Hvorfor vi bør bekymre oss for bærekraften til KI

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Forskninggruppe ved Ifi

TSF Technology and Sustainable Futures

The TSF research group envisions future worlds in which digital technologies produce thriving social and natural communities and environments. We work towards more sustainable futures through a radical rethinking of digital technologies. Our practice focusses on the co-creation and sharing of knowledges and imaginaries. We take a systems-oriented and critical approach to technological, social, and ecological transformation, with the aim of creating more harmonious futures for all living beings.

Ongoing projects

- **The Materials Library for the Digital World** | Maja van der Velden, Andrea Gasparini, and Siv Årsand.
- **EMPOWER: Sustainable Batteries in Mobility** | Maja van der Velden and Arian Mahzouni.
- **Reimagining AI for Social and Ecological Flourishing** | Henrik Skaug Sætra, Enya Esuna Rogerson

Approach

The research team is highly interdisciplinary, combining approaches and theories from futures studies, philosophy, ethics, critical theory, STS, design, and informatics. Conceptual and theoretical work is combined with empirical, speculative, and practice-based research in partnership with industry and civil society. Our activities are based on our four core values:

4C
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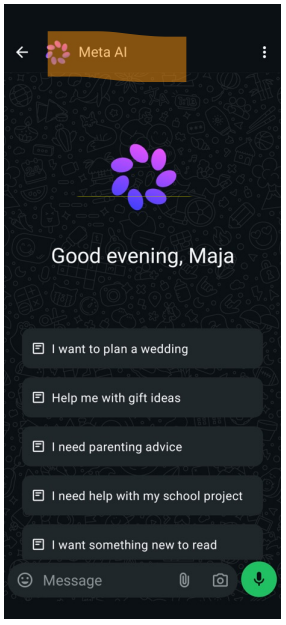
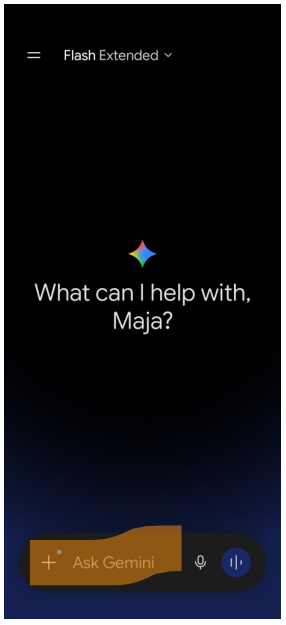
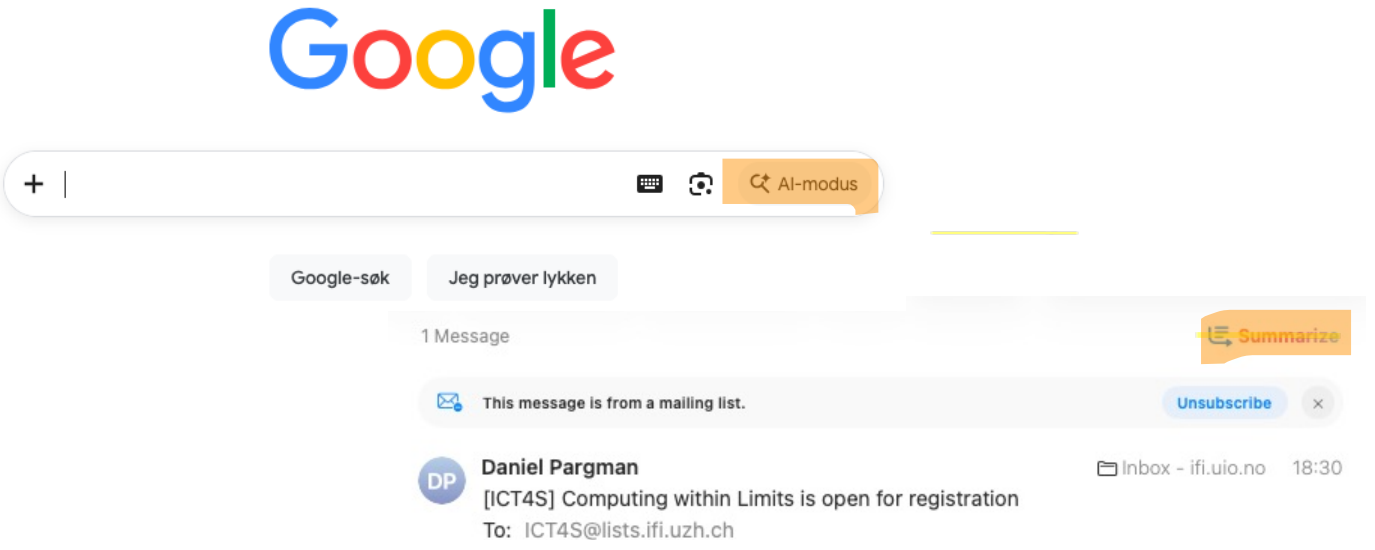
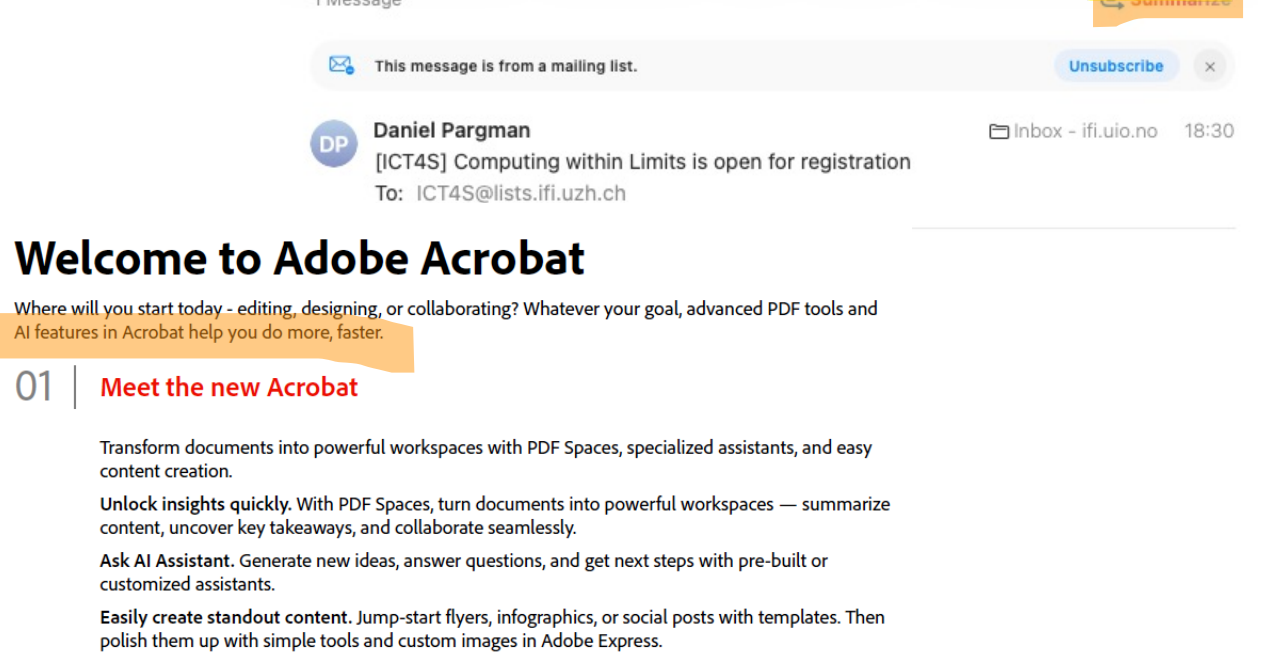
Source: https://www.mn.uio.no/ifi/english/research/groups/tsf/

KI er overalt









Er KI en bærekraftsversting?

Debatt | Kunstig intelligens

Kunstig intelligens får skylden for et enormt strømforbruk den ikke har

Morten Goodwin *Professor, Universitetet i Agder*
Karl Audun Borgersen *Stipendiat, Universitetet i Agder*
Rebekka Olsson Omslandseter *Førsteamanuensis, Universitetet i Agder*

Source: Aftenposten, 3.11.2025

Menneske vs. maskin

Hva står egentlig for mest utslipp – en skribent eller ChatGPT?

En amerikansk studie sammenlignet utslippene fra et menneske og generative KI-verktøy som fikk i oppgave å skrive den samme teksten.

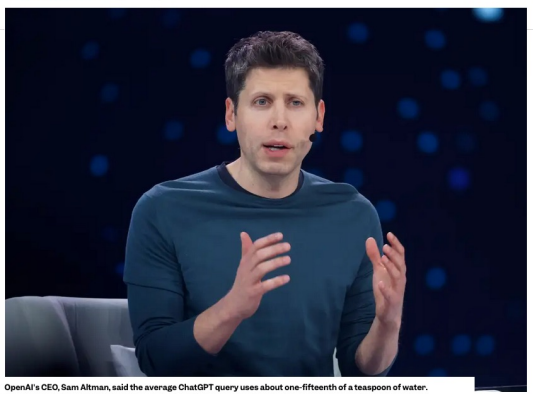
Resultatene viser at mennesket produserer opptil 1500 ganger *mer* CO2 enn KI-verktøyet.

