Environmental Impact of the AI Supply Chain

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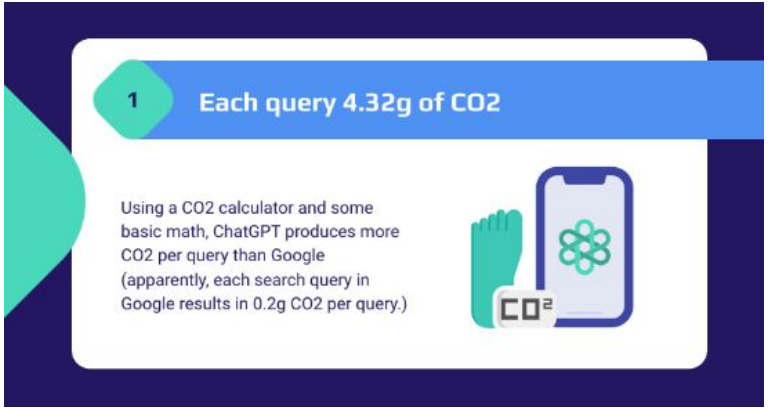
How bad is it to “Operate AI”?

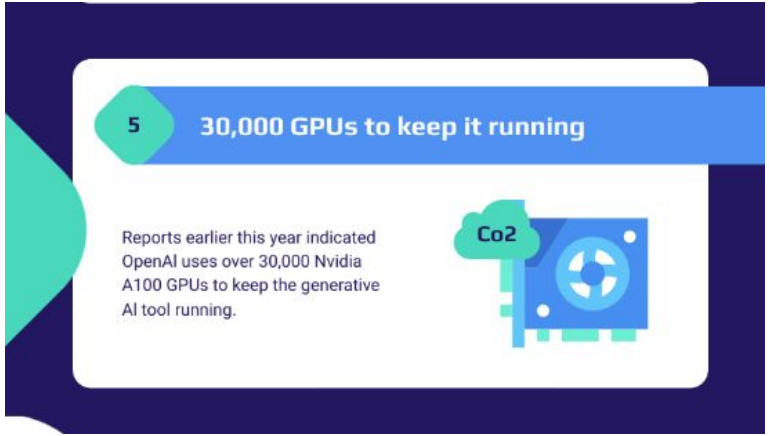
Inference carbon emissions

Every 2 images require the same electricity as a modern smartphone takes for a full charge

On the estimate of 13 million daily users, each doing 15 queries.
Emissions would be 10K tons CO2eq/ month.

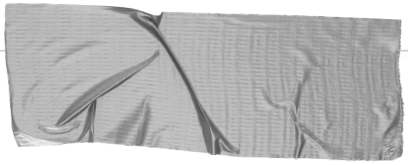
GPT4 causes 10 to 100 times more emissions than GPT3





PIKTOCHART - Carbon Footprint of ChatGPT towardsdatascience.com

How bad is it to “Train AI”?



Training Emissions

Training emissions of LLAMA models went up from 600 to 2290 tons of CO2eq In the years 2023, and 2024.

Google's greenhouse gas emissions in 2023 were 48% higher than in 2019, according to its latest environmental report.

[Voronoi: The carbon emissions of training AI models]

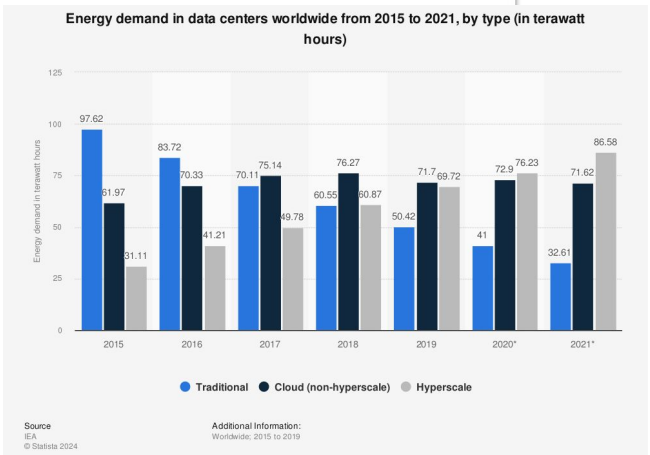
[LLAMA-3 on hugging Face]

How bad is it to
“Operate a Data Center for AI” ?

