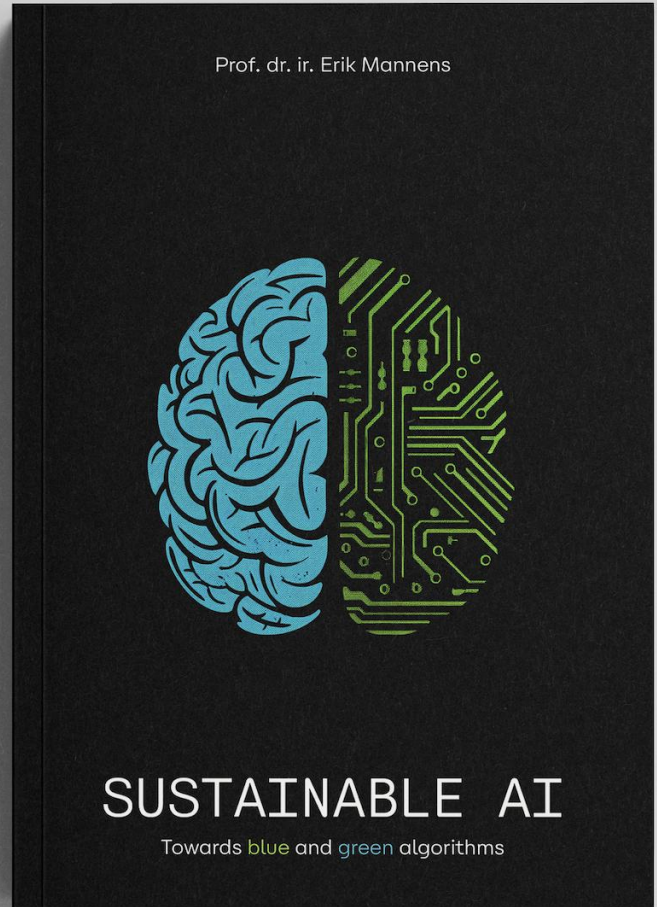


# the Future of AI

AI Strategist @ Howest, AZ MM, Digital Flanders, 8Weeks  
Prof. Sustainable AI @ UAntwerp  
Prof. Semantic Intelligence @ Ghent University



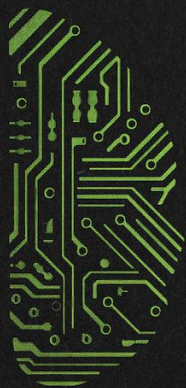


**a\$\$holes**





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ABLE AI

green algorithms

# Intro

(what you should  
know ... before we  
go further)

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university of applied sciences

Prof. dr. ir. E



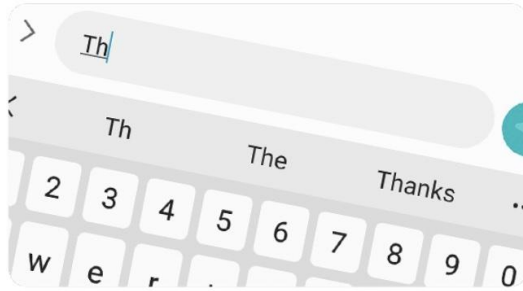
SUSTAIN

Towards blue and

# AI LINGO – TYPES OF MACHINE LEARNING

- Semantics (e.g., Google Knowledge Graph)
- Supervised (e.g., Google Image Search)
- Unsupervised (e.g., Netflix' Recommendation Engine)
- Transfer Learning (e.g., Self-Driving Simulations)
- Deep Learning (e.g., Smart Speakers)
- Re-inforcement Learning (e.g., Google's Alpha Go)
- GANs (e.g., NVidia's "Real" City Generation)
- LLMs (e.g., OpenAI's CHAT-GPT-4)
- Multi-Modal Ensembles (e.g. Dall-E, MidJourney, Stable Diffusion, SORA)
- Chain of Thought (e.g. OpenAI's o1, xAI's Grok3, Google's Co-scientist)

