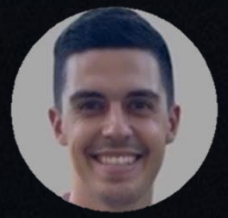
OECD.AI Policy Observatory

# Can AI help save the planet?

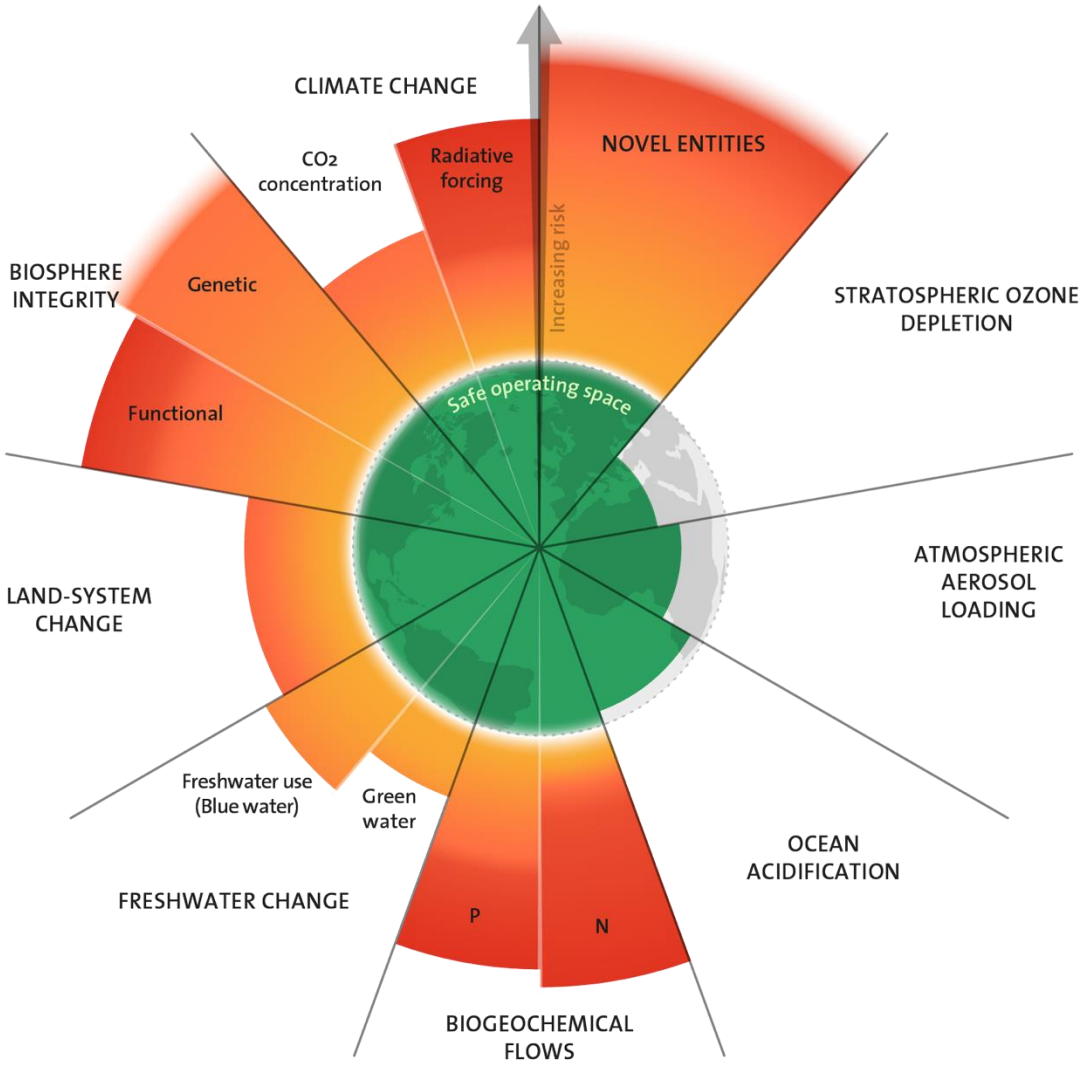
## Trilateral AI Conference 2024



**Johannes Leon Kirnberger**
Policy Advisor, AI & Sustainability
Organisation for Economic Co-operation and Development (OECD)

“**Six of the nine** planetary boundaries are transgressed, Earth is now well **outside of the safe operating space** for humanity”

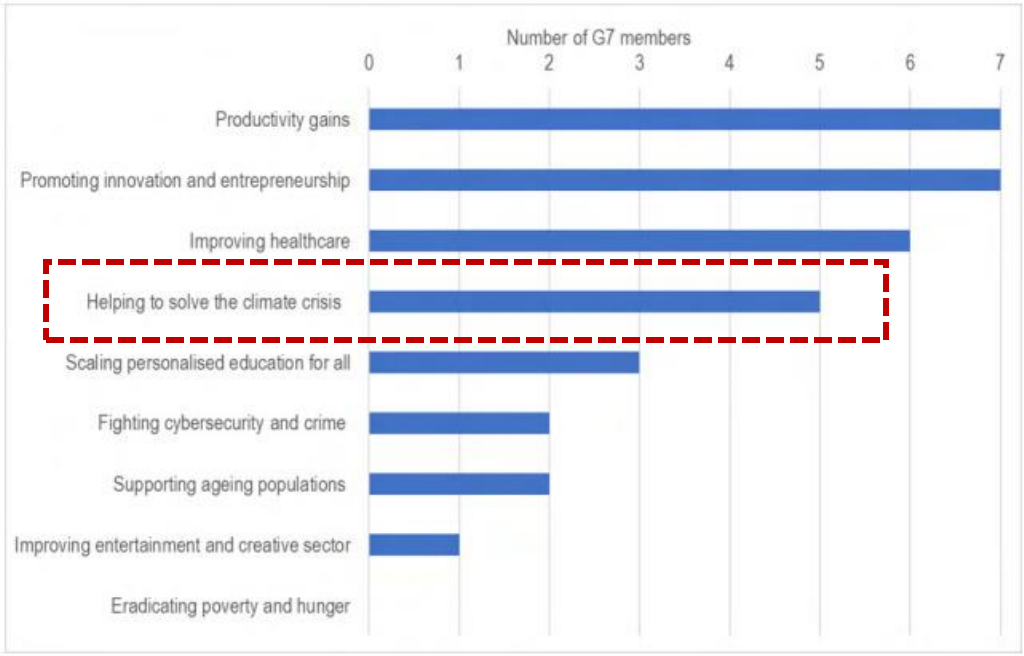
*Richardson et al., 2023*



# Can AI help save the planet?

FIGURE 2.1. TOP FIVE *OPPORTUNITIES* OF GENERATIVE AI TO HELP ACHIEVE NATIONAL AND REGIONAL GOALS

Number of G7 members that selected (five) specific opportunities from a pre-populated drop-down list




*Note*: The figure aggregates responses from seven respondents to the question: "*From your country or region's perspective, what are the top five opportunities generative AI presents to help achieve national and regional goals? (Please select five options)*".

