Powering AI could use as much electricity as a small country

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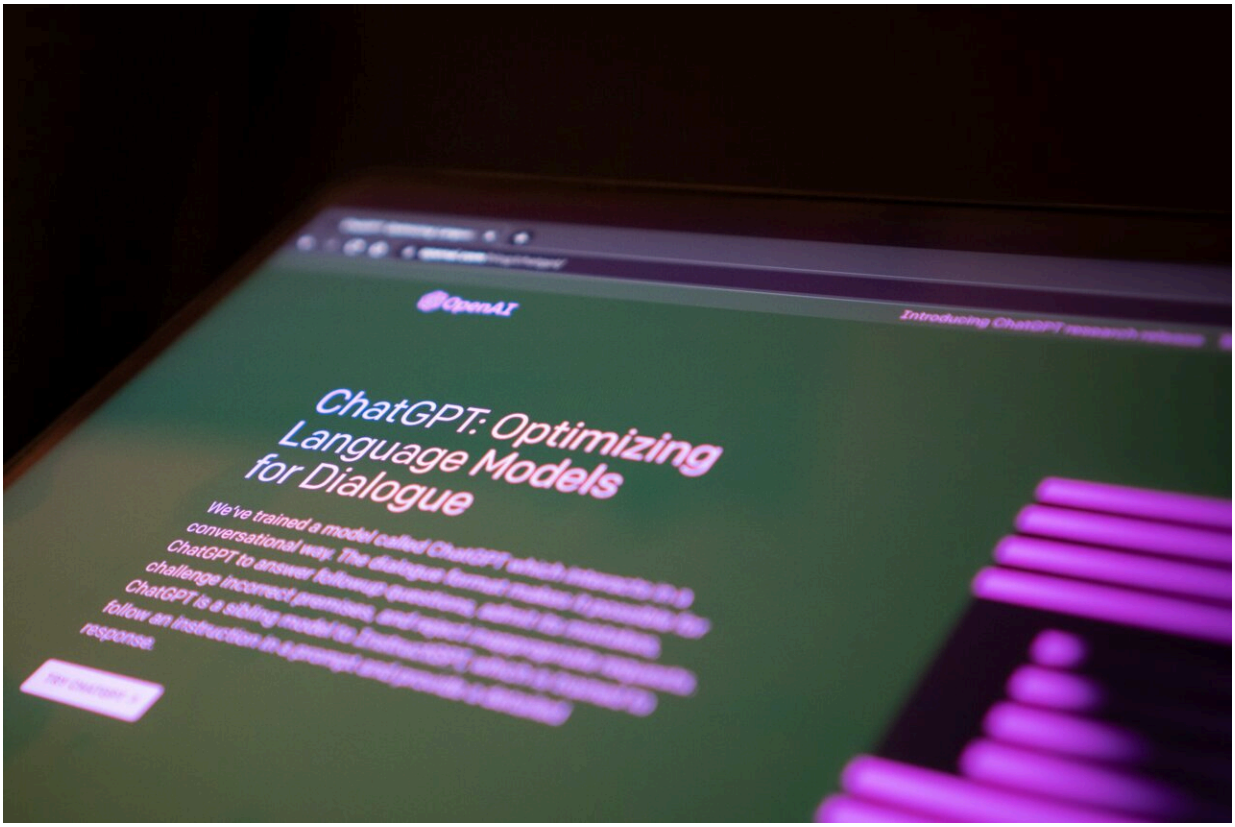

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Artificial intelligence (AI) comes with promises of helping coders code faster, drivers drive safer, and making daily tasks less time-consuming. But in a commentary published October 10 in the journal *Joule*, the

founder of Digiconomist demonstrates that the tool, when adopted widely, could have a large energy footprint, which in the future may exceed the power demands of some countries.

"Looking at the growing demand for AI service, it's very likely that energy consumption related to AI will significantly increase in the coming years," says author Alex de Vries, a Ph.D. candidate at Vrije Universiteit Amsterdam.

Since 2022, generative AI, which can produce text, images, or other data, has undergone rapid growth, including OpenAI's ChatGPT. Training these AI tools requires feeding the models a large amount of data, a process that is energy intensive. Hugging Face, an AI-developing company based in New York, reported that its multilingual text-generating AI tool consumed about 433 megawatt-hours (MWH) during training, enough to power 40 average American homes for a year.

AI's energy footprint does not end with training. De Vries's analysis shows that when the tool is put to work—generating data based on prompts—every time the tool generates a text or image, it also uses a significant amount of computing power and thus energy. For example, ChatGPT could cost 564 MWh of electricity a day to run.

While companies around the world are working on improving the efficiencies of AI hardware and software to make the tool less energy intensive, de Vries says that an increase in machines' efficiency often increases demand. In the end, technological advancements will lead to a net increase in resource use, a phenomenon known as Jevons' Paradox.

"The result of making these tools more efficient and accessible can be that we just allow more applications of it and more people to use it," de Vries says.

Google, for example, has been incorporating generative AI in the company's email service and is testing out powering its search engine with AI. The company processes up to 9 billion searches a day currently. Based on the data, de Vries estimates that if every Google search uses AI, it would need about 29.2 TWh of power a year, which is equivalent to the annual electricity consumption of Ireland.

This extreme scenario is unlikely to happen in the short term because of the high costs associated with additional AI servers and bottlenecks in the AI server supply chain, de Vries says. But the production of AI servers is projected to grow rapidly in the near future. By 2027, worldwide AI-related electricity consumption could increase by 85 to 134 TWh annually based on the projection of AI server production.

The amount is comparable to the annual electricity consumption of countries such as the Netherlands, Argentina, and Sweden. Moreover, improvements in AI efficiency could also enable developers to repurpose some computer processing chips for AI use, which could further increase AI-related electricity consumption.

"The potential growth highlights that we need to be very mindful about what we use AI for. It's energy intensive, so we don't want to put it in all kinds of things where we don't actually need it," de Vries says.

More information: Alex de Vries, The Growing Energy Footprint of Artificial Intelligence, *Joule* (2023). DOI: 10.1016/j.joule.2023.09.004. www.cell.com/joule/fulltext/S2542-4351(23)00365-3

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