Forum: Special Conference on Environment

Issue: Addressing and reducing the severe effects the usage of AI has on the environment and natural resources

Student Officer: Serap Tuba Kudaloğlu

Position: Deputy Chair

Introduction

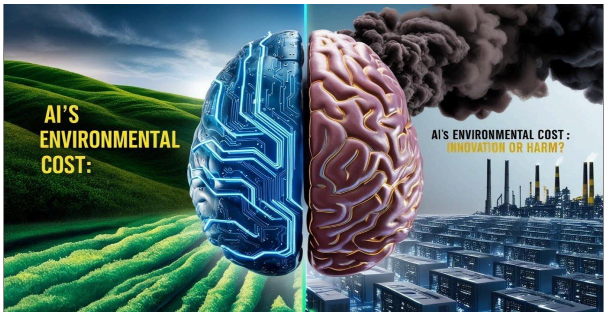

Figure 1: Contrasting AI's benefits with it's environmental costs.

One of the most significant technologies of our time is artificial intelligence (AI), which is changing every aspect of how people interact, work, and solve problems. Medical diagnosis systems and virtual assistants are two examples of how this technology is improving human life. However, there is an unnoticed environmental cost associated with this technology's revolutionary power. Now that these systems are becoming more sophisticated and widely used, their environmental impact is only growing. In addition to attempting to identify solutions, this report analyzes the effects that artificial intelligence has on massive energy consumption, water use, and e-waste generation.

The massive amount of electricity required mostly to run and cool the computers running the AI systems is one way that AI is beginning to disrupt the environment. Currently, data centers that house these devices consume more electricity than many small nations, roughly 3% of global electricity consumption. One contemporary AI model's training is the same as emitting as much carbon dioxide as 300 round-trip flights between New York and London. The majority of these data centers are powered by fossil fuel plants, which makes the situation worse. Think about this: an AI training run uses enough water to fill an Olympic swimming pool, demonstrating how intensive water cooling is for such systems.

Hardware for AI is another severe crisis. The production of computer chips and servers requires rare minerals that pose a threat to the environment because their mining methods damage natural habitats. After the completion of their life cycle, this hardware turns into a form of e-waste that has toxic substances in it. At the moment, there is barely 20% of this e-waste that is recycled properly, while the rest is poured into landfills, polluting the soil and water. With the rapid growth of AI, all these problems will only be multiplied unless we act now.

AI hardware is another serious crisis. Rare minerals are needed to make computer chips and servers, but their mining practices harm natural habitats, making them environmentally hazardous. Upon completion of their life cycle, this hardware becomes a type of e-waste that contains hazardous materials. Only 20% of this e-waste is currently recycled effectively; the remainder is dumped in landfills, where it pollutes the land and water. Unless we take immediate action, all of these issues will only get worse due to AI's explosive growth.

Our lifetime choices will be the ones we make regarding AI and the environment. For the sake of the planet's future, it is necessary to draw a thin line between innovation and sustainability as this technology grows in strength and use.

Definition of Key Terms

Artificial intelligence (AI)

In computing, artificial intelligence means the execution of human intelligence tasks such as problem-solving, decision-making, and language processing. Consider chatbots, image recognition software, or self-driving cars as examples of AI technologies. For instance, ChatGPT is an AI program capable of generating human-like text in response to user prompts.

Carbon footprint

A carbon footprint is the general measure of greenhouse gas emission by an individual, an organization, or an activity expressed in terms of carbon dioxide equivalents (CO_2e). With respect to AI, the carbon footprint would come from emissions due to training the ML models, emissions from operating data centers, and manufacturing emissions from hardware. For instance, training a single AI model emits as much carbon dioxide as 300 round-trip flights between New York and London.

Data center

A data center is a facility where teams of computer systems are set to store, process, and distribute large quantities of data. In its training and automated use, AI depends on data centers that consume huge amounts of energy and water to sustain cooling. In 2023, for example, Google's data centers will race through 15.5 terawatt hours of electricity, which is equal to Puerto Rico's consumption for an entire year.

