

Inside the matrix – the environmental footprint of Artificial Intelligence

BACKGROUND AND CHALLENGES

In the face of worsening climate and environmental crises and their disproportionate impact on the most vulnerable populations, the [Humanitarian Environment Network](#) (REH) has, since 2020, been supporting a collective initiative involving international solidarity organisations. Adopted in December 2020 by 10 organisations, the [Statement of Commitment by International Solidarity Organisations on Climate and the Environment](#) has gradually brought together 15 signatory NGOs, committed to reducing their environmental impacts and transforming their operational practices. They have set a **target to reduce their operational carbon emissions by 50 per cent by 2030**, compared with an individually defined baseline year.

Digital technology now accounts for a growing share of global greenhouse gas emissions. Whilst artificial intelligence (AI) is often presented as a driver of efficiency, innovation and optimisation, it relies on **heavy infrastructure with a considerable material footprint** (data centres, networks, equipment) and on **energy-intensive uses** that remain largely invisible. Within humanitarian organisations, AI is beginning to be integrated into various tools and applications (office automation, information retrieval, data analysis, etc.). With a view to reducing our environmental footprint, it is therefore essential to **gain a better understanding of this environmental footprint** and to propose best practices that are compatible with the organisation's operational constraints.

BEFORE WE BEGIN: A METHODOLOGICAL NOTE

Before discussing the environmental footprint of AI, it is vital to take into account the lack of reliability of existing data on this subject. Indeed, measuring the environmental footprint relies on data provided by suppliers, which remains highly opaque. For example, *Amazon* does not disclose the water consumption of its data centres, arguing that this is not a suitable metric¹. Another example is the *Mistral* life-cycle assessment (in collaboration with ADEME and Carbone4), which is currently one of the most advanced studies on the environmental footprint of AI, but the methodology is not publicly available². A few studies have been published recently, and their data can be used with greater accuracy, but it is important to bear in mind the limitations of these studies. Thus, the figures presented in this document:

- are **estimates** rather than direct measurements and should therefore be understood as **orders of magnitude**.
- **vary significantly** depending on the AI model, the length of the prompts, the technical infrastructure and the energy mix of the country in which the data centres are located.

Finally, a significant limitation in environmental footprint calculations lies in the fact that this note focuses on the impact associated with the **use** of AI tools (for example, a prompt). However, the phase with the greatest impact in the life cycle of AI systems is generally their **training**. For reasons of data accessibility, this phase is not included in the data. The figures presented should therefore be regarded as **structurally underestimated** and subject to a significant margin of error.

The real challenge of AI's environmental footprint – its potential for exponential growth

We often talk about the impacts at a *given moment* or for a single query. However, the real challenge with AI is its potential for exponential growth. In fact, its environmental footprint is mathematically bound to increase, as AI is gradually integrated into our everyday work tools. Thus, even if the AI tools we use were to become increasingly efficient in their use of resources (which is not currently the case³), their integration into everyday tools is highly likely to lead to a *rebound effect* – that is, an overall increase in environmental impacts.

¹ <https://www.thetimes.com/uk/technology-uk/article/thirsty-chatgpt-uses-four-times-more-water-than-previously-thought-bc0pqswdr>

² <https://librairie.ademe.fr/industrie-et-production-durable/8506-etude-d-impact-environnemental-de-mistral-ai.html>

³ <https://www.deloitte.com/us/en/insights/industry/technology/technology-media-and-telecom-predictions/2026/compute-power-ai.html>

WHAT IS THIS IMPACT?

On a global scale

The environmental footprint of artificial intelligence spans its entire life cycle and is driven by several major factors :



Energy

Every request sent to an AI tool involves **data centres**, which consume electricity for computing, storage and server cooling. This consumption stems from both:

- everyday use (inference, text, image and video queries)
- the training of ever more powerful models, which require very large amounts of computing power.

Electricity consumption by data centres is expected to grow around **four times faster than global electricity consumption** by 2030.



Water

Data centres use large quantities of water for **cooling**. Some studies estimate that a query generating 100 words of text could use the equivalent of **a 500 mL bottle of water**, or even more, depending on the data centre's location.

Globally, water consumption linked to AI could amount to **4 to 6 times the annual consumption of a country such as Denmark** in the coming years.