Source: OECD (2023), G7 Hiroshima Process on Generative Artificial Intelligence (AI): Towards a G7 Common Understanding on Generative AI, OECD Publishing, Paris, https://doi.org/10.1787/bf3c0c60-en.

# Can AI help ruin the planet?

WIRED

## The Generative AI Race Has a Dirty Secret

Integrating large language models into search engines could mean a fivefold increase in computing power and huge carbon emissions.

Forbes

Jun 17, 2020, 11:54am EDT | 21,756 views

## Deep Learning's Carbon Emissions Problem

MIT Technology Review

## Training a single AI model can emit as much carbon as five cars in their lifetimes

Deep learning has a terrible carbon footprint.
Strubell et al. (2019)

ASK NYT CLIMATE

## *Will A.I. Ruin the Planet or Save the Planet?*

MIT News
ON CAMPUS AND AROUND THE WORLD

SUBSCRIBE

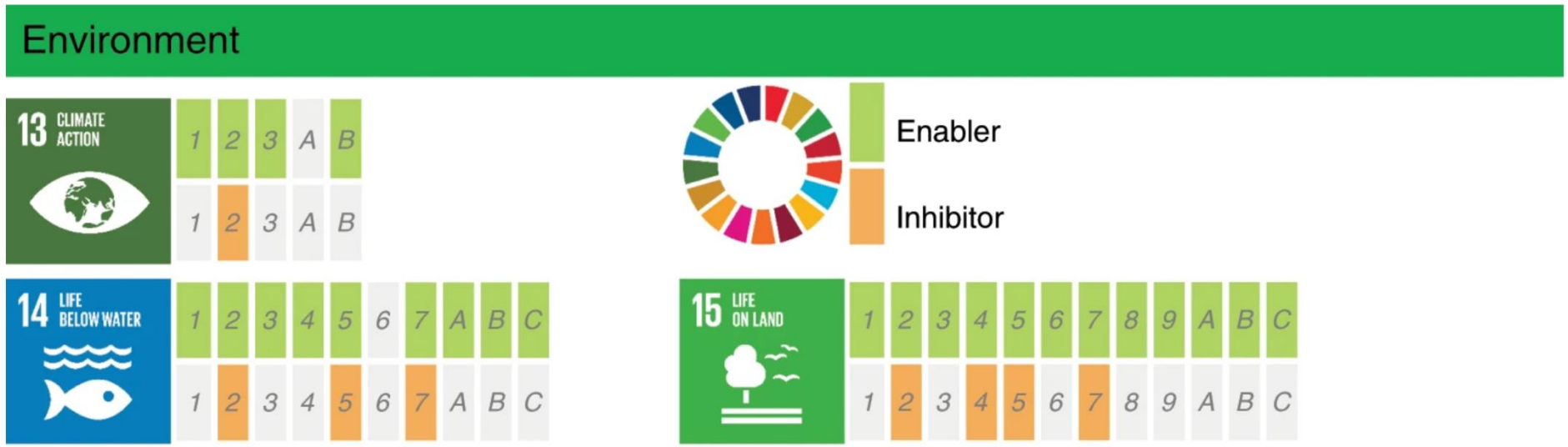
## Computers that power self-driving cars could be a huge driver of global carbon emissions

Study shows that if autonomous vehicles are widely adopted, hardware efficiency will need to advance rapidly to keep computing-related emissions in check.

Adam Zewe | MIT News Office
January 13, 2023

## Fig. 4: Detailed assessment of the impact of AI on the SDGs within the Environment group.

From: The role of artificial intelligence in achieving the Sustainable Development Goals




Documented evidence of positive or negative impact of AI on the achievement of each of the targets from SDGs 13, 14, and 15 (https://www.un.org/sustainabledevelopment/). The interpretation of the blocks and colors is as in Fig. 2. (The content of of this figure has not been reviewed by the United Nations and does not reflect its views).

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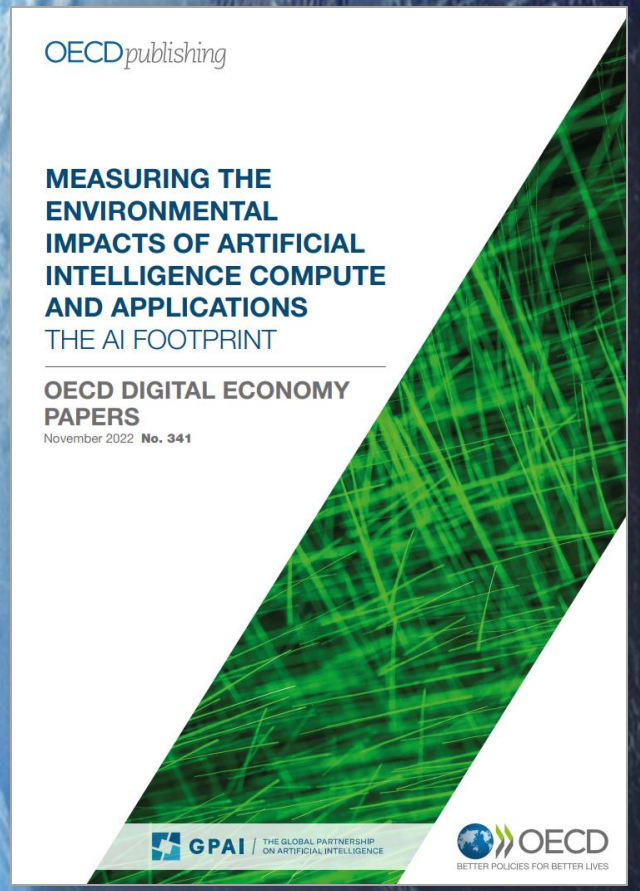
# Measuring the environmental impacts of AI

