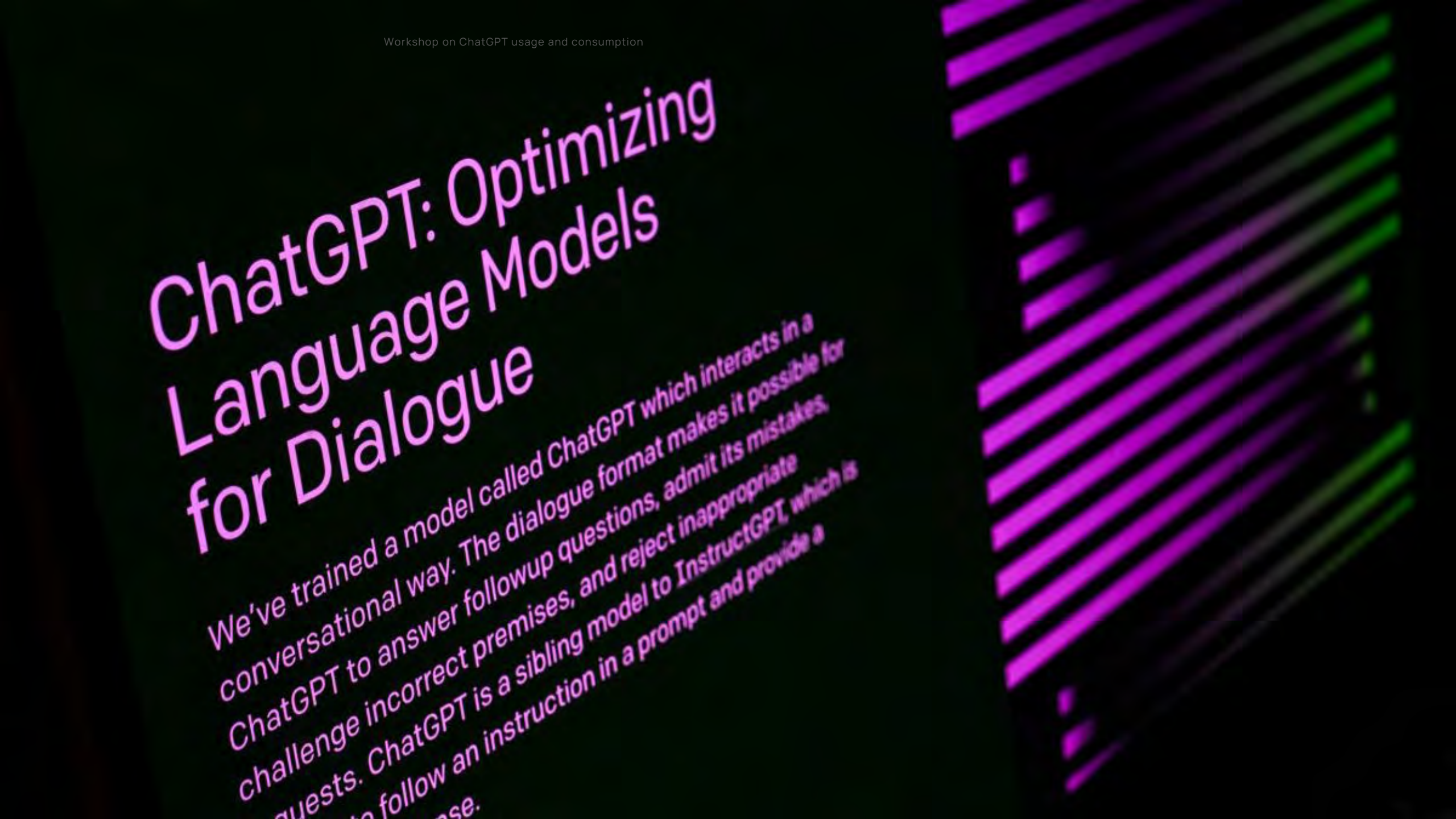
POLITECNICO
MILANO 1863

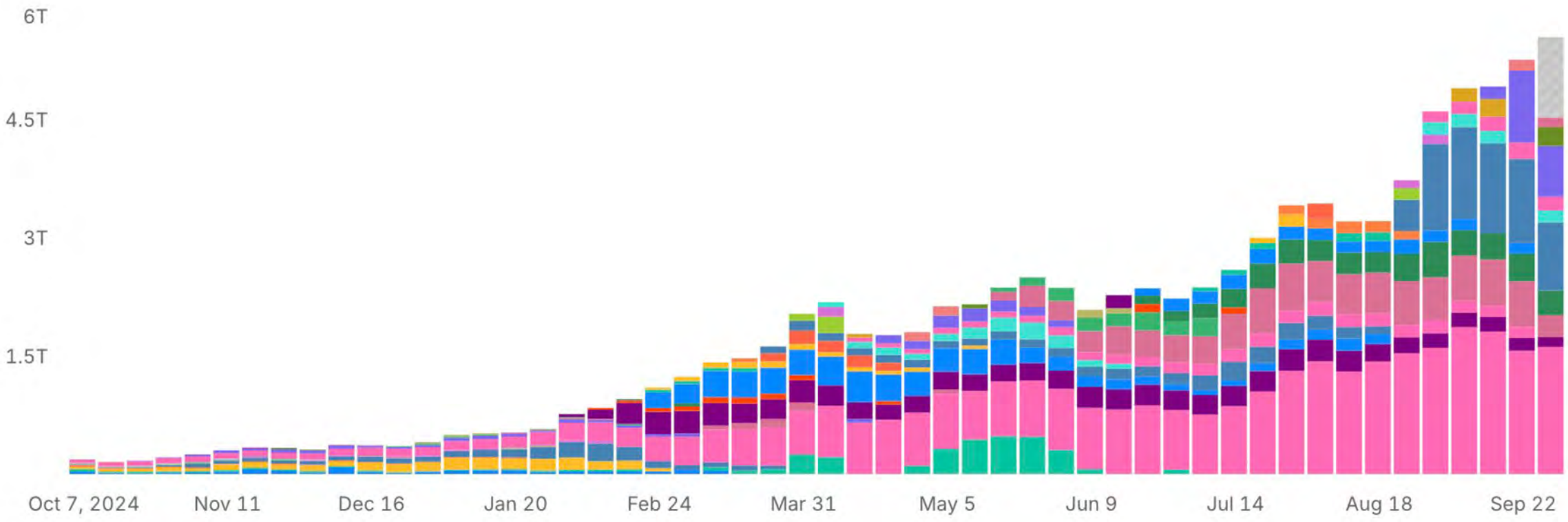
International Staff Training Week at Politecnico di Milano
(6-10 ottobre 2025)