# LLMS = “AUTOCOMPLETION ON STEROIDS” $\neq$ KNOWLEDGE



AI IS A GOLDRUSH

AI IS TAKING YOUR JOB

AI IS A BUBBLE

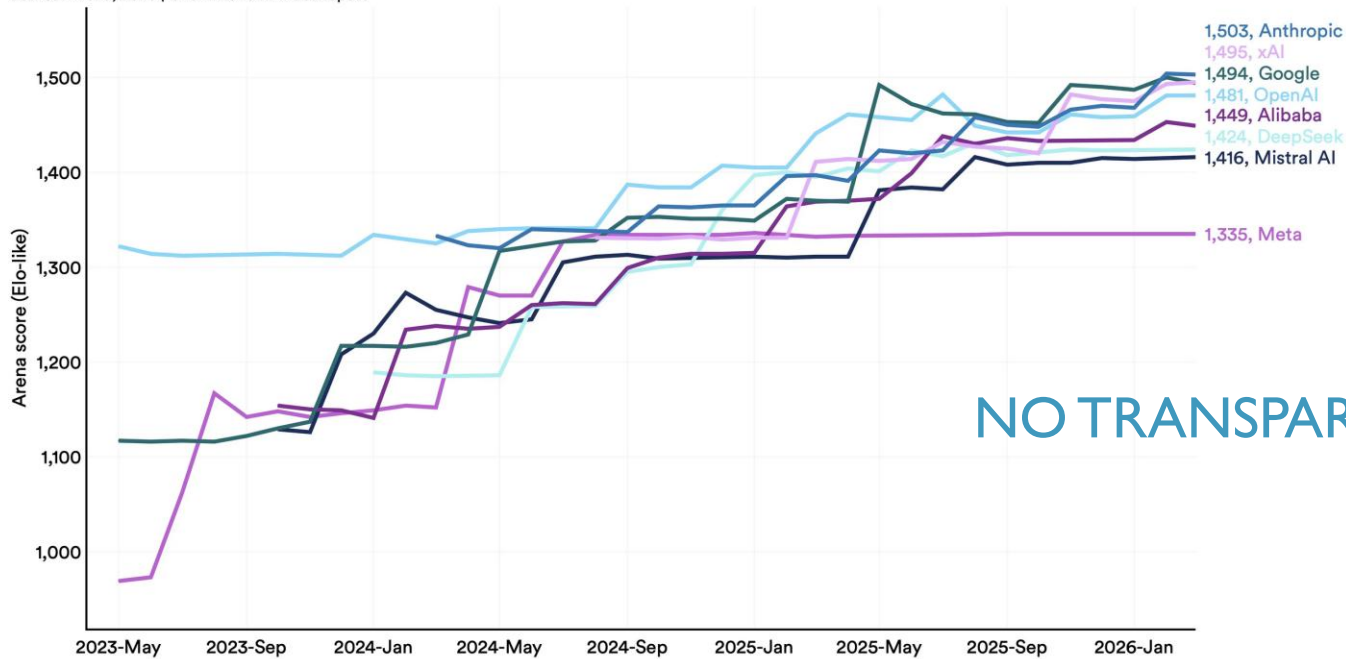
AI CAN'T EVEN READ A ANALOG CLOCK

“JAGGED” INTELLIGENCE

# IT'S A TIED RACE BETWEEN US & CHINA

## Performance of top models on the Arena by select providers

Source: Arena, 2026 | Chart: 2026 AI Index report

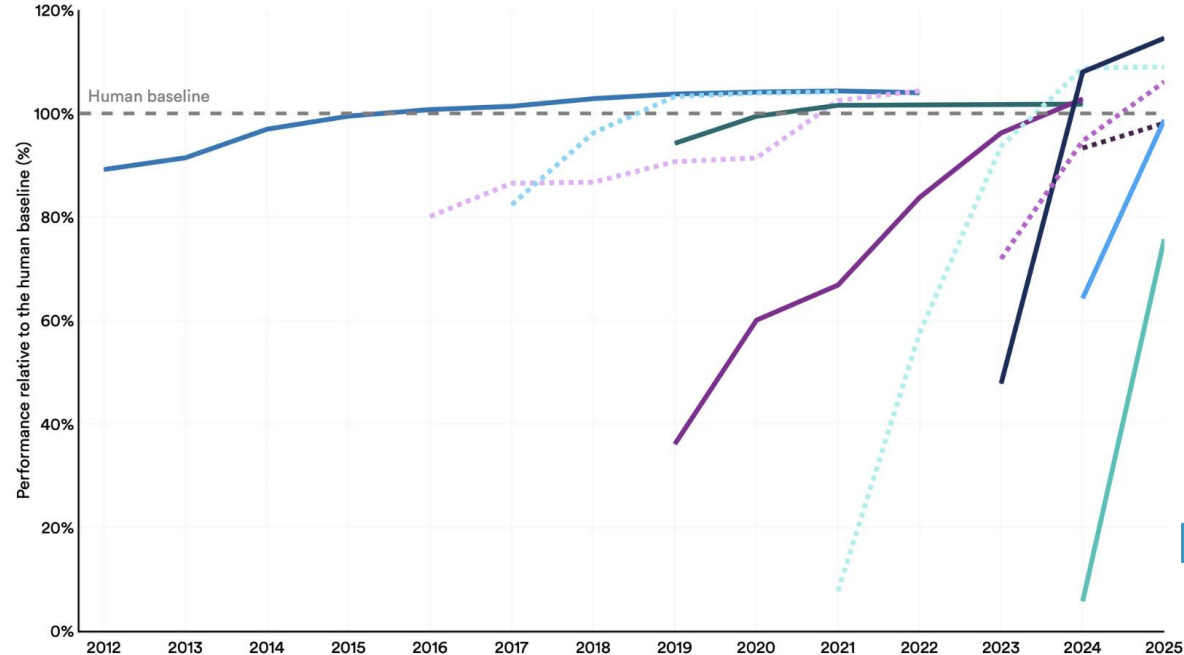


NO TRANSPARENCY 😞

# AI MODELS ARE (STILL) ADVANCING SUPER FAST

## Select AI Index technical performance benchmarks vs. human performance

Source: AI Index, 2026 | Chart: 2026 AI Index report

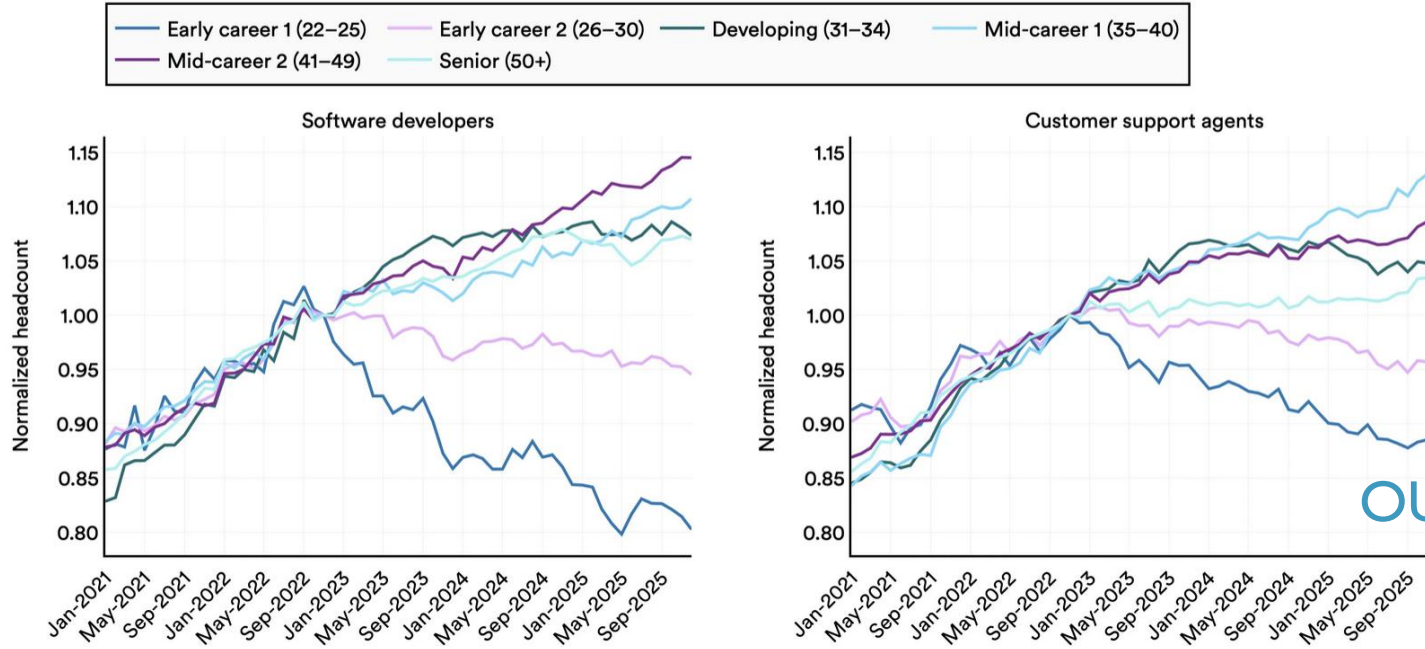


ROBOTS  
12% OF TASKS

# AI IS STARTING TO AFFECT JOBS

## Normalized headcount trends by age group for software developers and customer service agents, 2021–25

Source: Brynjolfsson et al., 2025 | Chart: 2026 AI Index report