E-waste

E-waste is basically discarded AI hardware such as servers and chips that otherwise comprise toxic materials, including lead and mercury. A mere 20 percent of global e-waste sees recycling; the rest pollutes landfills. This issue is worsened by AI's rapid development because outdated machinery is continuously replaced with newer ones.

Machine learning

A subset of AI, machine learning involves algorithms that improve automatically through experience and data analysis. For example, recommendation systems on Netflix use machine learning to suggest shows based on viewing history. However, training these algorithms requires vast energy resources.

Water footprint

The water footprint measures the total freshwater used directly and indirectly to sustain AI operations. Cooling data centers consumes significant water; Microsoft's AI training for GPT-3 used 700,000 liters (enough to fill an Olympic-sized swimming pool). In drought-prone regions, this strains local water supplies.

Background Information

Energy consumption and carbon emissions

The rapid development of artificial intelligence (AI) has equally seen a rise in energy demand. Training of large AI models like GPT-4 requires massive computation power, which often consumes thousands of megawatt-hours of electricity and releases hundreds of tons of carbon dioxide . A study that analyzed 79 prominent AI systems released from 2020 to 2024 estimated that the top 20 systems could emit conjointly up to 102.6 million metric tons of CO_2 equivalent each year .

Data centers being crucial to any AI program, the demand for energy from them is quite high. Google's 2024 Environmental Report stated that its greenhouse gas emissions climbed up by 13% in just one year due to energy consumption of AI and its data centers . The carbon footprint of the AI is surely on a rise despite the energy efficiency enhancement; can this really be sustainable?

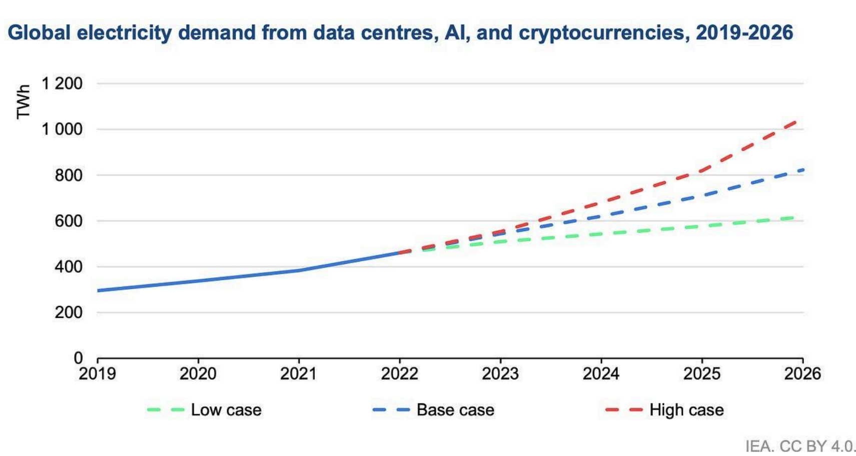

Figure 2: Global electricity demand from data centres, AI, and cryptocurrencies, 2019-2026. Data indicates a significant upward trend, highlighting the environmental impact of AI development.

Water usage in AI data centers

Another factor thrusting water economies open consists of water-intensive activities, specifically cooling processes. Data centers in the US draw approximately 7,100 liters of water for every megawatt-hour of energy consumed. For 2021, Google aside accounted for 12.7 billion liters of fresh water consumed within U.S. data centers.

Large water consumption is challenging from many perspectives, especially when water availability is threatened. The estimated water consumption by AI technologies, if escalated, will reach 6.6 billion cubic meters by 2027, making the freshwater concern more severe. The depleting factors involve thermal pollution, whereby the lubricated warm water is able to annihilate aquatic ecosystems.

