

Minimising the environmental harm of AI through principle thinking

UKSG Webinar, 30 June 2026

Prof Daniel Schien, Associate Professor in Computer Science, University of Bristol

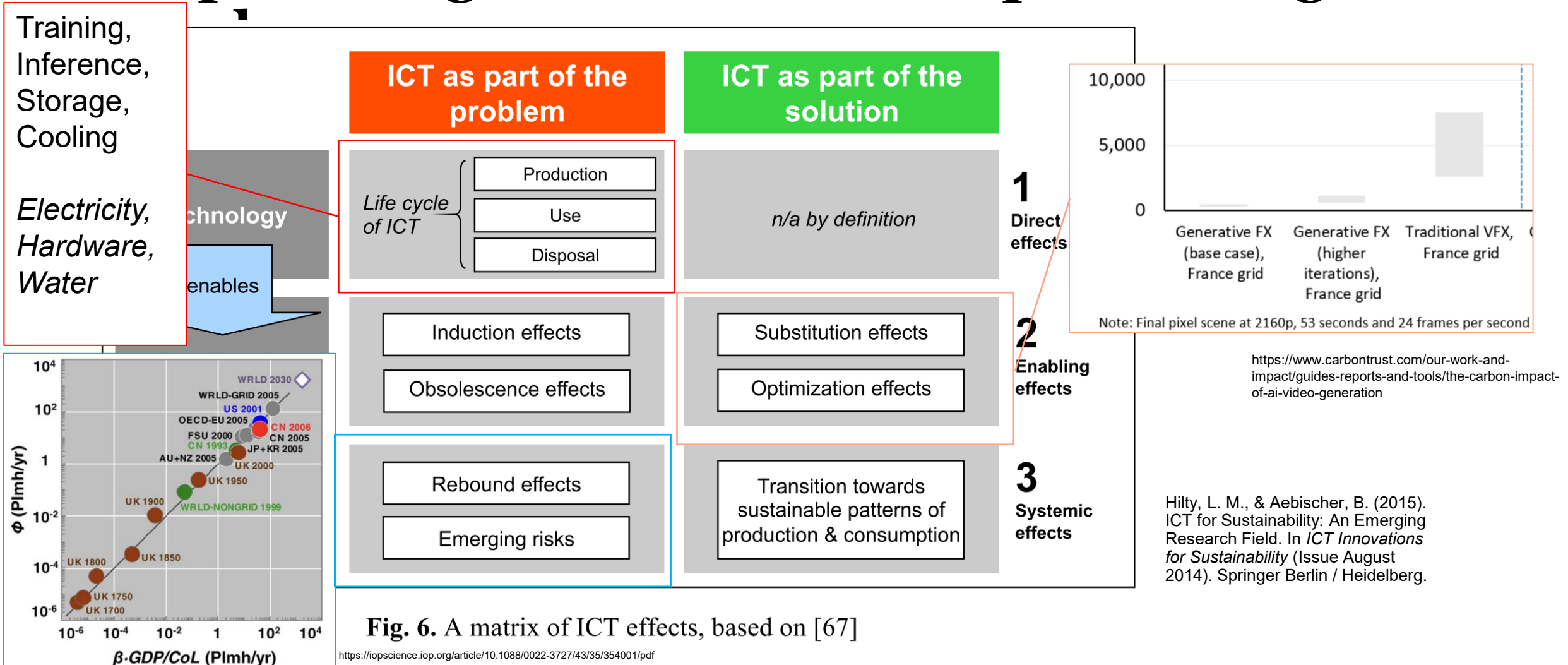
Andri Johnston, Digital Sustainability Lead, Cambridge University Press & Assessment



