

Internet Governance and Environmental Sustainability

Draft, November 2023

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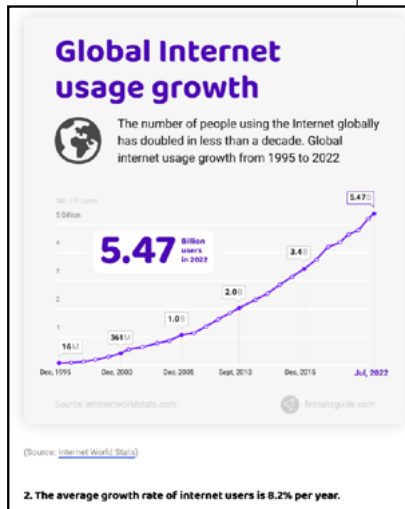
Motivation

- We are in an environmental emergency!
- Within Internet Governance community, we must focus on immediate actions!
 - **decreasing** material & energy consumption
 - **reducing** GHG emissions
 - **decelerating** growth
- Let's build the **Internet within planetary boundaries**
- Goals of this talk: Inform, Invite, Inspire

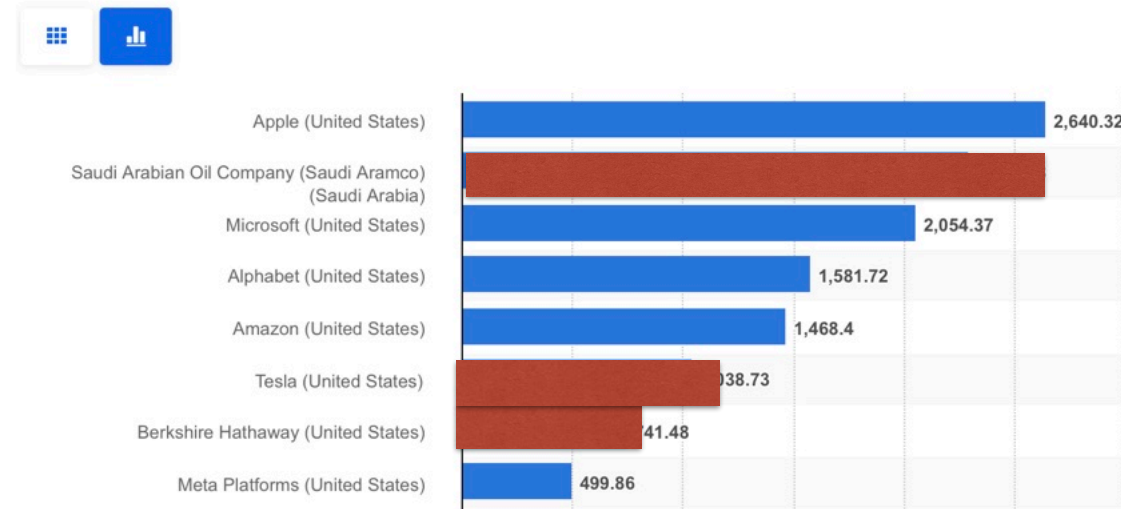
Problem Statements

- Growth in consumption of energy /materials / water
- Growth of GHG emissions of ICT services
- Big Tech, big responsibility

Source: <https://www.statista.com/statistics/263264/top-companies-in-the-world-by-market-capitalization/>



The 100 largest companies in the world by market capitalization in 2022 (in billion U.S. dollars)



Global trends in digital and energy indicators, 2015-2021

	2015	2021	Change
Internet users	3 billion	4.9 billion	+60%
Internet traffic	0.6 ZB	3.4 ZB	+440%
Data centre workloads	180 million	650 million	+260%
Data centre energy use (excluding crypto)	200 TWh	220-320 TWh	+10-60%
Crypto mining energy use	4 TWh	100-140 TWh	+2 300-3 300%
Data transmission network energy use	220 TWh	260-340 TWh	+20-60%

Source: <https://www.iea.org/reports/data-centres-and-data-transmission-networks>

