

# What's stopping emissions monitoring across compute services?

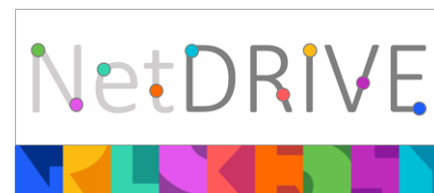
Jessica Huntley  
David McDonagh  
Sarah Hanrahan



Scientific Computing



Hartree Centre

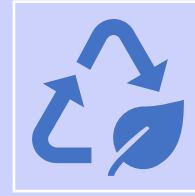


# Introduction

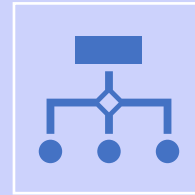
Jessica Huntley

# Problem

- Many resources now available discussing broad principles in sustainable computing
- There is often a gap in targeted, practical information to facilitate change
  - Having an awareness of carbon footprint has been shown to drive behaviour change [1]
- Measuring emissions across DRI is a priority for many institutions, but this is far from being realised



Compute users may be unaware of the environmental costs of their work. If they have the information, it can be unclear how it should be used



For developers and facilitators, it can be unclear which tools they should deploy for monitoring emissions, or if it would be a valuable use of their time.



For researchers, it can be unclear if calculating emissions is valued by grant funders and what is expected in journal articles.

# Survey of CoSeC Collaborative Computational Projects (2025):



8. Please rank your existing knowledge in the following topics

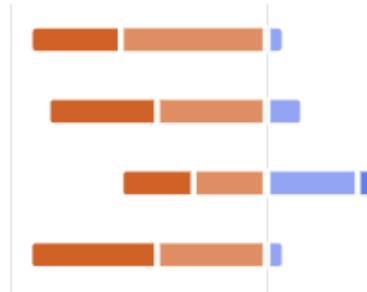
● No knowledge ● Basic Awareness/learning about it ● Proficient/Experience applying in own work ● Expert knowledge

Measuring Software Carbon Emissions

Energy-Aware Job Scheduling

Writing/Using Energy Efficient Algorithms

Embodied Carbon



# Survey of Scientific Computing Department's Service managers (2026):



12. Please indicate how often you implement the following environmental sustainability practices

● Never ● Rarely ● Sometimes ● Often ● Always

Regular review and cleanup of unused resources

Considering environmental sustainability in service design

Measurement of carbon/energy impact

Promoting environmentally sustainable user behaviours



# Existing work

David McDonagh

- ~200 staff supporting tens of thousands of users

### Dynamic computing

## STFC Cloud

- ~45,000 CPU cores
- ~840 GPUs
- ~10 PB storage



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### HPC

## JASMIN

- ~18,000 CPU cores
- ~15,000 users
- ~72 GPUs
- ~100 PB tape storage
- ~90 PB disc storage

### HPC

## SCARF

- ~26,000 CPU cores
- ~52,000 hyperthreads
- ~40 GPUs
- ~6 PB storage



**197**

Full-time employees



**900**

Organisations

**5995**

Individuals trained



**208**

Industry projects



**20**

Platforms



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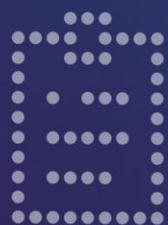
**500+**

Industry collaborators



**10**

Patents



**80**

Peer-reviewed papers

**100**

Assets



**£27M**

Operational budget

**£30M**

Capital budget



# Hartree Centre Environmental Sustainability Working Group



STRATEGY



BUILDINGS



COMPUTE



PROJECT PLANNING,  
SELECTION, AND  
EVALUATION



STAKEHOLDER  
ENGAGEMENT



BEHAVIOUR CHANGE



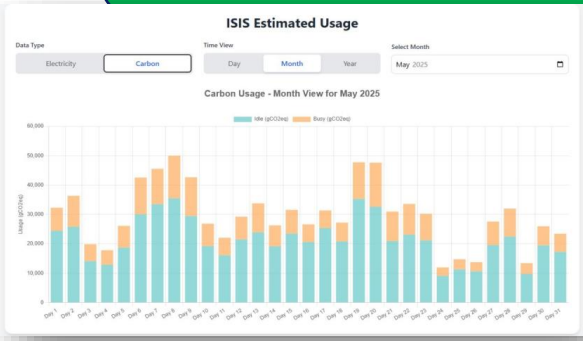
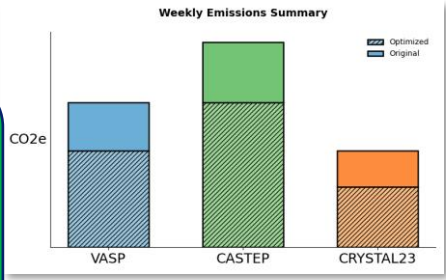
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## The Hartree Centre

