# Generative AI’s environmental impact raises concerns over energy and resource use



Generative artificial intelligence (AI) presents growing environmental challenges as its adoption becomes widespread, with concerns extending across electricity consumption, water usage, and air pollution. Industry experts and academic researchers highlight the complexity involved in evaluating the full environmental footprint of generative AI, calling for companies to carefully consider these impacts when setting sustainability goals.

A significant element of AI's energy demand arises during the model training phase. The International Energy Agency (IEA), in its 2025 Energy and AI World Energy Outlook Special Report, detailed that training OpenAI’s GPT-4 required 42.4 gigawatt-hours of electricity—equivalent to the daily power consumption of approximately 28,500 households in a developed country. This energy-intensive process involves graphics processing units (GPUs) whose consumption at peak power can be compared to that of household toasters. Professor Alex de Vries, founder of the research blog Digiconomist, noted in an email to TechRepublic that while training is energy-intensive, the ongoing inference stage—when AI models process real-time prompts—already accounts for roughly 60% of AI's energy costs at companies like Google even before the widespread use of generative AI models. He added that the growing adoption of such AI applications increasingly shifts energy demand toward this operational phase.

The downstream effect of increased AI-related electricity use also carries consequences beyond electricity bills. Research conducted by the University of California, Riverside, and the California Institute of Technology in December 2024 assessed the environmental cost of training Meta’s Llama-3.1, a large language model. They concluded the air pollution generated during training was comparable to over 10,000 round trips by car between Los Angeles and New York City. The study further revealed that backup generators at AI data centres contributing to power demands cause regional public health costs estimated between $190 million and $260 million annually. These findings underscore the broader impact of AI on air quality.

Water consumption is another area of concern, particularly as data centres draw on water resources for cooling. Regions already facing drought conditions, such as Phoenix, Arizona, and parts of California, could experience increased strain on water supplies due to data centre operations linked with AI computing needs. The IEA highlighted the risk of supplying electricity and water infrastructure outages, including brownouts or blackouts, as utilities attempt to meet the growing demand. An interesting comparative example is that sending a single email using AI tools like ChatGPT can equate to the water consumption involved in producing a bottle of water, illustrating the hidden resource costs of AI use.

The question of whether newer AI models consume less power remains nuanced. Some models, like those developed by DeepSeek, claim improved energy efficiency through a mixture-of-experts approach, which processes relationships between concepts in batches, reducing training computational demands. However, the IEA’s 2025 Energy and AI report points out that the inference phase of such models can be highly energy-intensive. DeepSeek-R1 and OpenAI’s 'o1' models, for instance, have been found to consume significant amounts of electricity during use. The phenomenon known as the “rebound effect,” where increased efficiency leads to a broader adoption of AI applications and thus higher overall energy consumption, complicates the narrative of straightforward energy savings.

Tech companies maintain commitments to mitigate these environmental impacts. Google has pursued energy-conscious certifications globally and is a signatory of Europe’s Climate Neutral Data Centre Pact. Microsoft reported increased water and electricity utilisation in 2024 attributed in part to AI, with plans underway to potentially reactivate a nuclear power plant at Three Mile Island, Pennsylvania, to support its AI data centres. These efforts are part of attempts to balance the growing computational demands with sustainability frameworks.

Generative AI’s expanding presence in consumer technology also amplifies energy consumption challenges. Microsoft’s Copilot AI is now included by default on various personal computers, smartphone manufacturers are incorporating video editing AI and assistant features, and Google offers its Gemini Advanced AI model freely to students. This proliferation is expected to impact companies’ environmental, social, and governance (ESG) reports and their ability to meet climate targets. Alex de Vries remarked to TechRepublic that AI “can have dramatic impacts on ESG reports and also the ability of the companies concerned to reach their own climate goals.”

In its 2024 Environmental Report, Google disclosed that its data centres consumed 17% more water than the previous year, attributing the rise to the expansion of AI products and services, alongside similar increases in electricity consumption and waste generation. Dan Root, head of global strategic alliances at ClickShare, noted, “As AI adoption accelerates, IT leaders are increasingly aware that smarter devices don’t directly correlate to more efficient power consumption. The spike in compute demand from AI tools means IT departments must look for offset opportunities elsewhere in their stack.”

The challenge also involves assessing how far along the AI supply chain environmental impacts ought to be traced. The IEA points to indirect emissions from electricity consumption during semiconductor manufacturing as a substantial contributor to overall emissions. Advances in hardware designed specifically for generative AI are delivering cost reductions and improved energy efficiency—Stanford University’s 2025 AI Index Report identified annual hardware cost declines of 30% and energy efficiency improvements of 40%. Nonetheless, the “bigger is better” paradigm prevalent in AI development tends to increase energy consumption commensurate with model size and performance improvements.

De Vries summarised the tension between AI growth and sustainability succinctly: “You can make/keep models a bit smaller to reduce their energy requirement, but this also means you have to be prepared to sacrifice performance.” He added, “Due to the ‘bigger is better’ dynamic AI is fundamentally incompatible with environmental sustainability.”

The complexities inherent in the environmental ramifications of generative AI highlight the multifaceted considerations organisations face as they integrate AI into their operations while managing sustainability commitments. The TechRepublic is reporting on ongoing developments in understanding and addressing the energy and resource impacts associated with this rapidly evolving technology.

Source: [Noah Wire Services](https://www.noahwire.com)

## Bibliography

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