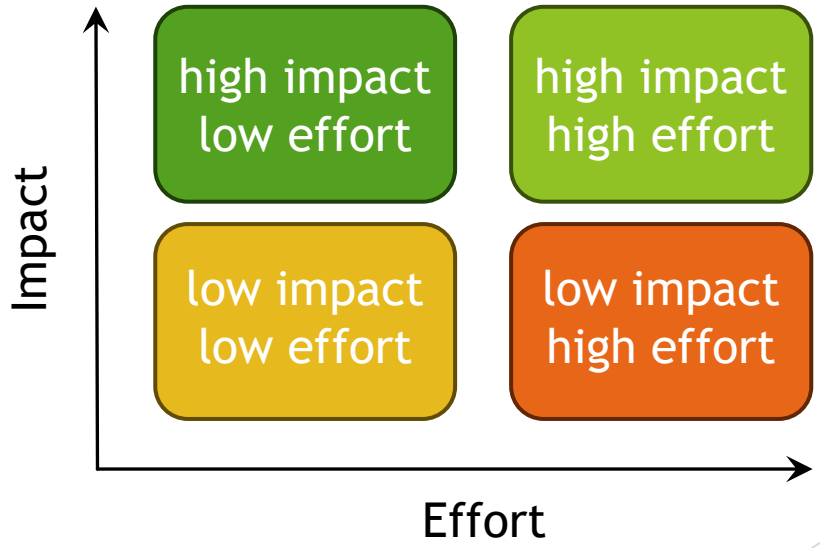
However…

- In 2023, 42% UK energy was renewable
- Only so much infrastructure that can physically be built (land availability)
- There are ecological impacts, e.g. mining to manufacture renewable infrastructure
- This affects biodiversity
- Every other sector of society also needs renewable energy to decarbonise (transport, heating…)
- **Renewable energy** is **finite**

We need to pull every lever

- We need to **reduce energy consumption** in every way we can
- We need to do it **now**
- We need to have another conversation about **demand management**

- But where should we start?
- High impact, low effort actions



Individual actions make a difference

- Governments don't understand our work, and therefore **don't know what needs to be done**
- As practicing scientists, we have a **moral duty** to take responsibility for our own scientific footprints
- Beyond the actual carbon saving, there is a very important influence on **social norms**

Individual actions make a difference

Rae et al (2022) *Brain and Neuroscience Advances*

Individual actions make a difference

These levels all influence each other

Rae et al (2022) *Brain and Neuroscience Advances*

Individual actions make a difference

Rae et al (2022) *Brain and Neuroscience Advances*

But we also need collective action

- How the environmental impacts of research are currently being addressed (the role of funders and institutions) – **Gabrielle Samuel, King's College London**