# Scientific Computing Department Sustainability Strategy

Emissions Monitoring Across Compute Services



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Scientific Computing

**Developing a Sustainable Sustainability Strategy for the STFC Scientific Computing Department**

David McDonagh

Hartree Centre Computing for Sustainable Innovation 2025

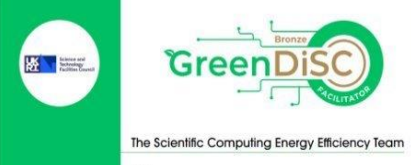
Support Hub

Sustainability Spotlight Series: Monitoring HPC Carbon Emissions with George Roe and Kiran Jonathan



**Green DiSC: a Digital Sustainability Certification**

Common Sustainability Standards



User Education

Best Practice



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Search or jump to... ctrl+k

Home > Dashboards > Hieu-Dev > Virtual Machine Power & Carbon Emission v2

instance\_name benchmark\_i3.tiny VM uuid All Host hv713.nubes.rl.ac.uk

### Virtual Machine Power & Carbon Emissions Dashboard

This dashboard estimates the power consumption and carbon emissions of an OpenStack Virtual Machine (VM) over a selected time period. The calculation is based on the VM's allocated CPU cores and its utilisation relative to the host's power profile.

- The results represent an approximation, not an exact measurement of VM energy usage.
- This dashboard supports Compute (CPU) flavours only.
- GPU flavours are not supported and may produce incorrect estimates.

#### How to Use This Dashboard

- Select your VM Instance Name:** Use the Instance Name dropdown at the top of the dashboard to select your VM.
- Handle duplicate VM names (if applicable):**
  - If multiple VMs share the same name:
  - Go to: <https://openstack.sfc.ac.uk>
  - Navigate to: Project → Instances
  - Find the correct VM and copy its Instance ID (UUID)
  - In Grafana, after selecting the instance name, choose the corresponding VM UUID from the UUID variable dropdown
- Select the time range:** Choose the time period you want to analyse using the time picker.
- View the Results, the dashboard will display:**
  - Estimated VM power consumption
  - Estimated carbon emissions

#### Calculation Method

The VM power consumption is estimated based on:

- How much of the host machine your VM is allocated (CPU cores)

Days Calculated:

**1.0 week**

Total Carbon Emission (gCO2)

**327 g**

Carbon Emission of VM per Hour (gCO2)

**2 g**

VM Average Power

**15 w**

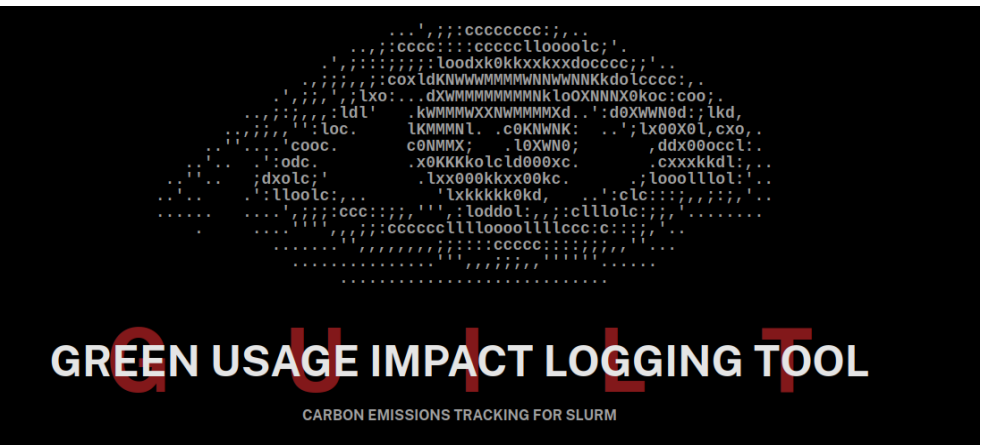
VM Total Energy

VM Energy

Emissions Monitoring  
Across Compute  
Services



Hieu Le



George Roe



# NetDRIVE EMIT

Sarah Hanrahan

# NetDRIVE

- Network for sustainable Digital Research Infrastructure Vision and Expertise
- “a forum for managers, software engineers, academics and others to come together to build a common vision for a sustainable future and to incite a transition to sustainable working practices in the Digital Research Infrastructure communities”
- Funded by UK Research and Innovation (UKRI)
- <https://uknetdrive.org/>