@britishmuseum
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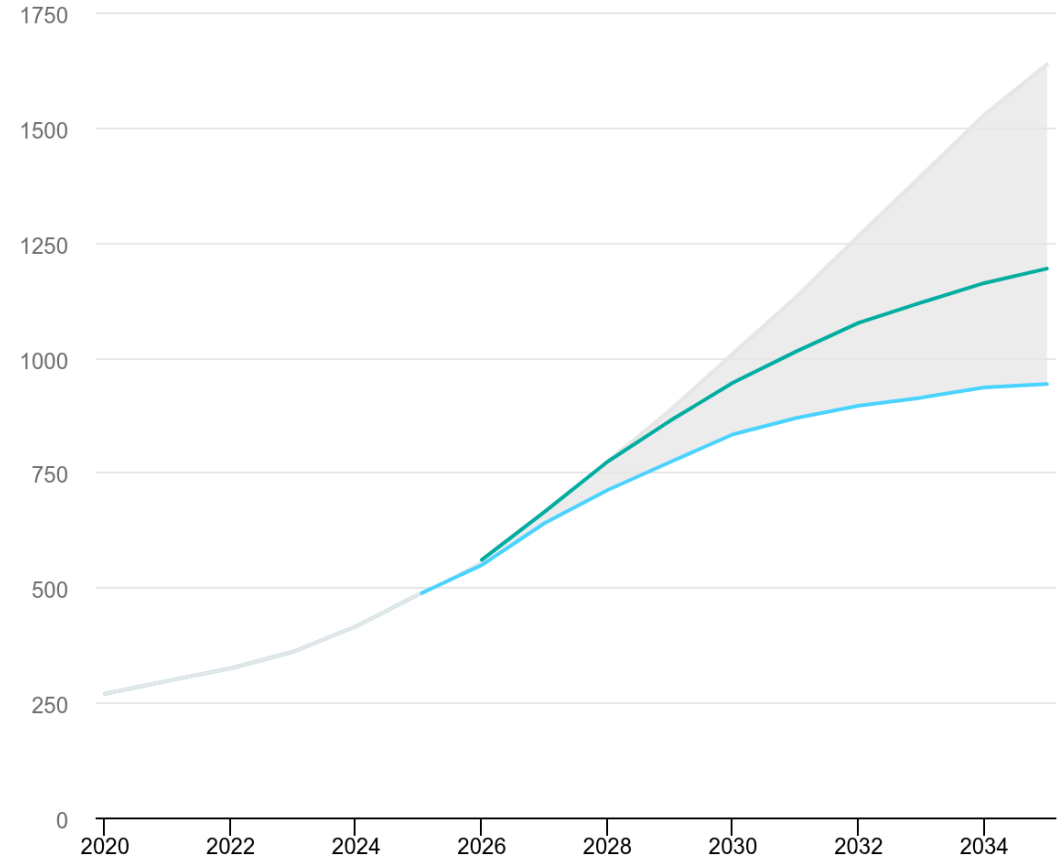
London. Published 1858 by the Proprietor J.C. Bouton, 19, Lamb's Conduit Street and Ackermanns, 8 & C^o Strand
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Conceptualising Environmental Impacts of Digital



Absolute DC energy consumption is increasing

- Half of *increase* '24-'30 is for AI (~30GW / 250TWh) >> ~0.8% of global '30
- Natural gas and coal 40% of aggregate demand
- “Behind-the-meter” gas results in ~30–70% capacity overbuild



<https://www.iea.org/reports/key-questions-on-energy-and-ai/executive-summary>

Direct Effects - Infrastructure Dynamics

- Infrastructure is inelastic and built for peaks (> avoid)
- Demand shapes the *future* capacity
> long-term effect chains
- Problem: System is highly unstable
> Carbon Footprints are highly uncertain, at best directional

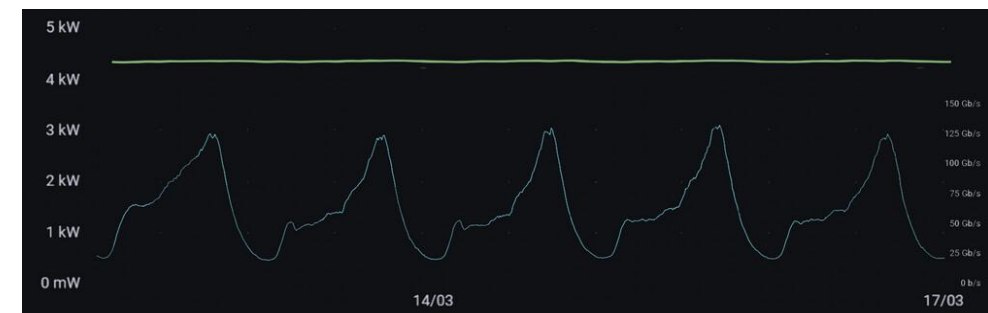
Monthly spending on data center construction in the United States

Cost of on-site work to build data centers each month, including materials and construction labor. It excludes the cost of IT hardware like servers and storage, which can account for a large share of total investment. This data is expressed in US dollars, adjusted for inflation.