www.oecd.ai/footprint



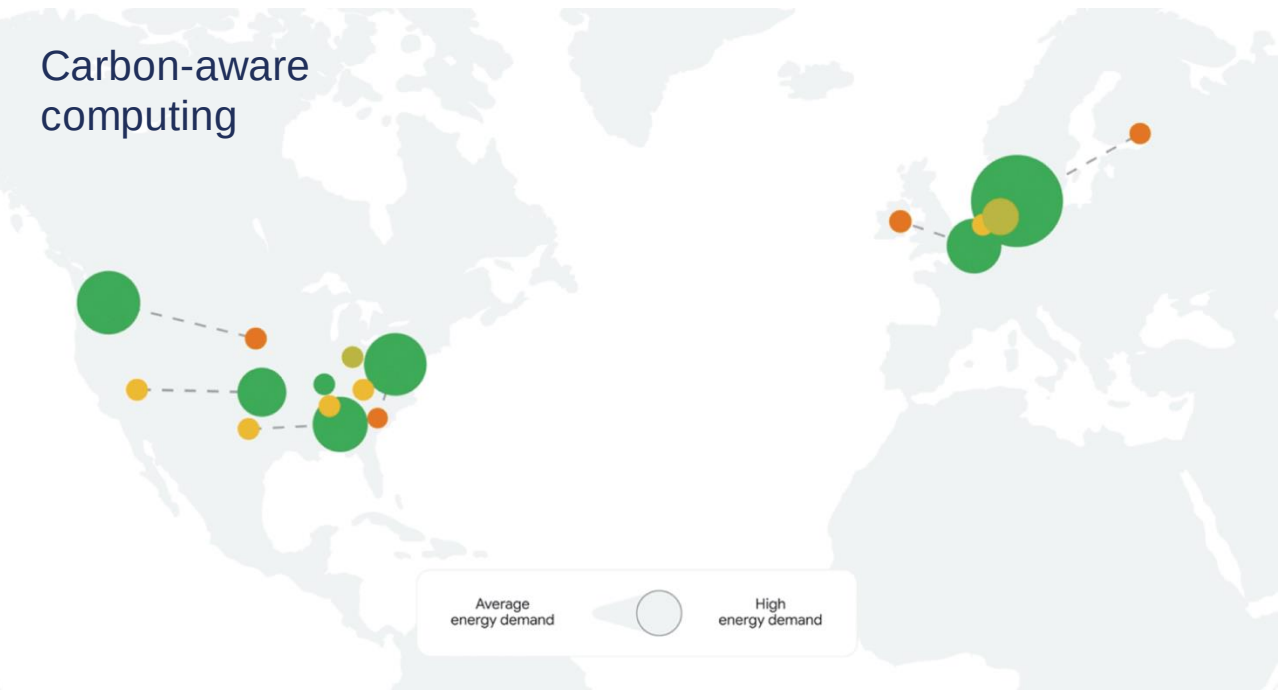
## Direct environmental impacts AI compute resources lifecycle

| Production | Transport | Operations | End-of-life |
|---|---|---|---|
| • Raw material extraction<br>• Assembly<br>• Manufacturing | • Distribution<br>• Freight transportation<br>• Handling & storage | • Energy consumption<br>• Water consumption<br>• Carbon footprint | • Collection & shipping<br>• Dismantling & recycling<br>• Waste disposal |

## Indirect environmental impacts AI compute applications

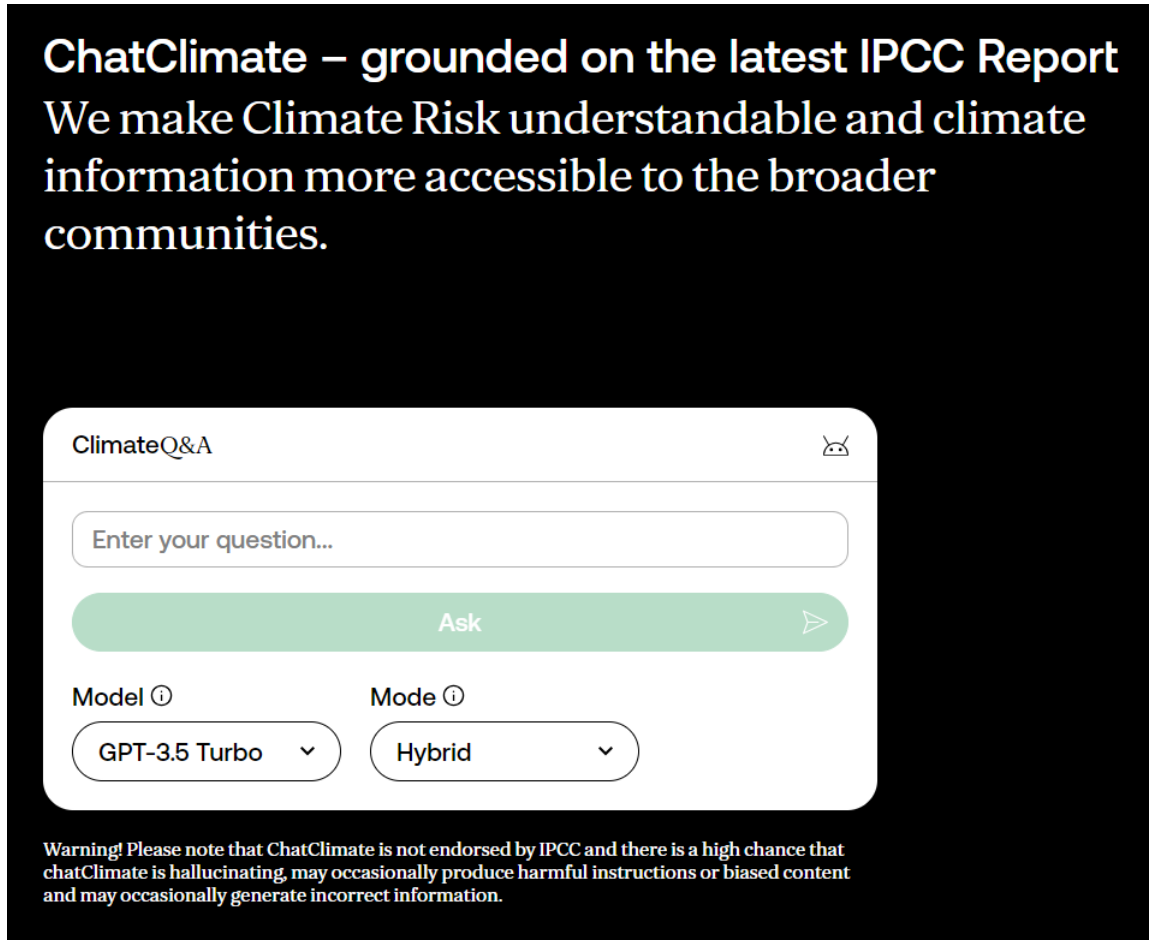
| Positive impacts | Negative impacts |
|---|---|
| • Beneficial sectoral applications<br>• Climate mitigation and adaptation<br>• Environmental modelling and forecasting | • Harmful sectoral applications<br>• Carbon leakage (net increase in emissions)<br>• Consumption patterns and rebound effects |