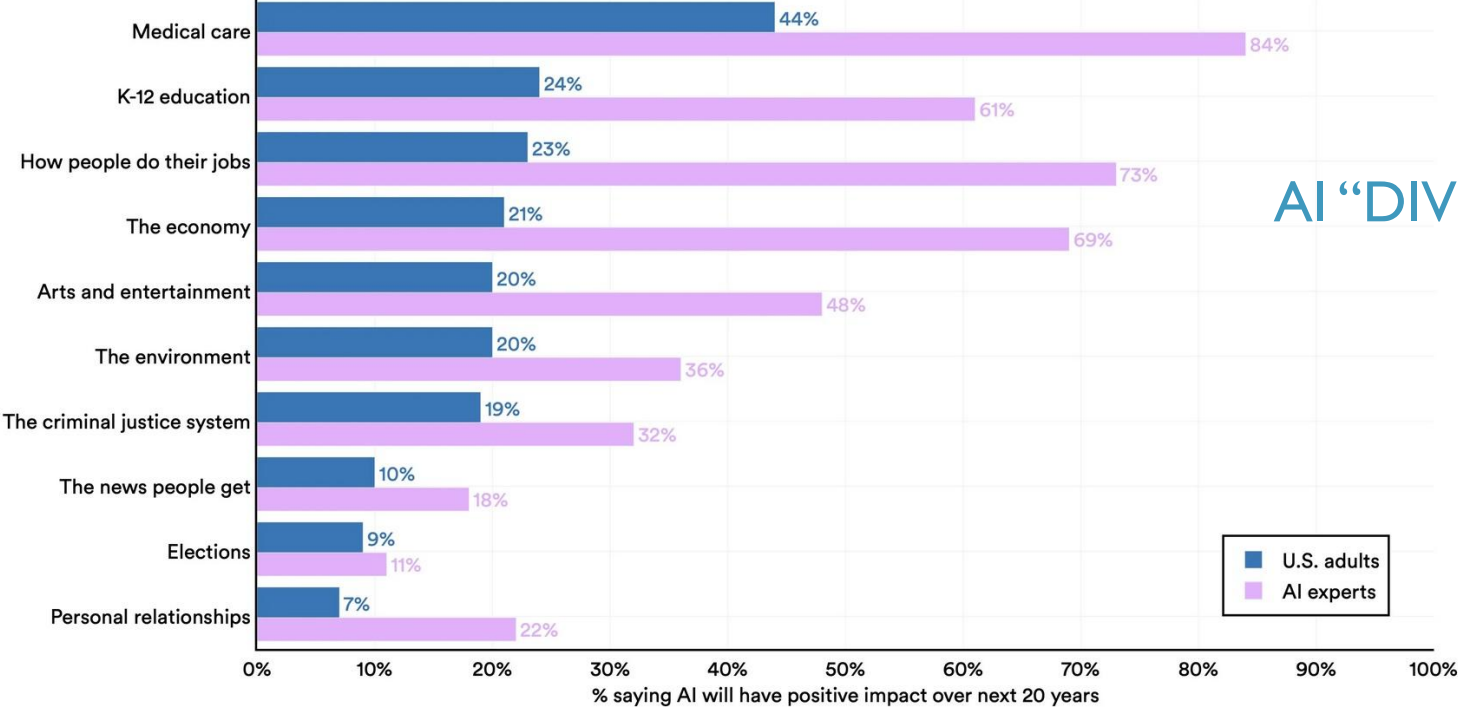


OUR KIDS 😞

# PEOPLE HAVE COMPLICATED FEELINGS ABOUT AI

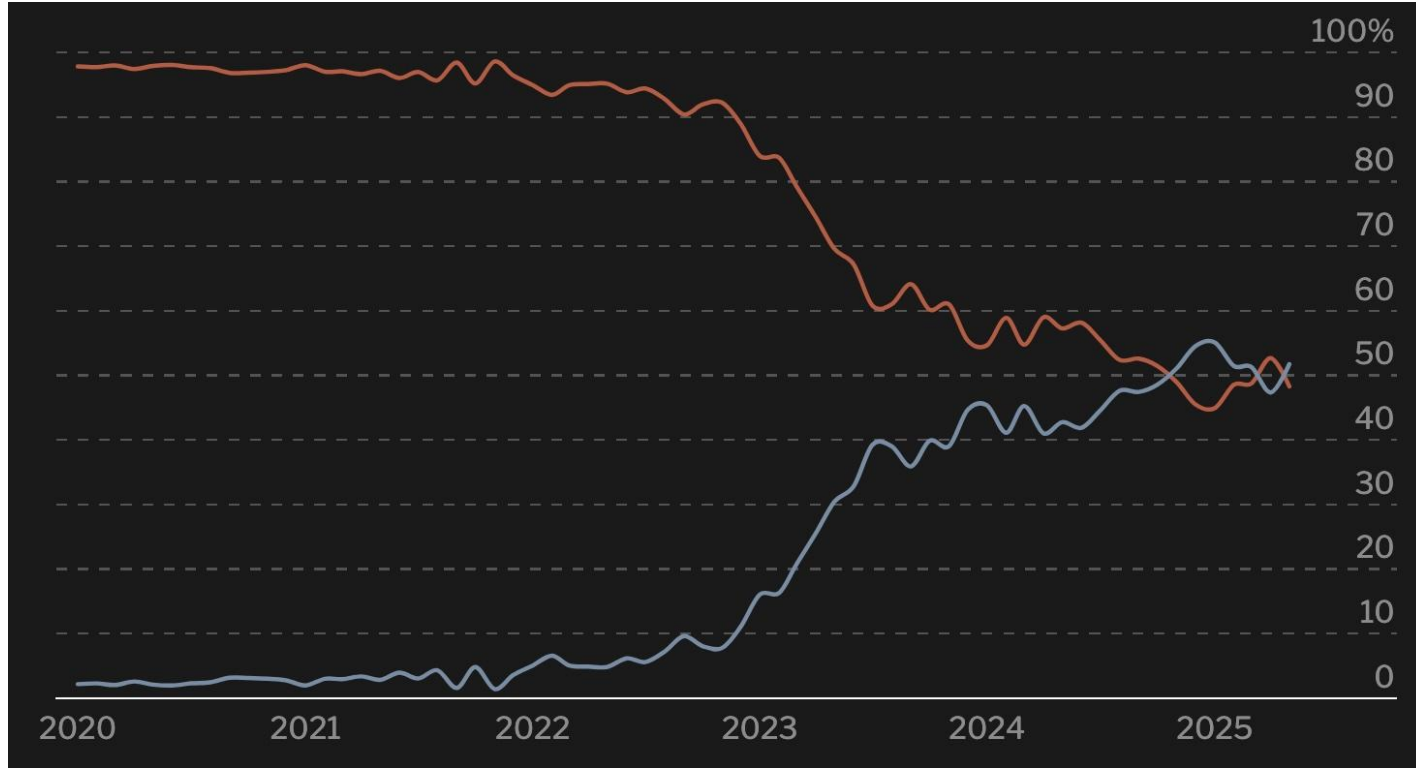
## US perceptions of AI's societal impact: general public vs. experts

Source: Pew Research, 2025 | Chart: 2026 AI Index report



AI "DIVIDE"

# MORE CONTENT IS GENERATED BY AI THEN BY HUMANS



# Sustainability of AI (for us Humans)





**“trump”**  
57.7% confidence

+  $\epsilon$



=



**“poetin”**  
99.3% confidence

# CHAT-GPT3 TRAINING DATA

- 500 billion (GPT-3)
  - Compare kids aged 3 : 10 – 40 million words input
- Basis of the LLM's knowledge (here Llama)
  - **Fact and fiction**
  - Books, code, news, social media,  
...