Our World in Data

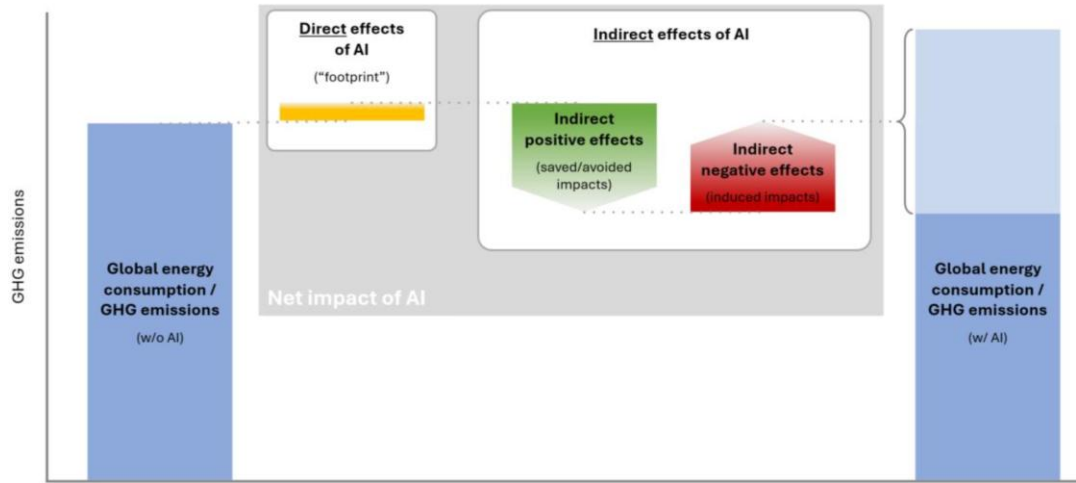


<https://ourworldindata.org/grapher/monthly-spending-data-center-us>



Schien 2025,
<https://onlinelibrary.wiley.com/doi/10.1111/jiec.70057?af=R>

Indirect impacts



Coroama

- Gen AI produces text -> humans need to take action

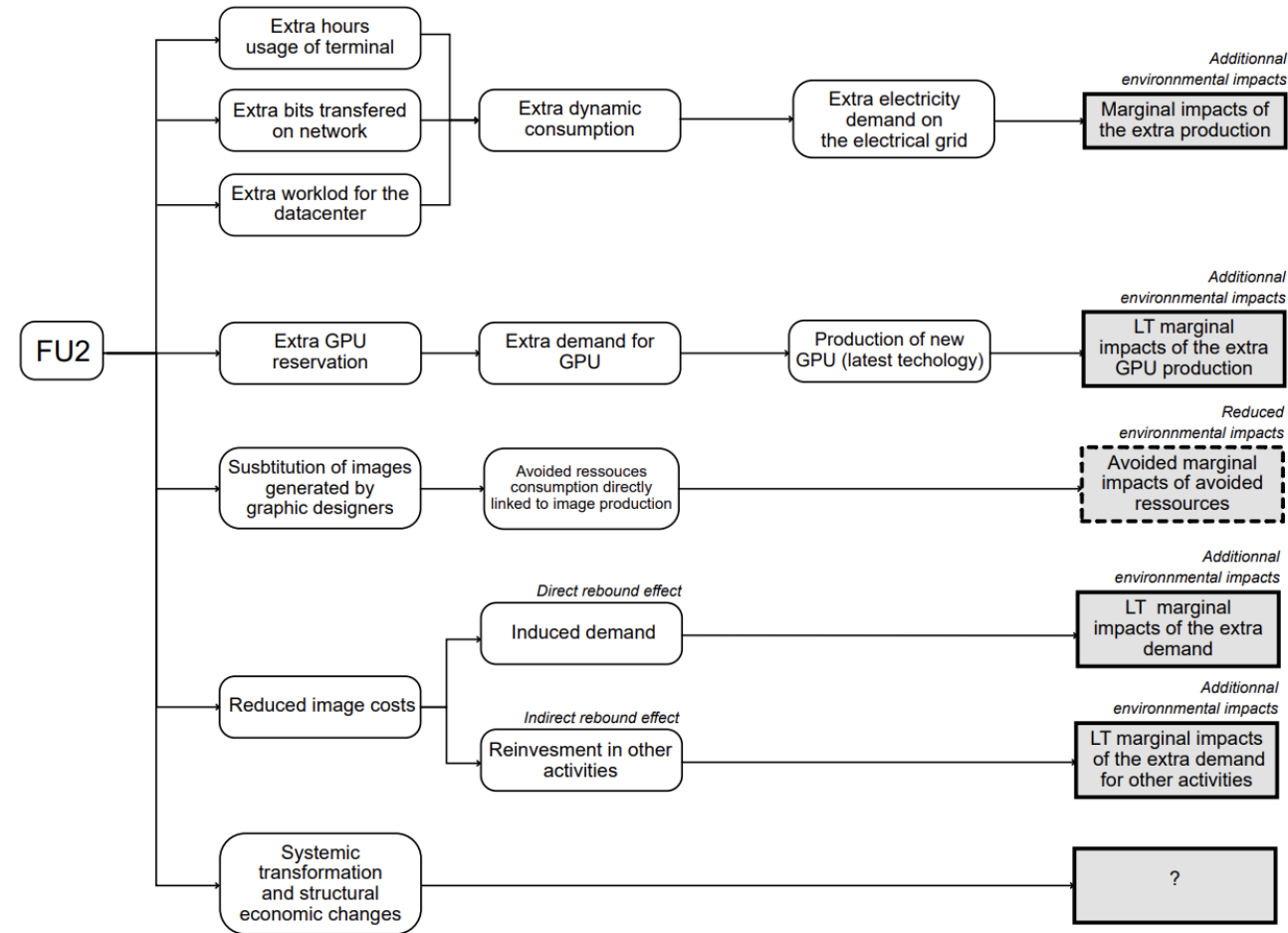
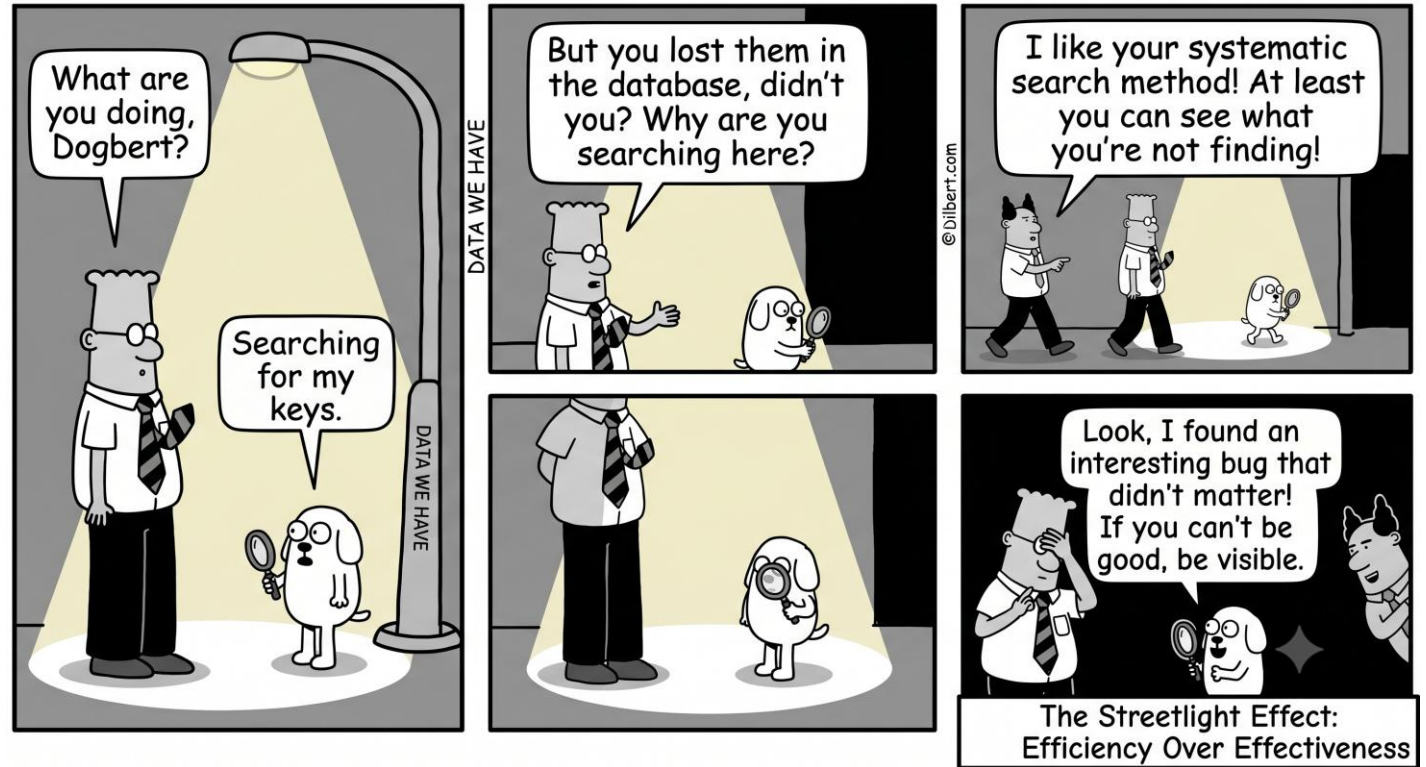


