Sustainable Data Centers
How We Can Learn from World-Leading Solutions?

Thomas Fricke

September 2, 2025
Skien Norway

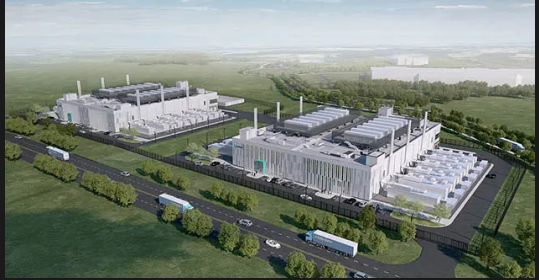
Who am I?

Thomas Fricke

- Kubernetes Cloud Security
  - critical infrastructure
  - architecture
  - examination
- Former life: Statistical Physics
- Disclaimer

  Work for the German Administration
  - Pro Bono: OpenCode, Consulting IT Planning Counsel
  - Payed: OpenDesk, FITKO

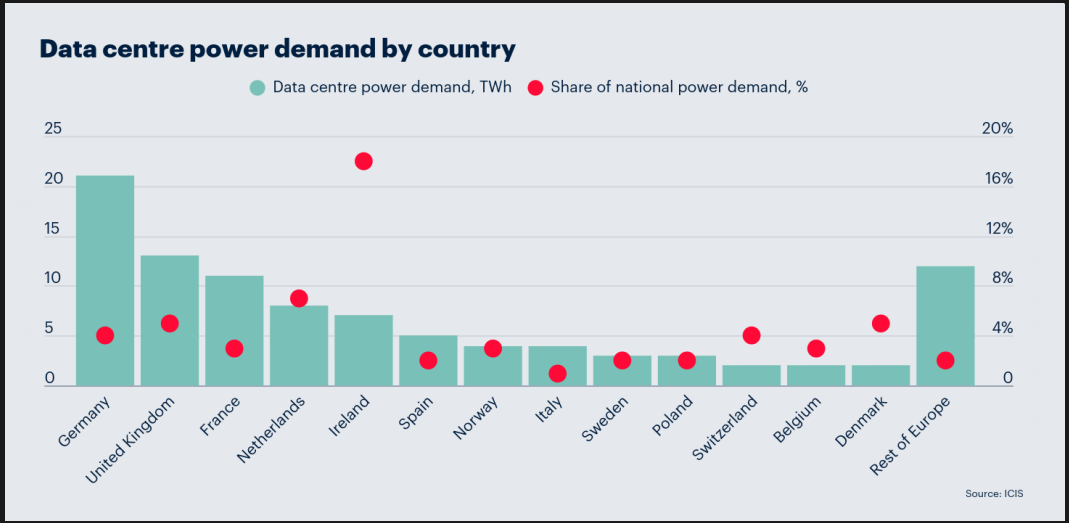
Datacenter



Datacenters are Factories

- Energy consumption
  - 12 MW small German DC
  - 40 MW state of the art German DC
  - 300 MW planned in Berlin
- Diesel emergency power Generator
  - 1 day onsite
  - transport capacity for longer
  - ship
  - vans
- Access to transmission grid
  - transformer station
  - power lines 110kV
- total consumption
  - Berlin/Brandenburg planned 1-2 GW
- Water
  - cooling
  - transport
- several Billions of servers
  - typical rack 900.000€
  - several thousand racks
- access to multiple redundant fiber lines
- German setup
  - 2 x Telekom
  - Vodafone
  - Colt
- access control
  - typical vans
  - Kalaschnikov safe amoured glass entrance
- noisy (90 dB+)
- completely unprotected roof

EU Datacenter Power Demand by Country 2024



Electric Power Research Institute – US Predictions

Electric Power Research Institute
Epoch AI Joint Report Finds Surging Power Demand from AI Model Training August 2025

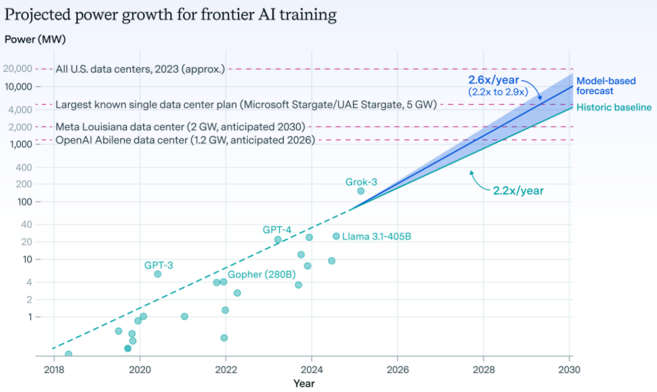


Figure 1. *Forecast for peak power demand required to train the largest frontier models, with historic frontier AI power growth and historic training runs highlighted for context. Graph prepared by Epoch AI.*