Dataset	Sampling prop.	Epochs	Disk size
CommonCrawl	67.0%	1.10	3.3 TB
C4	15.0%	1.06	783 GB
Github	4.5%	0.64	328 GB
Wikipedia	4.5%	2.45	83 GB
Books	4.5%	2.23	85 GB
ArXiv	2.5%	1.06	92 GB
StackExchange	2.0%	1.03	78 GB

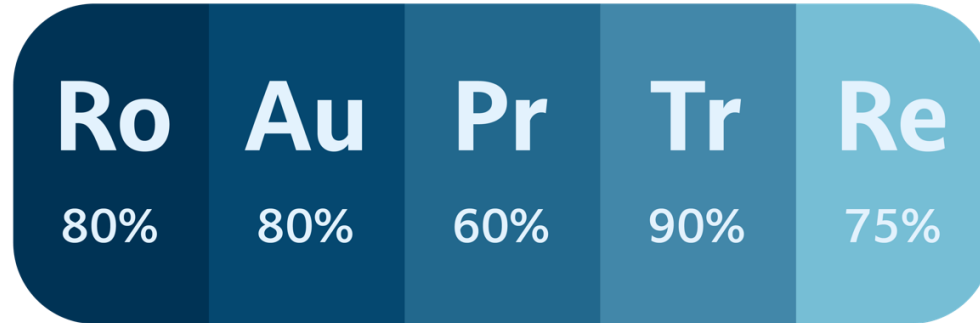
TRUTH? OWNERSHIP? BIAS?



# IMAGENET (CORE TRAININGSSET FOR #VISUAL AI ALGORITHMS)

- 14 M labeled photo's
- 45% VS, rest primarily EU & Canada
- 1% China & 2% India

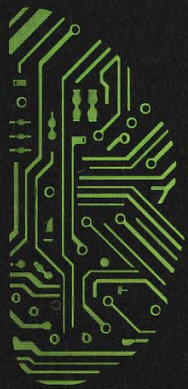
# Sustainability Score for Humans



# SUSTAINABLE AI FOR US HUMANS

- Robustness
- Auditability
- Predictability
- Transparency
- Responsibility
- Good Quality Data & Diversity
- Model Monitoring
- Explainable Models
- Bias Mitigation & Fairness
- Human-in-the-Loop Approaches

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# Sustainability of AI (for our Planet)