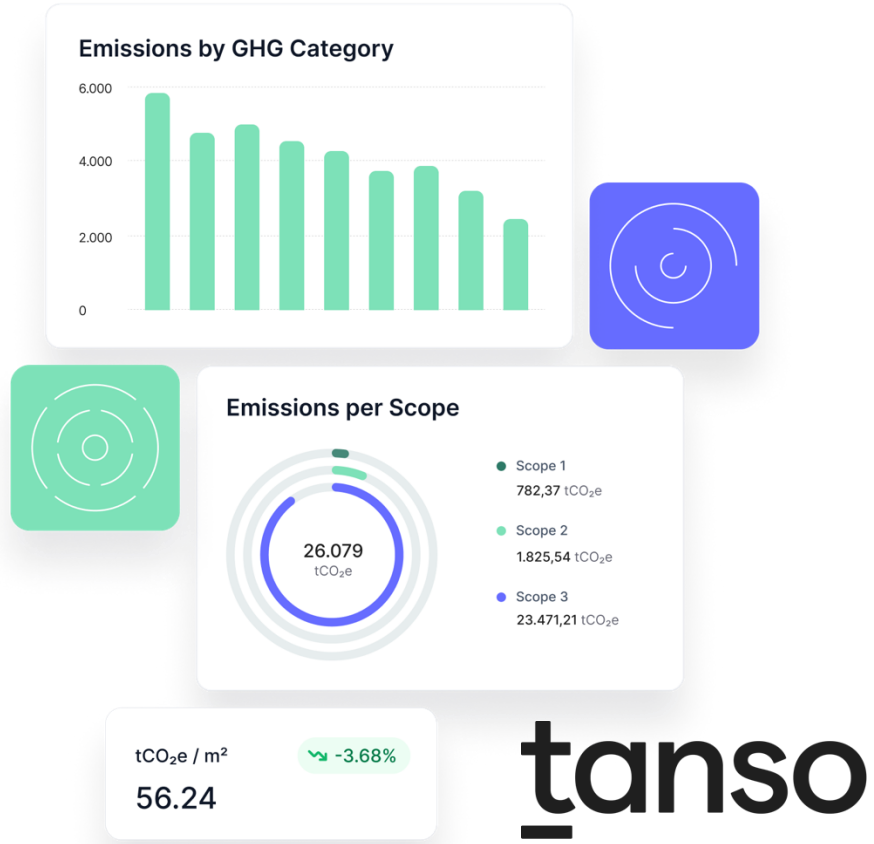





# AI applications enable sustainability solutions

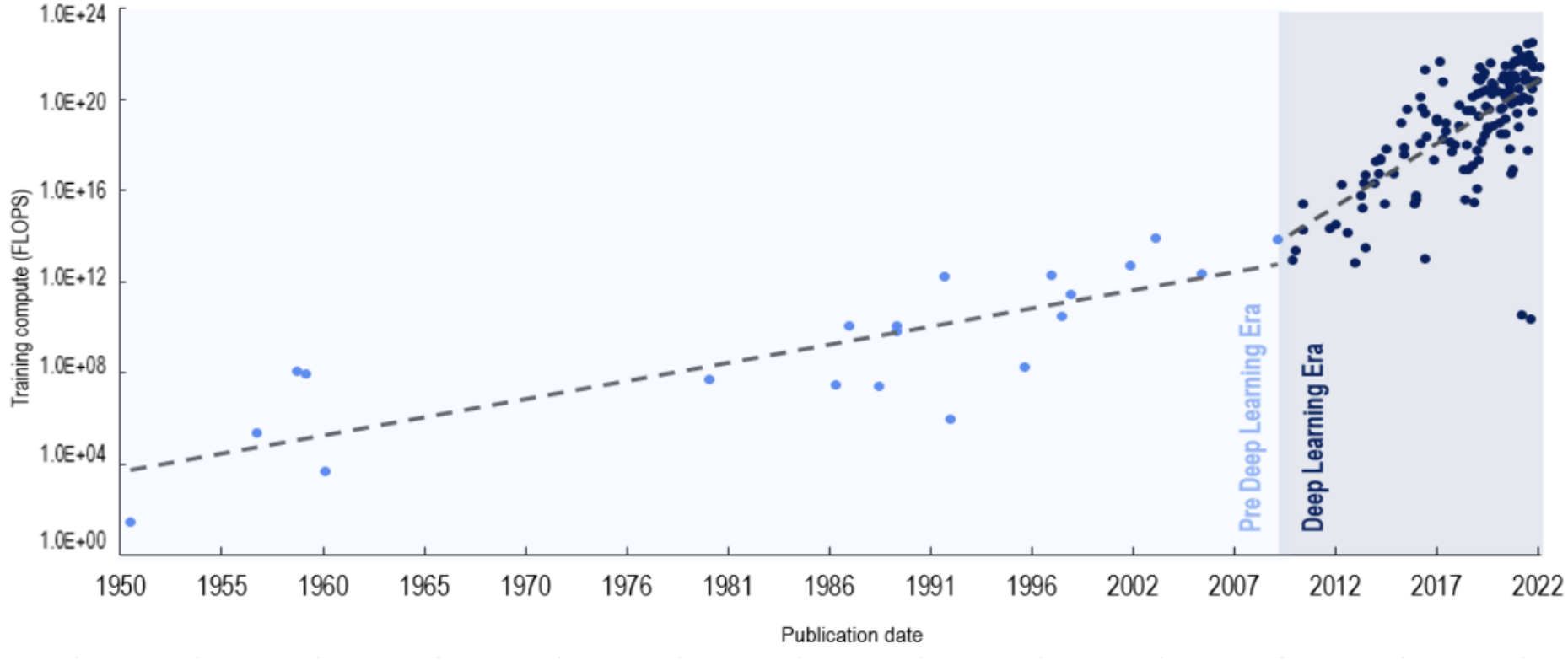
# Generative AI use cases for sustainability