Workshop on ChatGPT usage and consumption

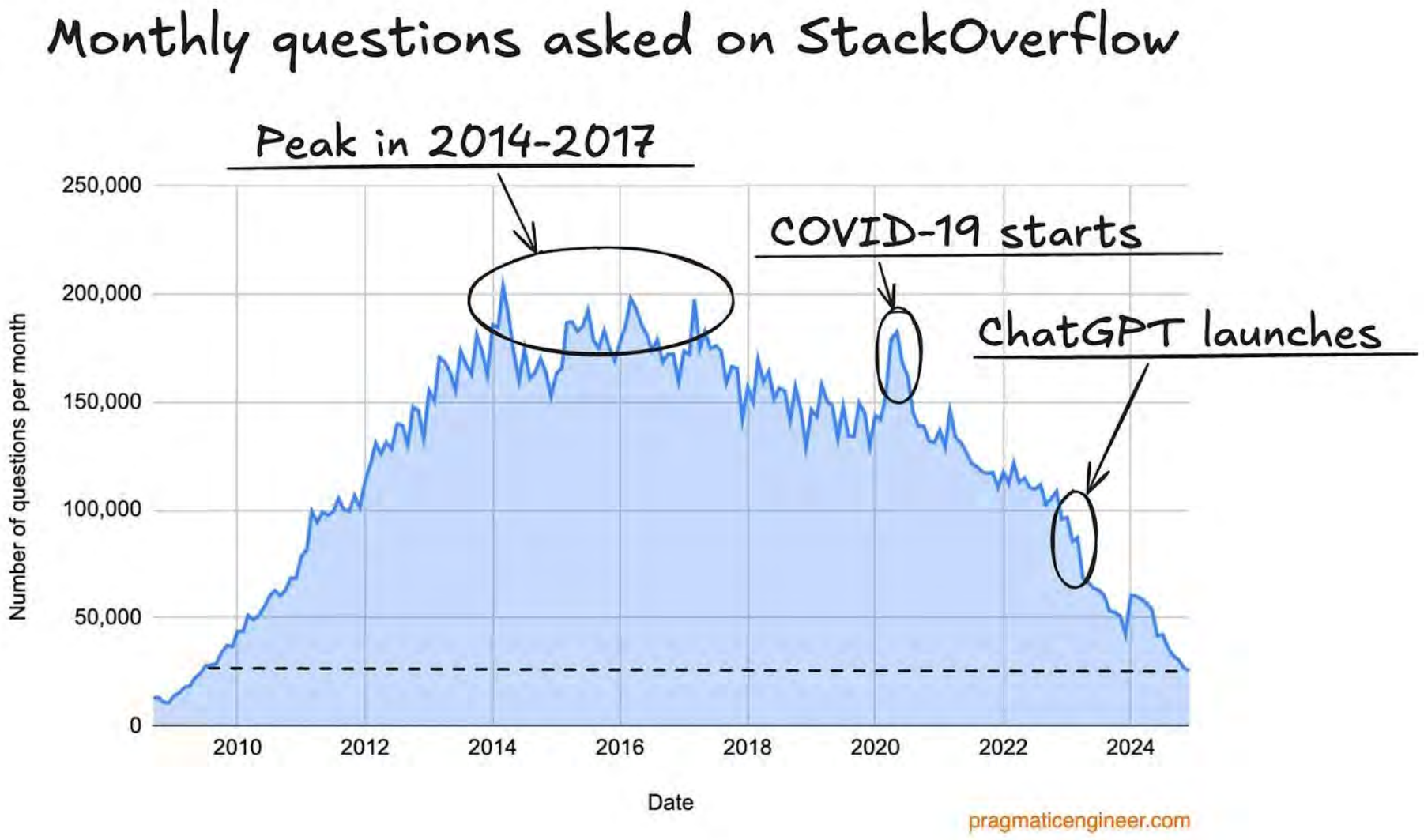
07.10.2025 I Monica Vitali and Mathyas Giudici

Who we are


ChatGPT: Optimizing Language Models for Dialogue
We've trained a model called ChatGPT which interacts in a conversational way. The dialogue format makes it possible for ChatGPT to answer followup questions, admit its mistakes, challenge incorrect premises, and reject inappropriate
quests. ChatGPT is a sibling model to InstructGPT, which is
follow an instruction in a prompt and provide a
se.



https://openrouter.ai/rankings



https://www.ericholscher.com/blog/2025/jan/21/stack-overflows-decline

Computational cost

- Search engines distribute the computational cost among multiple users, whereas LLMs generate responses individually, leading to higher per-user energy use.