Source: https://digitalnorway.sana.ai/s/PDxGPjafaNXj/file:HqBMz4fQNvDD

AI

Sam Altman says the energy needed for an average ChatGPT query can power a lightbulb for a few minutes

By Kwan Wei Kevin Tan + Follow



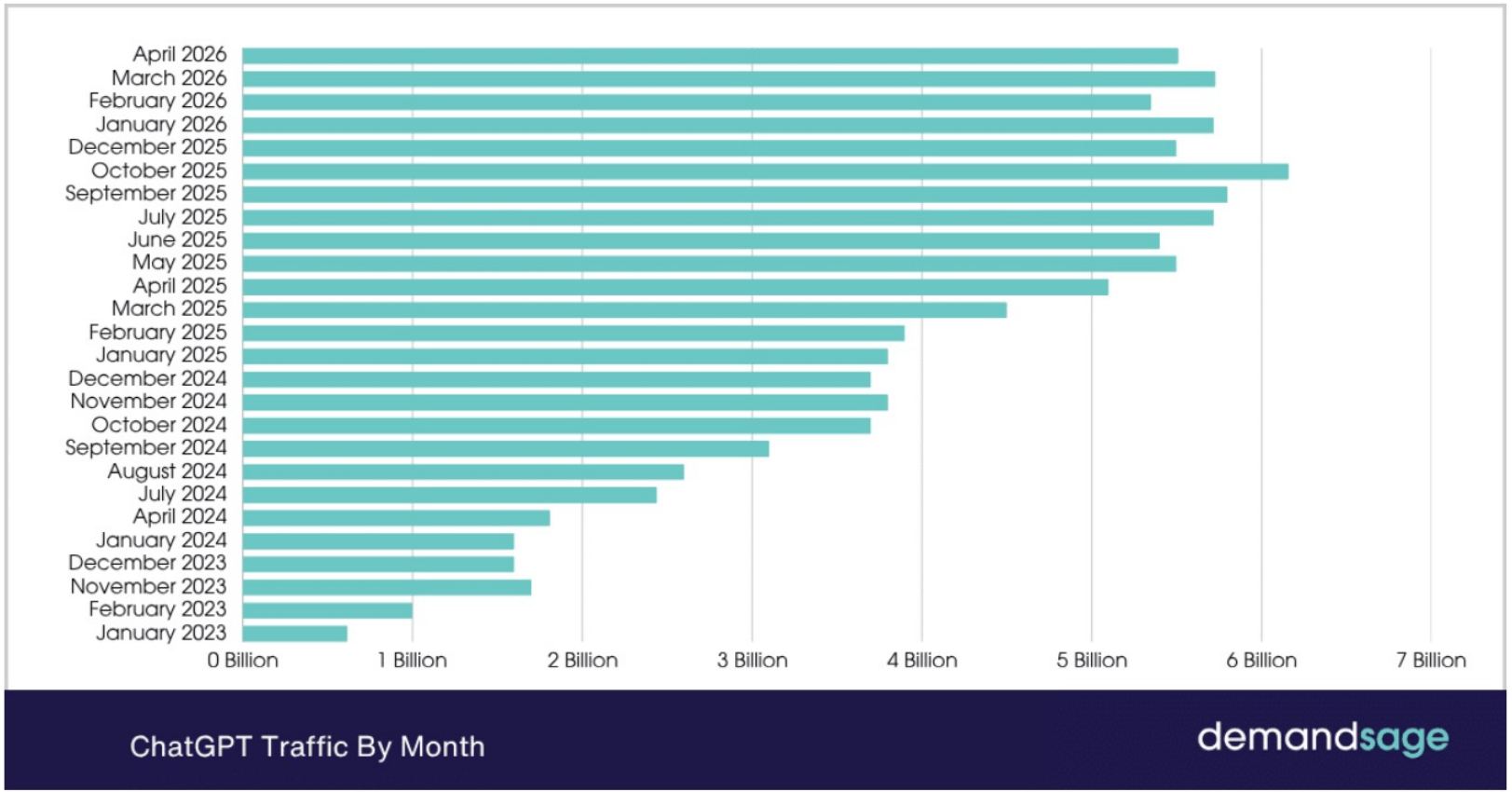
OpenAI's CEO, Sam Altman, said the average ChatGPT query uses about one-fifteenth of a teaspoon of water.
Justin Sullivan via Getty Images

"People are often curious about how much energy a ChatGPT query uses; the average query uses about 0.34 watt-hours, about what an oven would use in a little over one second, or a high-efficiency lightbulb would use in a couple of minutes," Altman wrote.

"It also uses about 0.000085 gallons of water; roughly one-fifteenth of a teaspoon," he continued.

Source: https://www.businessinsider.com/how-much-energy-does-chatgpt-use-average-query-watts-altman-2025-6

Er KI en bærekraftsversting?



Source: https://www.demandsage.com/chatgpt-statistics

KI og planetens tålegrenser

Resource extraction

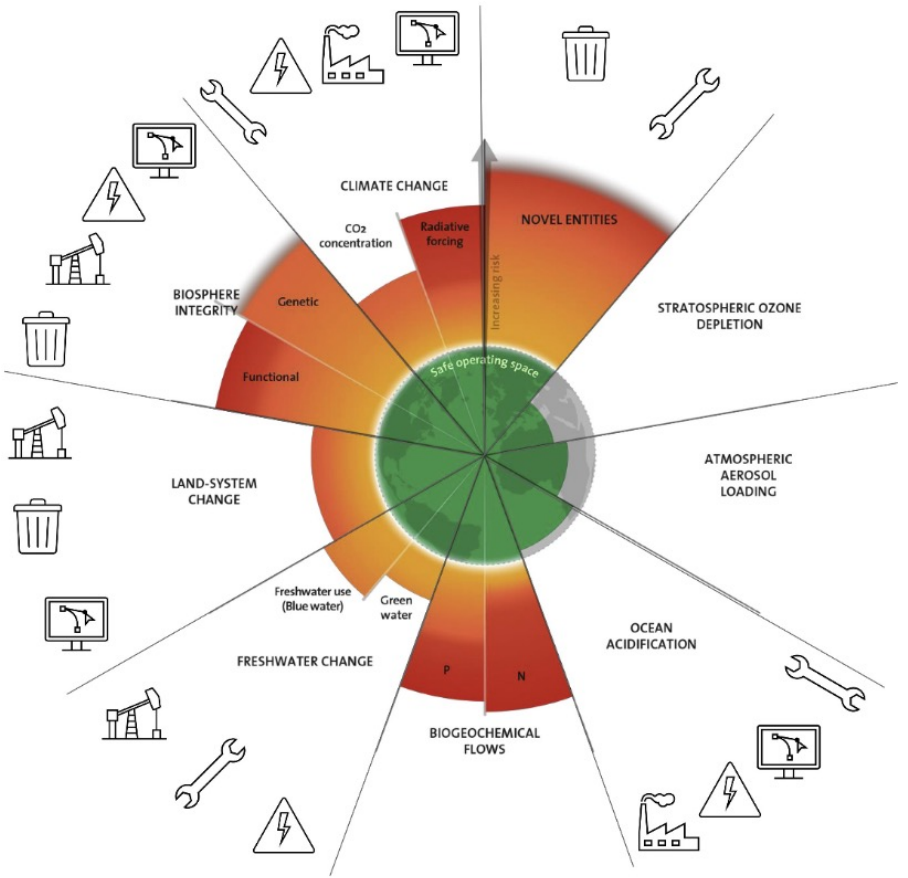
Manufacturing

Electricity

CO_2 emissions

AI systems

E-waste



Source: Falk et al. (2024)

Klimaendringer

Nye stoffer

Kjemiske forurensing

Bruk av ferskvann

Endret arealutnyttelse

Tap av naturmangvold

KI livssyklus

Under vurdering!

NORDIC MACHINE INTELLIGENCE

Nordic Machine Intelligence, vol. x, pp. x-y, 20xx
Received 1 Jan 20xx / published 1 Jan 20xx
https://doi.org/10.5617/NMI.####

An Ethical Framework for AI Infrastructure Providers and Users

M. van der Velden[1], L. O. Bergsjø [2,3], A.A. Gasparini[4], S. Touileb[5], T. Roehr [6], R. Prabhu[7], K-A. Lyng[8], A. Azab Mohammed[9], G. Thomassen[10], S. Razick[10]

Abstract

This paper presents a framework for the ethical use of the state-funded artificial intelligence infrastructure in Norway. The framework, which addresses both infrastructure providers and users, is grounded in four key elements: the AI life cycle; the understanding of AI as a sociotechnical system; environmental sustainability and sovereignty as components of ethical AI; and AI governance and literacy. The proposed ethical framework is based on a core set of ethical principles. (more)

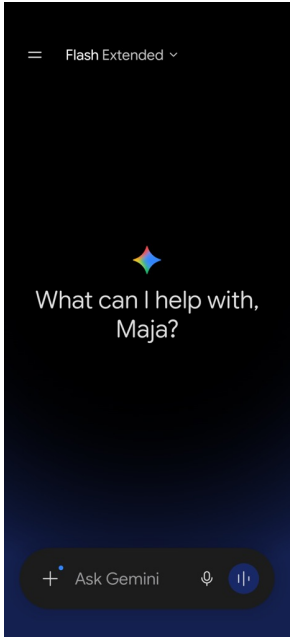
Keywords: governance; guidelines; AI life cycle; literacy; risk assessment; sovereignty; sustainability

KI forsyningskjede

Maskinvare → Skyinfrastruktur → Trening data → Grunnleggende modeller → KI applikasjoner

Mineraler → Datasentre → Usynlig arbeid → Skjevheter

KI og miljøpåvirkninger i Norge → Globalt perspektiv → Mineraler → Ubærekraftig på grunn av KI → Hva trengs?