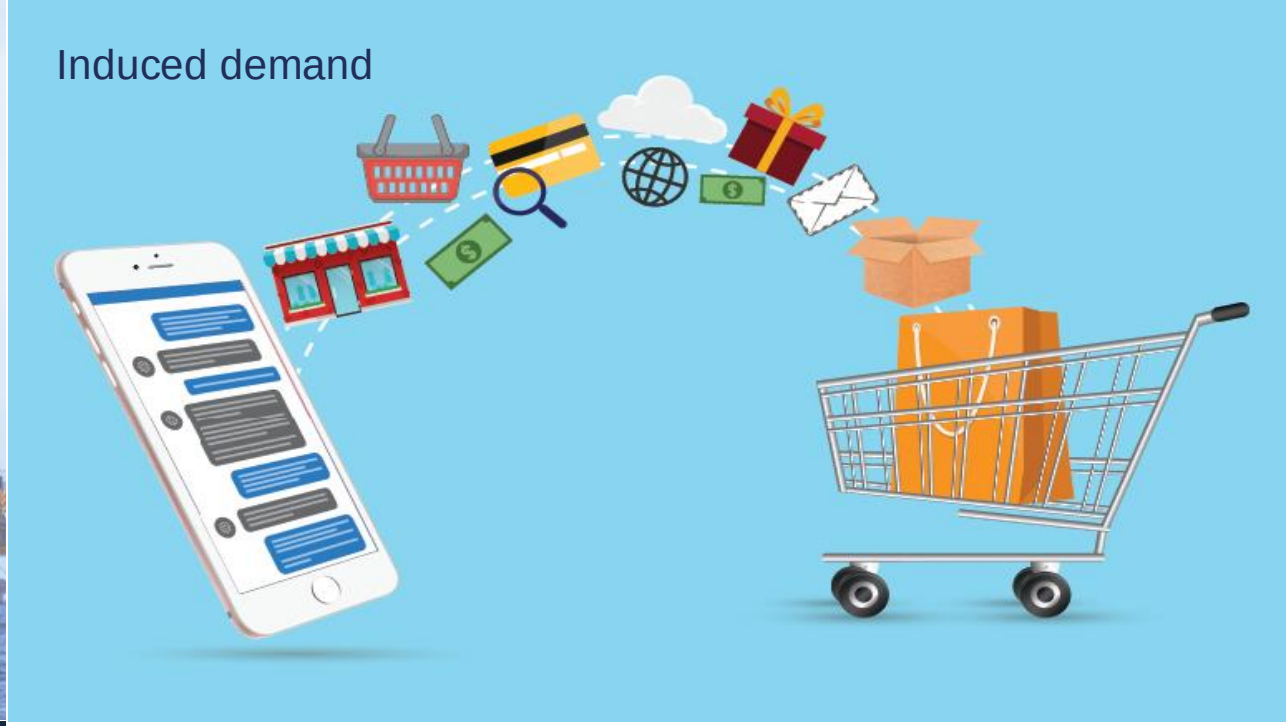



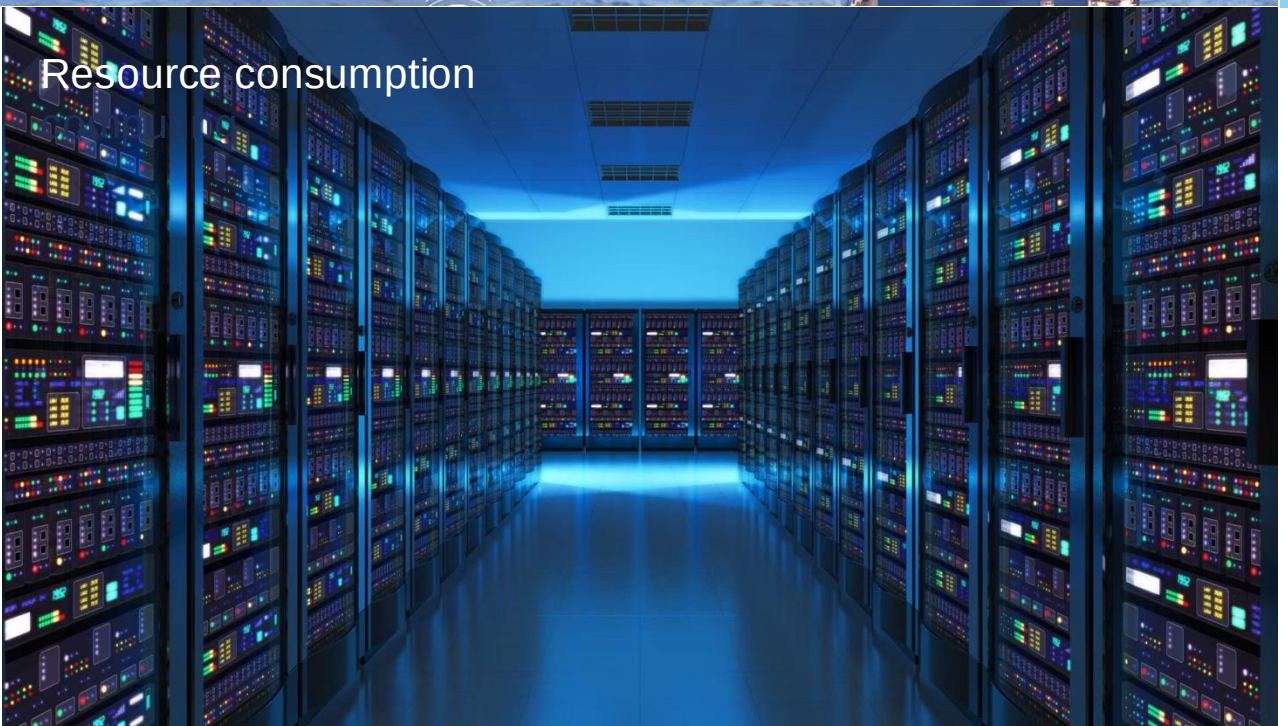
# Computation needs of AI systems are growing