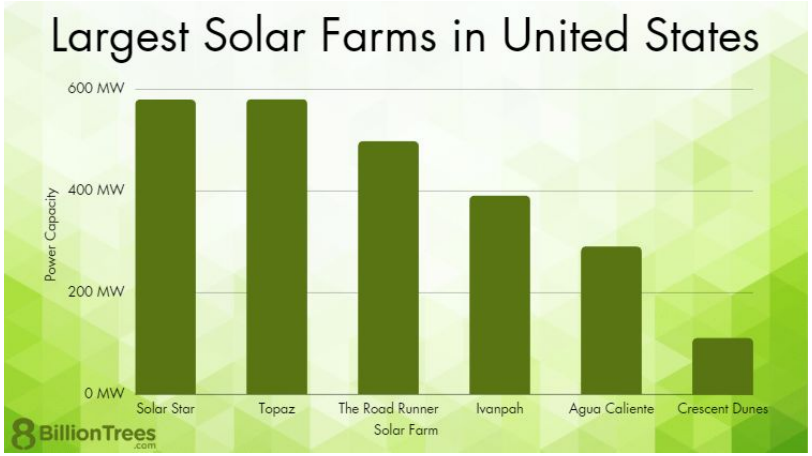
Data Centers

Microsoft & OpenAI consider $100bn 5GW (~43 TWh/ year) 'Stargate' AI data center

Total Energy consumption in 2021 was 190 TWh. 1~2 % of global Electricity.



datacenterdynamics.com
ArxiV: COMPUTE AT SCALE



8billiontrees.com

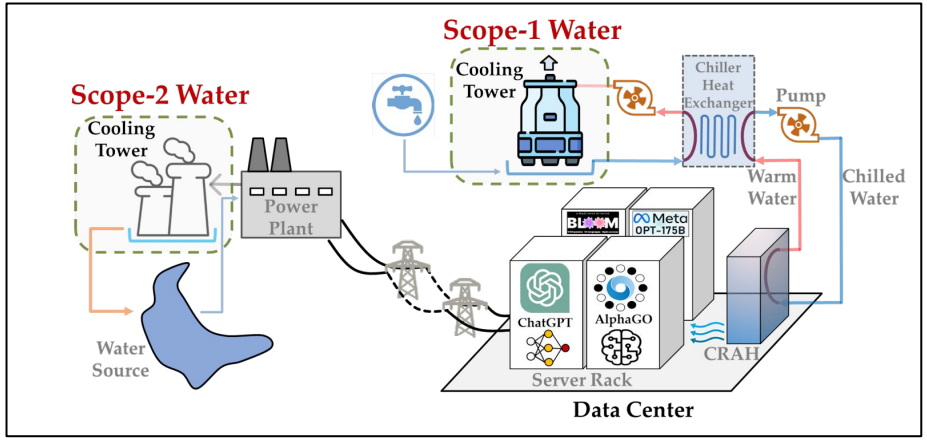
How thirsty is AI?

Data Centers - Water footprint

To produce a microchip takes > 8000 liters of Ultra-Pure Water (UPW)

running GPT-3 inference for 10-50 queries consumes 500 millilitres of water

Across the US, data center water consumption is already estimated at 1.7 billion litres per day.



Global AI's Scope 1 & 2 Water Withdrawal in 2027

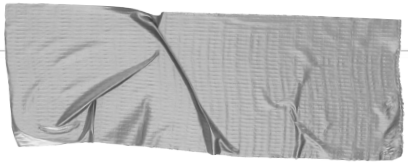
Est. 4.2~6.6 Billion Cubic Meters

AI ≈

4~6x Annual Water Withdrawal of Denmark

OECD.ai - how much water does AI consume paper: Making AI Less "Thirsty"
Joining the 2030 water positive club: Amazon makes Water+ commitment

How bad is it to manufacture for AI?

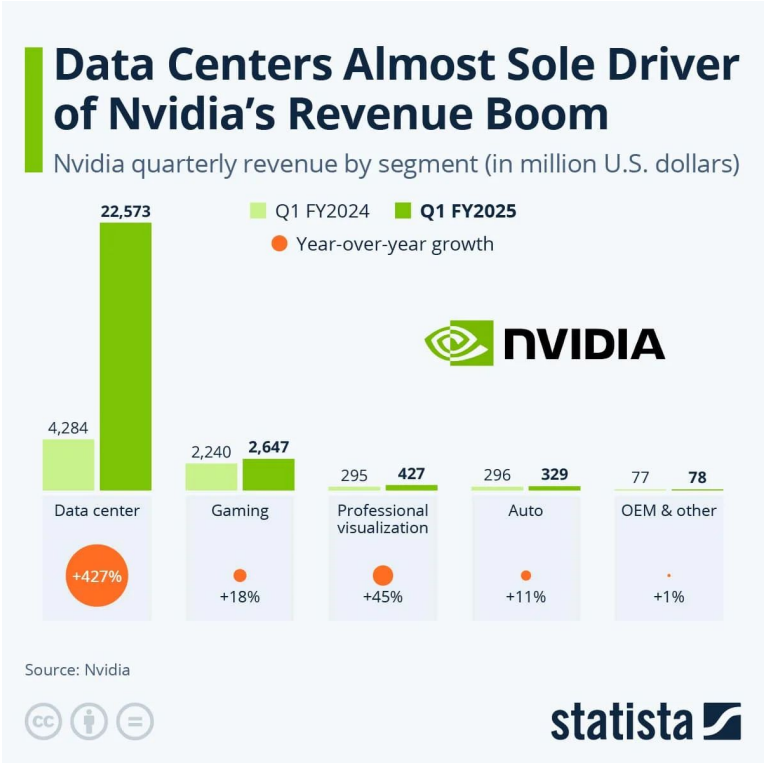


Data Centers - GPUs and waste

The new Blackwell GPU will have 208 billion transistors compared to the current 80 billion.