KI og miljøpåvirkninger i Norge

- Avskoging
- Tap av biologisk mangfold
- Endring av arealbruk
- Høyt vannforbruk
- Støyforurensing
- Vannforurensning – utslipp til vann (også termisk forurensning)
- Luftforurensing – utslipp fra nødstrømsaggregater (diesel)

Forskere om økt hogst: Fortsetter det slik, kan skogen bli en utslippskilde

For første gang på flere tiår går skogen i «manko» flere steder i landet. Det kan bety at skogen slipper ut mer CO_2 enn den fanger.

MYE HOGST: I Innlandet fylke er det nå mer hogst og skogdød enn ny tilvekst. Her fra en hogst på Hadeland.

Reidar Gregersen
Journalist og fotograf

Vi rapporterer fra **Hadeland**

Publisert 2. mars kl. 13:25

Source: https://www.nrk.no/innlandet/forskere-om-okt-hogst_-fortsetter-det-slik_-kan-skogen-bli-en-utslippskilde-1.17786173

KI og arealbruk

Planlegg gigantutbygging av datasenter: – Dette er vi svært kritiske til

Eit område med datasenter i Sarpsborg kan beslagleggje skogsområde på størrelse med Monaco.

Skogsområdet der eit mogleg datasenter er planlagt på Hasle i Sarpsborg.
INGRID M LANGVIK / NRK

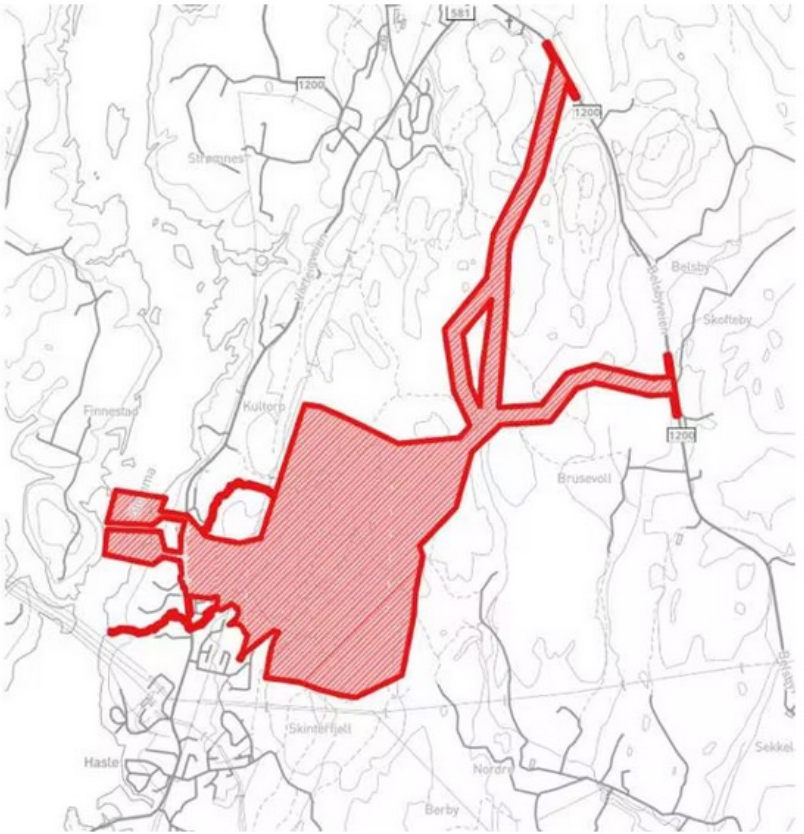
Erling Leegaard
Journalist

Caroline Bergli Tolfsen
Journalist

Ingrid Mathilde Langvik
Fotograf

Publisert 25. nov. 2025 kl. 18:10
Oppdatert 25. nov. 2025 kl. 22:14

Planområdet er på cirka 2152 dekar, omtrent på størrelse med Monaco.



Slik ser området ut der datasenteret er planlagt: Det strekker seg over eit areal som svarer til 300 fotballbanar.
FOTO: SARPSBORG KOMMUNE

Source: https://www.nrk.no/ostfold/planlegg-gigantutbygging-av-datasenter_-_-kjem-til-a-bruke-vanvitig-mykje-straum-1.17648599

Globalt perspektiv: Vann

Bare 3 % av jordens vann er ferskvann, og bare 0,5 % av alt vann er tilgjengelig og trygt for menneskelig konsum.

I USA, en stor datasenter kan bruke mellom 3.8 og 30 million liter vann per dag for kjøling

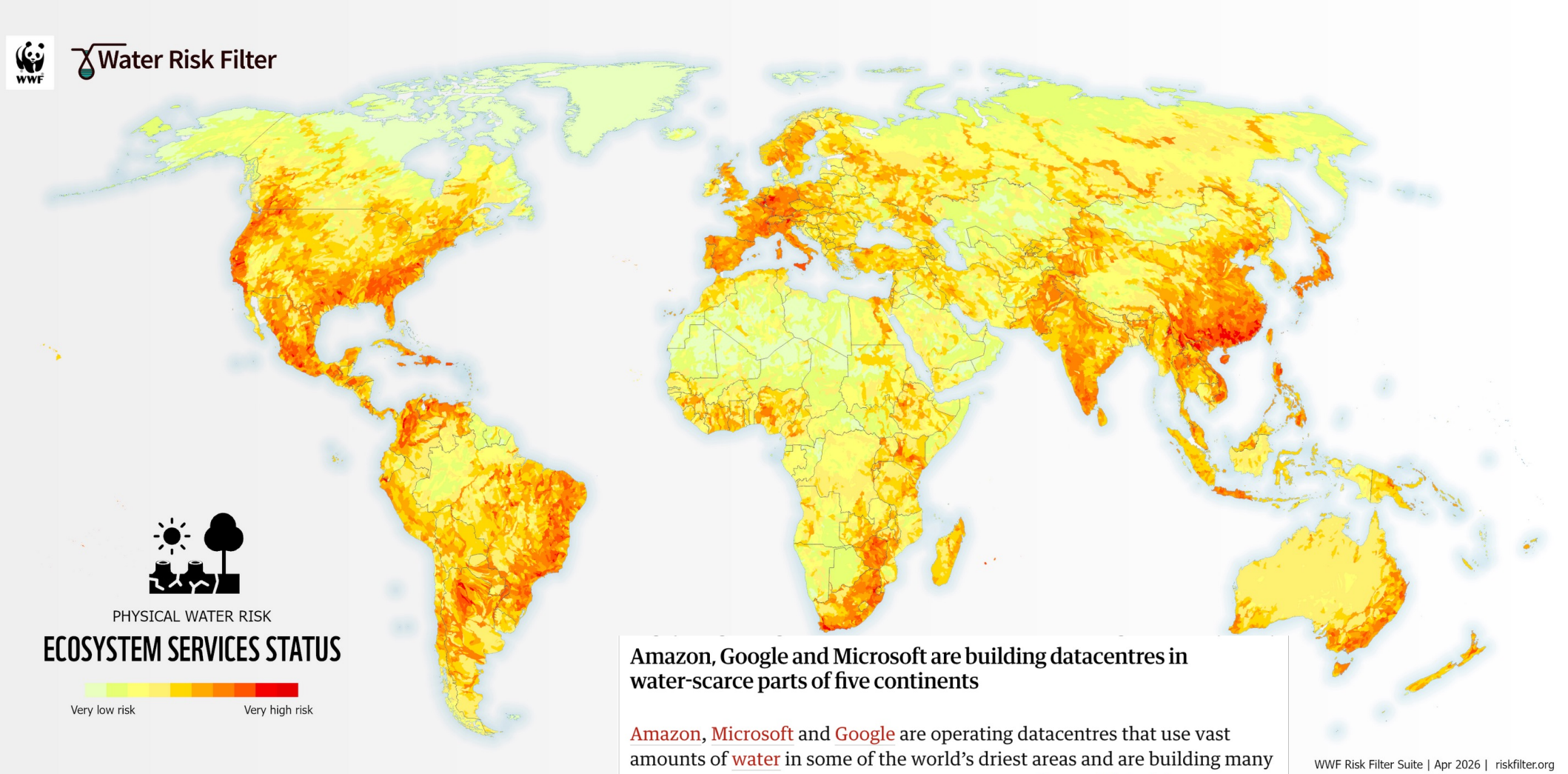
Et datasenters vannavtrykk beregnes som summen av tre kategorier:

1. vannforbruk på stedet

2. vannforbruk fra energi infrastruktur som forsyner datasentre med strøm, og

3. vannforbruk under produksjonsprosessen av databrikker og andre materialer

Source: Han et. Al, 2026



Amazon, Google and Microsoft are building datacentres in water-scarce parts of five continents

Amazon, Microsoft and Google are operating datacentres that use vast amounts of water in some of the world's driest areas and are building many more, the non-profit investigatory organisation SourceMaterial and the Guardian have found.