Exponential Growth

- explosives
- nuclear chain reactions
- population growth
- infections at the beginning of an epedemy SIR Model
- limited by resources

Gromstulskogen

- €600 million ($646.4m)
- *jobs both locally and nationally*
- 200 hectares in Gromstul
- 240 MW
  - really 20MW
  - ramp up until 2030
- (860MW earlier planning was a confusion)
- go live in 2026.

Data Center Dynamics 2024

Resistance against AI

- **Bloomberg**:

  NIMBYs Are Coming for the Data Centers AI Needs
  Elected officials have been punished by voters for greenlighting the massive, energy-hogging facilities.

- **Datacenter Watch**:

  $64 billion of data center projects have been blocked or delayed amid local opposition

- **Bloomberg**:

  Sam Altman's Energy 'New Deal' Is Good for AI. What About Americans?

- **Business Human Rights**

  Peru: Indigenous communities protest against Glencore's Antapaccay copper mine expansion concerned with potential environmental damage

Prediction Recap and FOMO

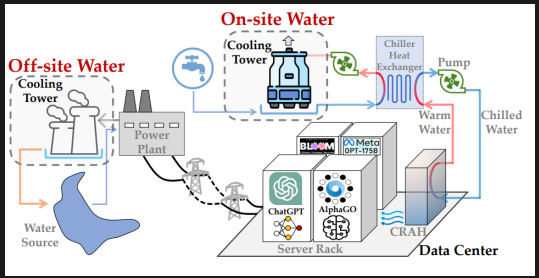
- never seen before 5 fold increase
- from 3.7% to 5-15% of the 2030 prediction
- adding 10% to the US grid
  - unprepared
  - instable
- FOMO (fear of missing out) propaganda
  - China will lead in 2030
  - at the brink of World War III
  - Retain US leadership in AI
  - US Gov: AI linchpin of our economy
  - AI New Deal
- nuclear power to the rescue – SMR

We need serious numbers!

- Output
  - How many jobs are created
    - locally
    - nationally
  - No vague numbers please
  - Illinois: $468 million in subsidies for only 339 jobs ($1.4 million per job)
  - Good Jobs First: New Data on Data Center Subsidies, Same Old Problems
- resources consumed
  - Locally
    - Land
    - Energy
    - Transmission Grid
    - Water
  - Globally
    - Copper
    - Other metals

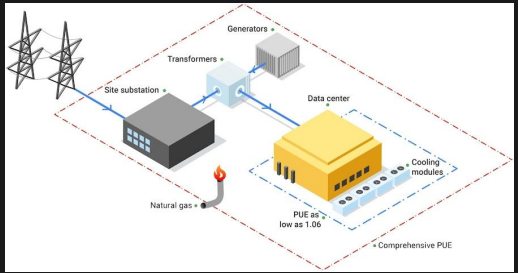
Water

Data Center Dynamics: How to cut water usage in cloud data centers

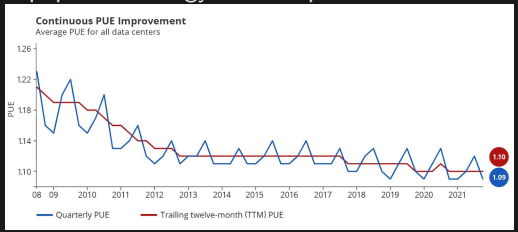


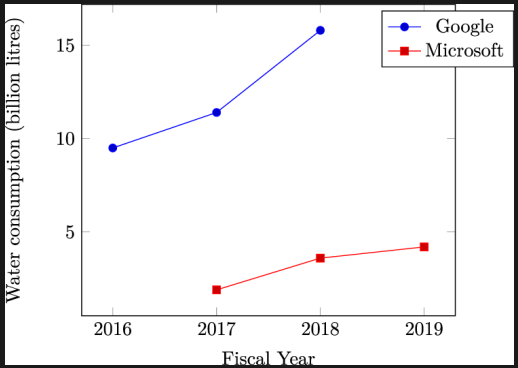
- Its complicated
- 1 – 9 l of water per kWh
- first post 1 MW consumes 26 Million litres a year $\approx$ 3 l/kWh
- variations of efficiency
- weather conditions