An estimate of 1.5 million units have been sold in 2023, and the predictions for following years are also in the single digit millions.

One A100 unit produces 0.15 tonnes CO2 emissions



There is a need for a lot more transparency in this area!

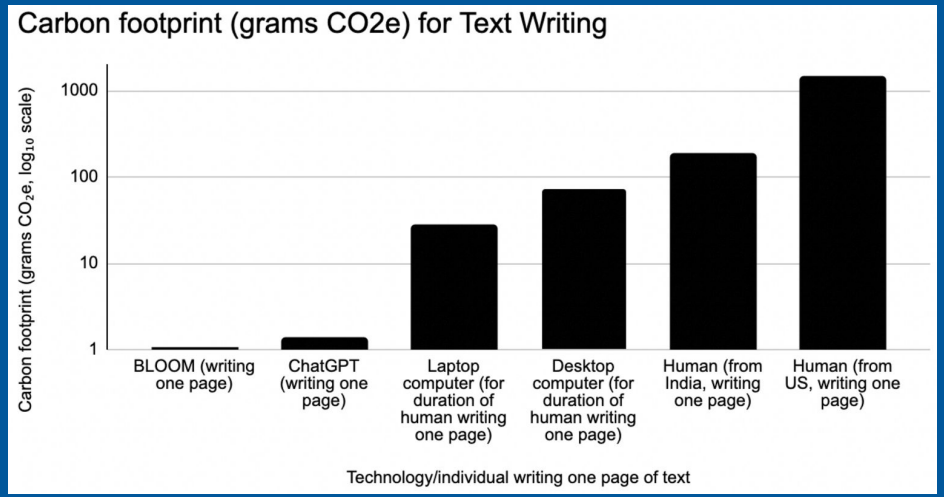
- Natural Resources
- CO2eq Emissions
- Water Withdrawal

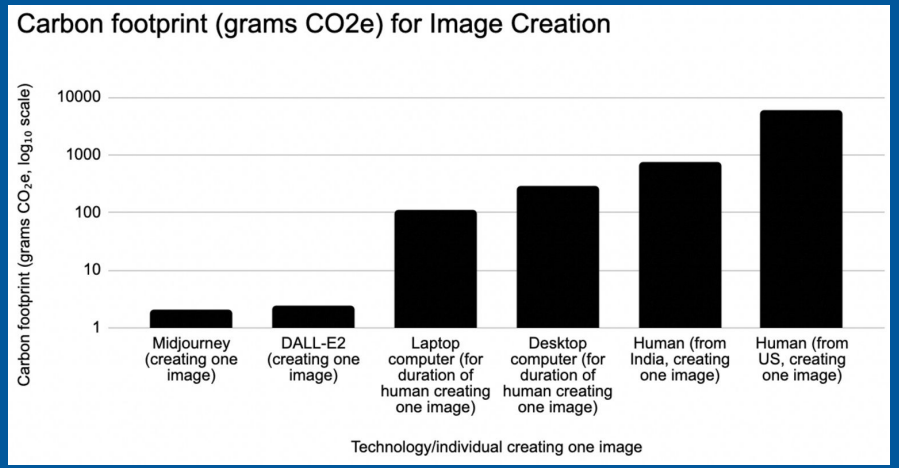
But it’s not all bad…

But..

Typical tasks using an LLM might be significantly less than humans performing the same task !

nature.com





Then what?

➔ **Monitoring**
The carbon and water footprint of AI and data centers.

➔ **Transparency**
Publish all relevant information, because your users deserve to know.

➔ **Environmental goals baked-in**
Environmental impact should be part of design/ innovation phase not in the feedback stage.

Extra References

- https://www.visualcapitalist.com/carbon-footprint-daily-activities/
- https://clevercarbon.io/
- https://ourworldindata.org/co2-and-greenhouse-gas-emissions
- https://arxiv.org/pdf/2311.16863
- https://www.componentsense.com/blog/the-link-between-ai-electronics-and-sustainability
- https://chinawaterrisk.org/resources/analysis-reviews/8-things-you-should-know-about-water-and-semiconductors/
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Tip

There's a lot of research being done on the environmental impact of AI, and IT in general, and there's many hidden aspects.

Let's keep an eye out!

Advertisement

RSE WG to further research the environmental impact of “IT”

First meeting in January 21st @ 2 PM

Current members: Valerian, Charlotte, Ahmed