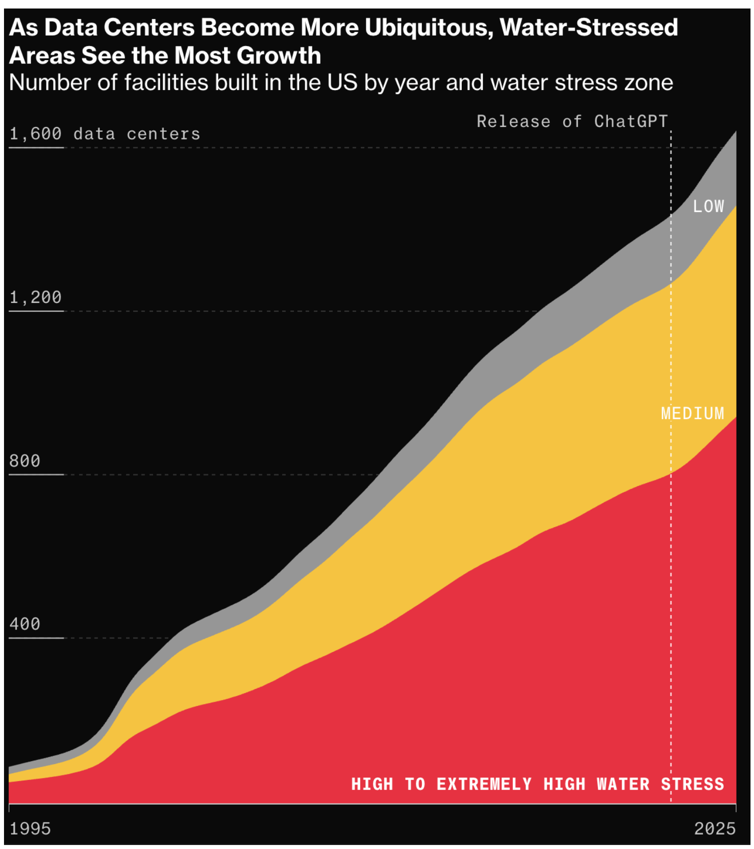

Figure 3: Geographical overlap of AI data center locations and water stress levels in these areas. The map shows the environmental implications of water-intensive AI operations in vulnerable areas.

Electronic waste (e-waste) generated by AI hardware

GAI technology proliferation has resulted in a mushrooming amount of e-waste due to the frequent upgrading or simply disposing of hardware components like GPUs and servers. A few researchers have projected that in a highly aggressive AI scenario, generative AI might expire 5 million tons of e-waste in between 2023 and 2030. What is scary about this is that at this point in time, only 22% of e-waste is recycled in an environmentally friendly manner.

E-waste contains hazardous materials such as lead, chromium, and mercury, all of which pose serious health and environmental risks ifnot managed. With the swift turnover of AI hardware for more powerful and efficient components, the situation is worsening for e-waste and urgently demanding the sustainability toward hardware lifecycle management.

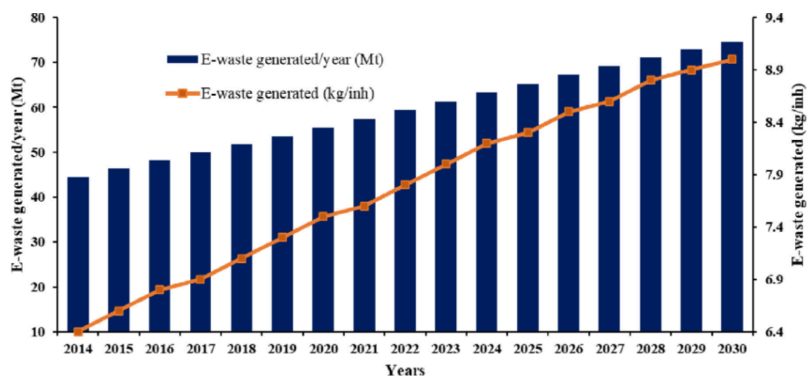

Figure 4: Projected increase in e-waste (2014–2030). The chart illustrates the potential escalation of e-waste generation in correlation with years, thus AI expansion.

Uneven distribution of environmental impacts

The environmental impacts of AI are not distributed evenly around the globe. Developed countries build and maintain most AI services and data centers and often-worker environmental burdens to less-developed areas. For example, extraction of rare earth minerals essential for AI hardware mostly happens in countries with loose environmental regulations, causing environmental degradation and health effects to local communities.

Furthermore, placing data centers in locations with cheap electricity and water resources can prove burdensome for the local infrastructure and ecosystem. These instances, in turn, raise ethical issues about environmental justice and equitable sharing of the by-products and benefits of AI.