Google Power Usage Effectiveness – PUE Greenwashing



Centre Total Energy Consumption PUE= ICT Equipment Energy Consumption

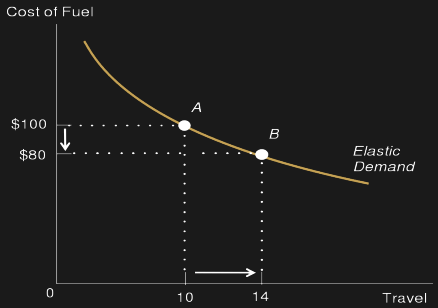




$$\text{PUE} = \frac{\text{Data Centre Total Energy Consumption}}{\text{ICT Equipment Energy Consumption}}$$

Source: Google(left), Nature (right)

Jevons Paradox



Jevons Paradox

Experts are skeptical about Google's AI water consumption claims

- *Google's five drops per query is just the tip of the iceberg*
- individual user problem now
- get over it – don't look up

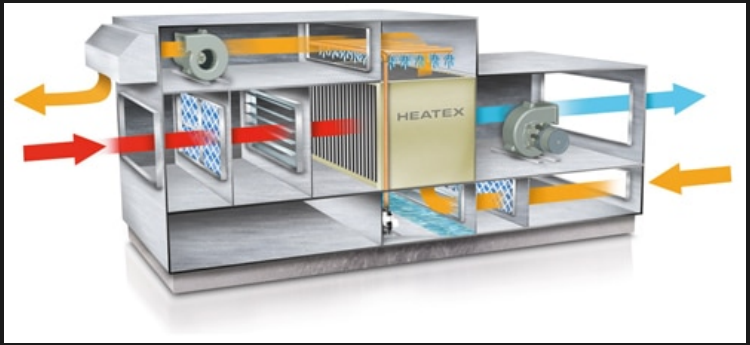
Jevons Paradox

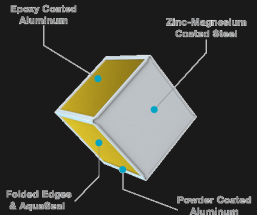
- first described for steam engines
- example is for travelling costs
- Rebound Effects in Cloud Computing: Towards a Conceptual Framework

Personal observations

- provisioning times are hidden costs
- self provisioning
- cloud enabling
- virtualisation
- containers
- Kubernetes
- CI/CD pipelines

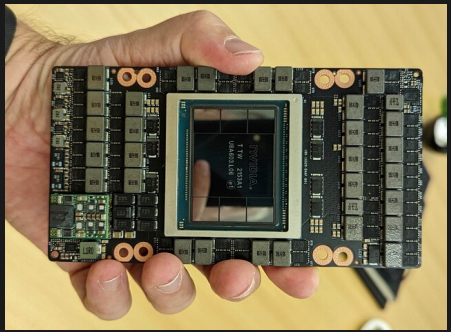
Cooling



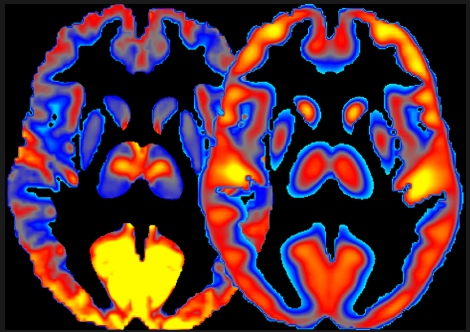


Source: Heatex

Comparison NVIDIA Hopper H100 vs Homo Sapiens[2]



700 Watts



20 Watts

Energy Consumption

- Single Graphics Card
- 700 Watts = 0.7kW
- ~ ~~30~~ 100 kW / rack
- instead of 3 to 6 KW / rack

New method for combining measures of brain activity (left) and glucose consumption (right)

...

