



RESOURCE CONSUMPTION OF AI

3803

DEGROW OR DIE

Thomas Fricke

December 30, 2024



Innovationsverbund Öffentliche Gesundheit

INOEG

- ▶ commenting
 - ▶ public health care
 - ▶ CRA and Open Source
 - ▶ digitalization
- ▶ projects
 - ▶ Iris Connect
 - ▶ Labhive
- ▶ Funding partially Björn Steiger Stiftung

Thomas Fricke

- ▶ Kubernetes Cloud Security
 - ▶ critical infrastructure
 - ▶ architecture
 - ▶ examination
- ▶ Former life: Statistical Physics
- ▶ Disclaimer
 - ▶ Pro Bono: OpenCode, Beratung IT Planungsrat
 - ▶ Payed: OpenDesk, FITKO



Datacenter



Thomas Fricke



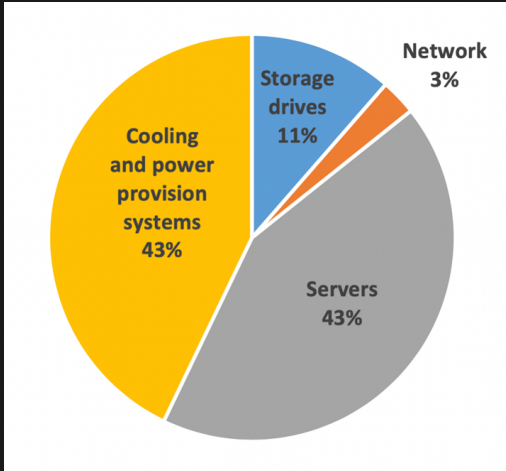
Resource Consumption of AI – Degrow or Die

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 save armoured glass entrance
- ▶ noisy (90 dB+)
- ▶ completely unprotected roof



Power Usage in a typical Data Center



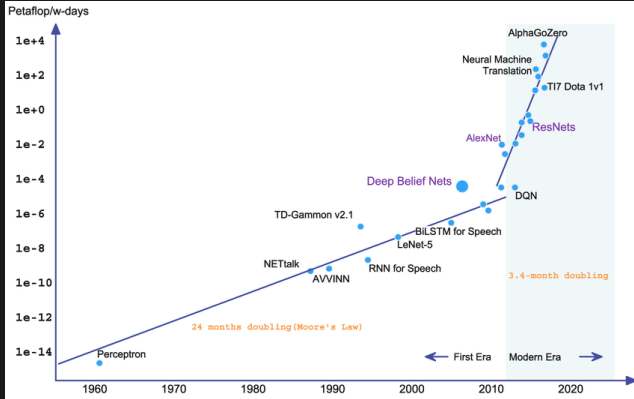
Fraction of U.S. data center electricity use in 2014, by end use. Source: Shehabi 2016

- ▶ mostly wasted
- ▶ not changed in the last 10 years
- ▶ cooling and power as much as compute
 - ▶ water evaporation
 - ▶ immersion cooling
 - ▶ adiabatic cooling



Moore's Law for Training Neural Networks

How AI will really kill us



Moore's Law by Open AI AI and Compute

- ▶ H100
 - ▶ 10.6 TFlops single precision
 - ▶ 5.3 TFlops double precision
- ▶ 10000 TFlops
 - ▶ 1000 H100 single precision
 - ▶ 700 kW
 - ▶ 2000 H100 double precision
 - ▶ 1400 kW
 - ▶ cooling
 - ▶ PUE=1.6