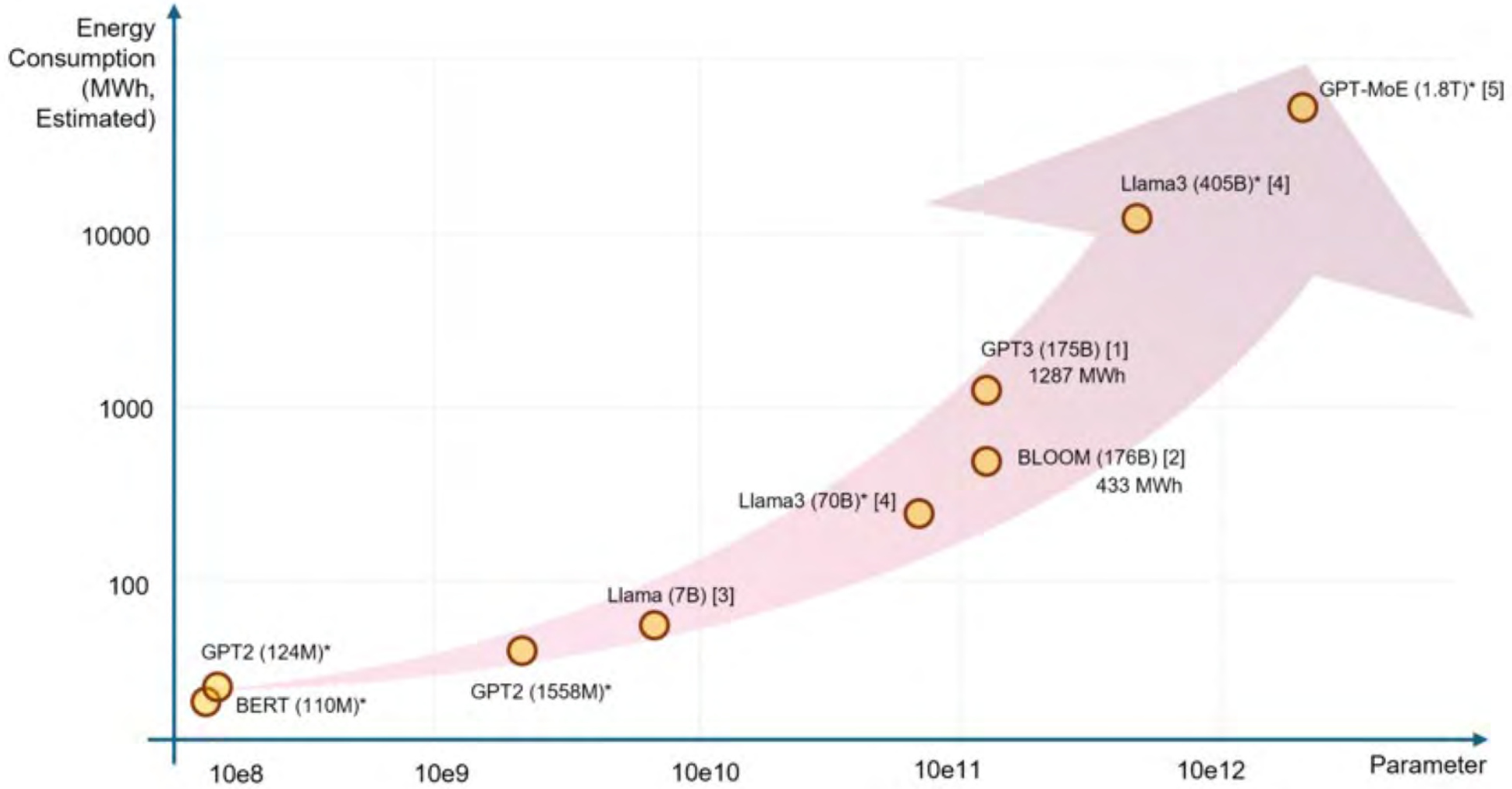
- Most LLM providers do not display energy usage per query, so users cannot currently compare the energy impact of different AI models.

- If an LLM is used for highly specialized or complex tasks, its environmental impact may be justified. However, for simpler tasks, a traditional search engine may be a more sustainable choice.