Source: https://www.theguardian.com/environment/2025/apr/09/big-tech-datacentres-water

Globalt vann forbruk datasentre

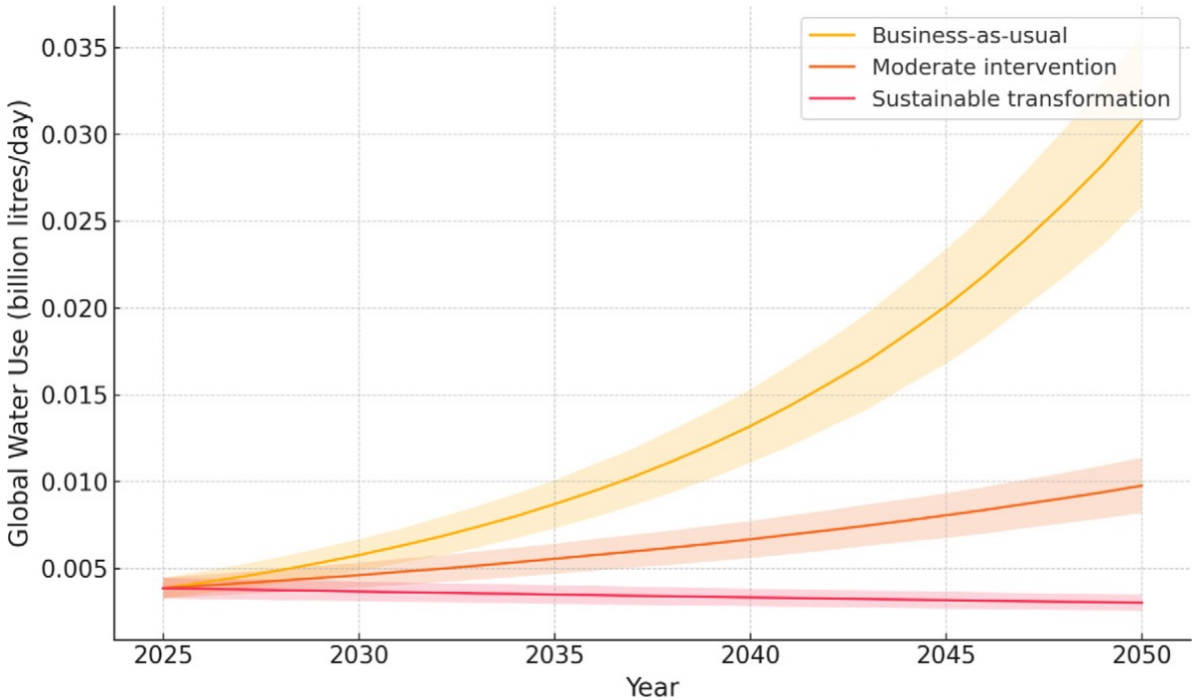
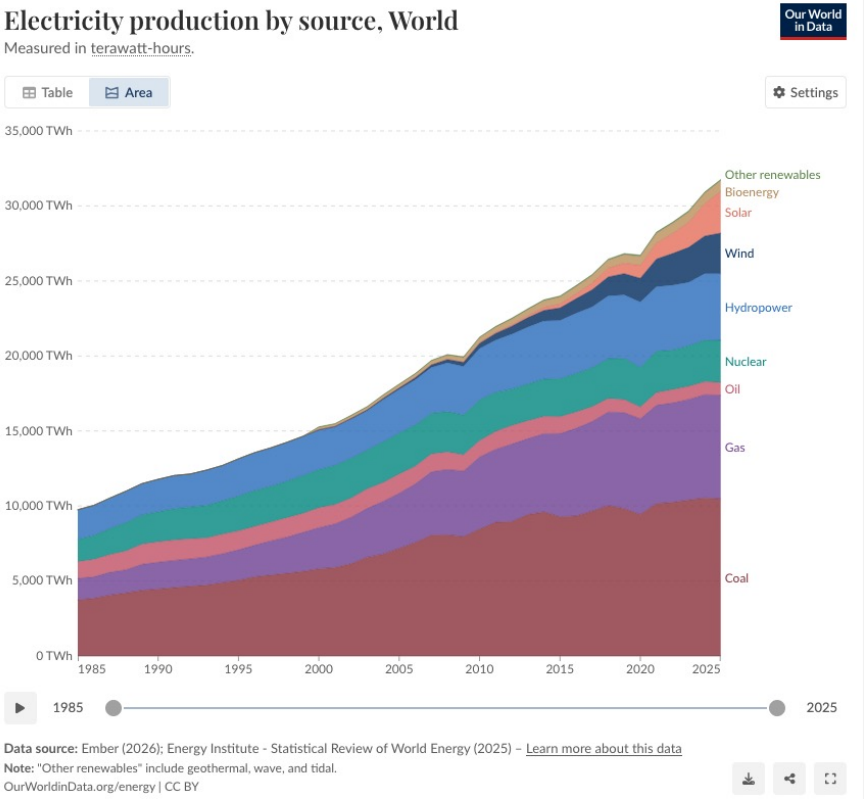
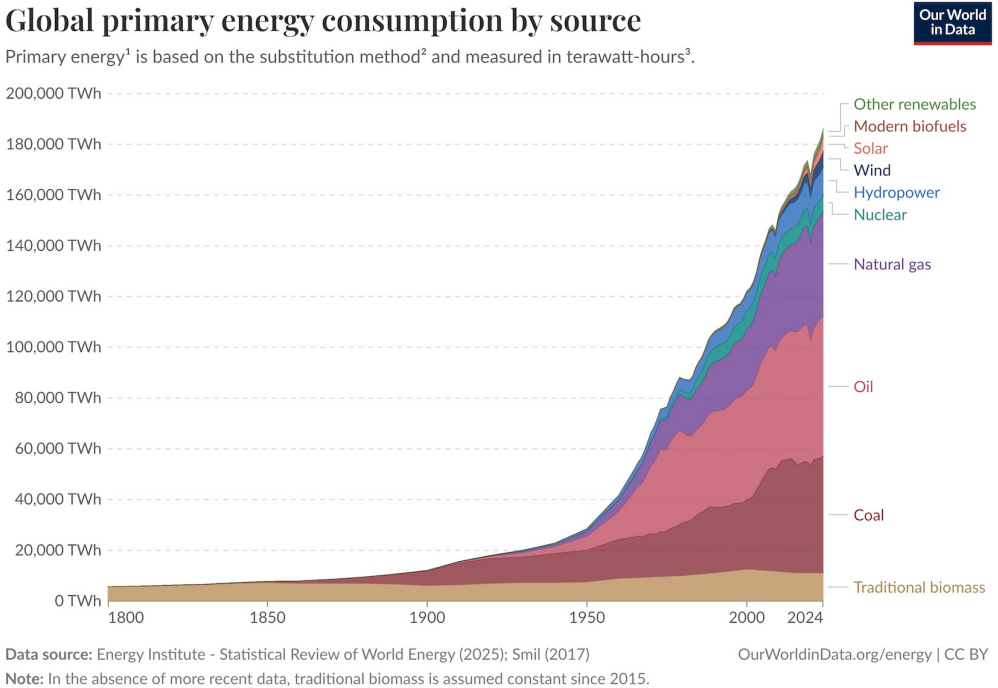


Fig. 6. Simulated mean estimates and 90% credible intervals for data centre water consumption under each scenario.

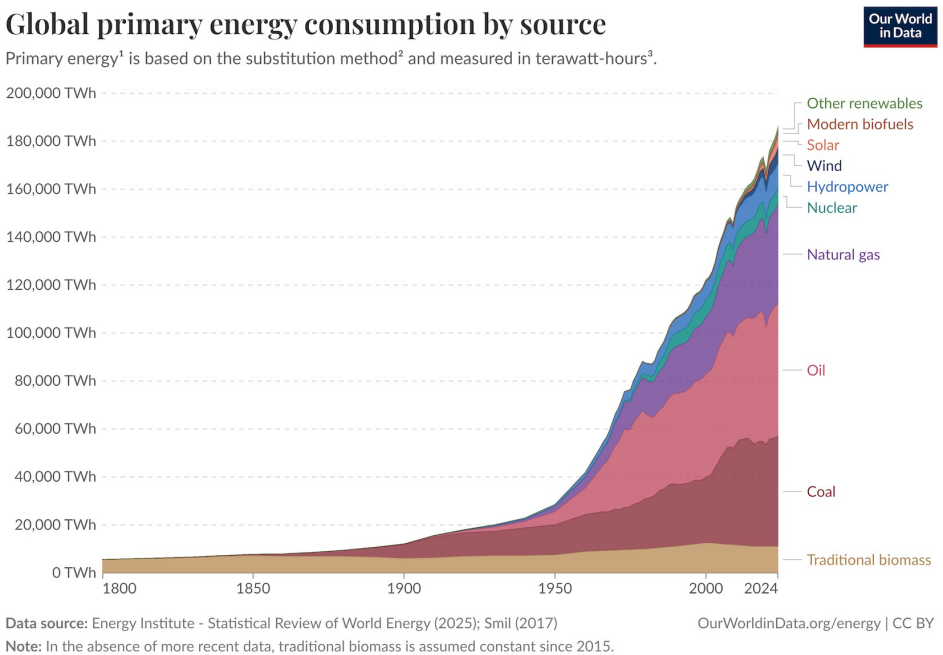
Source: Herrera et. Al., 2025, see also Han et. Al, 2026

