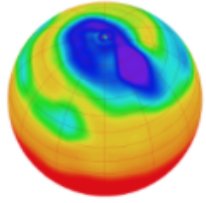




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# UKRI Net Zero Digital Research Infrastructure Scoping Project

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# Net Zero Digital Research Infrastructure (DRI) Scoping Project - Aims

- Collect **evidence** to inform UKRI DRI Investment decisions
- Provide UKRI and their community with an **outline roadmap** for achieving carbon neutrality in their DRI by 2040 or sooner
- Enable UKRI to **play a positive and leading role** in the national and global transition to a sustainable economy

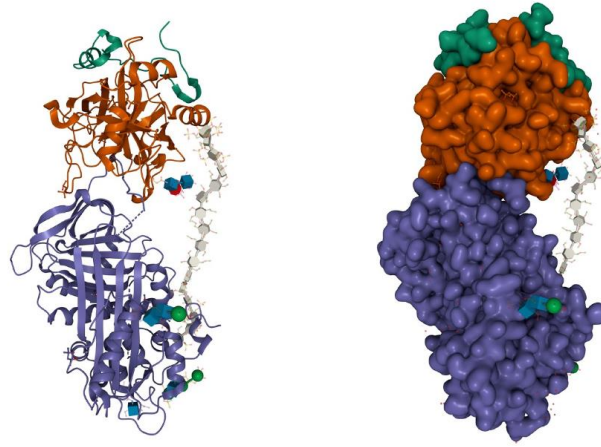


# UKRI Digital Research Infrastructure

- large scale compute facilities, including high-throughput, high-performance, and cloud computing
- data storage facilities, repositories, stewardship and security
- software and shared code libraries
- mechanisms for access, such as networks and user authentication systems
- people: the users, and the experts who develop and maintain these powerful resources.

These components interact in an interconnected **ecosystem** and underpin research conducted across disciplines

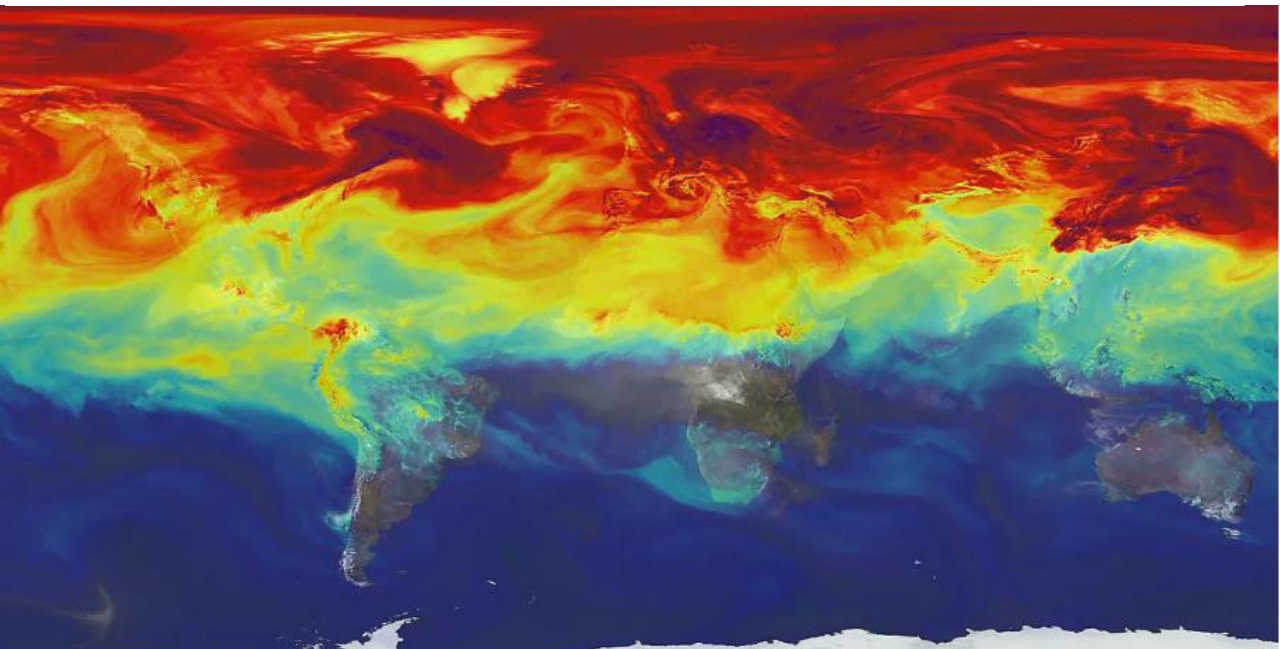
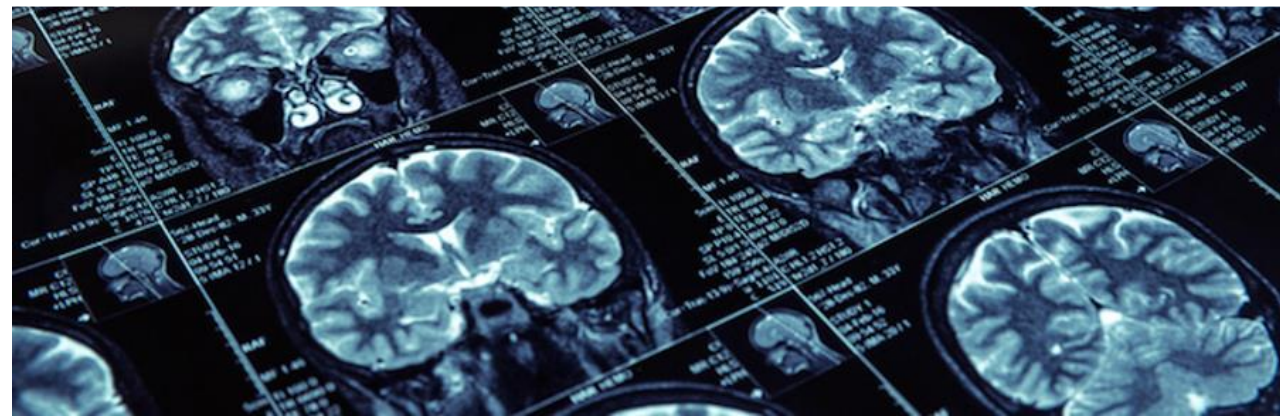
# (Some) Uses of DRI