# MULTI-MODAL ENSEMBLES (OPENAI'S DALL-E-2)



**100%  
iPhone  
charge**



**I generated  
image Dall-E-2**

**100%  
iPhone  
charge**



**I generated  
image Dall-E-2**

**100%**  
**iPhone SE**  
**Charge (20.000 Joules)**



**10%**  
**iPhone SE**  
**Charge (2.000 Joules)**

**I generated**  
**HD image Dall-E-2**

**I prompt**  
**Llama 70B**

**MIT Tech Review**  
**01/11/25**

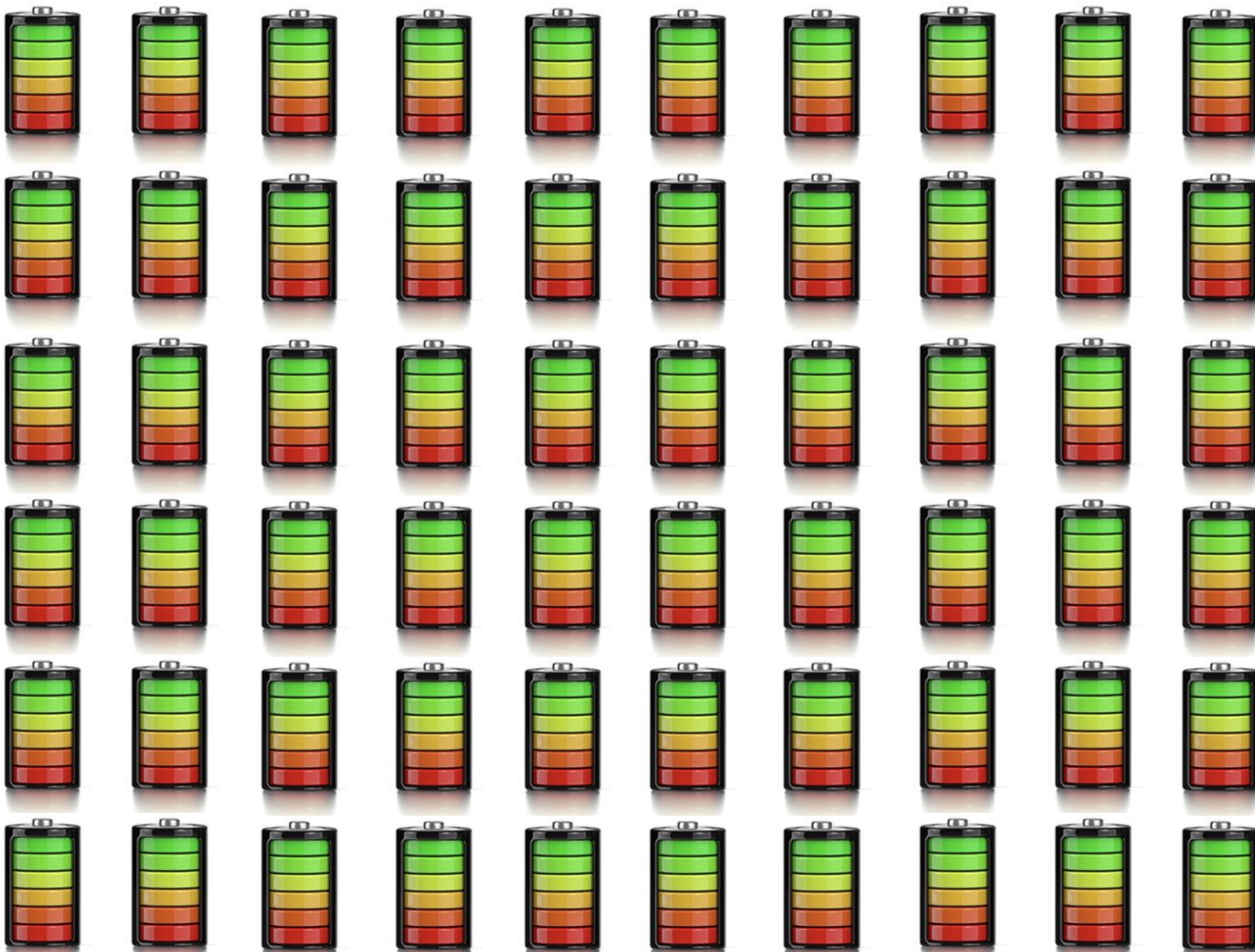
# ONE IPHONE SE CHARGE = 20.000 JOULES

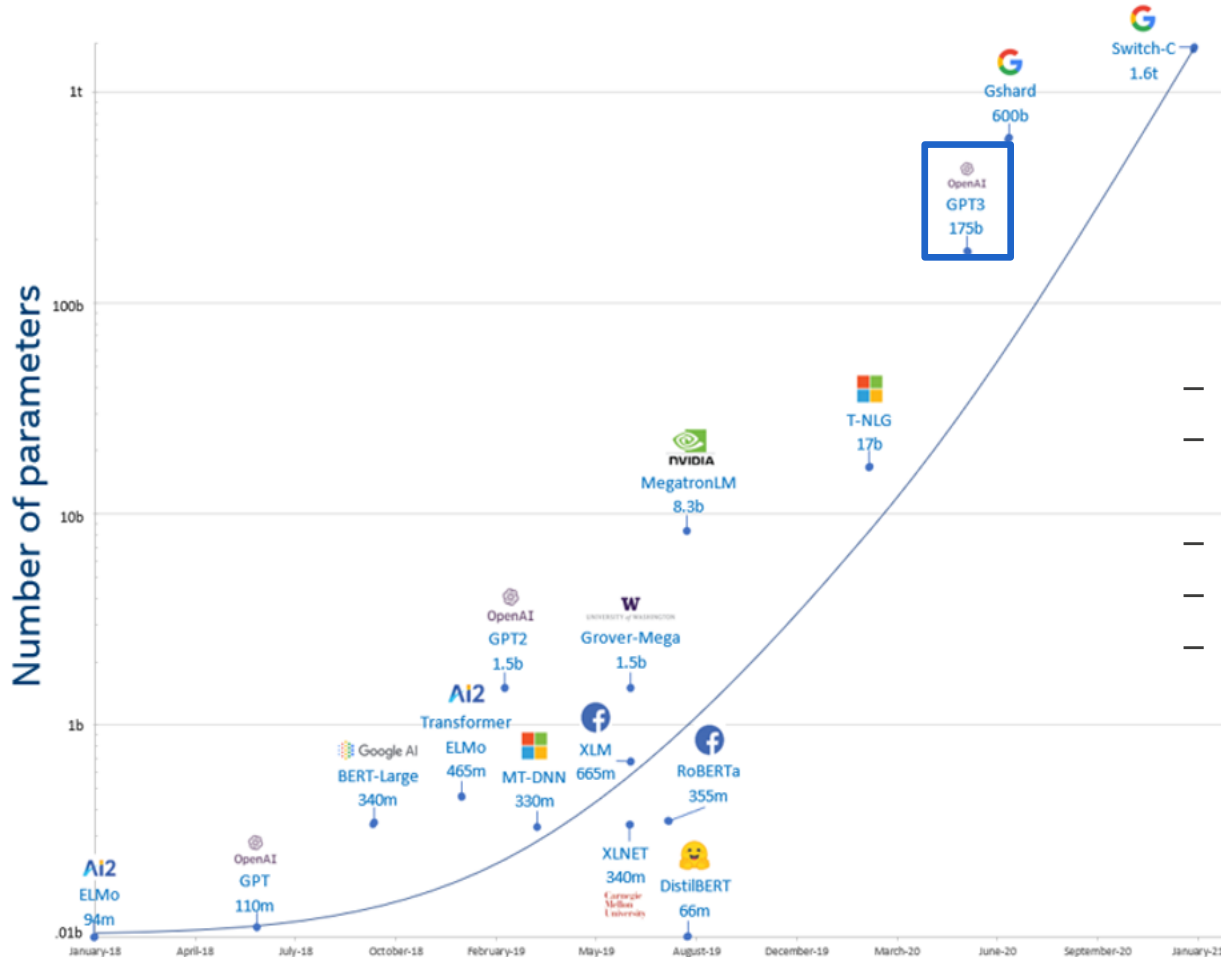
MIT Tech Review  
01/11/25

I google search	: 390 Joules
I very simple Llama (8B) prompt	: 120 Joules
I very simple Llama (70B) prompt	: 2.350 Joules (10% iPhone Charge)
I very simple Llama (400B) prompt	: 6.700 Joules
I complicated Gemini Ultra (+/- 2T) prompt	: 20.000 Joules (est.) (iPhone Charge)
I generated Standard Image (1k x 1k)	: 2500 Joules
I generated HD Image (8k x 8k)	: 20.000 Joules (iPhone Charge)
I generated short video (5s @ 16 frames/s)	: 3.400.000 Joules (170 iPhone Charges)
I generated video SORA (30s @ HD)	: 50.000.000 Joules (est.) (2.5k iPhone Charges)

1kWh = +/- 3M Joules = tea kettle (for an hour)

15kWh = +/- 50M Joules = microwave (for an hour) or 8 deep fryers (for an hour)



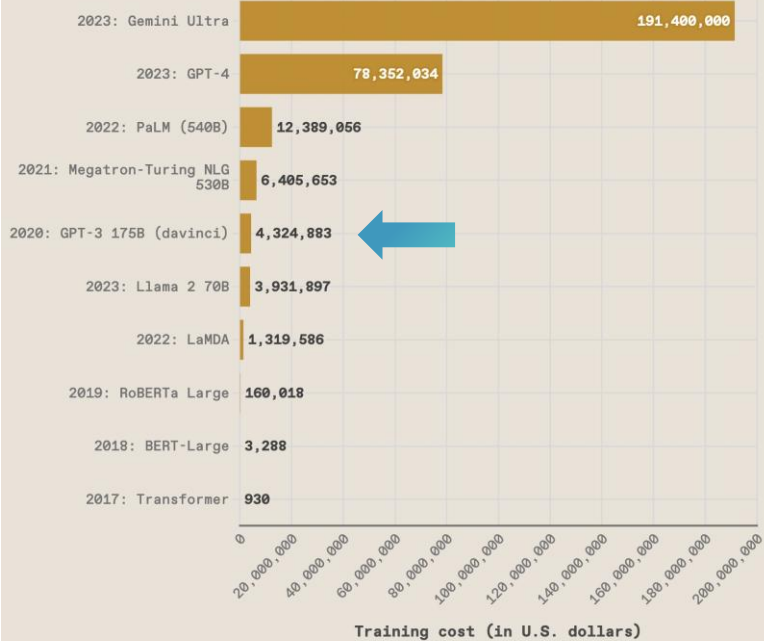


- \$4.3 million dollars
- 9 days to train
- 936 MWh
- 600.000 kg CO2
- 10% Water Maine

Figure 1: Exponential growth of number of parameters in DL models



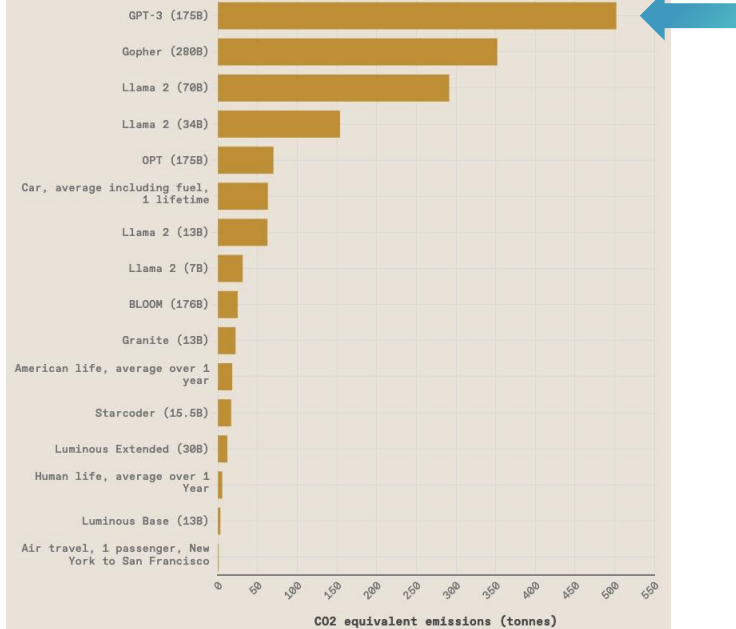
Estimated training cost of select AI models, 2017-23



Source: Epoch, 2023 | Chart: 2024 AI Index report

IEEE Spectrum

CO<sub>2</sub> equivalent emissions (tonnes) by select machine learning models and real-life examples, 2020-23