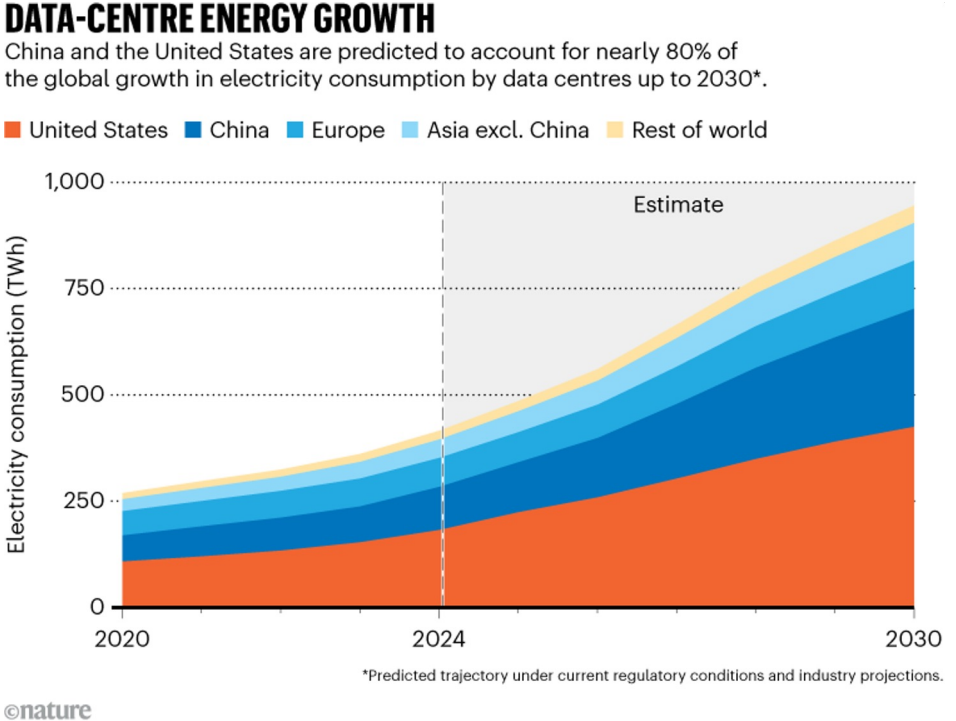
Globalt perspektiv: Energi





Globalt energibruk datasentre





Source: https://www.scientificamerican.com/article/ai-will-drive-doubling-of-data-center-energy-demand-by-2030/

KI trenger mer og mer energi

Amazon buys nuclear-powered data center

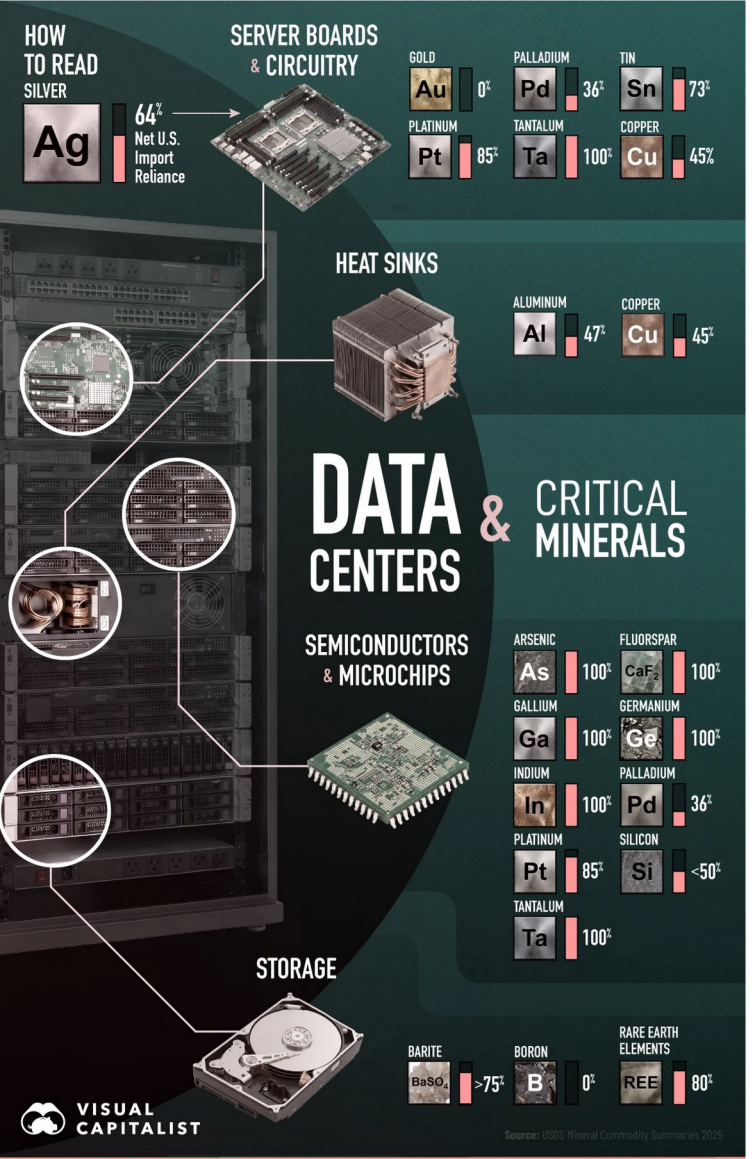
Energi og klima

Gjenåpner atomkraftverk for å selge strøm til Microsoft

AI-boomen blåser nytt liv i utkonkurrerte atomkraftverk.

MSFT −0.45% 408.83 USD

Source: https://e24.no/energi-og-klima/i/LMPG91/gjenaapner-atomkraftverk-for-aa-selge-stroem-til-microsoft



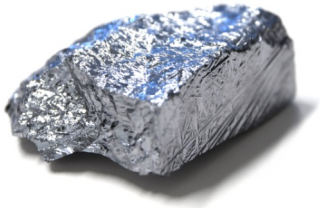
KI og mineraler

barium

kobber

krom

nikkel



silikon

tin

Source: https://www.visualcapitalist.com/the-critical-minerals-powering-the-ai-boom/; Materials Library of Minerals; copper.org

Mineraler i en GPU

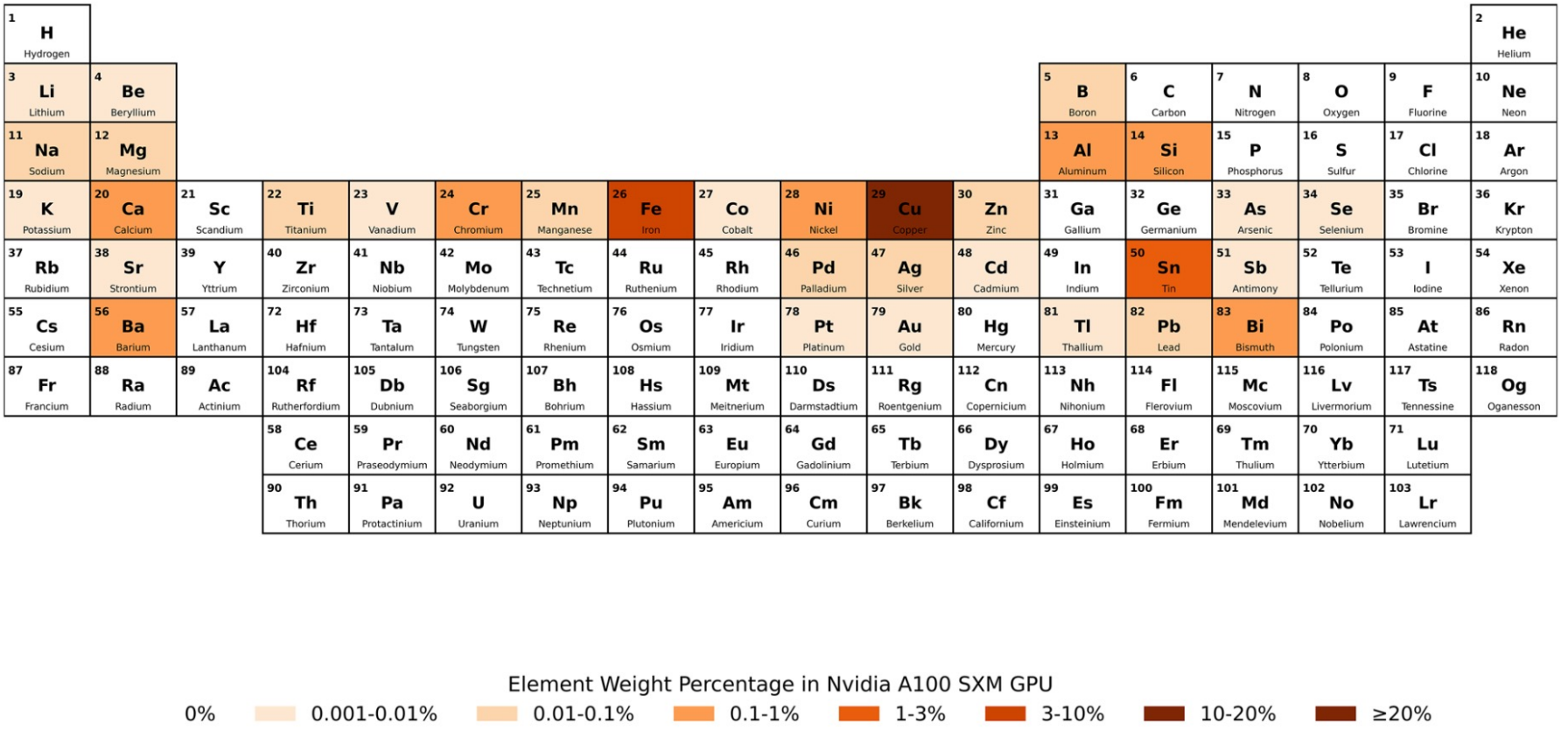


Fig. 1 | Elemental composition of the NVIDIA A100 SXM GPU. Proportion of elements in the Nvidia A100 SXM 40 GB GPU (author illustration).