some 67 MW hours

Explosion



Exponential Growth

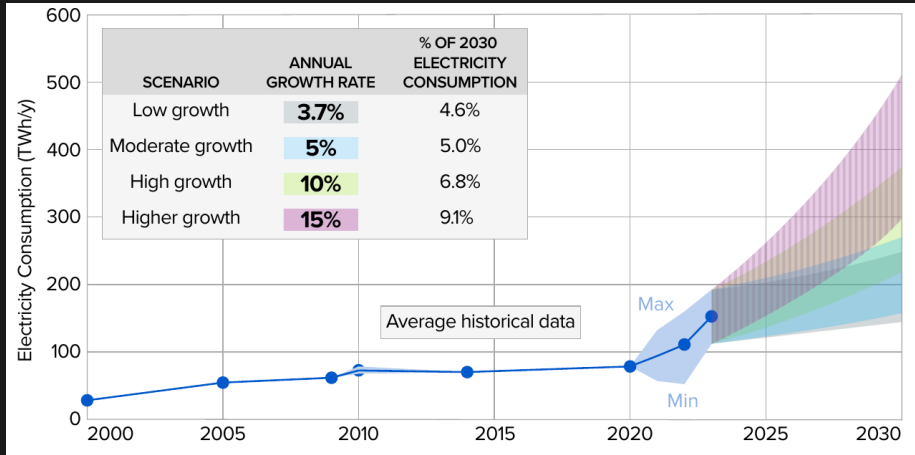
- ▶ explosives
- ▶ nuclear chain reactions
- ▶ population growth
- ▶ infections at the beginning of an epidemic **SIR Model**
- ▶ **limited by resources**



Electric Power Research Institute – US Predictions

Electric Power Research Institute – EPRI Projections, May 2024

$$1 \text{ TWh/y} = 0.114 \text{ GW} \approx \frac{1}{7} \text{ GW}$$



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



Small Modular Reactor (SMR) – Green and Safe?



Nuscale

- ▶ 77 MW / unit
- ▶ 4 - 12 units
- ▶ too expensive
- ▶ now solar and wind power



X-Energy XE 100

- ▶ Uranium under Russian control
- ▶ hard to mine
- ▶ final repository
- ▶ proliferation

- ▶ Gen-IV High-Temperature Helium-cooled Reactors (HTGR)
- ▶ U²³⁵ 15% enriched Pebbles
- ▶ can be shipped by trucks
- ▶ 60 years of usage
- ▶ 4 x 80 MW