Dr. Ehsan Shokri Kojori, NIAAA

Comparison Brain – Datacenter

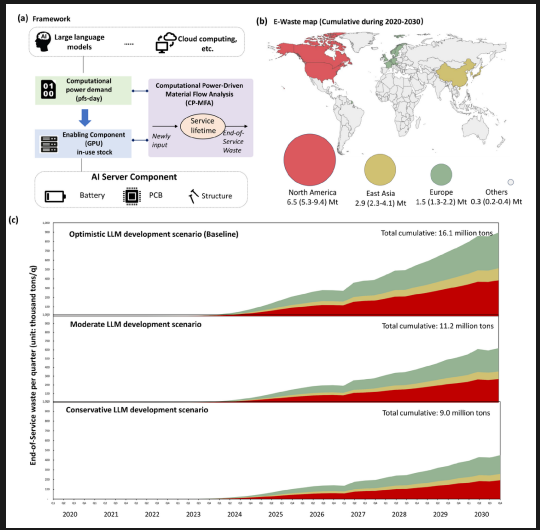
$$\text{Transistor} \approx \text{Synapse}$$
$$4.000\ \text{Blackwell} \approx 10.000\ \text{H100} \approx \text{Brain}$$
$$7\ \text{MW} \equiv 20\ \text{W}$$

$x10$ Transistors and $x2$ for cooling and network $\approx$ 140MW (50MW Blackwell)
that is the true reason why the Matrix AI is using humans to live in

Average usage of a GPU in Kubernetes is 20%

AI-Waste

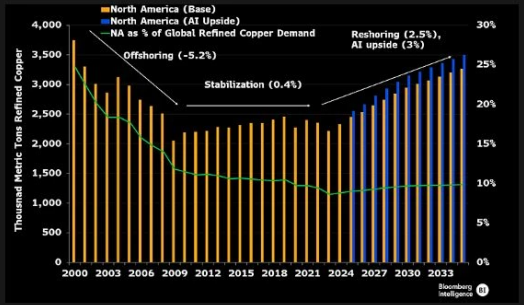
- Lifecycle of Data Center Hardware: **3 – 5 years**
- Peng Wang, Chinese Academy of Sciences, Lingyu Zhang, Institut National des Sciences Appliquées de Lyon, Asaf Tzachor, Eric Masanet, University of California, Santa Barbara:
  E-waste Challenges of Generative Artificial Intelligence
  also in Nature
- Data Center Hardware Lifecycle 3-5 years
- Deutsche Welle E-waste from AI computers could 'escalate beyond control'
  - Nature E-waste challenges of generative artificial intelligence
  - 1.2-5.0 million metric tons in 2030
- **1,000** fold increase of waste



E-Waste

Copper in US data centers

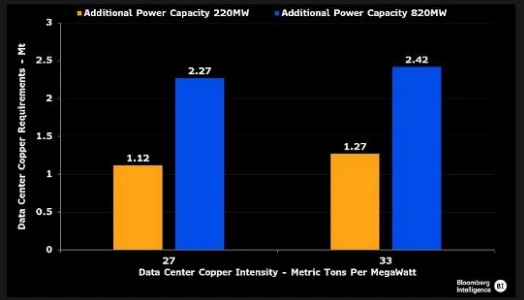
North American Refined-Copper Demand



Source: Data Center Knowledge, Wakefield & Cushman, Wood Mackenzie, ICSG, Bloomberg Intelligence

- 3% increase every year
- 1.1 million tons in 2030

North American Data-Center Copper Demand by 2030

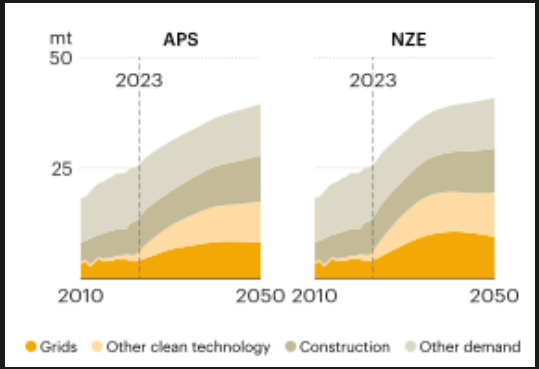


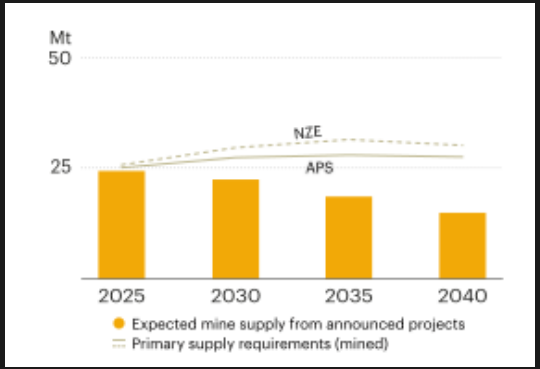
Source: US Department of Energy, US Energy Information Administration, IDC, eMarketer, Data Center Knowledge, Navigant Research, Cushman & Wakefield, Bloomberg Intelligence