Source: Falke et al., 2026

Mineraler i en GPU

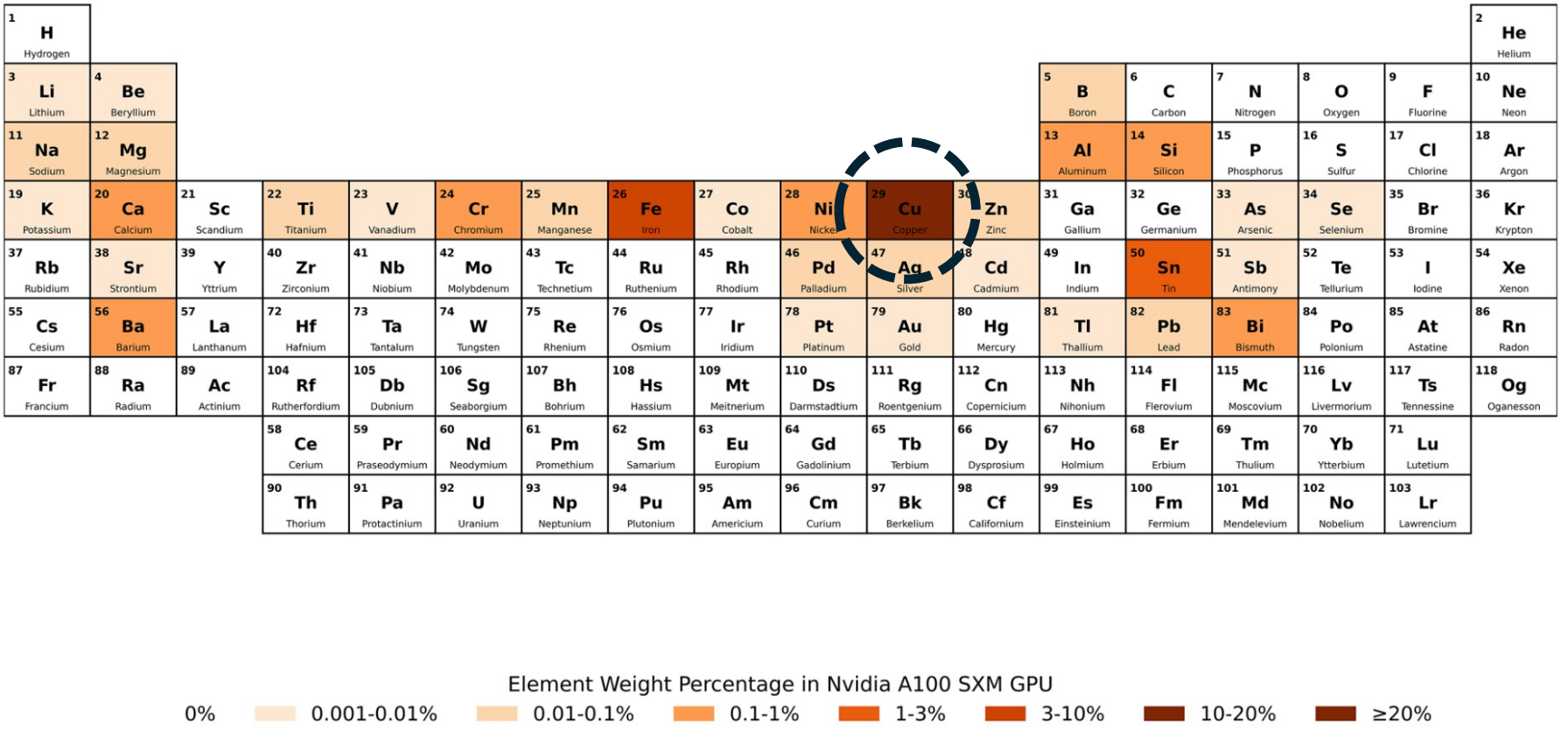


Fig. 1 | Elemental composition of the NVIDIA A100 SXM GPU. Proportion of elements in the Nvidia A100 SXM 40 GB GPU (author illustration).

Source: Falke et al., 2026

Kobber for KI

Kamoa kobber gruve i Zambia:

- Tvangsutkastelser
- Luftforurensning
- Vannforurensning
- Drikkevannsforurensning
- Avskoging

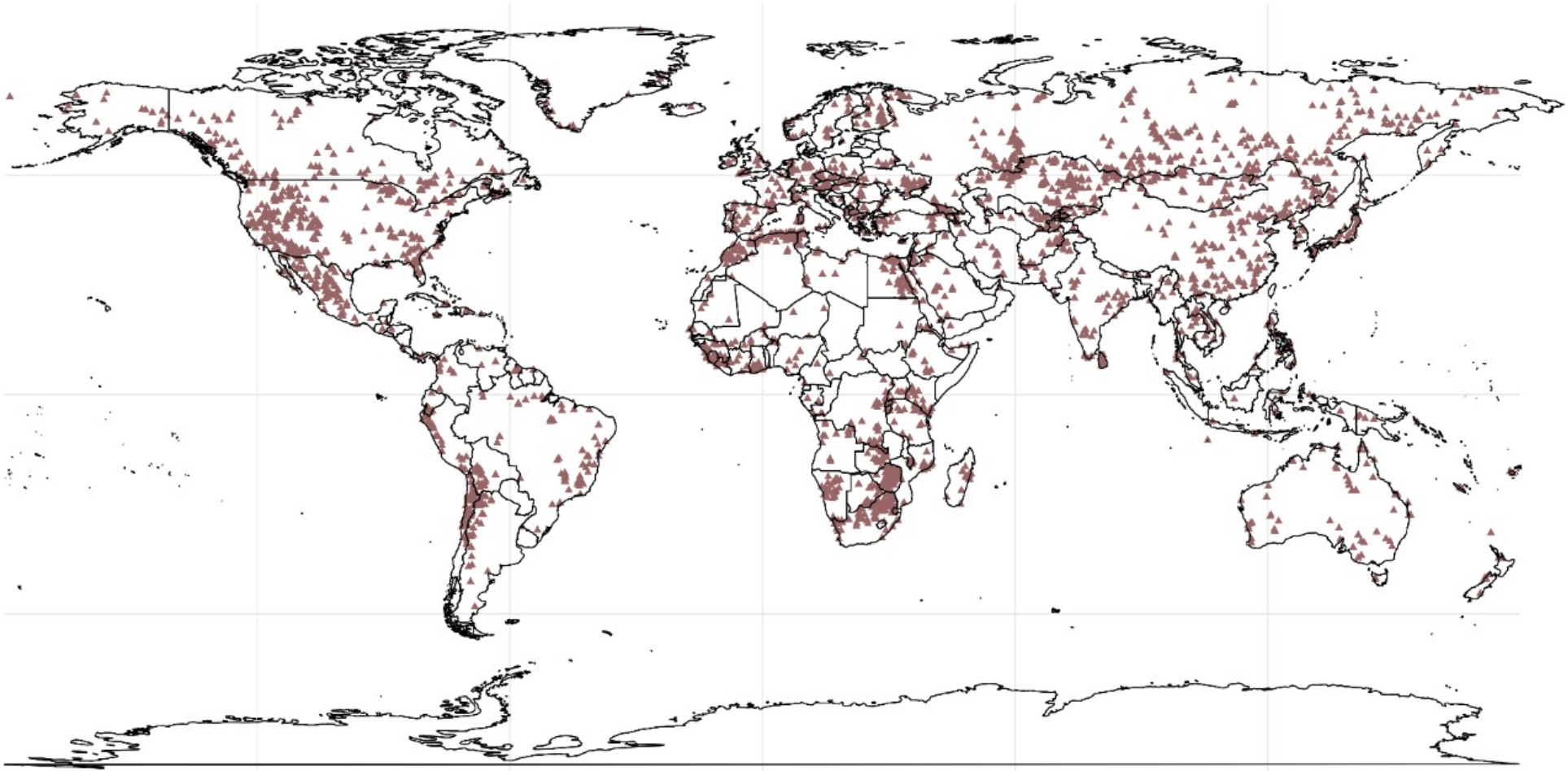
Source: Laplane et al., 2025)

Kolwezi kobber gruve i DR Congo:

- Tvangsutkastelser
- Luftforurensning
- Vannforurensning
- Drikkevannsforurensning
- Avskoging