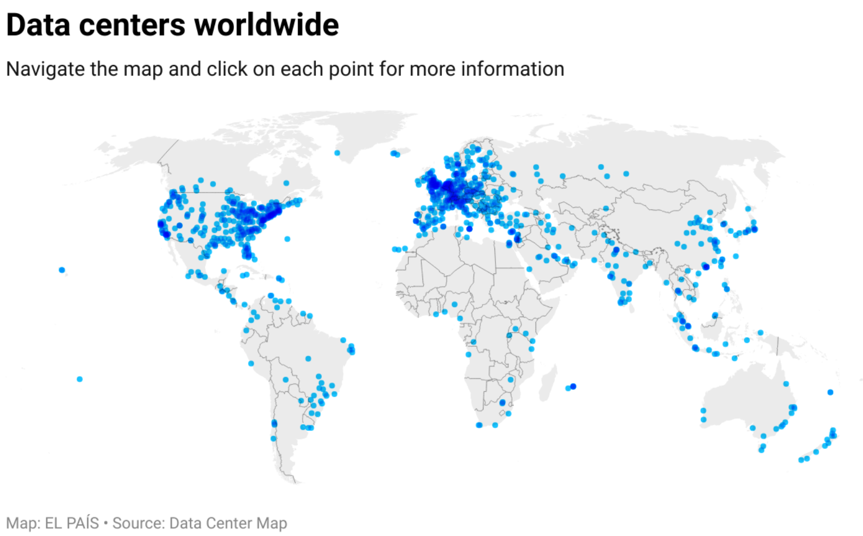

Figure 5: Global distribution of AI data centers and resource extraction sites. The map highlights the environmental inequalities associated with AI infrastructure.

Major Countries and Organizations Involved

United States

Leading the world in AI innovation, the United States is nonetheless faced with criticism regarding the environmental cost involved in making technologies work. President Biden's 2023 Executive Order on AI (EO 14110), which indeed emphasized the establishment of energy-efficient data centers, has been undermined by many data centers in the U.S. which remain reliant on fossil fuels, thereby contributing to 45% of the global electricity use by data centers. Launched in 2024, together with companies such as Google and Microsoft, the Partnership for Global Inclusivity on AI (PGIAI) seeks to advocate for sustainable AI. However, activists critique it for having no binding targets. Sierra points at that Silicon Valley make tons of empty "green pledges" while building and expanding an energy-intensive AI infrastructure.

China

China dominates AI hardware production but struggles with its environmental impact. Its 2023 "Green AI" guidelines encourage energy-saving algorithms, but data centers are 60% coal-powered and rare-earth mining (for gallium in chips) is highly polluting. China claims to be carbon-neutral by 2060, but enforcement is lax, and the AI industry here favors growth over sustainability. More controversially, Chinese firms such as Huawei promote "eco-friendly" AI whilst sourcing their materials from mines that have been implicated in the deforestation of areas in Africa and Southeast Asia.

France

France has become a prominent leader in the advocacy of environmentally sustainable AI. At the AI Action Summit in Paris during the beginning of 2025, the Coalition for Environmentally Sustainable Artificial Intelligence was formed. This brought together over 90 individuals, governments, companies, and UN agencies in support of AI technologies that respect the environment. France also released the General Framework for Frugal AI, a voluntary national standard for promoting low-resource, low-impact AI systems, thus signaling a pragmatic shift toward "frugal" or appropriate innovation. This movement has the support of French research institution Inria and the Ministry for Ecological Transition, who then published a Position Paper on AI and the Environment in 2024 that identified key issues such as raw material use, carbon emissions, and e-waste.

The United Kingdom

The United Kingdom, meanwhile, has been subjected to increasing criticism for sending contradictory signals about AI development and environmental protection. In January 2025, the government named Oxfordshire its first AI Growth Zone, in a bid to promote infrastructure and investment into high-tech fields. However, the placement within the context of the planning of Abingdon Reservoir has stirred some controversy with worries being raised on the water scarcity aspect, as vast quantities of water are needed for cooling AI data centers. Environmental groups and MPs all warned that the proliferation of AI could exacerbate existing infrastructure and climate vulnerabilities within the UK. The UK, though supporting the ideals underpinning the EU AI Act and funding initiatives into AI ethics, is, by contrast, not in the habit of legislating upfront on the environmental impacts of AI, so the picture is suggestive of a more reactive approach.