# NetDRIVE EMIT



NetDRIVE-funded project



'Emissions Measurement and Interpretation Training' (EMIT)



We aim to provide targeted, practical information to embed best practice for the measurement and effective use of carbon emissions across Digital Research Infrastructure (DRI)



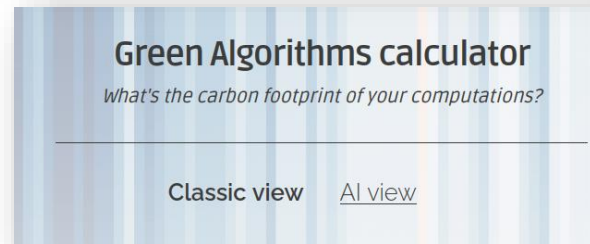
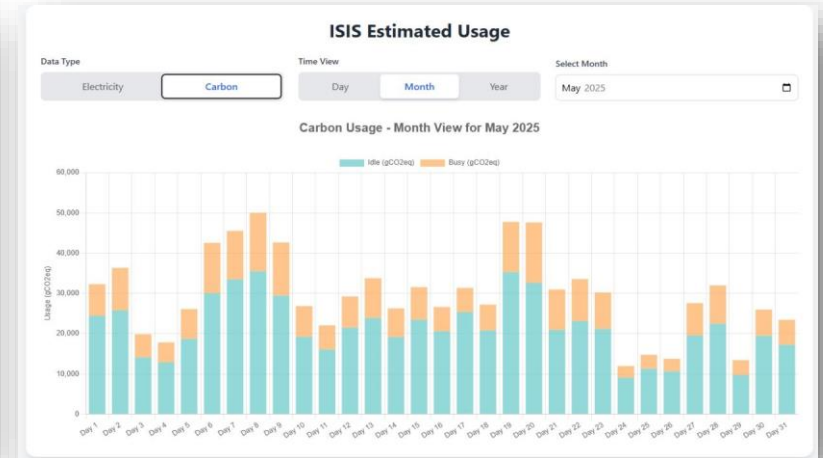
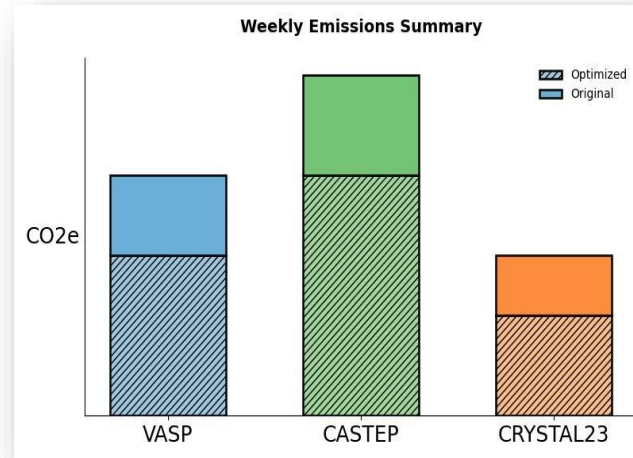
This will be achieved by consolidating existing resources and developing training modules to explain the current state of emissions monitoring for developers, managers, facilitators, and users



A dynamic resource will be created that the community can continue to update, to use as a resource for future training material

# Context

- Collaboration between The Scientific Computing Department and The Hartree Centre
- Collating the expertise of:
  - Ongoing monitoring projects
  - Current knowledge bases
  - Hartree training team



# The project team

## Technical Staff:

Sarah Hanrahan\*  
Jessica Huntley^  
Ashraf Hussain^  
David McDonagh^  
Andrew Smith\*