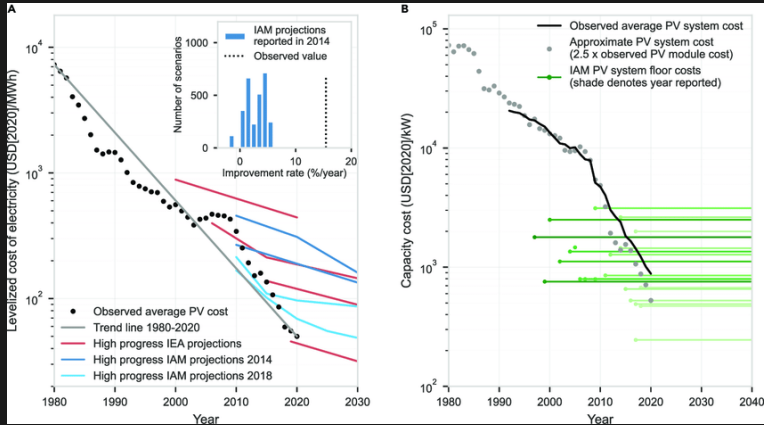


Fact Sheet

- ▶ Bloomberg: Sam Altman's Energy 'New Deal' Is Good for AI. What About Americans?
- ▶ Demand per Hyperscaler 5GW (roughly 8-10 power station blocks)
- ▶ Total 47GW (> 150 reactors of 300 MW)
 - ▶ 3 prototypes (1 Russia, 1 China)
 - ▶ none in the US or EU
 - ▶ Uranium mostly under Russian control
 - ▶ Reopen Wismut???
- ▶ Small ... Reactors Have A Big Problem
- ▶ PG&E: Pacific Gas & Electric Company
 - ▶ PG&E Launches First Commercial Deployment of On-Site Generative AI Solution for the Nuclear Energy Sector at Diablo Canyon
 - ▶ Utility giant PG&E agrees to \$45 million settlement related to California's second-largest wildfire
 - ▶ PG&E fined \$1.7 million over 2021 power shutoff lapses
- ▶ Illinois: \$468 million in subsidies for only 339 jobs (\$1.4 million per job)
- ▶ Nebraska: costs for Google and Meta passed onto residents, estimated rate increase 2.5% to 3% per year
- ▶ Datacenters are extremely unequally distributed (Chicago, Texas, Virginia)
- ▶ Washington Post: Biden plan would encourage AI data centers on federal lands
- ▶ Europe
 - ▶ Ireland: 20% of electricity consumption
 - ▶ Energy Consumption in Data Centres and Broadband Communication Networks in the EU



Nuclear Fusion – Remote 149 Mio km Distance – needs storage



Rupert Way, Matthew C Ives, Penny Mealy University of Oxford, J. Doyne Farmer:

Empirically grounded technology forecasts and the energy transition, September 2022



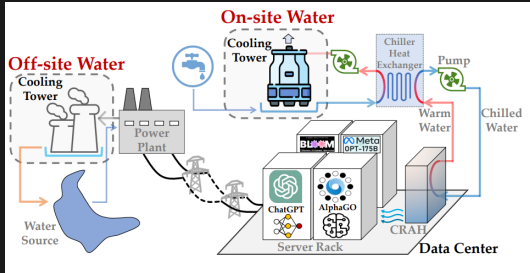
Comparison nuclear power – PV + Wind + Batteries

Topic	Nuclear	Sun + Tides + Wind + Batteries
Costs	Exploding	Falling
Fuel	U ²³⁵	free
Stock predictions	12-130 years	<i>what?</i>
Size	300 MW	5 MW
Number	4	several hundred
Cooling	Water	<i>none</i>
Problems	radioactive waste, no final repositories, proliferation	several days of dark doldrums, recycling
Solutions	<i>none</i>	transmission grids, local buffer



Water

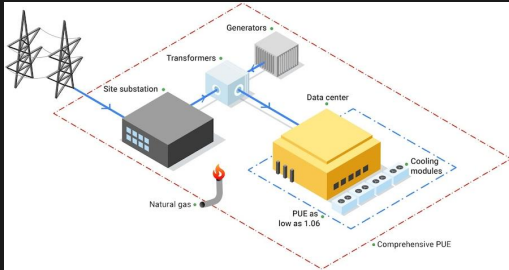
Data Center Dynamics: How to cut water usage in cloud data centers



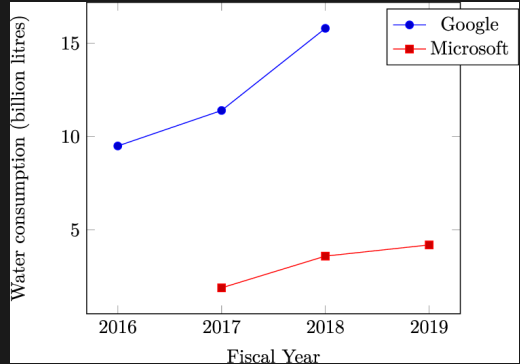
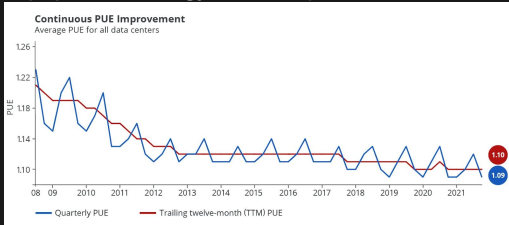
- ▶ Its complicated
- ▶ 1 – 9 l of water per kWh
- ▶ first post 1 MW consumes 26 Million litres a year ≈ 3 l/kWh
- ▶ variations of efficiency
- ▶ weather conditions