Brazil

The advantages of clean energy in Brazil draw AI investments from around the world into the country since almost 90% of its electricity is from renewable sources, with hydropower being the primary source. The low-carbon infrastructure is favorable for the country's digital transformation and green economy ambitions. However, experts recommend that Brazil must develop improved data security, hardware recycling capabilities, and AI governance frameworks for it to achieve sustainable scaling. The gains of clean electricity can be negated by uncontrolled growth and spread of e-waste, and therefore there needs to be better data protection and governance.

European Union (EU)

The EU is one of the global leaders in regulating the environmental footprint of AI. Its AI Act (2024) requires transparency concerning energy consumption, while the European Green Deal funds projects like "Climate-Neutral Data Centers by 2030". Germany, for instance, powers its data centers with renewable energy and uses AI to optimize energy grids. The EU, however, receives pushback from corporations who blame these regulations for inhibiting innovation, and Eastern European members (like Poland) resist because they rely on coal.

International Energy Agency

According to the 2024 report by the IEA, Energy and AI, AI could bring about a doubling of the electricity demand by data centers by 2030, thus calling for a shift to renewables. While the IEA engages in a collaboration with tech firms to increase efficiency, its recommendations are non-binding. Critics have pointed out that the close relationship to fossil fuel industries compromises the credibility of IEA since it still considers gas and nuclear power as “sustainable” solutions to AI energy needs.

United Nations

The 2024 AI Resolution of the UN tries to link AI development to the Sustainable Development Goals (SDGs), while its Environment Programme (UNEP) works toward reducing e-waste from AI hardware. Nevertheless, dependence on voluntary pledges (such as the “AI for Good” Summit) limits the abilities of the UN to move forward. Developing countries fault the UN for allowing rich countries and corporations to drive the agenda at the expense of regions in the Global South (such as Ghana, Bangladesh), which are bearing the heaviest cost of e-waste dumping from discarded AI equipment.

Tech Companies

- Google: Promises carbon-free data centers by 2030 and builds efficient AI models such as “Green Transformer,” yet its expansion into AI-powered cloud services is driving a global increase in energy consumption.
- Microsoft: Investing in nuclear-powered data centers and a “Planetary Computer” for environmental monitoring, yet its partnership with oil companies (e.g., Chevron) to optimize oil drilling conflicts with its sustainability credentials.
- NVIDIA: Designs low-power AI chips, but the crypto-mining boom (fuelled by its GPUs) has caused massive energy waste, raising questions about its commitment to sustainability.

Timeline of Events

Date	Description of event

7 June 2018	Researchers at UMass Amherst publish study showing training a single AI model could emit as much carbon as five cars over their lifetimes.
8 October 2021	UN Human Rights Council adopts Resolution A/HRC/RES/48/13 recognizing access to clean environment as human right.
21 April 2022	European Commission publishes first draft of EU AI Act.
15 March 2023	UC Riverside study reveals training GPT-3 in Microsoft's Iowa data center consumed 700,000 liters of freshwater.
5 June 2023 (World Environment Day)	"Artificial Intelligence and Climate Change: Opportunities and Challenges" is released by UNEP.
30 November 2023	At COP28 in Dubai, 28 nations launch "AI for Climate Action" coalition.
13 February 2024	OpenAI discloses that GPT-4 training consumed 51,803 MWh electricity.
8 May 2024	US-EU Trade and Technology Council agrees on "Green AI Partnership"
1 July 2024	Google converts its Oklahoma data center to full liquid cooling system, reducing water usage by 42%.
6-11 February 2025	The AI Action Summit is held in Paris, where 58 countries sign the "Statement on Inclusive and Sustainable Artificial Intelligence for People and the Planet".

May 13 2025	An IMF study shows that AI could contribute up to 1.7 gigatons of CO_2 emissions from 2025 to 2030.