Figure 7: Consequence tree for long-term CLCA

Rebound

- Economic effects
- Form of economic growth



Dan Schien 2026, via Google Gemini

Don't use GenAI when

... other systems do equally well.

- Deterministic / rule-based work:
- Simple image recognition: OCR, spell/grammar checking, barcode/QR reading
- Simple search and retrieval: faster, cheaper, and reproducible

Keep GenAI for synthesis across messy inputs

Buy from those with Green energy (Mistral?)

How to Convert
CELSIUS → **FAHRENHEIT**

USE THE FOLLOWING CONVERSION FORMULA:

$$^{\circ}\mathbf{F} = \frac{9}{5} (^{\circ}\mathbf{C}) + 32$$

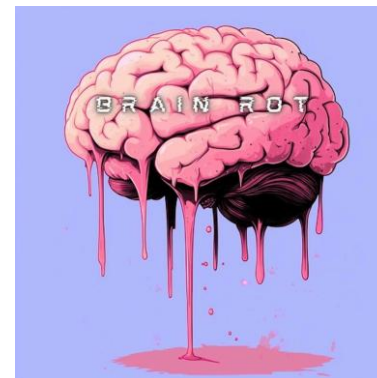
Where:
C = degrees Celsius
F = degrees Fahrenheit

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Use precise location



Our commitment

Cambridge University Press & Assessment has committed to being carbon zero on all energy-related emissions by 2048, with a 72% reduction by 2030