Google Power Usage Effectiveness – PUE Greenwashing



Centre Total Energy Consumption PUE= ICT Equipment Energy Consumption

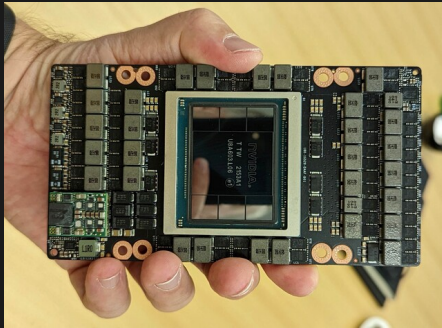


$$PUE = \frac{\text{Data Centre Total Energy Consumption}}{\text{ICT Equipment Energy Consumption}}$$

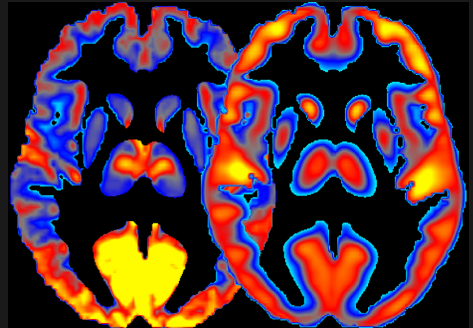
Source: Google(left), Nature (right)



Comparison NVIDIA Hopper H100 vs Homo Sapiens²



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

Transistor \approx Synapse

4.000 Blackwell \approx 10.000 H100 \approx Brain

7 MW \equiv 20 W

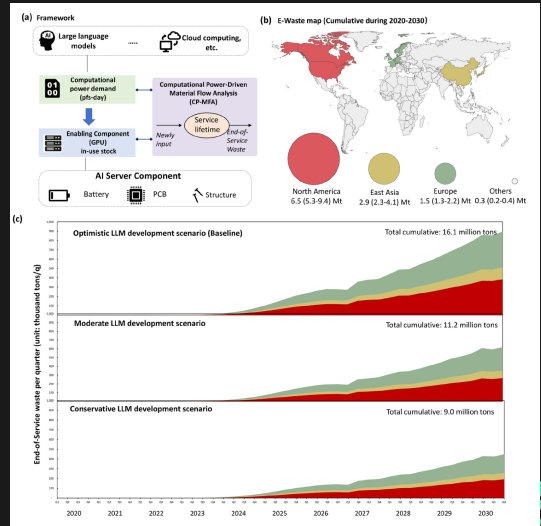
x10 Transistors and x2 for cooling and network \approx 140MW (50MW Blackwell)
that is the true reason why the Matrix AI is using humans to live in

Average usage of a GPU in Kubernetes is 20%



AI-Waste

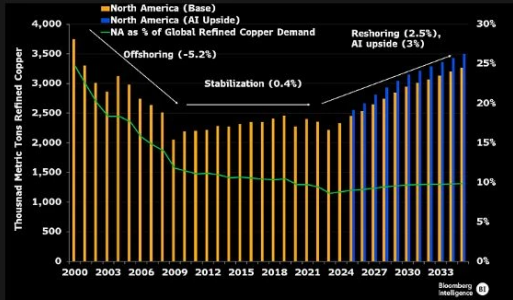
- ▶ Lifecycle of Data Center Hardware: **3 – 5 years**
- ▶ Peng Wang, Chinese Academy of Sciences, Lingyu Zhang, Institut National des Sciences Appliquées de Lyon, Asaf Tzachor, Eric Masanet, University of California, Santa Barbara:
E-waste Challenges of Generative Artificial Intelligence also in Nature
- ▶ 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