**Figure 3. Estimated compute used for training milestone ML systems between 1952-2022**



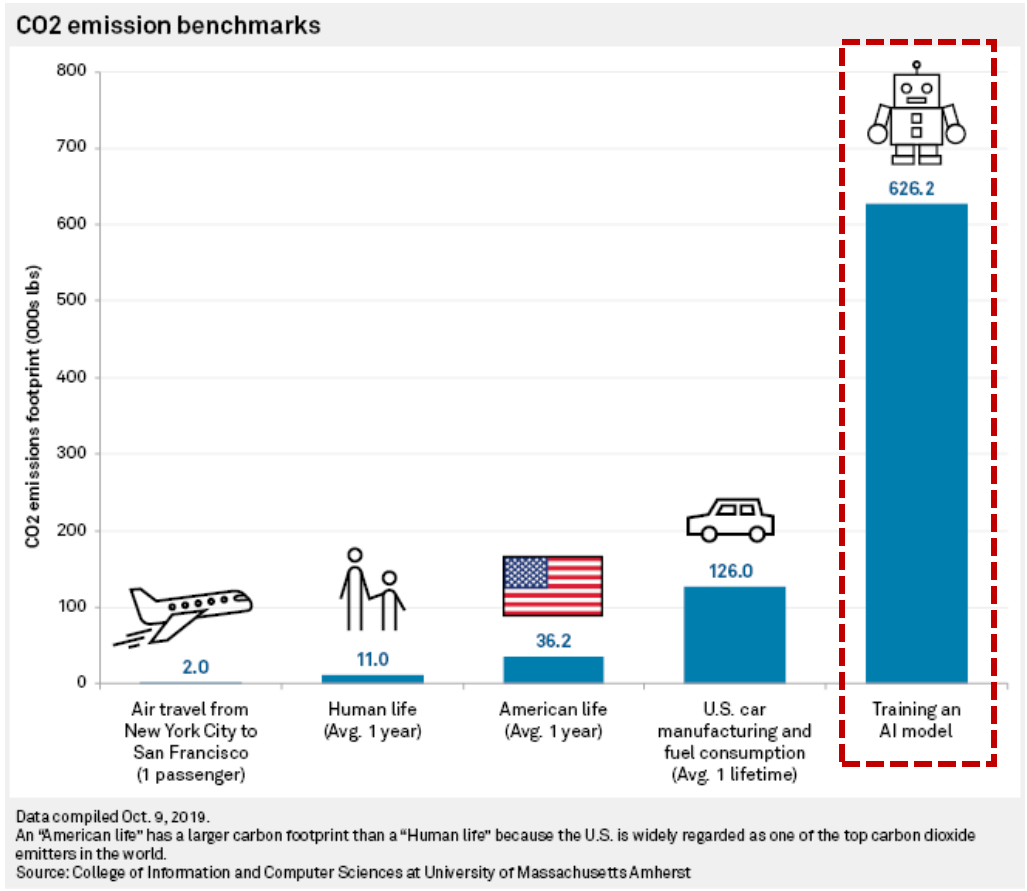

Source: Figure produced and adapted from data included in original work by (Sevilla et al., 2022[2])