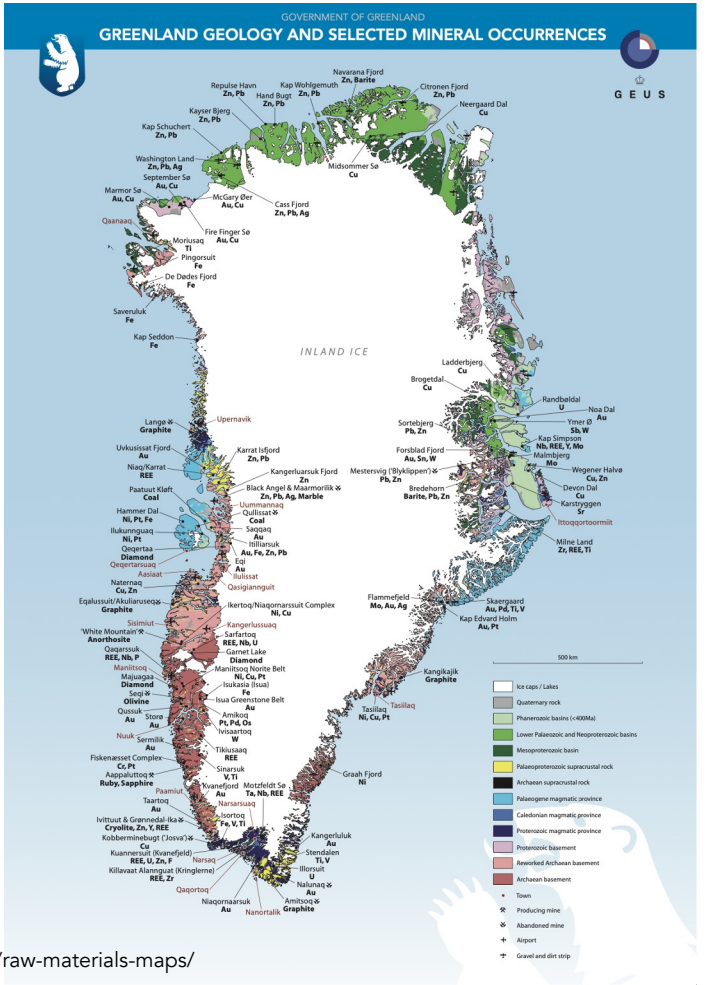
Source: https://www.amnesty.org/en/latest/news/2023/09/drc-cobalt-and-copper-mining-for-batteries-leading-to-human-rights-abuses/

Kritiske mineraler



Source: Marin & Palazzo, 2024

Mineraler og geopolitikk



Source: https://www.greenmin.gl/raw-materials-maps/

Mineraler og geopolitikk

WORLD • AFRICA

Trump Wants Minerals, Health Data for Aid. African Nations Are Pushing Back.

Governments bridle at U.S. demands for private medical data and, in some cases, access to minerals

By Caroline Kimeu Follow in Nairobi and Betsy McKay Follow in New York

Updated May 31, 2026 5:04 pm ET

Source: https://www.wsj.com/world/africa/trump-wants-minerals-health-data-for-aid-african-nations-are-pushing-back-c04bed87

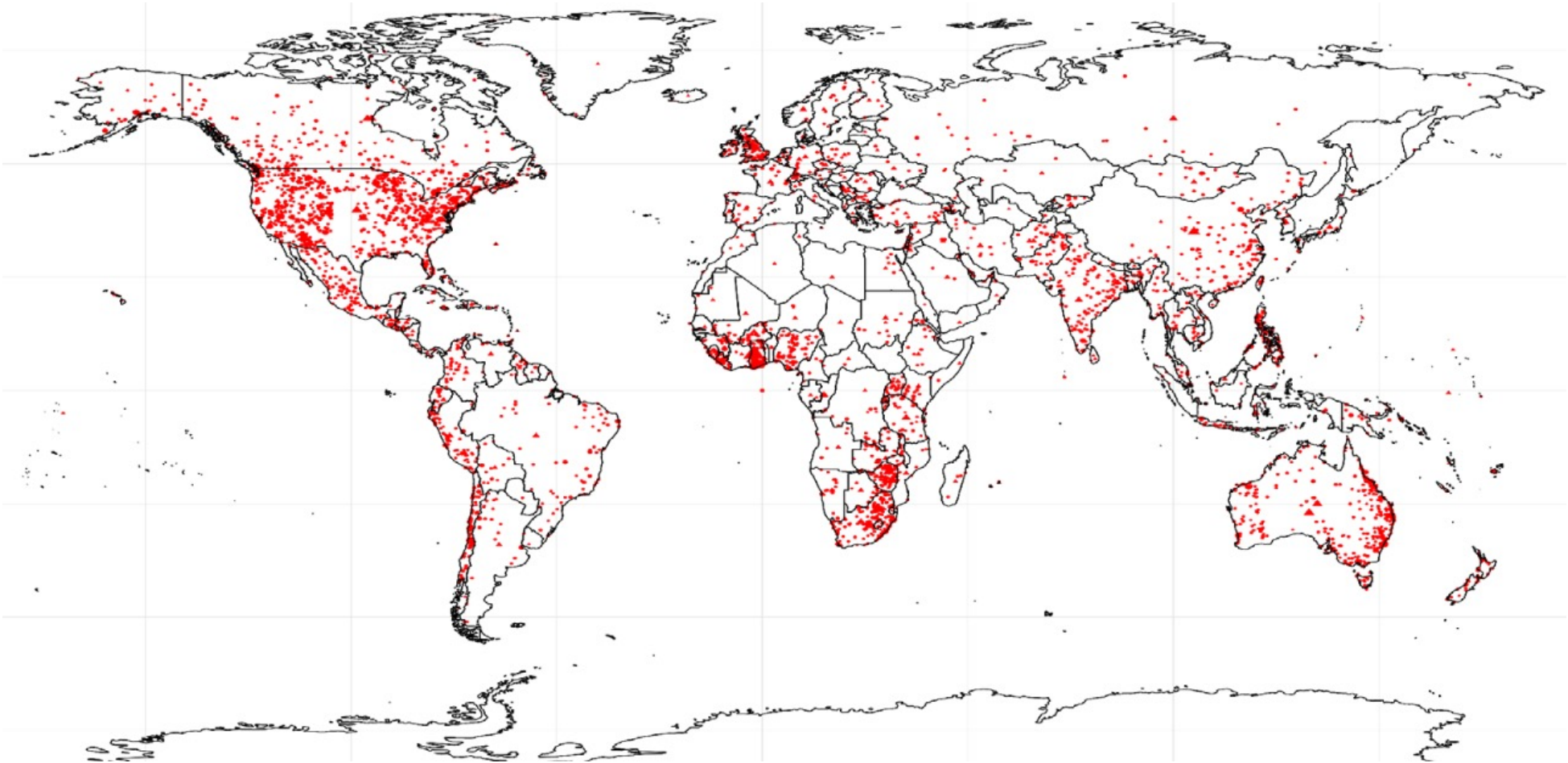
Verden

Norge slutter seg til USAs Pax Silica – skal sikre mineraler til KI-utvikling

Norge slutter seg til det amerikanske initiativet Pax Silica, som skal bidra til å sikre viktige råvarer til utvikling av KI, bekrefter Næringsdepartementet.

Source: https://www.aftenposten.no/verden/i/Rj1L98/norge-slutter-seg-til-usas-pax-silica-skal-sikre-mineraler-til-ki-utvikling