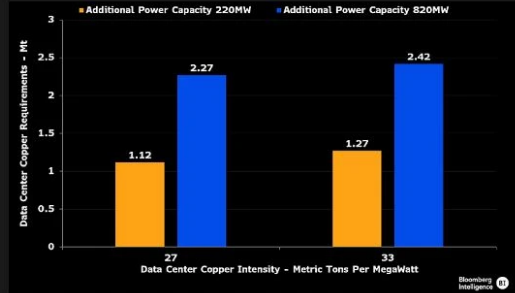
North American Refined-Copper Demand



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



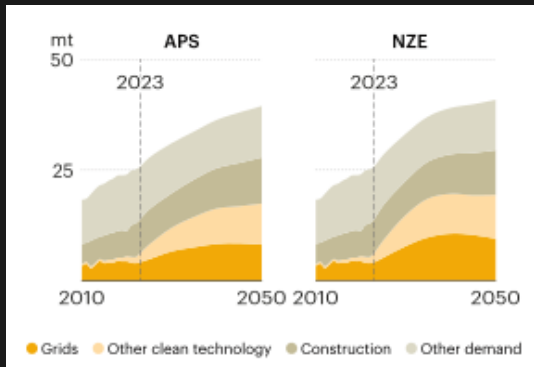
Source: US Department of Energy, US Energy Information Administration, IDC, eMarketer, Data Center Knowledge, Navigant Research, Cushman & Wakefield, Bloomberg Intelligence

- ▶ 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



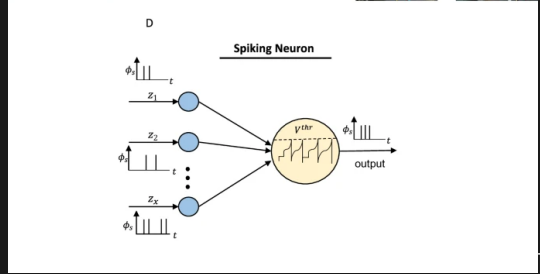
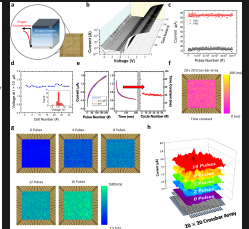
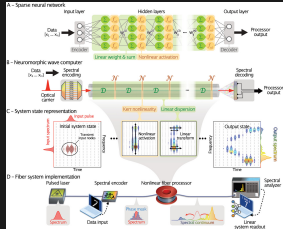
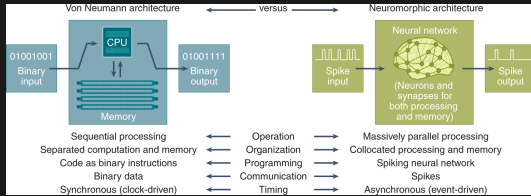
Impact on the Environment

Neo Colonialism

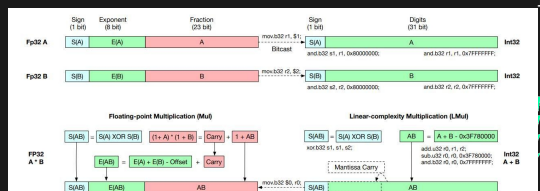
- ▶ Reporter Brasil Documents link Amazon and Google to companies investigated for illegal gold mining
- ▶ Tucson: Arizona opinion: Data centers redefine the Copper State
- ▶ Dan Watch: Impacts of copper mining on people and nature
- ▶ Monga Bay Renewables won't save us from climate catastrophe, experts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



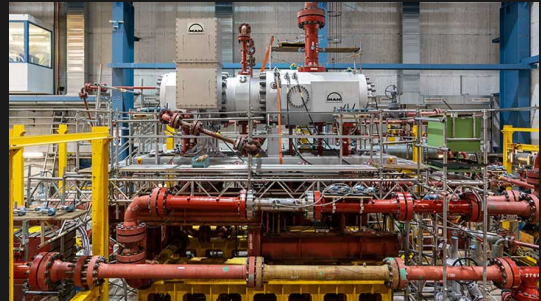
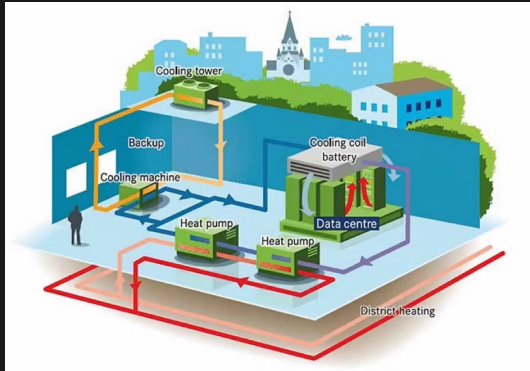
Neuromorphic Computing – Can Tech Save us?