Search Engines vs AI: energy comparison

Energy use and emissions comparison table

Metric	Google Search	ChatGPT	Impact Factor
Energy per Query	0.0003 kWh	0.0029 kWh	About 10x higher for AI
Daily Queries	Billions	200 million	–
Daily Energy Use	~10.8 MWh	621.4 MWh	About 58x higher for AI
Annual Home Equivalent	~2,000 US homes	21,602 US homes	About 11x higher for AI
Scalability Efficiency	High	Limited by energy demands	–



https://doi.org/10.48550/arXiv.2409.11416

EcoLogits Calculator

EcoLogits is a python library that tracks the **energy consumption** and **environmental footprint** of using **generative AI** models through APIs.
This Calculator allows a broader access to **EcoLogits** estimates through a visual application.

https://huggingface.co/spaces/genai-impact/ecologits-calculator

Provider: OpenAI

Model: chatgpt 4o

Example prompt: Write a report of 5 pages (5000 ou…

⚠ The model architecture has not been publicly released and is multimodal, expect lower precision of estimations.

Energy
Electricity consumption
439 Wh
Min 183 Wh — Max 695 Wh

GHG Emissions
Effect on global warming
268 gCO2eq
Min 112 gCO2eq — Max 423 gCO2eq

Abiotic Resources
Use of metals and minerals
6.23e-07 kgSbeq
Min 3.09e-07 kgSbeq — Max 9.36e-07 kgSbeq

Primary Energy
Use of natural energy resources
4.49 MJ
Min 1.88 MJ — Max 7.11 MJ

Evaluate
Upc

Energy
439 Wh

Running
≈ 5.37 *km*

Electric Vehicle
≈ 2.58 *km*

What if 1% of the planet does the same everyday for 1 year ?

439 Wh x 1% of 8 billion people x 365 days are ≈ equivalent to

2 Nuclear power plants
Energy produced yearly

0.388 x Ireland
Yearly electricity consumption

It’s not just on the model

Users tend to perceive and utilize technologies based on their **efficiency**, **ease of use**, and **reliability**.

The interaction with digital systems is mediated by the symbolic, immaterial nature of digital interfaces, which **shape user behavior** and cognitive processes.

Users often develop **mental models** of how digital systems work based on past experiences, tutorials, or trial-and-error, which affects how they approach problem-solving tasks.

Inform the user

Energy Use per Query:
show estimated Wh or CO_2 emissions for each AI request.