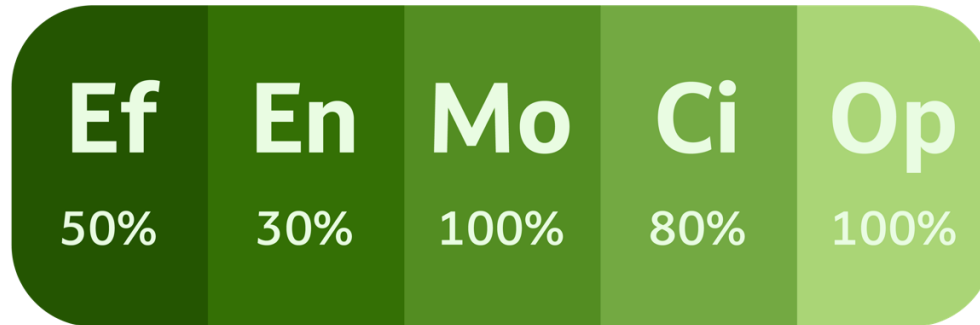


Source: AI Index, 2024; Luccioni et al., 2022; Strubell et al., 2019 | Chart: 2024 AI Index report

IEEE Spectrum

ONE WEEK OF ENERGY

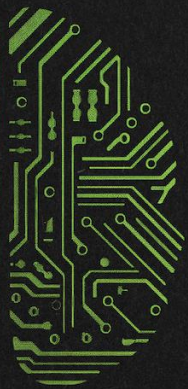
# Sustainability Score for the Planet



# SUSTAINABLE AI FOR THE PLANET

- Efficient
- Energy-aware
- Modular
- Circular
- Open
- Few Shot Learning
- FL on the Edge
- AI MicroServices
- Chiplets
- Open Model/Code/Data

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# Sustainability in AI

(some working  
sustainable  
examples)

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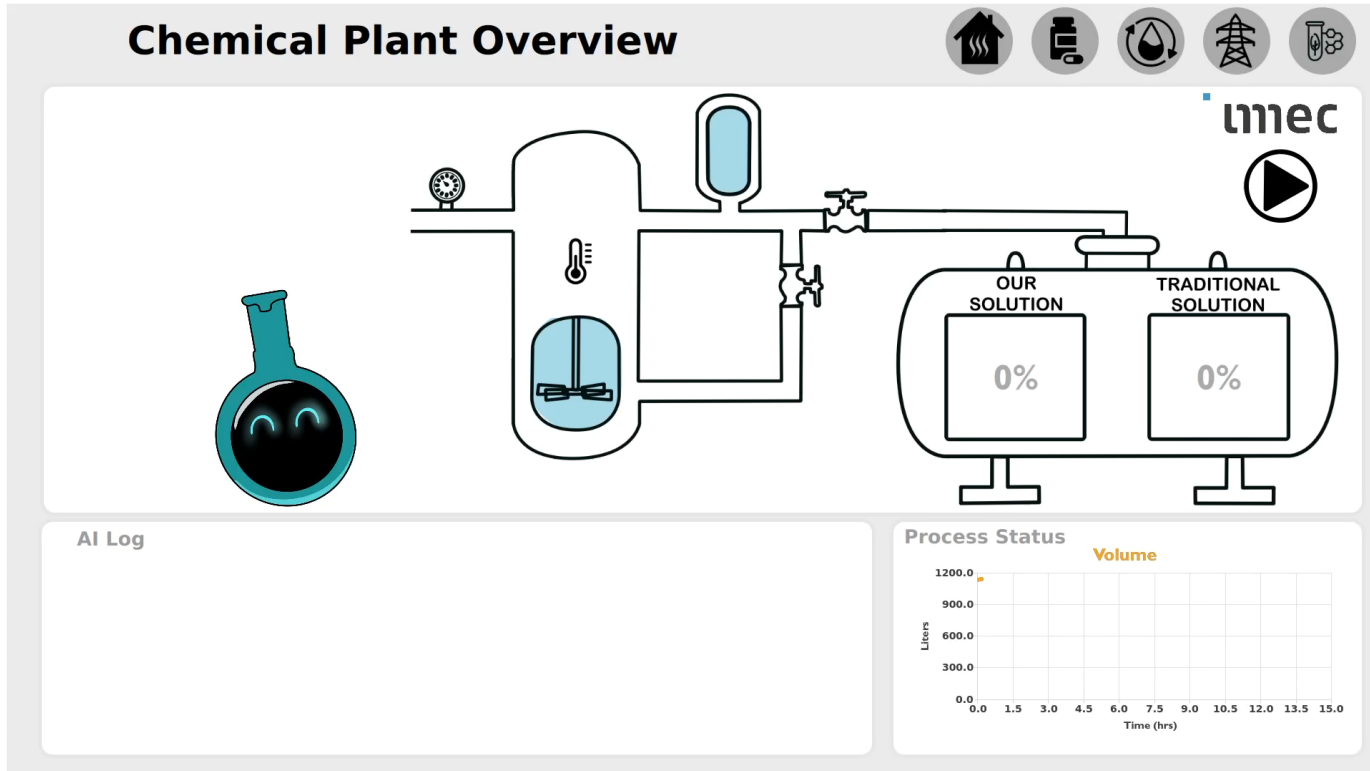
SUSTAIN

Towards blue and

# USE CASE I : EXPLAINABLE SMART CHEMICAL PROCESSES

INTELLIGENT SOLVENT SWITCH (EXTRA LAYER OF EXPLAINABLE AI INCLUDED)