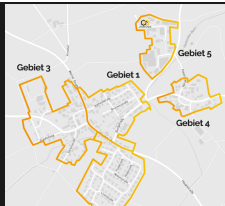
Could save 95% of the energy needed



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



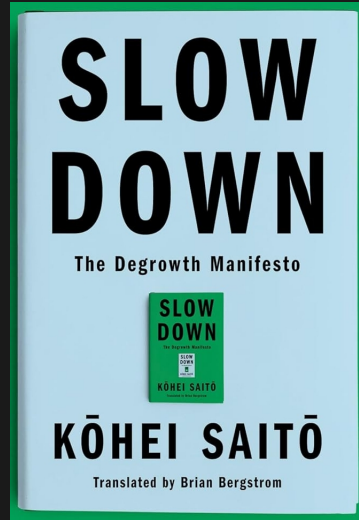
Touching Limits: Energy, Water, Metal CO₂

- ▶ 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



Externalities

indirect cost or benefit to an uninvolved third party

Examples:

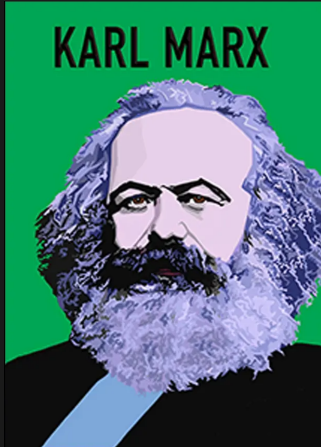
- ▶ environment – humans
- ▶ the future – current generation
- ▶ colonies – imperial countries
- ▶ women – men
- ▶ minorities – majority
- ▶ disabled – abled
- ▶ unrepresented – represented
- ▶ animals – humans
- ▶ proxy fighters – empire
- ▶ worker – capitalist

Orthodox Marxism

- ▶ main contradiction of capital accumulation
- ▶ secondary contradictions
 - ▶ lot of frictions in the socialist movement
 - ▶ woman and man
 - ▶ local and foreign workers



A spectre is haunting Europe



Kohei Saito:
Karl Marx was Green

- ▶ nobody wants a communist party
- ▶ no working class any more
- ▶ revolutions are only successful after wars
- ▶ externalisation is real
- ▶ concentration of power
 - ▶ post capitalism
 - ▶ feudalism
- ▶ *degrowth communism*
 - ▶ collaboration
 - ▶ works Open Source and Wikimedia
 - ▶ privileged
- ▶ data center externalities
 - ▶ environment
 - ▶ colonial supply chains
 - ▶ waste
- ▶ exhaustion of external resource
- ▶ refugees
- ▶ climate collapse
- ▶ AI content
- ▶ green tech needed anyway
 - ▶ prevent collapse
 - ▶ not sufficient

Further problems: emergent informal relationships as currencies

Journal of Monetary Economics:

A theory of a generally acceptable medium of exchange and barter



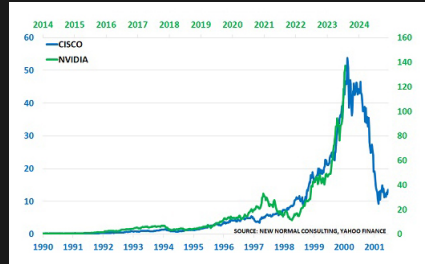
Warnings

- ▶ 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

- ▶ charlatantry
- ▶ 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/38c3.pdf>

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