## Training Staff:

John Barlow\*  
Rachel Williamson\*  
Wendy Winnard\*

## Comms Staff:

Zara Findlay\*

## Project Manager:

Temitope Owoyomi\*

## Key:

^



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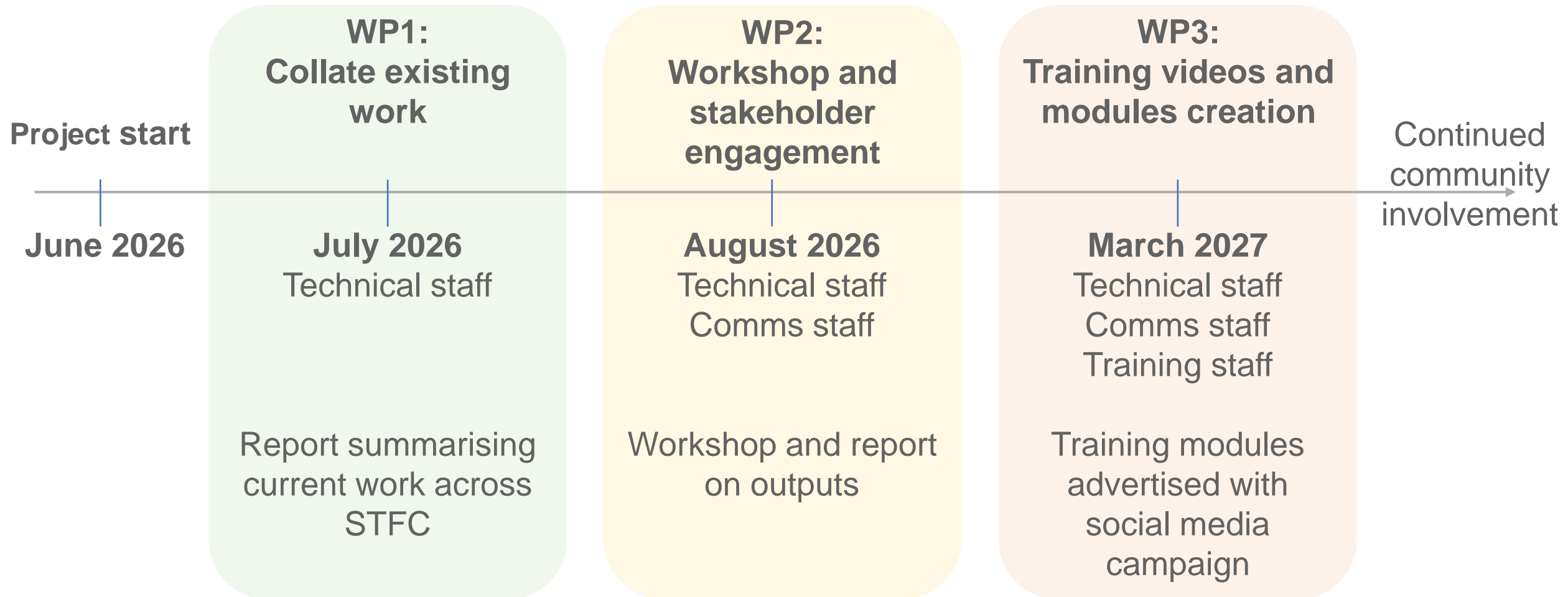
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# Milestones and deliverables



# Topics

- Topics will be community-driven, based on a workshop involving stakeholders from across DRI
- This will identify where key gaps remain, and what material is most important

Emissions monitoring across services:

- HPC
- Cloud
- Storage

Embedding emissions monitoring in software

Guidance on current journal/funder expectations

Communicating carbon emissions data to users

Green Scheduling

Reporting project carbon emissions



## Social and economic impact

- Empower individuals and institutions to make more environmentally sustainable choices in the way that DRI facilities are managed and used
- Long-term behavioural change through open-source resources and training modules
- We aim to get the training CPD accredited, which will encourage the community to upskill in this area
- Subsequent reductions in greenhouse gas emissions will mitigate against the effects of climate change, such as extreme weather events
- Will allow researchers and DRI users to get more value from their financial and (future) carbon budgetary constraints



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# Survey

<https://forms.office.com/e/rgPxfV54ae>

SC4RC Carbon Emissions Tracking  
Poll



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Technology Facilities Council

**Twitter:** @STFC\_matters

**YouTube:** Science and  
Technology Facilities Council



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# Thank you

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**Twitter:** @STFC\_matters

**YouTube:** Science and  
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