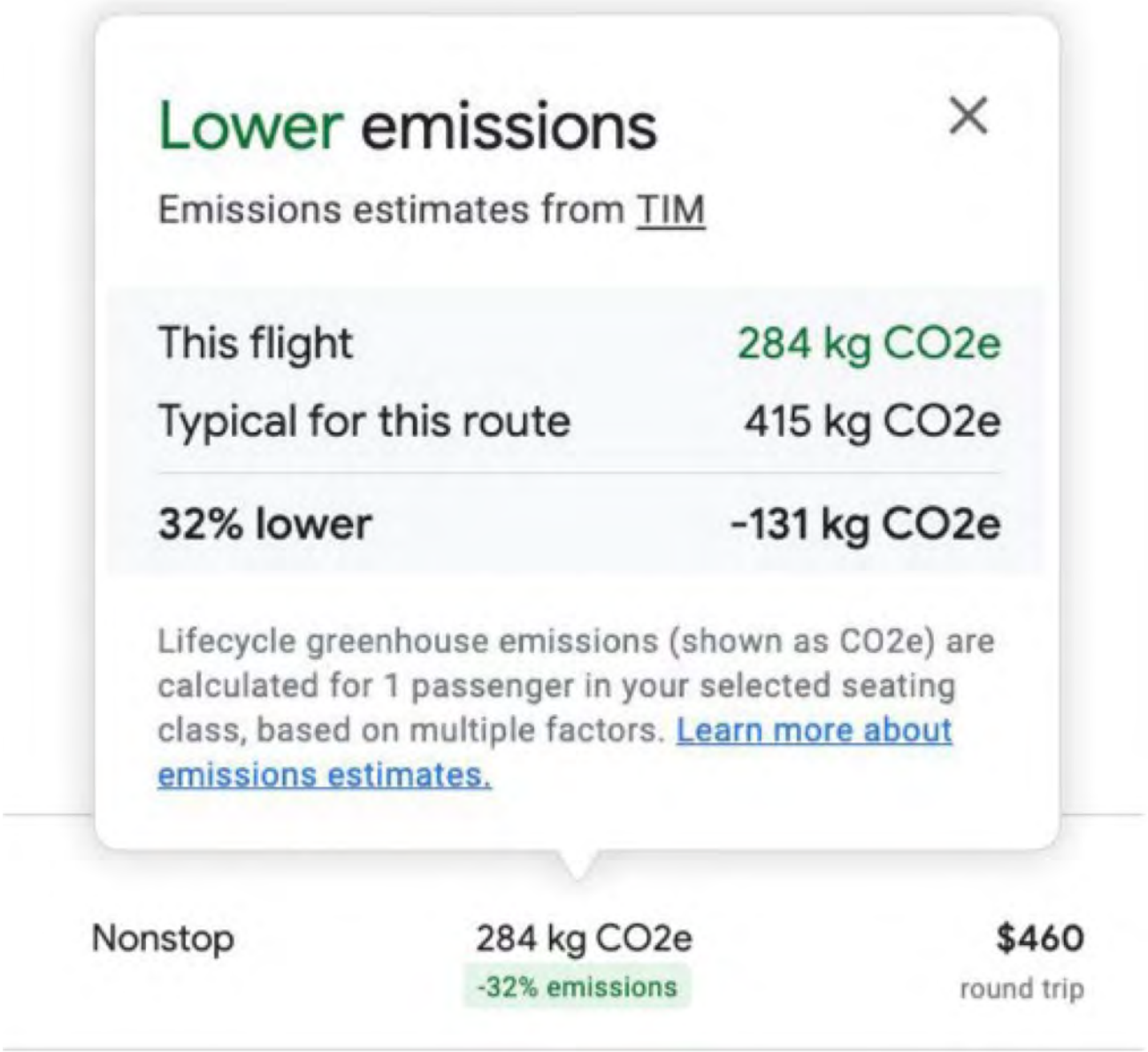
Eco-Labels:
carbon footprint display for digital tools

Task-Specific Recommendations:
suggest lower-energy options for simpler queries.