Terminology is important

Sustainable AI

AI for Sustainability

AI & Sustainability

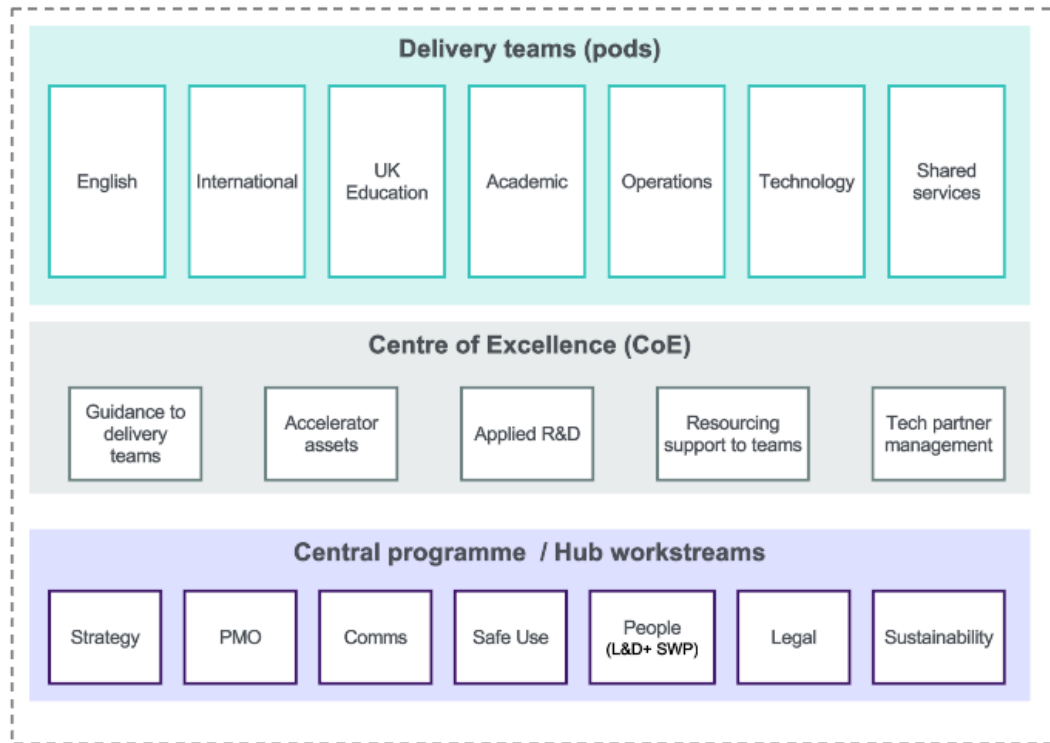
Alignment with corporate strategy



Delivering our commitments towards supporting a more sustainable future for our planet and being a more global and inclusive organisation...