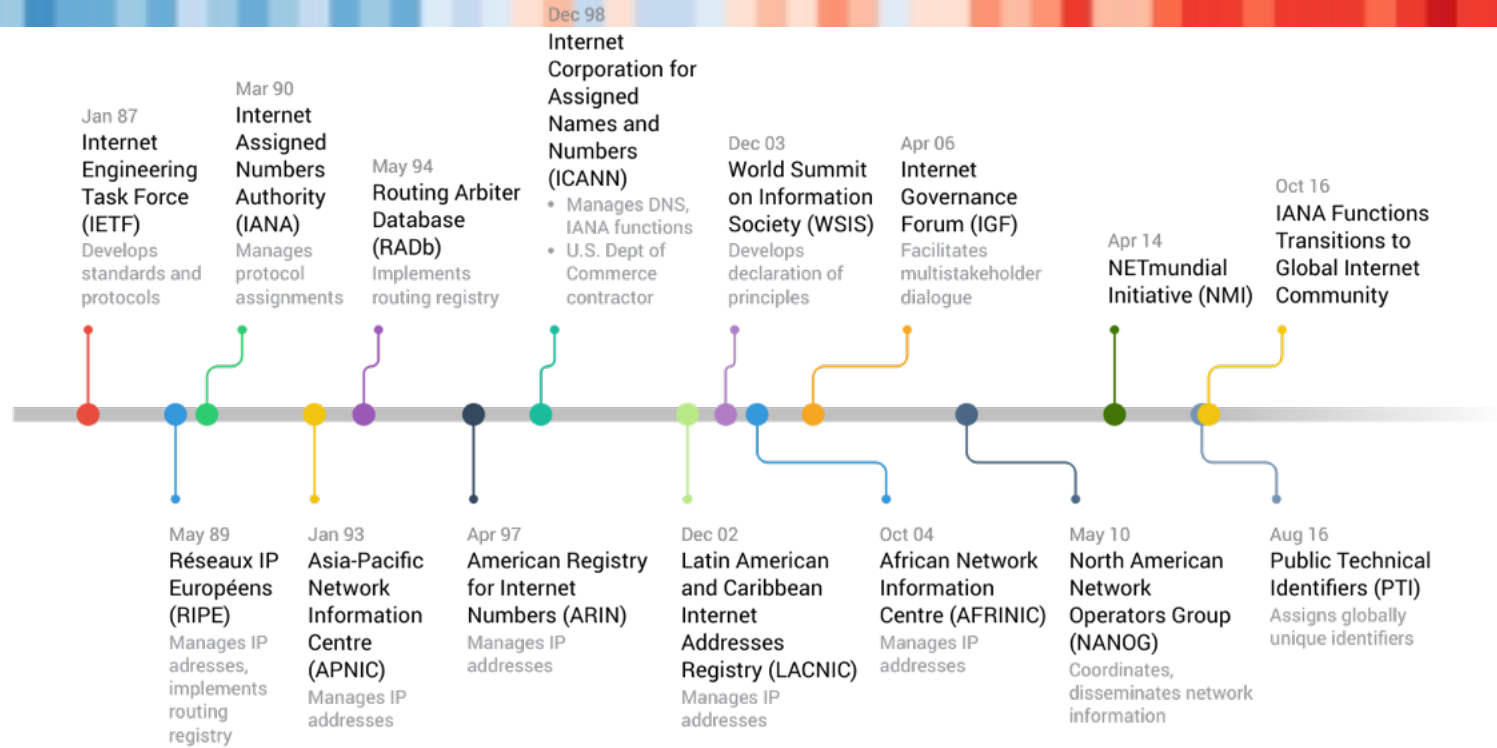


Sustainability in Tech: Who is Who

- Policy Coordination (Governments, Regulators, NGOs)
- Technical Standards Bodies
- Economists
- Network Operators
- Researchers & Academics
- Artists, (Digital Rights) activists, hackers



Internet governance timeline



Policy Coordination

- EuroDig 2023
 - https://eurodigwiki.org/wiki/WS_04_2023
 - EuroDig 2021 https://eurodigwiki.org/wiki/Greening_Internet_governance_-_Environmental_sustainability_and_digital_transformation_-_2020/2021
- IGF 2023
 - “Climate change and Technology implementation” https://www.youtube.com/watch?v=eirpgX_U5EA
 - https://labs.ripe.net/author/gergana_petrova/igf-2023-liveblog/
 - https://www.intgovforum.org/en/filedepot_download/249/20850

Technical Standards

- **IETF**

- <https://datatracker.ietf.org/group/eimpact/about/>

- <https://www.iab.org/activities/workshops/e-impact/>

- **ITU** in 2020: “**reduce ICT GHG emissions by 45% by 2030**”

- <https://www.itu.int/rec/T-REC-L/en>

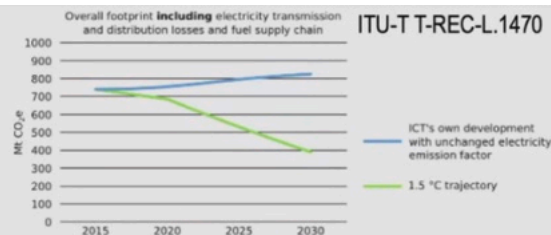
- **ETSI** <https://www.etsi.org/committee/1395-ee>

- **IEEE** <https://sagroups.ieee.org/planetpositive2030/>

- **3GPP** https://hexa-x-ii.eu/wp-content/uploads/2023/07/Hexa-X-II_D1.1_final-website.pdf

IETF Documents

Goals?