- 1 MW $\approx$ 27 -33 metric tons
- Data Centre Magazine How the AI Data Centre Boom Could Threaten Global Copper

International Energy Agency (IEA): Copper

Copper Outlook for key energy transition minerals





- 3% increase every year
- 1.1 million tons in 2030
- 1 MW $\approx$ 27 metric tons

Thumb Rules

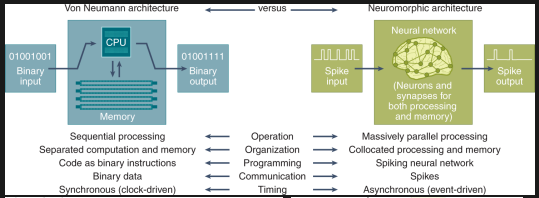
Resource	Unit	Source	Main competition	Impact Blast Radius
Power	1 MW	power plants	industry, households	earth
Transmission		power lines	landscape	
Copper	27 t		mining industry, electric cars	indigenous communities in the mining area
Water	1000 – 9000 l/h	ground water, rivers	farms, households	local to the datacenter

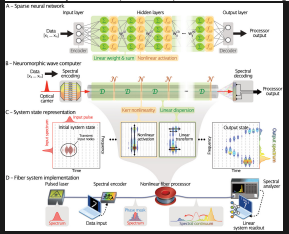
Impact on the Environment

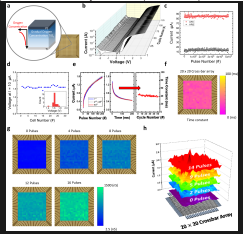
Neo Colonialism

- Reporter Brasil Documents link Amazon and Google to companies investigated for illegal gold mining
- Tucson: Arizona opinion: Data centers redefine the Copper State
- Dan Watch: Impacts of copper mining on people and nature
- Monga Bay Renewables won't save us from climate catastrophe, experts warn; what will?
- The Guardian How the rise of copper reveals clean energy's dark side

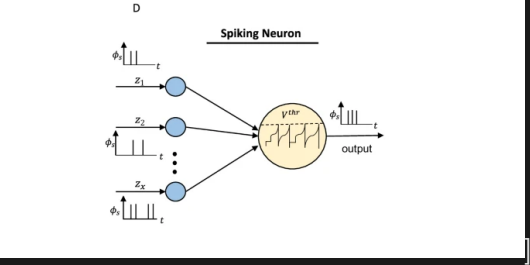
Neuromorphic Computing – Can Tech Save us?

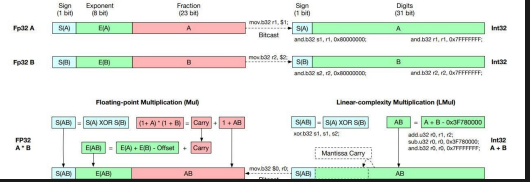




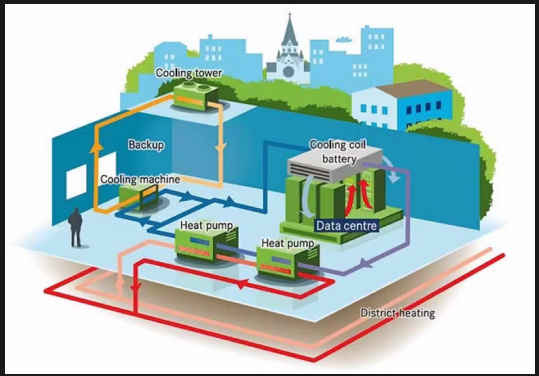


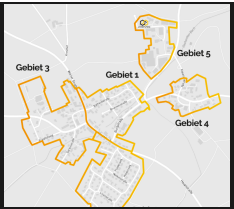
Could save 95% of the energy needed





Reusing the heat





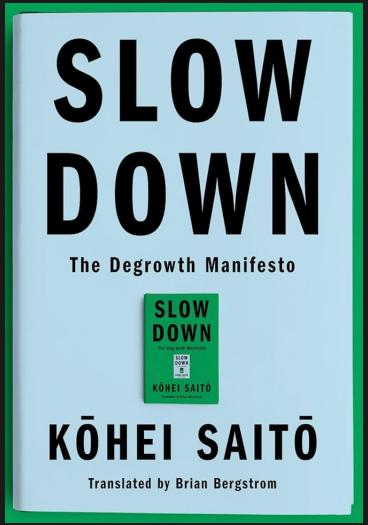
- Integration into district heating
- Small scale J-H Computers
- NTT Berlin 2 – Gasag
  - district heating does not really fit
  - must be planned and implemented together
- better than Geothermal energy
- integration into