Relevant UN Resolutions and Other Documents

- UN General Assembly Resolution on Safe, Secure, and Trustworthy AI: Resolution A/78/L.49, proposes that AI systems be developed in a safe, secure, and trustworthy manner. It highlights the importance of linking AI development with human rights and the Sustainable Development Goals.nb
- UNEP Issue Note: Artificial Intelligence (AI) End-to-End – The Environmental Impact of the Full AI Lifecycle Needs to Be Comprehensively Assessed: This issue note by UNEP highlightes the necessity of assessing the environmental impacts of AI throughout its entire lifecycle.
- UNESCO Recommendation on the Ethics of Artificial Intelligence: This recommendation provides a global framework for the ethical development and use of AI, emphasizing principles such as human rights, inclusiveness, and environmental sustainability.

Previous Attempts to Solve the Issue

UN Efforts:

- UNESCO Recommendation on the Ethics of Artificial Intelligence (2021): This recommendation was the first time that UNESCO and any other UN organization laid down ethical standards for AI. It considers fairness, transparency, and humanity in broad terms while explicitly underlining environment sustainability. It encourages member states to make sure that AI models are energy-efficient and that at every stage of development, deployment, and disposal, this new technology does not cause undue ecological harm. Hence, many members consider it a framework document in working out their own policies toward AI.
- UNEP Issue Note on AI and Environmental Sustainability (2024):

In this briefing paper, the UN Environment Programme (UNEP) examined the full lifecycle impacts of AI. It considers water usages, carbon emissions, and hardware demands. The paper called for a standard environmental impact assessment methodology to be developed for AI systems and for collaboration among governments, academia, and tech companies to set down clear guidelines on sustainability.

Government's Attempts:

- President Biden's Executive Order 14110 on AI (2023):
  This U.S. executive order urged federal agencies to advance AI in a manner that was safe, secure, and trustworthy. Although the main thrust was national security and civil rights, the order also urged investment in energy-efficient AI infrastructure and sustainable AI model development.However, critics noted the order lacked binding sustainability benchmarks and gave tech companies significant autonomy in self-regulation.
- France's General Framework for Frugal AI (2024):
  France established a voluntary standard of low-resource AI models with low impact on environment called Frugal AI. It was established by the Ministry of Ecological Transition and Inria as a part of a bigger platform for digital sustainability in France. The framework, though significant for the EU, is non-binding and remains an implementation issue left to developers and companies.

Private Sectors' Attempts:

- Microsoft's Water-Positive by 2030 Pledge (2021):
  Under this pledge, Microsoft will become water-positive by 2030 by replenishing more water than it consumes for use in water balancing operations related to AI-powered cloud and data center operations. It introduced AI systems to optimize the cooling operations. However, critics believe the company could be negating its gains by presently erecting water-intensive data centers.
- Google's Carbon-Free by 2030 Initiative (2020–present):

Google is committed to operating on 24/7 carbon-free energy in all its data centers and campuses by 2030. The company is currently finishing development in making AI inference and training energy-efficient via custom chips known as Tensor Processing Units (TPUs) and experimenting with novel cooling technologies, such as liquid immersion. Although the advances are being made, little to no transparency has been provided on third-party AI use and outsourcing.

Possible Solutions

Delegates should prioritize sustainable innovation along with regulation to address environmental harms caused by AI. Developing and promoting "Frugal AI": energy-efficient models that are low on computational needs, according to the French national plan, is one approach. Governments can require the carrying out of environmental impact assessments for big AI projects such that energy, water, and materials are considered upfront before the deployment. The delegates might consider an optional UN-led "Green AI" certification to award sustainable AI practices. Data centers hosting AI workloads should be encouraged to reduce emissions by adopting renewable energy and carbon-aware scheduling, which schedules energy-intensive workloads when renewable energy is most abundant. Water consumption can be minimized by using modern cooling technologies and water recycling and reuse on the site. The delegates could support extended producer responsibility policies and ethical requirements for rare earth material sourcing to reduce e-waste generation and rare earth mineral consumption. Additionally, the creation of a global research initiative to monitor the environmental footprint of AI and the incorporation of sustainability into national AI strategies would facilitate long-term governance. These options provide the delegates with the groundwork to propose novel, practical, and enforceable clauses.

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