Material and waste

The development of AI involves the **construction, expansion and refurbishment** of data centres, as well as the manufacture of specific electronic components (chips, servers), leading to:

- increased extraction of raw materials
- an increase in **waste electrical and electronic equipment (WEEE)**

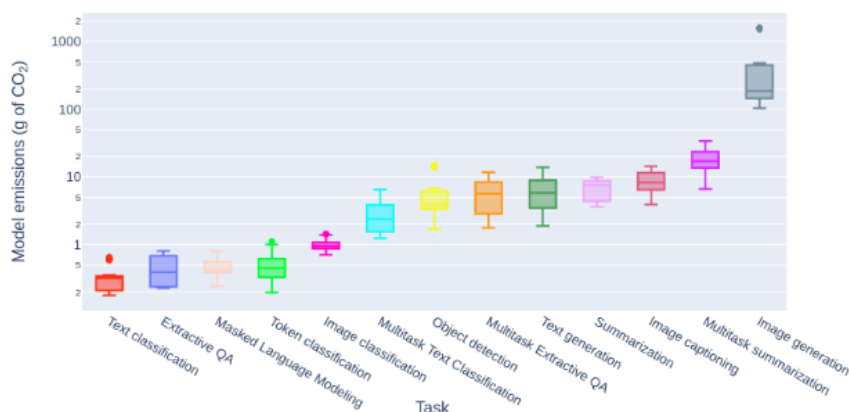
Some projections estimate that generative AI could be responsible for an additional **1.2 to 5 million tonnes of electronic waste** by 2030

Are all queries equal?

The environmental impact of a query depends heavily on:

- the complexity of the task requested
- the volume of data processed
- the type of content generated

The graph below provides some figures of magnitude⁴ :



Requests to **generate videos and images are by far the most resource-intensive⁵**, far more so than simple text requests. Furthermore, certain uses are more about experimentation or convenience than any real operational need. Beyond the environmental impact, these uses also raise **ethical questions**,

Figure1: The tasks examined in the study and the average amount of carbon emissions they generated (in gCO₂e) per 1,000 queries.

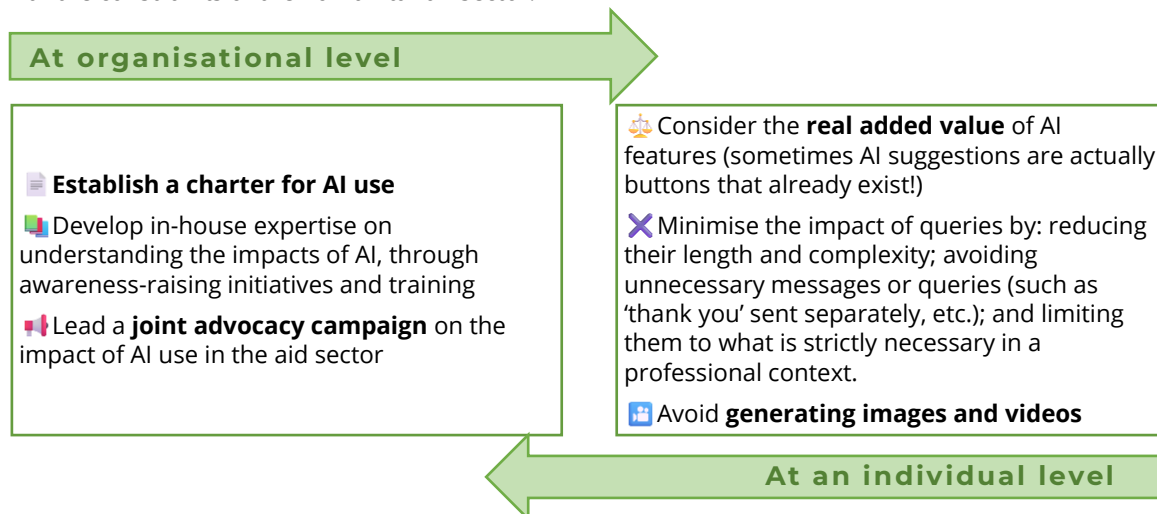
⁴ Alexandra Sasha Luccioni, Yacine Jernite, and Emma Strubell. 2024. Power Hungry Processing: Watts Driving the Cost of AI Deployment?. In ACM Conference on Fairness, Accountability, and Transparency (ACM FAccT '24), 3–6 June 2024, Rio de Janeiro, Brazil. ACM, New York, NY, USA, 21 pages. <https://doi.org/10.1145/3630106.3658542>

⁵ https://hai-production.s3.amazonaws.com/files/hai_ai-index-report-2024-smaller2.pdf

particularly regarding the generation of visual or textual content that does not exist, its biases and its effects on representations.