Touching Limits: Energy, Water, Metal CO_2

- Ireland: AI Data Center Moratorium until 2028 because of Blackout fears
- Netherlands: Inside the data centre moratorium movement
- Tech HQ: Heating up: how much energy does AI use? *What we do know is that training ChatGPT used 1.287 gigawatt hours, roughly equivalent to the consumption of 120 US homes for a year.*
- Moomoo: Chicago data center electricity demand increased by 900%! AI continues to detonate global energy challenges
- Cleanroom Technology: data centers run out of power
- Business Today: OpenAI might go bankrupt by end of 2024
- Business Insider: The AI boom will push America's shaky power grid to its limit
- Wired: AI's Energy Demands Are Out of Control. Welcome to the Internet's Hyper-Consumption Era
- OECD: How much water does AI consume? The public deserves to know
- Substack: The Great Salt Lake is Disappearing. So, Utah Banned the Rights of Nature.
- Straight Arrow News: AI tools consume up to 4 times more water than estimated
- Substack: Material Sacrifices To tackle climate chaos, decolonize the labor movement
- The Driller: Growing Demand for Copper Drives Need for Increased Domestic Mining, Experts Suggest
- Generative AI is reportedly tripling carbon dioxide emissions from data centers
- Odessa American Online: AI to boom natural gas market
- Arabian Gulf Business Insight: Aramco partners with US startup Groq for AI data centre

Degrowth

- if you don't kill exponential growth, the explosion will kill **us**
  - **our** economy
  - **our** energy grids
  - **our** business
  - **our** environment
  - **our** entire planet
  - **all limits are nearly exhausted**
- **Degrowth** kills nearly all of your business models
  - advertising
  - surveillance
  - selling without limits
  - keeping people busy
  - anything with **Growth**
  - **as unlimited growth will do**
- the current economy is like a junkie looking for money to buy drugs



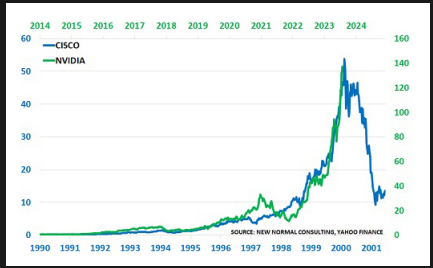
Warnings

- Lot of Left Behind FOMO expected
- D.O.G.E (Department of Government Efficiency)

  will be abused to remove environmental protection
- EU will follow? Call to action!
- if a data center is planned in you region ask for
  - resource consumption
    - locally
    - globally
- Immediate warning for Cologne Area, Germany
  - Microsoft will riesige Rechenzentren in Bedburg und Bergheim bauen
  - RWE cannot provide enough power
  - brown coal mining FOMO will start

Conclusion

- Don't believe the AI bullshit bingo
  In from three to eight years we will have a machine with the general intelligence of an average human being.
  Marvin Minsky, Life magazine 1970
- Resource consumption totally out of control
- whatever resource is exhausted first will terminate the AI
  - money
  - energy
  - energy grid
  - water
  - metal resources
- data needed
- degrowth
  - start with different AI
  - degrow your workload
- will harm the planet on every possible scale



Stock market bubbles follow the same pattern, as Nvidia and Cisco confirm

- charlatanry
- nuclear scam the scammers
- massive financial interest
- public protest

Question? Remarks?

Further reading

- Gerry McGovern
- Paris Marx
- Halloween Talk at SreCon Emea 2024
- Kohei Saito on archive.org: Marx in the Anthropocene

Some Answers

Slides: https://thomasfricke.de/skien2025.pdf

Mail: skien2025@thomasfricke.de

Mastodon: @thomasfricke@23.social

LinkedIn: https://www.linkedin.com/in/thomas-fricke-9840a21/