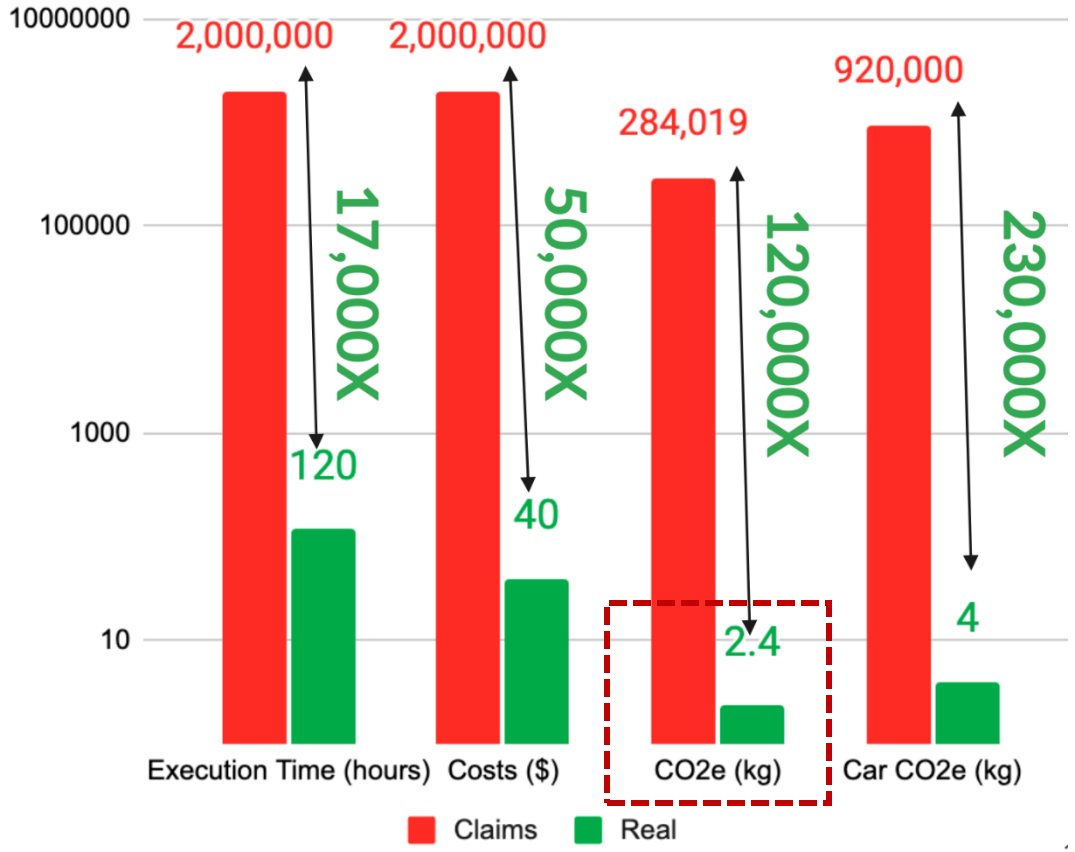




# AI applications accelerate the climate crisis

# Measuring the AI footprint is highly complex

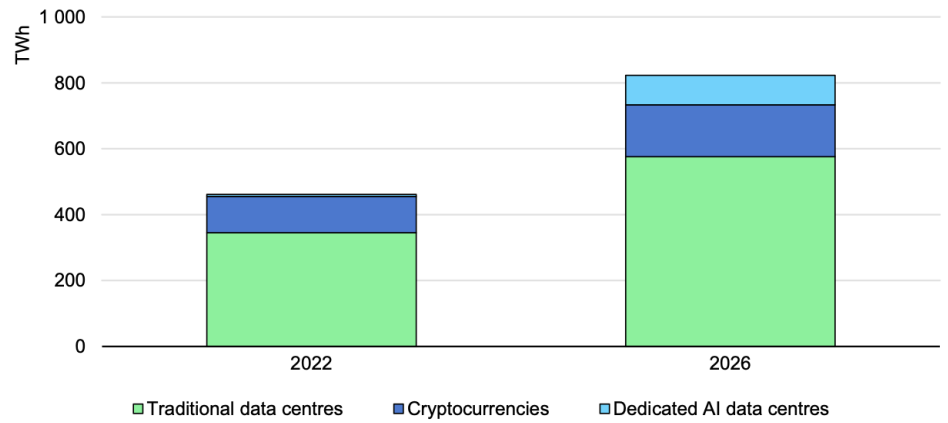



Source: Patterson, David, et al. "The carbon footprint of machine learning training will plateau, then shrink." Computer 55.7 (2022): 18-28.

# Does Generative AI change our analysis?

**Estimated electricity demand from traditional data centres, dedicated AI data centres and cryptocurrencies, 2022 and 2026, base case**

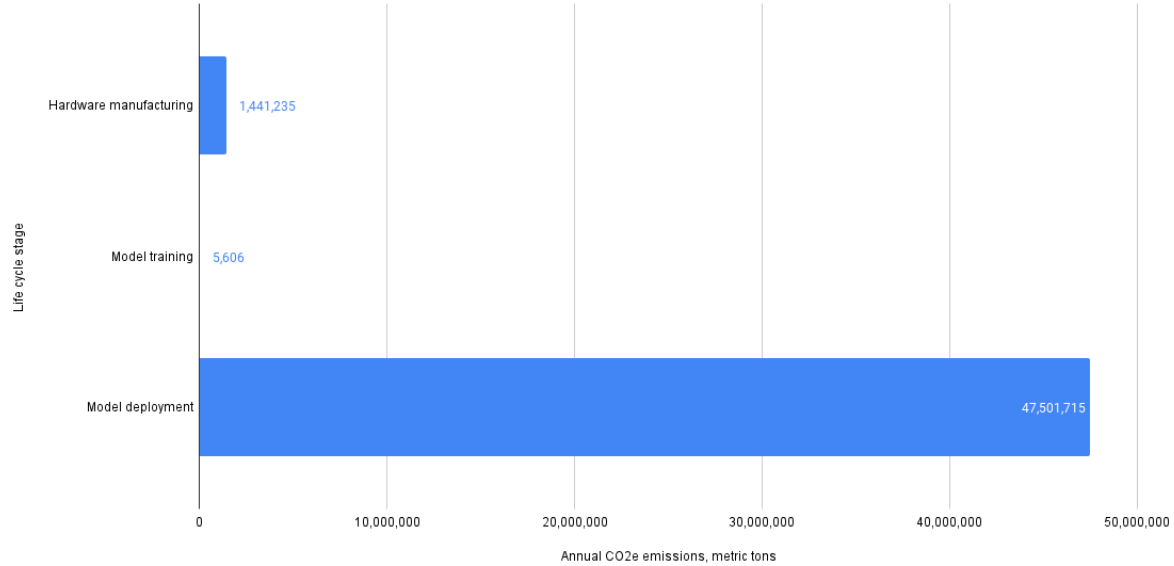





Note: Data centre electricity demand excludes consumption from data network centres.

Sources: IEA forecast based on data and projections from Data Centres and Data Transmission Networks; Joule (2023), Alex de Vries, The growing energy footprint of artificial intelligence; Crypto Carbon Ratings Institute, Indices; Ireland Central Statistics Office, Data Centres Metered Electricity Consumption 2022; and Danish Energy Agency, Denmark's Energy and Climate Outlook 2018.