Kritiske mineraler og konflikter



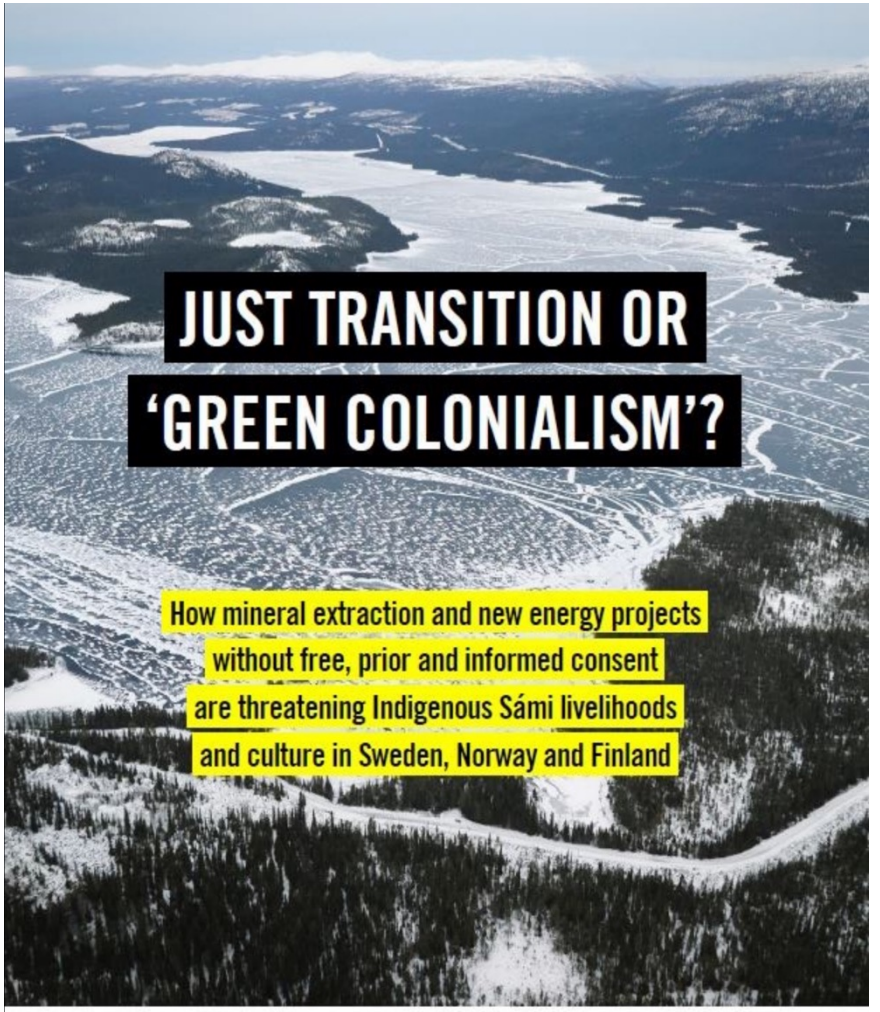
Source: Marin & Palazzo, 2024

Gruvedrift i Norge

Source: https://www.nu.no/

Gruvedrift i Norge

Photo: Lovise Tokle Rannekleiv / Natur og ungdom



Gruvedrift i verden

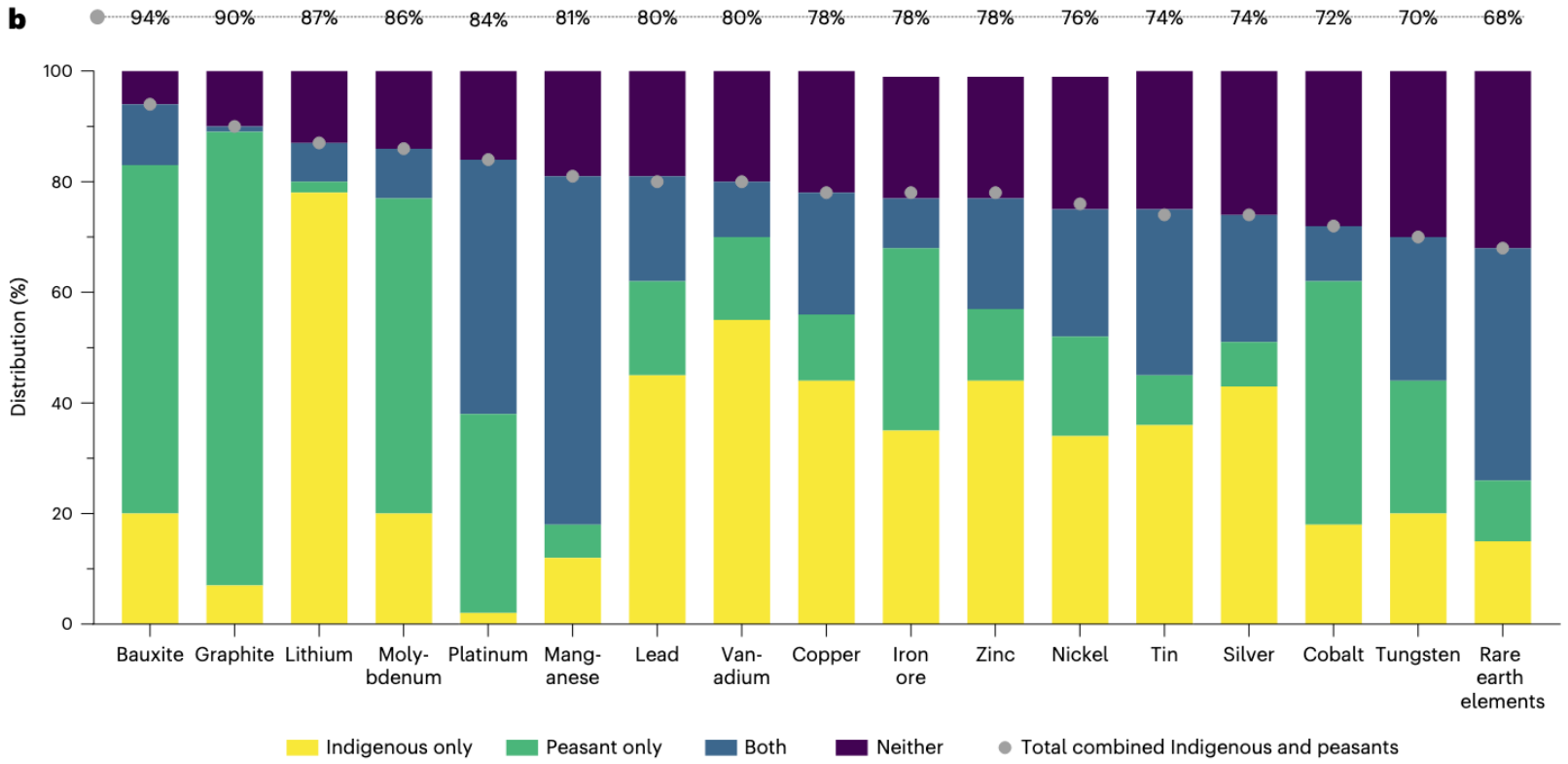


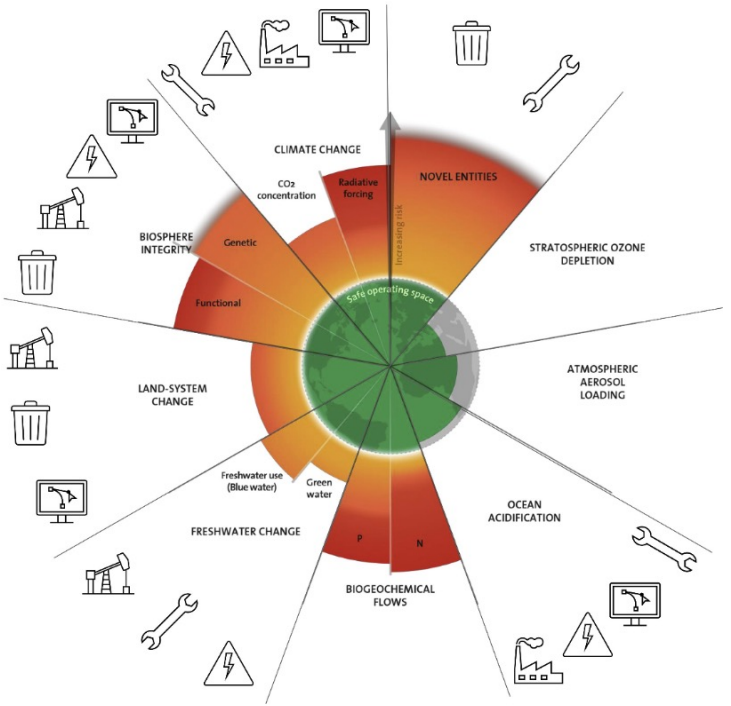
Fig. 1 | Distribution of ETMs by Indigenous peoples' and peasant land. a, Geographic distribution of mining projects, $n = 5{,}097$. **b**, Distribution of energy transition minerals and metals reserves and resources. The selected 17 minerals and metals have the highest number of extractive projects worldwide. Percentages at the top of the figure represent those for the 'total combined Indigenous and peasants' variable.

Source: Owen et al., 2023

Materialbiblioteket med mineraler

Ubærekraftig på grunn av KI

- Direkt rebound-effekt
- Indirekte rebound-effekter:
  - Størrelse-rebound
  - Tids-rebound
  - Ferdighets-rebound
- Induksjonseffekt



Sources: Falke et al., 2026; Lange et al., 2023; van der Velden, 2025)

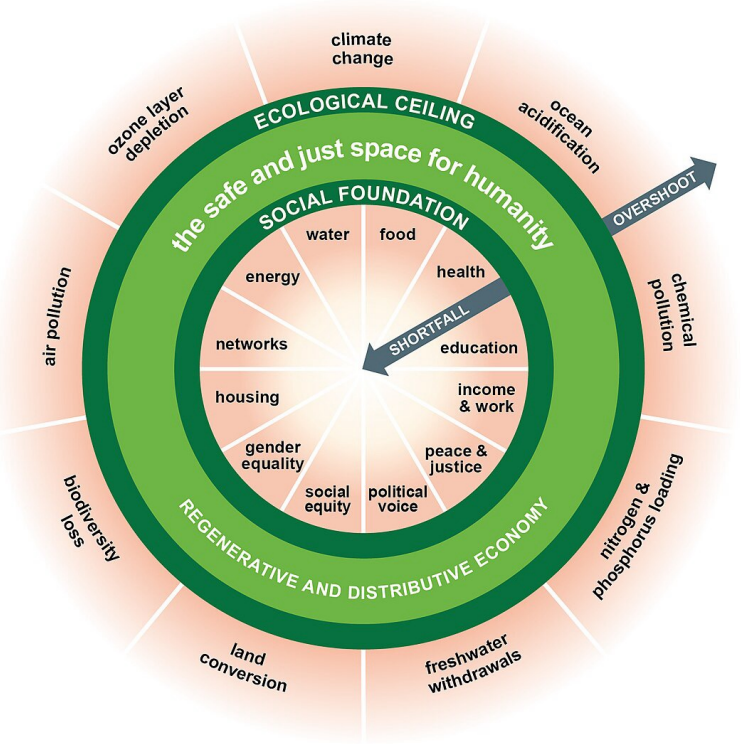
Source: Falk et al. (2024)

Hva trengs: Fra effektivisering til tilstrekkelighet

Tilstrekkelighet: "enhver strategi som tar sikte på å redusere det absolutte nivået av ressurs- og energiforbruk ved å redusere produksjons- og forbruksnivåene"

Tilstrekkelighet for å:

- bekjempe rebound-effekter
- overholde planetens grenser
- tilfredsstille grunnleggende menneskelige behov



Sources: Iten et al., 2024; Santarius et al., 2023; van der Velden, 2025)

Source: Raworth, 2027

KI og bærekraft: hva trengs?

- System-perspektiv: Tverfaglig tilnærming og mer kvalitative analyser
- Åpenhet: Obligatorisk og standardisert rapportering om ressursbruk, brukt kapasitet, og påvirkinger på miljø og menneskesrettigheter
- Mer regulering: EU AI Act minus AI Omnibus og Data Omnibus = de-regulering
- Fra effektivitet til tilstrekkelighet: Ned med forbruk av materialeressurser og muliggjør tilstrekkelighet

Tusen takk

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