Funding opportunity

## Artificial intelligence innovation to accelerate health research

≡ Google Translate



# MAP KIBERA



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# Environmental impact of DRI

## Embodied or 'Embedded' Carbon: Manufacture



- Extraction of minerals
- Transportation
- Manufacture of hardware

## Active emissions (of green house gases): Energy supply



- Energy source used to power DRI
- Energy efficiency of DRI (i.e power draw)
- Efficiency of DRI use (i.e. at capacity)

# Environmental impact of DRI

## Embodied or 'Embedded' Carbon: Manufacture



- Maintenance
- Replacement/Recycling
- Disposal/E-Waste

- Extraction of minerals
- Transportation
- Manufacture of hardware



## Active emissions (of green house gases): Energy supply



- Energy source used to power DRI
- Energy efficiency of DRI (i.e power draw)
- Efficiency of DRI use (i.e. at capacity)

# Challenges

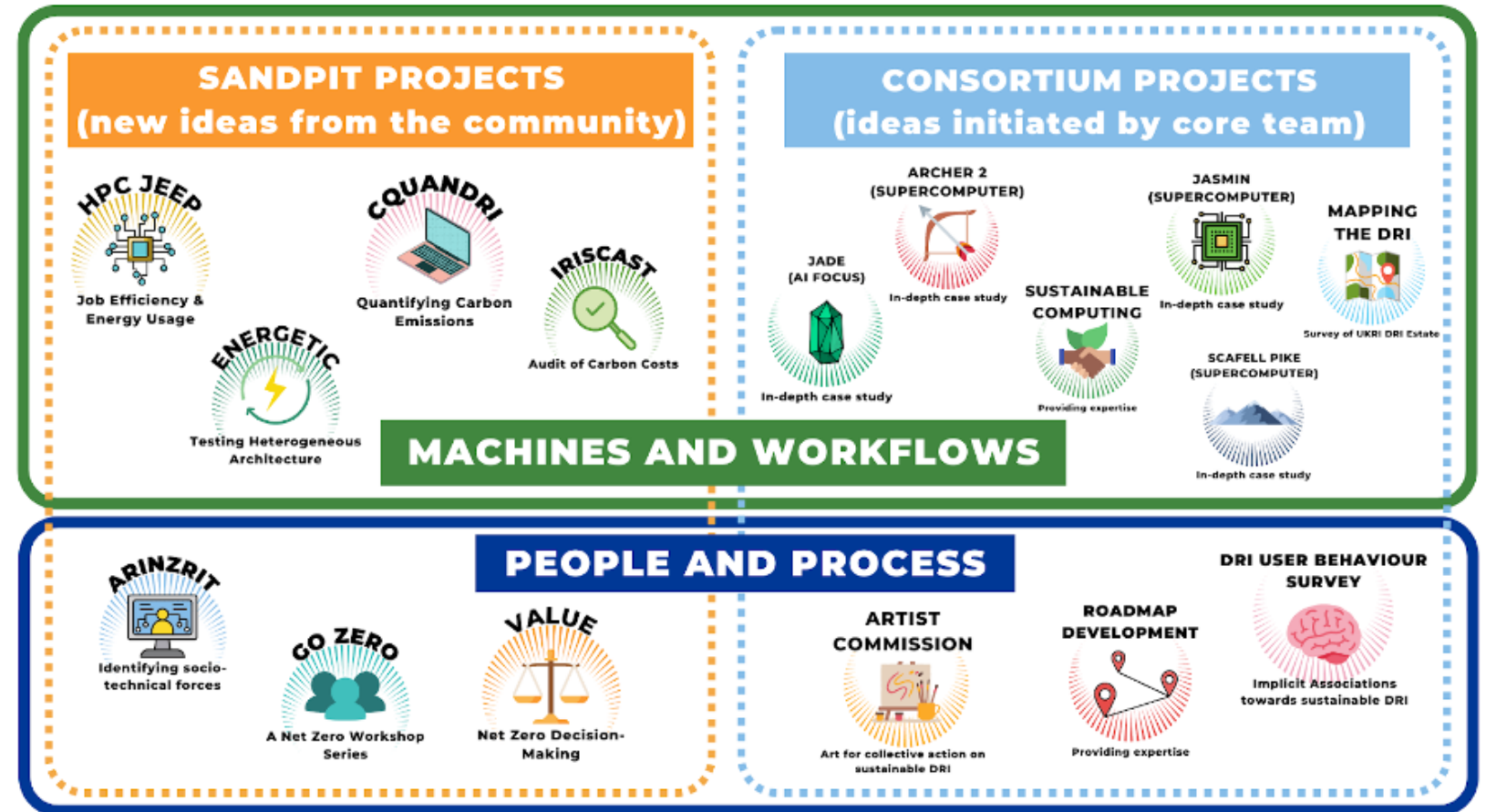
- Equivalence between operation of DRI and achieving Net Zero (1)
- Expansion of data driven research across subject domains (inc. Academic pressure to adopt new tools, demonstrate excellence through more ambitious – bigger – data driven approaches to research) (2)