AI & Sustainability Stakeholder Map

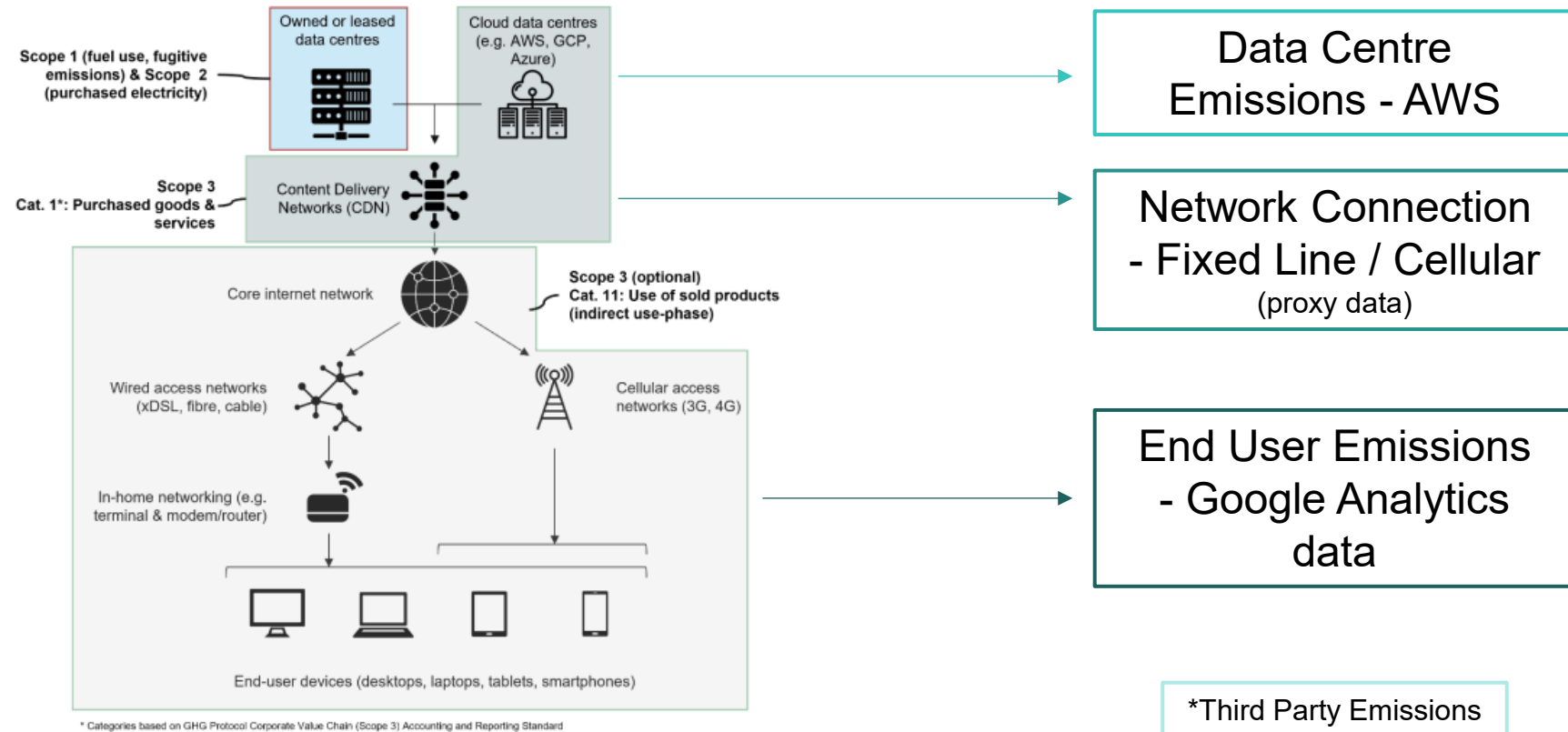
CUP&A AI Programme – Operating Model



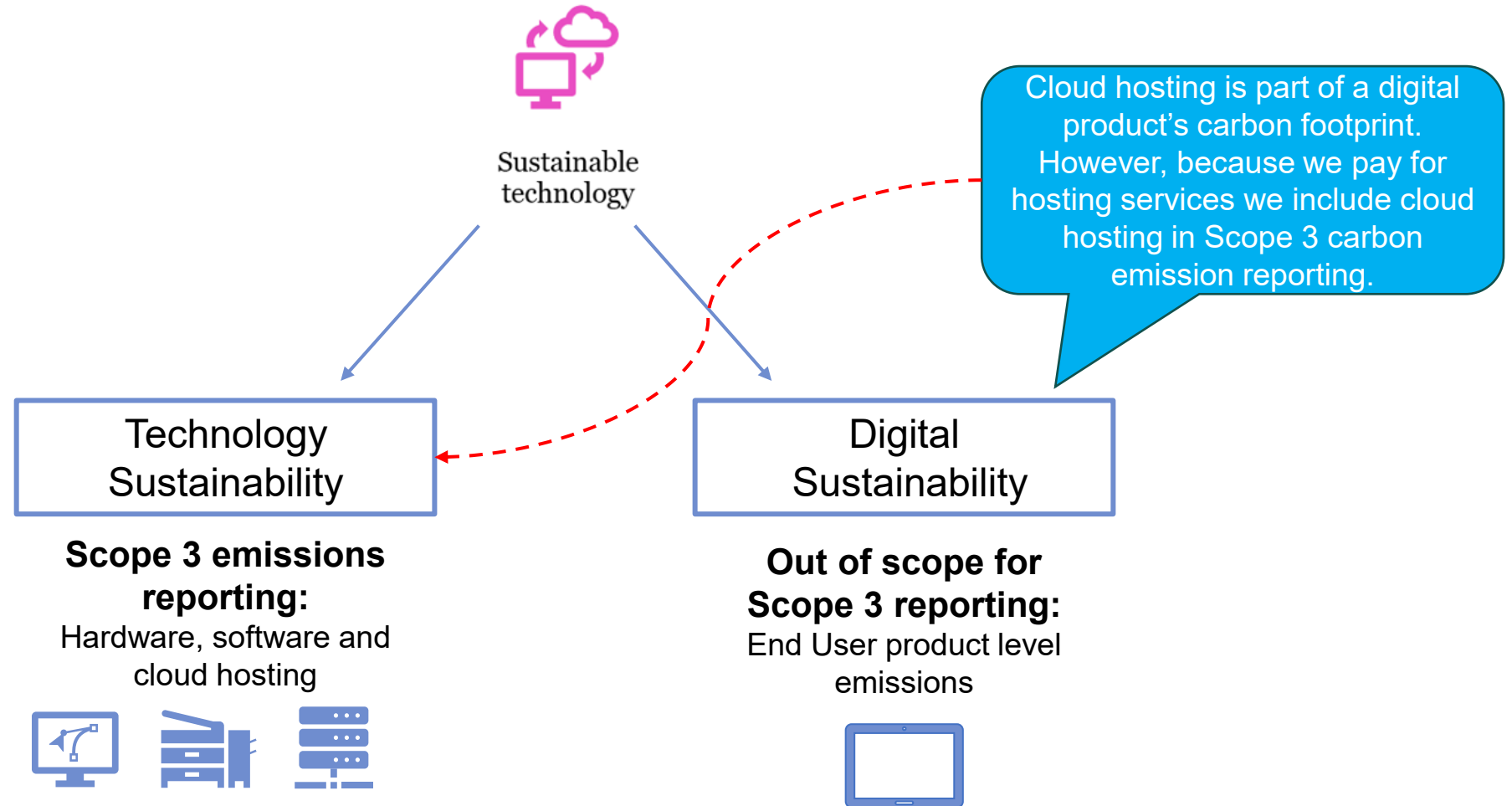
- Part of the operating model and central programme
- Working to embed sustainability principles into all areas of AI strategy
- Expertise to partner and consult with all areas of the business on AI & sustainability