(-20% OF TIME, -25% OF RESOURCES NEEDED) **(J&J CASE)**



# USE CASE 2 : ENERGY CONSTRAINED LOW ORBIT SATELLITE

## “1 WATT” RESOURCE-EFFICIENT, ROBUST AI FOR HYPERSPECTRAL IMAGING

**IDLab**  
INTERNET & DATA LAB

Model optimisation

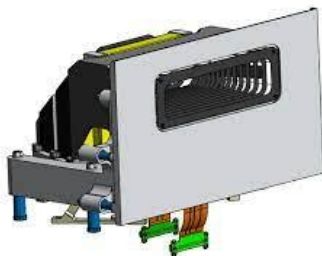


**vito**

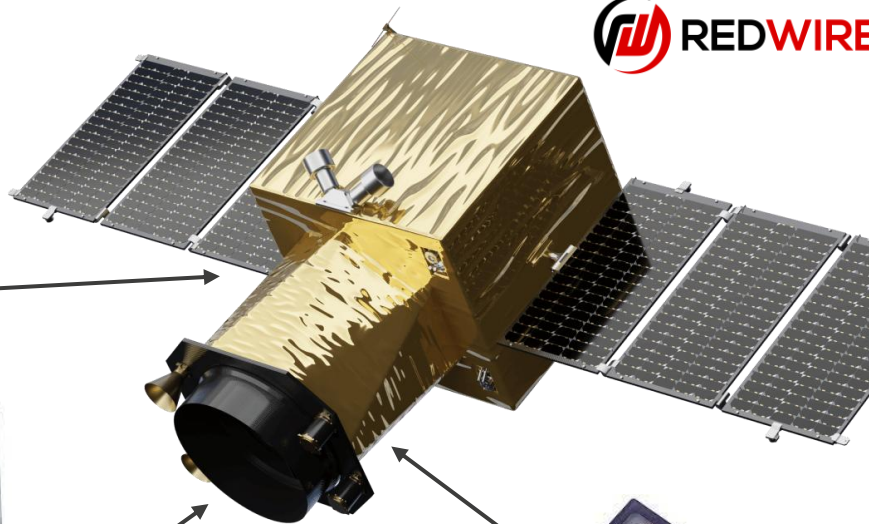
Image compression



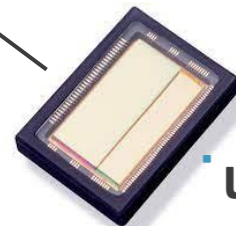
**MAGICS**



**OIP**  
Space Instruments



**REDWIRE**



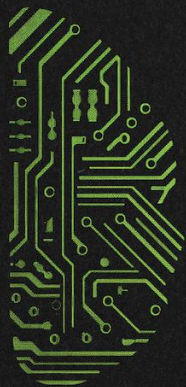
**umec**

**GHENT**  
UNIVERSITY

**howest**  
university of applied sciences

**Universiteit**  
Antwerpen

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# Sustainability in AI

(where we the EU  
should bet on)

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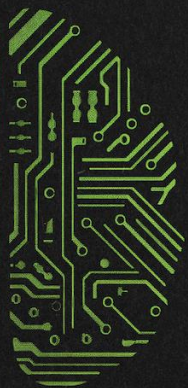
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# Coding

(changed forever)

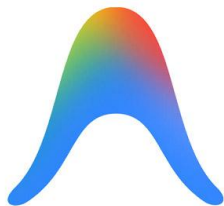
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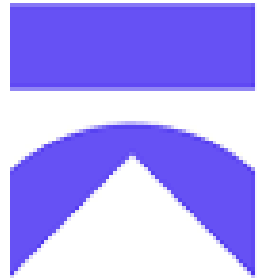
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Antigravity

ONE RING TO CHECK & TEST THEM ALL



**aikido**

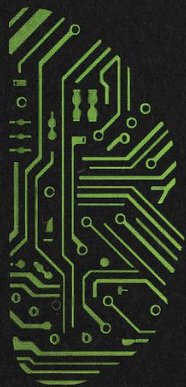
FROM ...

1 Project Manager for 10 Software Engineers

TO ...

10 Project Managers for 1 Software Engineer

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# Agents

## (coordination)

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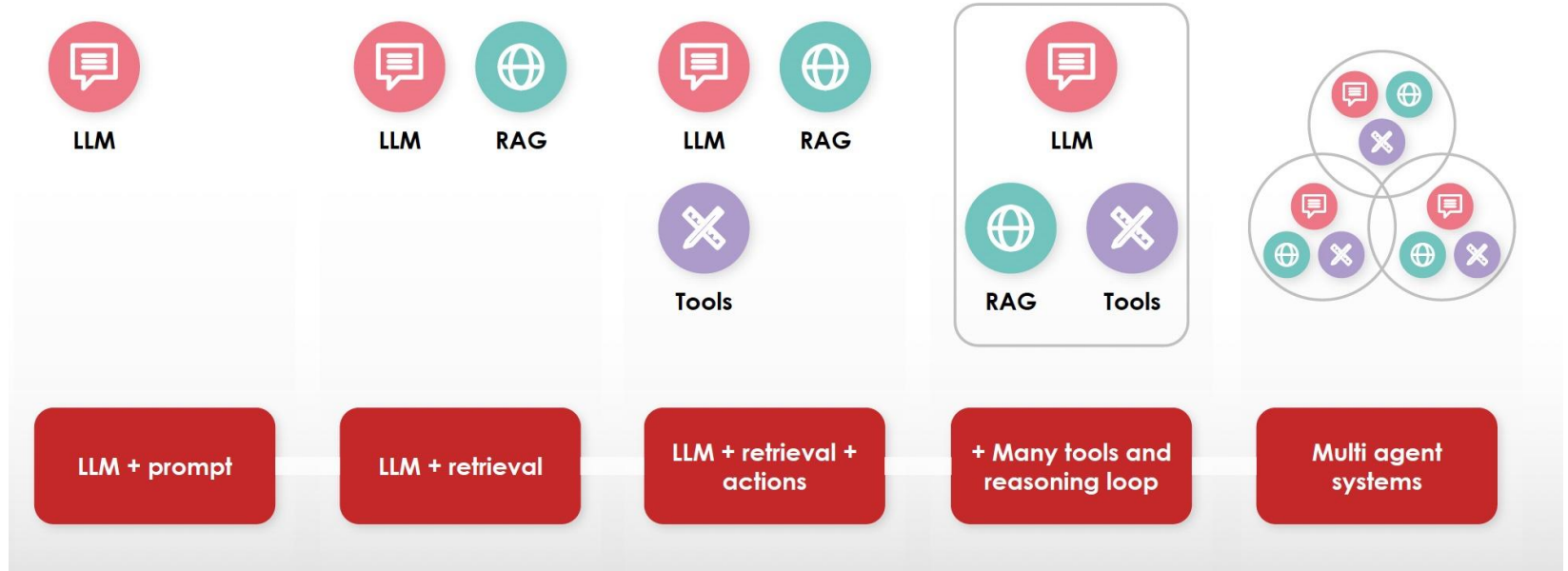
Prof. dr. ir. E