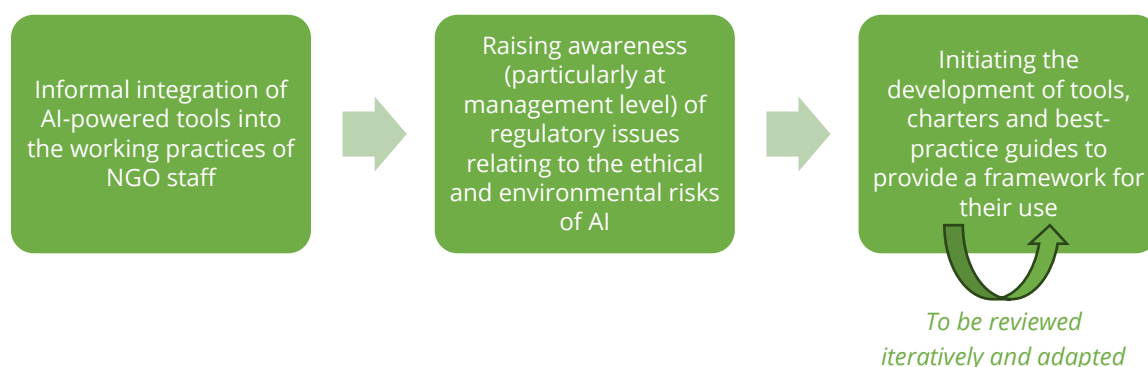
IN PRACTICAL TERMS, WHAT CAN BE DONE?

The courses of action identified by the Carbon Working Group are based on simple measures that are compatible with the constraints of the humanitarian sector:



Working Group's experience – how NGOs are attempting to address AI challenges at an organisational level

For the organisations in the Carbon Working Group, and for many other NGOs, the advent of AI is beginning to disrupt working practices and operational methods. The challenge lies in the fact that organisations need time and resources to adapt to a technology that is developing very rapidly. Against a backdrop of ever-tighter resources and competition for funding, the question of integrating AI into NGOs' operating models is therefore seen both as an opportunity and as a major risk, and may be experienced as 'a race against time' to regulate its use. The NGOs in the working group have adopted fairly similar practices:



For example, Médecins du Monde developed an AI charter to guide its use, which had to be revised retrospectively to incorporate certain principles, notably that of sobriety, in line with the organisation's environmental commitments. Première Urgence Internationale, as part of their initiative, worked with an internal working group to develop not only a policy, but also a charter and a guide to best practice to support their teams.

The need to support teams is a real challenge for NGOs in contexts where resources are already limited.

TO FIND OUT MORE

There are many other issues surrounding AI (such as ethics and data protection) and it is a constantly evolving ecosystem. The toolkit developed by CartONG provides access to up-to-date guidelines tailored to the humanitarian sector: https://cartong.pages.gitlab.cartong.org/learning-corner/fr/8_further_RD/8_3_AI

Several French associations and NGOs have also joined forces in an open letter to raise awareness of the impacts of AI and, above all, to call for appropriate resources to support them⁶. Joint advocacy can be a powerful tool available to NGOs to raise awareness of the impacts of AI and to equip themselves as effectively as possible to deal with these changes.

CONCLUSION

After nearly five years of sustained momentum, reflection and dialogue amongst NGOs regarding decarbonisation targets and monitoring, organisations are now considering and exploring various ways to reduce their carbon footprint. This knowledge-sharing document serves as a reminder that our use of AI generates negative environmental impacts, which must also be taken into account in NGOs' ecological transition. There are, in fact, ways to reduce these impacts both individually and collectively. The Carbon Working Group therefore conveys the following messages:

- Artificial intelligence is not intangible. Behind every query lies the consumption of energy, water and resources, as well as very real social and environmental impacts
- **It is not isolated uses that pose a problem, but their proliferation and normalisation.** Adopting a sensible and restrained use of AI is a simple, collective and immediately actionable lever for humanitarian organisations
- It is essential to continually scrutinise how AI is used and to support teams in applying the **principle of sobriety** in their use of AI

This knowledge-sharing sheet forms part of a broader initiative on the digital footprint led by the REH's Carbon Working Group. [Other sheets on the footprint of messaging services and equipment are also available](#). If you have any questions, or if you are interested in working on this topic, please do not hesitate to contact: carbone@environnementhumanitaire.org

⁶ <https://www.lesechos.fr/idees-debats/cercle/renforcer-les-associations-grace-au-numerique-et-a-lia-2184078>