Calculating Carbon Emissions from Digital Products

General Digital Emissions Calculation Methodology



Technology Sustainability & Digital Sustainability



*The IEA 2025 Energy & AI Report found that global electricity **consumption for data centres is projected to double** to reach around 945 TWh by 2030, representing just under 3% of total global electricity consumption in 2030.*

***Electricity consumption in accelerated servers, which is mainly driven by AI adoption, is projected to grow by 30% annually.** Accelerated servers account for almost half of the net increase in global data centre electricity consumption, while conventional servers account for only around 20%.*

Carbon emissions from Cloud Providers



Increase from
65.10M MTCO₂e in
2022 to **68.25M
MTCO₂e** in 2024

*Amazon wide not AWS specific



Emissions increase
of around **23.4%** in
their last financial
year.



Google Cloud

Google's greenhouse gas
emissions in 2025 were
52% higher than in 2019

*Was 48% higher in 2023

Google Cloud

**Estimated impact of a Gemini
prompt:**

0.24 Wh of energy

0.03 gCO₂e

0.26 mL of water



Google Cloud

Factors Impacting the Environmental Impact of Selecting an LLM

- parameters in a model
- the power usage
- effectiveness of the data centre
- the grid carbon intensity

Environmental Impact of Select Machine Learning Models, 2022

Source: Luccioni et al., 2022 | Table: 2023 AI Index Report

Model	Number of Parameters	Datacenter PUE	Grid Carbon Intensity	Power Consumption	CO2 Equivalent Emissions	CO2 Equivalent Emissions x PUE
Gopher	280B	1.08	330 gCO ₂ eq/kWh	1,066 MWh	352 tonnes	380 tonnes
BLOOM	176B	1.20	57 gCO ₂ eq/kWh	433 MWh	25 tonnes	30 tonnes
GPT-3	175B	1.10	429 gCO ₂ eq/kWh	1,287 MWh	502 tonnes	552 tonnes
OPT	175B	1.09	231 gCO ₂ eq/kWh	324 MWh	70 tonnes	76.3 tonnes

What are we doing to be more sustainable
in the digital world and with AI

Cambridge University Press & Assessment Communication Briefing on Sustainability & AI

Message

Cambridge University Press & Assessment's (Cambridge's) position is that the significant potential benefits of using artificial intelligence (AI) for education and research should be achieved in a manner that minimises the environmental impact. Like every organisation we are only beginning to understand the scale of both these impacts. We are committed to initiatives for driving benefits, reducing harms, and monitoring the consequences so that we can take ever-better informed positions in the future.

These commitments include:

- Ethical AI practices through the implementation of ethical AI governance and our Safe Use Framework
- A reusable operating model using composable AI architecture
- Developing and implementing carbon emissions reporting methodologies and practices in the development of new AI tools and products
- Implementing our Digital Sustainability Principles and Sustainability & AI Guidelines into the product development of new AI tools and products
- Educating and providing the needed tools to Cambridge colleagues about the impact of AI on society and the planet
- Setting requirements for evaluating the social impacts of the AI supply chain

Sustainability & AI Communication Briefing



Our approach

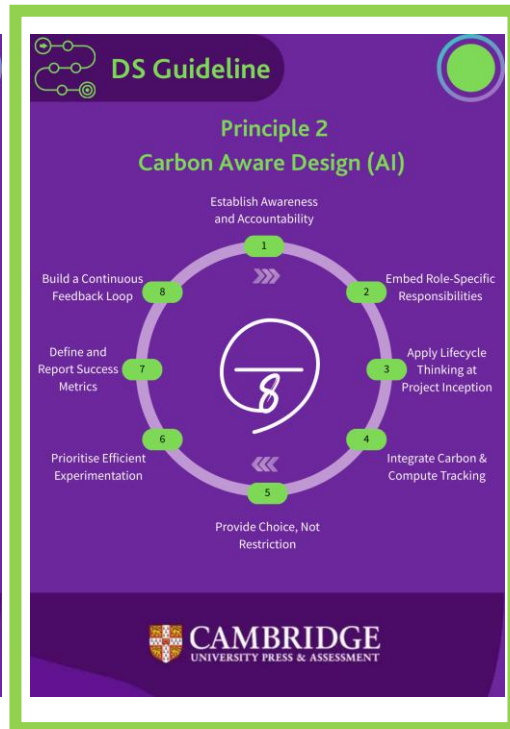
At Cambridge, we are committed to reducing our environmental impact across all areas of our operations, including being carbon zero on all energy-related emissions by 2048.