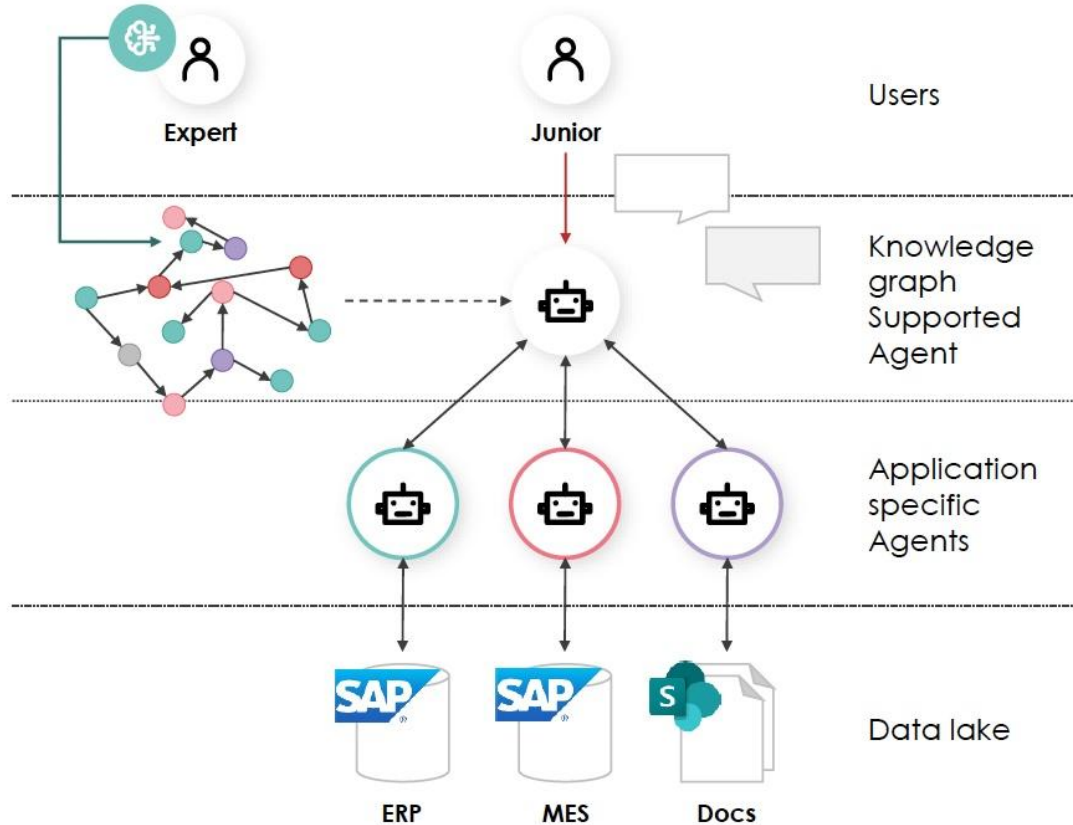
SUSTAIN

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# AGENTS



## Knowledge reinforced LLM-based chatbots



# SECURITY, SECURITY ... SECURITY

LEAKED // CLASSIFIED

CAPYBARA TIER // BEYOND OPUS

## CLAUDE MYTHOS

Step-change AI model with **unprecedented cybersecurity** capabilities. What it means for defenders.

ANTHROPIC

# AGENTS



## Sustainability Score for Humans

**Ro**

80%



**Au**

80%



**Pr**

60%



**Tr**

90%



**Re**

75%



## Sustainability Score for the Planet

**Ef**

50%



**En**

30%



**Mo**

100%



**Ci**

80%



**Op**

100%



Vermogen AI-chip Koeling, networking, enz...

30

Piekverbruik van **Nederland: 19 GW**



20

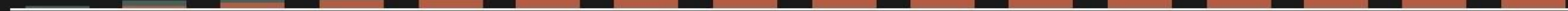
10

2022

2023

2024

2025





**FC BAYERN MÜNCHEN**

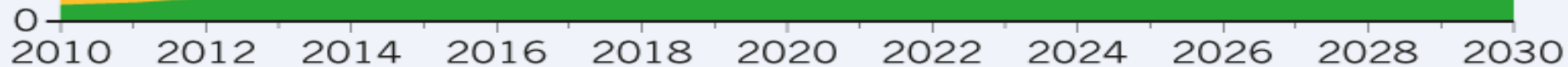
9,000 terawatt hours (TWh)

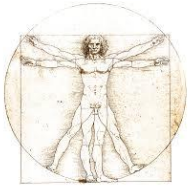
## ENERGY FORECAST

Widely cited forecasts suggest that the total electricity demand of information and communications technology (ICT) will accelerate in the 2020s, and that data centres will take a larger slice.

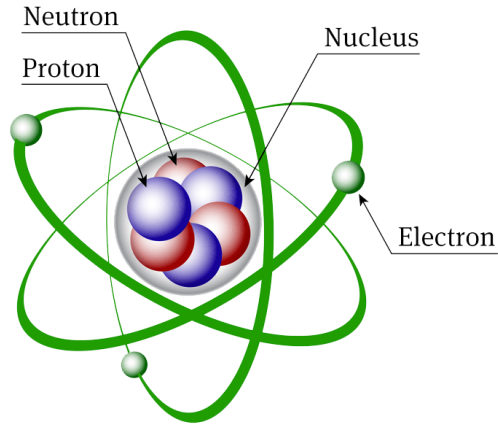
- Networks (wireless and wired)
- Production of ICT
- Consumer devices (televisions, computers, mobile phones)
- Data centres

20.9% of projected electricity demand





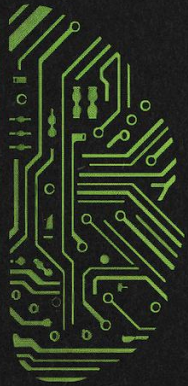
## ... FUTURE OF AI



 **open**chip

 **MISTRAL**  
**AI\_**

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# Geo-Politics

(world domination  
& agency)

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# STARGATE VS DEEPSEEK



“No more rules”

“Dual use” becomes the norm

Big / Bigger / Biggest

URSULA VON DER LEYEN SHOULD JUST SAY “F\*\*\* OFF, TRUMP”

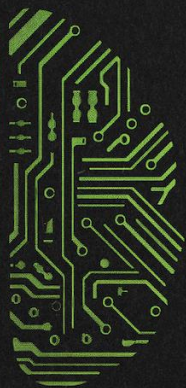
**ASML**

**mec**

ONE (!!!) FOUNDRY PRODUCES ALL TOP-NOTCH SILICON



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# World Models

(+ knowledge graphs  
= physical AI)

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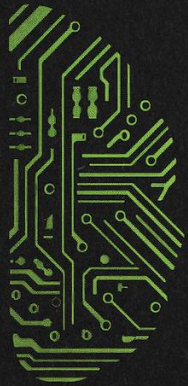
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# Sustainability of AI

(some final  
remark ;)

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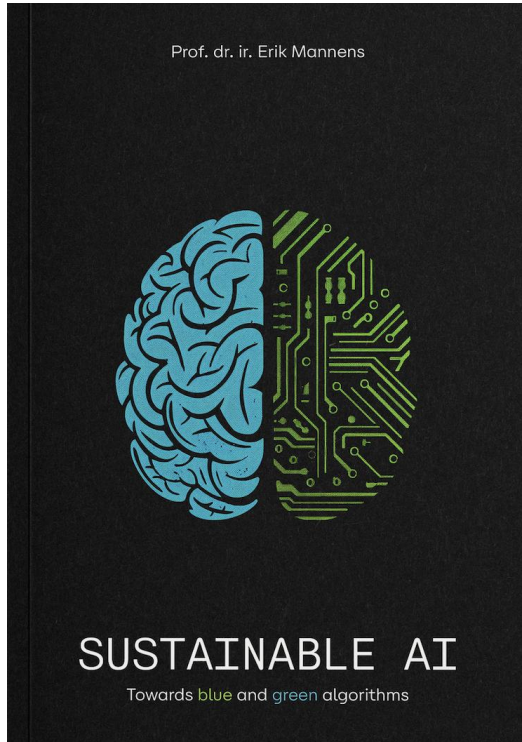
Towards blue and

# AWERENESS & MEASUREMENT (O.A. IN USE & TENDERS)

ONLY 10% OF THE USE CASES NEEDS AI  
ONLY 10% OF THIS 10% NEEDS GENAI ;)







- A very short history of AI
- Why current AI is not Sustainable for Humans
- Why current AI is not Sustainable for the Planet
- How to make AI Sustainable for Humans
- How to make AI Sustainable for the Planet
- 7 Real World Sustainable Use Cases
- Your Company Roadmap towards Sustainable AI
- Legacy for the Next Generation

FOR MORE INFO ON THIS BOOK



<http://sustainable-ai.be/>

WORLD FIRST 😊 ... WORKING ON MY BOOK #2 ...

“AI WARRIOR”  
OR  
HOW TO PREVAIL IN AN AGE OF ORANGE A\$\$HOLES

- Climate Change
- Energy Transition
- Mobility Transition
- Food Transition
- Health Care Transition
- Digital Governance Transition



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# prof. dr. ir. Erik Mannens

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