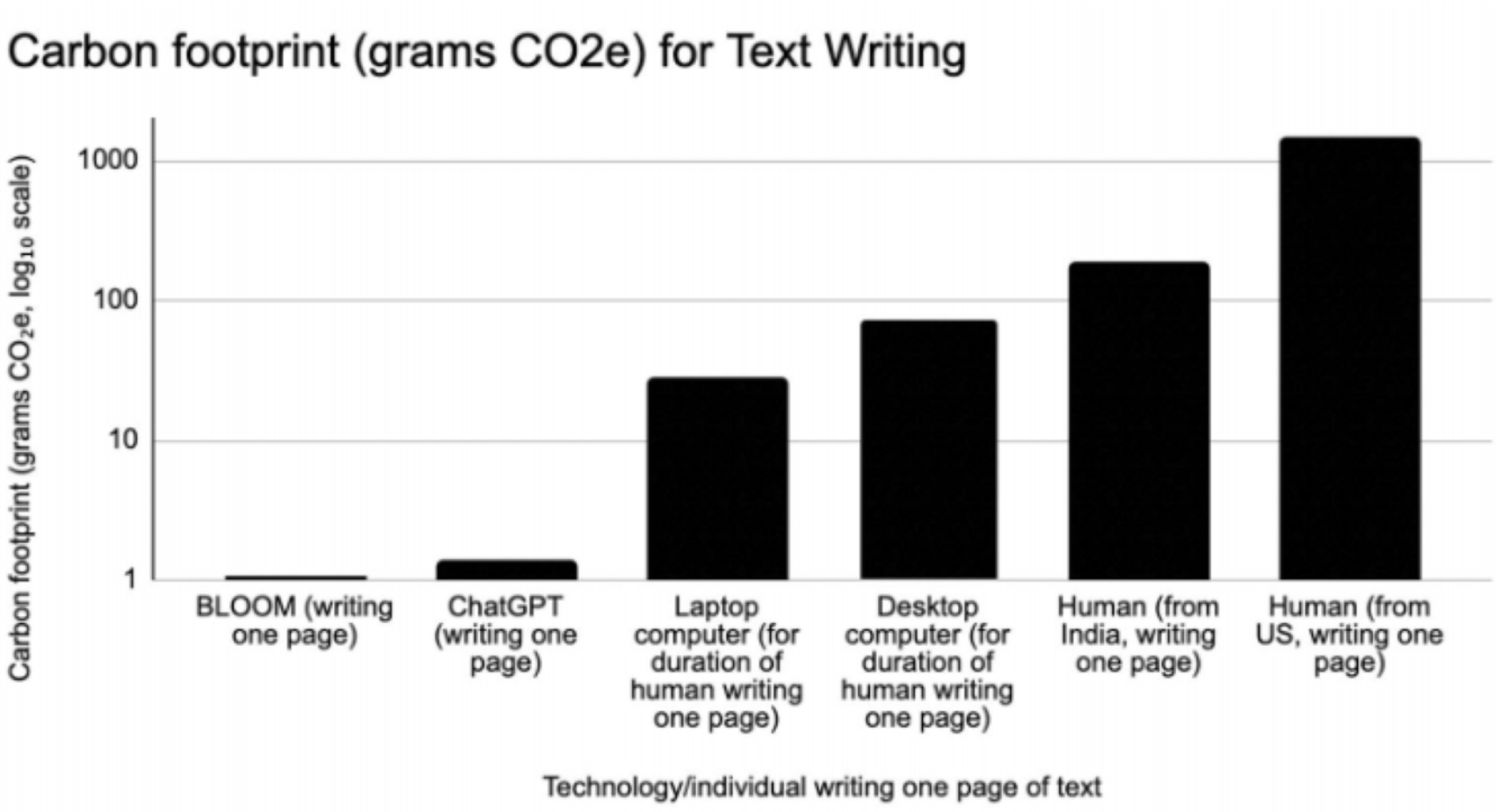
Green AI Defaults:
implement "low-energy mode" in LLM interfaces.

Google Example

Google's sustainability strategy involves organizing information through products, like **fuel-efficient routing** in Google Maps and **carbon emissions estimates** in Google Flights, to guide positive environmental actions.



The other side of the coin



https://www.nature.com/articles/s41598-024-54271-x.pdf

Hands-on

Tasks Documents

http://bit.ly/

46UbiNI

Tasks

Task 1

Write an email (newsletter style) to announce the following event within your organization.

Task 2

Summarise and extract the key points of the following presentation (in a bullet point list)