We recognise that Artificial Intelligence (AI) brings new considerations and implications for the environment. The broad scale and rapid pace of developments in AI also make it more difficult to keep track of its direct and indirect impact on sustainability efforts. It is therefore an ongoing goal for our organisation to understand, monitor and manage the environmental impacts of our AI approaches.

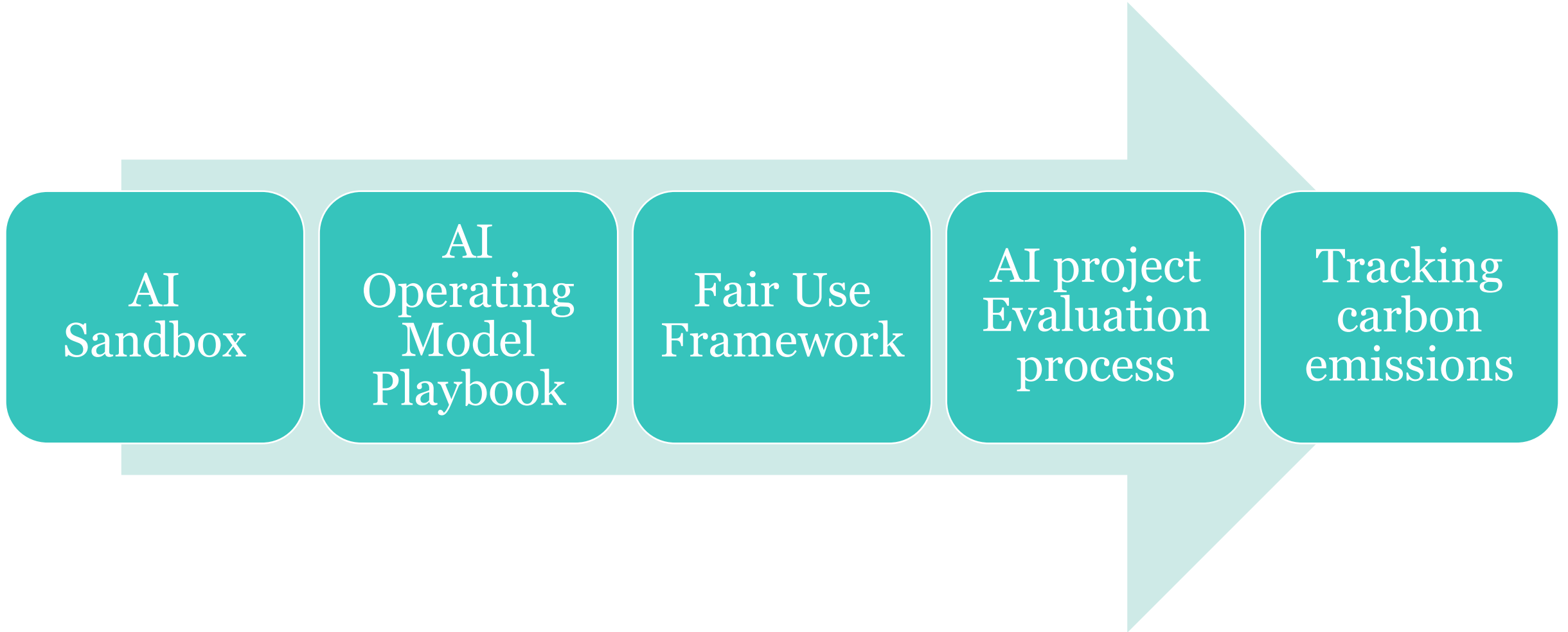
Guidance for leaders and teachers considering the use of AI technologies in school

Case study: agreeing AI & sustainability messaging for teachers with International Education team

The Digital Sustainability Guidelines



Embedding sustainability thinking



Embedding sustainability thinking

AI & Sustainability Questionnaire

You have an idea for an AI project—fantastic! This survey will help you ensure your approach is sustainable, efficient, and mindful of its impact on people and the planet.

Please review the **AI & Sustainability Guidelines** on the Digital Sustainability Connect page before starting:

cambridgeorg.sharepoint.com/sites/Connect/SitePages/Digital-sustainability-guidelines.aspx#we-re-very-excited-to-share-our-new-principle-specific-digital-sustainability-guidelines!

Section 1 

Getting started - Problem Framing

Right at the start of your thinking, this is the most important question to consider.

1

Is AI the most suitable solution for your challenge, or have you explored alternatives such as scripts or traditional tools? *

- Yes, AI is the best solution
- No, I haven't considered other options
- I considered alternatives but chose AI

Calculating Carbon Emissions of AI