**Balanced Pathway to Net Zero:** Climate Change Commission - research and innovation crucial to meeting Net Zero target, but assumes constant energy consumption – i.e. expansion of research within efficiency gains. (3)

**Rebound Effect:** typically efficiency gains lead to increased usage, estimated to diminish economy-wide energy savings by more than 50% (4)

# Evidence Gathering Activity

- Literature Review (Interim Report 2022)
- Consortium projects
- Sandpit projects
- Stakeholder engagement events: community and consensus building activity





# Recommendations for a Net Zero DRI: Technical Requirements

- Standards: for DRI interfaces and monitoring/reporting combinations (inc. per job reporting direct to users)
- Facility design and procurement: permissive of energy use monitoring, and reduced idle power draw
- Job scheduling: for low(er) grid carbon intensities and use at facility capacity
- Investment: in the development of environmentally sustainable research processes, and carbon accounting tools

# Recommendations for a Net Zero DRI: Training + Skills Development

- Environmental impacts of research practice e.g.
  - data-efficiency (how large does a data set/model need to be...?), appropriateness of technological approach to problem solving
- Best practices for use of DRI e.g.
  - Software design: code optimisation and testing
  - Effect of software + hardware combinations on emissions
  - Data management
- Invest in 'Green' Research Software Engineers; develop skills base to provide resource to wider research community

# Recommendations for a Net Zero DRI: Formalise incentives

- Funders should embed environmental impact estimates/monitoring in application criteria
- Funds available to include Green software engineers (i.e. 'Green' RSEs) on projects to support sustainable software development
- Open science & FAIR data principles should be required of researchers using UKRI DRI facilities
- DRI Facilities contribute to public energy register through annual monitoring of emissions

“Users of DRI ... are – generally – embedded in a ‘publish or perish’ culture, making it critical that research funders and institutions work collectively to establish practice for DRI that is Net Zero compliant”  
– ARINZRIT sandpit project, Friday et al (2023)

# Take home

- UKRI is committed to enacting environmentally sustainable policy
- The UKRI DRI has environmental impacts, and the implications of expanded usage should not be overlooked
- UKRI occupies a leadership role within R&I landscape in the UK
- Small, incremental changes support awareness raising, as well as emissions reductions, and are fundamental to leveraging **design and intent** to ensure environmentally sustainable DRI use and operation (Interim Report 2022)

# Publications

- [Technical Report 2023](#)
  - Details toolkit, roadmap and recommendations
- [Overview Report 2023](#)
  - Summary of the above
- [Interim Report 2022](#)
  - Detailed literature review

**Sandpit and Consortium project pages and reports:**

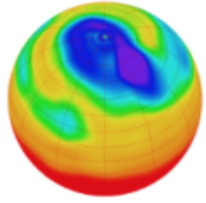
<https://net-zero-dri.ceda.ac.uk/project-activities/>

**Full list of recommendations:**

<https://zenodo.org/records/8199893>



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# Thank you!

Questions for me: [miranda.macfarlane@kcl.ac.uk](mailto:miranda.macfarlane@kcl.ac.uk)

Connect with the Net Zero DRI Scoping Project team at CEDA:

E: [support@ceda.ac.uk](mailto:support@ceda.ac.uk)

Subscribe to their newsletter [here](#).

The logo for King's College London, featuring the text 'KING'S' in a large, white, serif font, 'College' in a smaller, white, cursive font, and 'LONDON' in a white, serif font, all set against a red square background with two horizontal white lines at the bottom.

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