Estimated annual emissions from large-scale adoption of generative AI, by life cycle stage




Source: Towards Data Science, Environmental Impact of Ubiquitous Generative AI

# How long can efficiency improvements limit energy growth from computation?

## Global trends in digital and energy indicators, 2015-2022

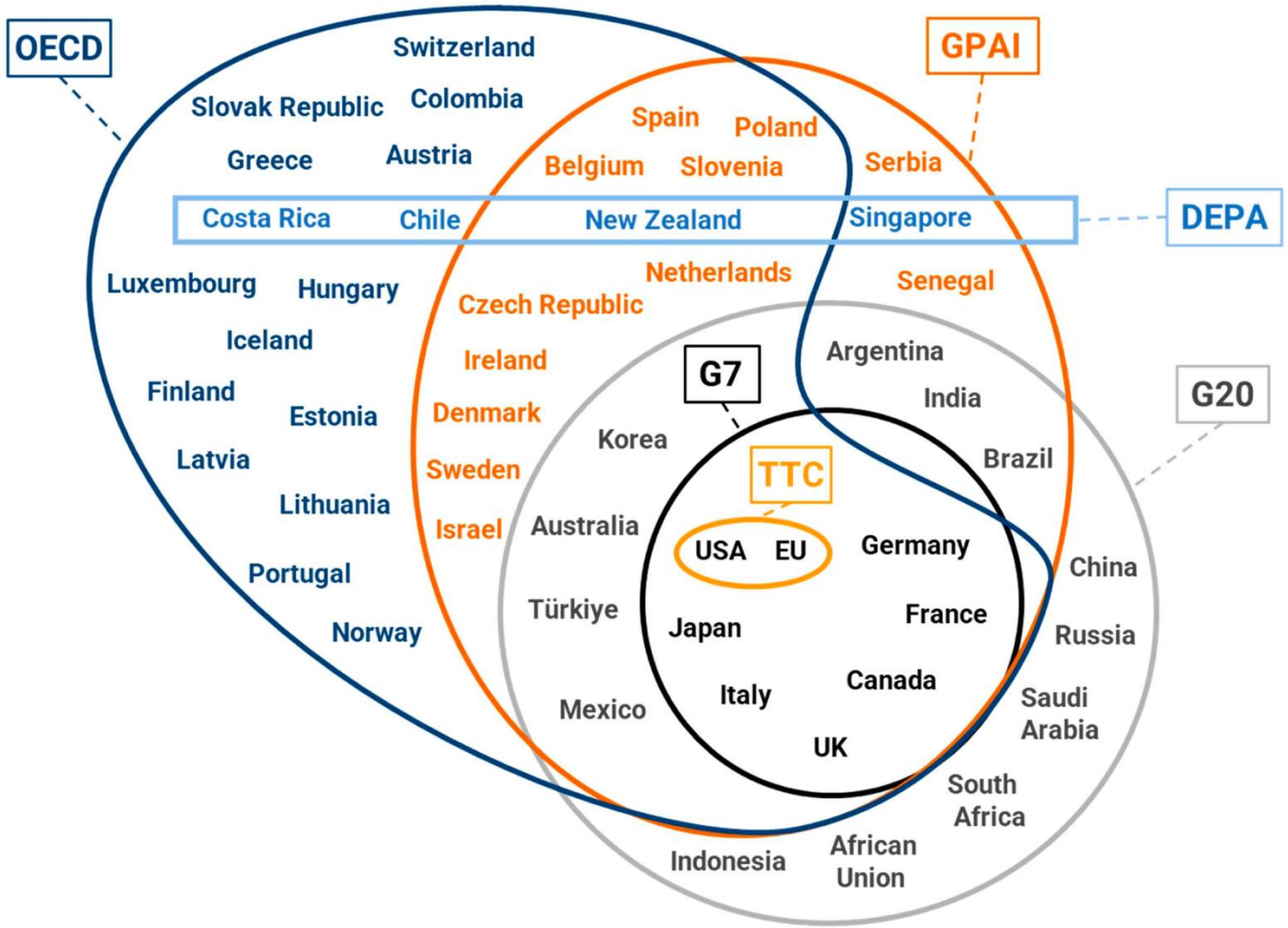
| | 2015 | 2022 | Change |
|---|---|---|---|
| Internet users | 3 billion | 5.3 billion | +78% |
| Internet traffic | 0.6 ZB | 4.4 ZB | +600% |
| Data centre workloads | 180 million | 800 million | +340% |
| Data centre energy use (excluding crypto) | 200 TWh | 240-340 TWh | +20-70% |
| Crypto mining energy use | 4 TWh | 100-150 TWh | +2300-3500% |
| Data transmission network energy use | 220 TWh | 260-360 TWh | +18-64% |

Sources: Internet users [ITU (2023)]; internet traffic [IEA analysis based on Cisco (2015); TeleGeography (2022); Telegeography (2023); Cisco (2019), Cisco Visual Networking Index]; data centre workloads [Cisco (2018), Cisco Global Cloud Index]; data centre energy use [IEA analysis based on Malmodin & Lundén (2018); ITU (2020); Masanet et al. (2020); Malmodin (2020); Hintemann & Hinterholzer (2022); Malmodin et al. (2023)]; cryptocurrency mining energy use [IEA analysis based on Cambridge Centre for Alternative Finance (2023); Gallersdörfer, Klaaßen and Stoll (2020); McDonald (2022)]; data transmission network energy use [Malmodin & Lundén (2018); Malmodin (2020); ITU (2020); Coroama (2021); GSMA (2022); GSMA (2023); Malmodin et al. (2023)].

BROOKINGS

CEPS

# Mapping International AI Governance Initiatives



THE AI ACT

"In order to (…) contribute to the **Union's environmental objectives** (…), it may be necessary to establish recommendations and guidelines and, eventually, **targets for sustainability**. For that purpose the Commission is entitled to develop a methodology to contribute towards having **KPIs and a reference for the SDGs."**

Social and environmental well-being' means that AI systems shall be developed and used in a **sustainable and environmentally friendly manner** as well as in a way to benefit all human beings, while monitoring and assessing the **long-term impacts** on the individual, society and democracy.

G7 2023 HIROSHIMA SUMMIT

**Code of Conduct**

9) Prioritize the development of advanced AI systems to **address the world's greatest challenges**, notably but not limited to the **climate crisis**, global health and education

OCTOBER 30, 2023

Executive Order on the Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence

"**Catalyze AI research** across the US through a pilot of the National AI Research Resource - a tool that will provide AI researchers and students access to key AI resources - and expanded AI research grants in vital areas like healthcare and **climate change**."

Policy paper

**The Bletchley Declaration by Countries Attending the AI Safety Summit, 1-2 November 2023**

Published 1 November 2023

We (…) affirm the need for the safe development of AI and for the transformative opportunities of AI to be used for good and for all, in an inclusive manner in our countries and globally. This includes (…), **clean energy, biodiversity, and climate**, to realise human rights, and to strengthen efforts towards the achievement of the **UN SDGs**.

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# Thank you!