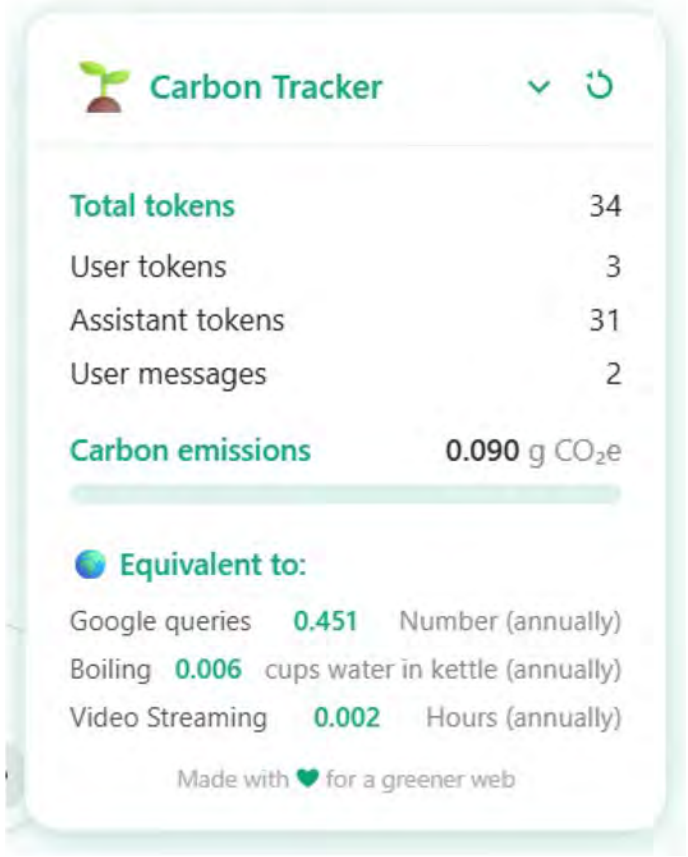
ONLY
Task 1 and 2

15 min

Our Solution

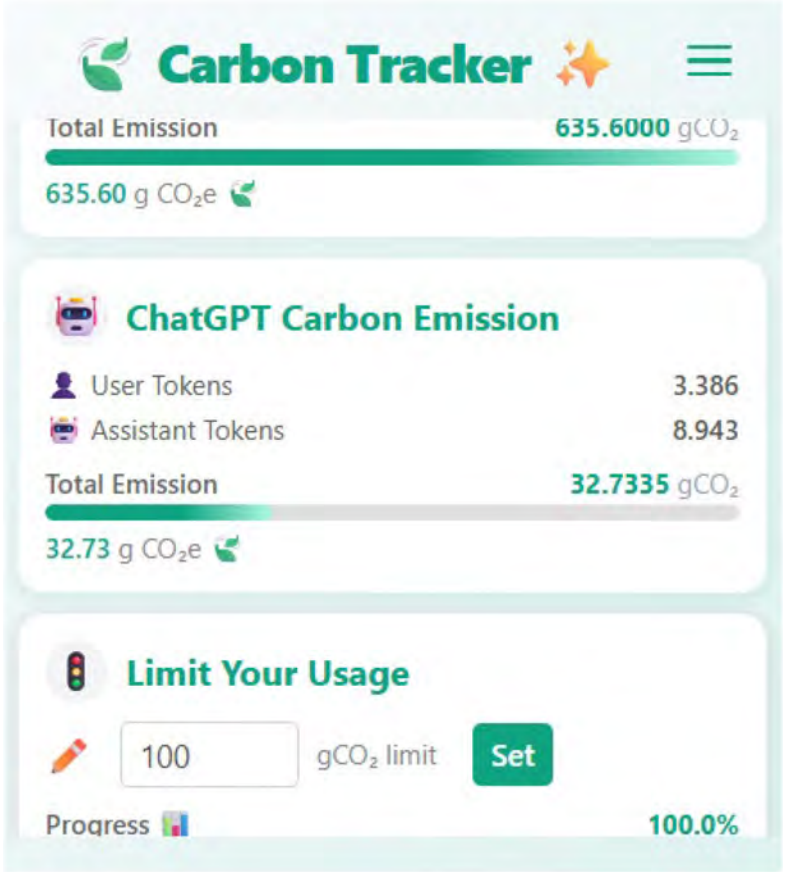
- A unified Chrome extension to track carbon emissions from both web activity and LLM usage
- It combines token-based tracking for ChatGPT with static metrics for general web usage (e.g., searches and page views)
- Designed for transparency and ease of use, helping users better understand and manage their digital carbon footprint

Two Interfaces in One Chrome Extension



FLOATING WINDOW FOR CHATGPT CONVERSATION

EXTENSION POPUP



Modular Interface

- Cumulative Carbon Emission
- Web Carbon Emission
- ChatGPT Carbon Emission
- Limit Your Usage
- Usage Chart

Chrome Carbon Tracker

http://bit.ly/

3VO66Gc

Tasks

Task 3

Replay to an email on a particular request of a student

Task 4

You are asked to write a document to promote internally (within your organization) on the organization of a staff week on a topic of your interest.

ONLY
Task 3 and 4

15 min

Discussion and Conclusion