- Reduction of environmental impact of **about 50%** by 2030 to align with the IPCC 1.5°C trajectory, [ITU-T L.1470] or severe effects for 2°C or ...

- **Keep warming at 1.5°C implies global emissions must peak by 2025 → in 9-10 IETF meetings**

<https://theconversation.com/ipcc-report-global-emissions-must-peak-by-2025-to-keep-warming-at-1-5-c-we-need-deeds-not-words-165598>

- Contribution of ICT in electricity usage is a major green-house gases factor:
 - By **2030** it could use up to 51% of global electricity, and contribute up to 23% of globally released GHG emissions

A. Andrae, T. Edler. *On Global Electricity Usage of Communication Technology: Trends to 2030*. Challenges 2015

- <https://datatracker.ietf.org/doc/slides-113-gaia-the-internet-and-environmental-sustainability-revolutionary/>
- <https://datatracker.ietf.org/doc/draft-eckert-ietf-and-energy-overview/>
- <https://datatracker.ietf.org/doc/draft-almprs-sustainability-insights/>
- <https://datatracker.ietf.org/doc/draft-irtf-nmrg-green-ps/>
- <https://datatracker.ietf.org/doc/html/draft-cx-green-metrics>

Economics



<https://www.apc.org/en/news/our-circular-future-if-youre-reading-youre-part-environmental-problem>

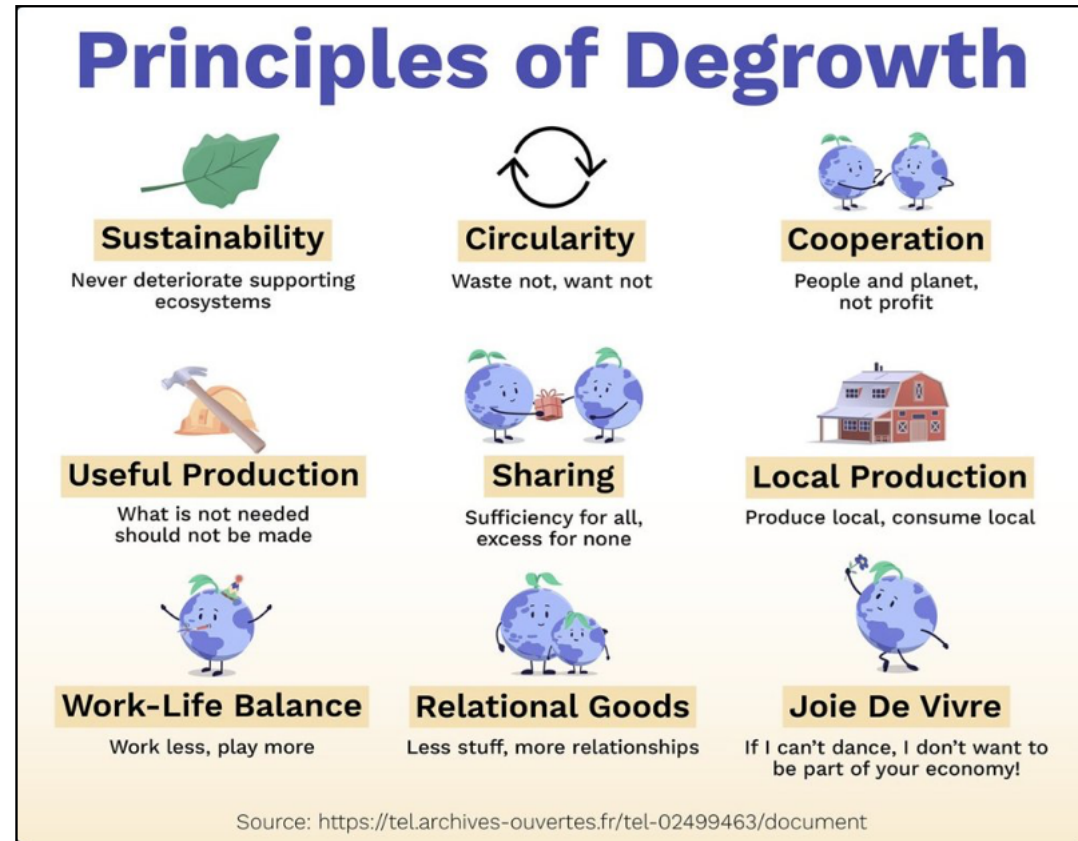
My Top 10 21st-Century Alternative Economic Theory Books:

- Giving Economy, Heather Marsh (in "Binding Chaos", 2013)
- Post-carbon Economy, Naomi Klein (in "On Fire", 2021)
- Caring Economy, Riane Eisler (2007) : <http://caringeconomy.org/>
- Decolonising Economics, Nonhlanhla Makuyana (2021)
<https://decolonisingeconomics.org/>
- Ecofeminism, Maria Mies and Vandana Shiva (2014)
<https://www.environmentandurbanization.org/ecofeminism>
- Mutualism, Sara Horowitz (2021)
- Doughnut Economics, Kate Raworth (2017)
<https://doughnuteconomics.org/>
- Mission Economy, Mariana Mazzucato (2021)
- The Support Economy: Shoshana Zuboff (2002)
<http://www.thesupporteconomy.com/>
- Enlightenment Economics, Diane Coyle (in "The Economics of Enough", 2011)

- <https://labs.ripe.net/author/becha/ripe-community-resilience-economy-of-care/>

DeGrowth

- A Degrowth Perspective on Artificial Intelligence - Analysing the Appropriateness of Machine Learning to a Degrowth Context <https://www.research-collection.ethz.ch/handle/20.500.11850/622669>
- Degrowth can work — here's how science can help: <https://www.nature.com/articles/d41586-022-04412-x>
- Digital Degrowth https://zagreb.degrowth.net/en/9_int_dg_conf_public/events/184



Network Operators Tips

- Kubernetes Efficient Power Level Exporter (Kepler) <https://sustainable-computing.io/>
- Carbon-neutral self-hosting & software development: <https://codeberg.org/Codeberg/Community/issues/856>
- Environmental sustainability at GitHub <https://github.blog/2021-04-22-environmental-sustainability-github/>
- Orange: Deep Sleep Mode for WiFi : slashes gateway power consumption to under 1W: “Sustainability in Broadband” webinar: <https://app.livestorm.co/rethink-technology-research/faultline-webinar-series-2023-or-sustainability-in-broadband?type=detailed>
- SubSee Cables Sustainability Map <https://suboptic.org/page/sustainability-map>
- Carbon-Intelligent Global Routing in Path-Aware Network https://netsec.ethz.ch/publications/papers/green_routing2023.pdf
- Green OSPF <https://www.sciencedirect.com/science/article/abs/pii/S1084804516300662>
- Optimizing Power Consumption in High-End Routers (Juniper) <https://www.linkedin.com/pulse/optimizing-power-consumption-high-end-routers-sharada-yeluri/>
- High Bandwidth Router Power Consumption & Cisco 8800 Power Provisioning <https://xrdocs.io/8000/blogs/cisco-8800-power-provisioning/>

Green Tech Tips

- Document: Sustainable subsea optic cables industry <https://suboptic.org/page/sustainability-map>
- “Build a Sustainable, Carbon-Aware Cloud” Microsoft <https://www.youtube.com/watch?v=s7K7QkhWnFU> May 2023
- Benchmark for sustainable software / FOSS Energy Efficiency Project <https://eco.kde.org/handbook/>
- Write “Open Source for Climate Tech”, IEEE <https://engagestandards.ieee.org/sosh-free-webinar-series.html> , April 2023
- The making of critical data center art <https://journals.sagepub.com/doi/10.1177/14614448221149942>
- Environmental effects of digitization <https://www.sciencedirect.com/science/article/pii/S187734352300043X>
- how ICT workers can contribute to a transition to ecosocialism <https://commonplace.doubleloop.net/reclaiming-the-stacks-ecosocialism-and-ict>
- https://en.m.wikipedia.org/wiki/Jevons_paradox

Researchers & Academia

- labs.ripe.net/sustainability
- ComputingWithinLimits.org
- ACM SIGPLAN (Special Interest Group on Programming Languages) & Climate : <https://www.sigplan.org/Resources/Climate/>
- ACM SIGCAS: Computers and Society <https://www.sigcas.org/events/sigcas-showcase-2022/>
- Theoretical Computer Scientists for Future (tcs4f.org) made a pledge to “reducing our emissions by at least 50% before 2030 relative to pre-2020 levels.”
- <https://www.nsuweb.org/circle-g-sustainability-ethics-environment-call-for-papers/>

EU / Green Digital / ICT

- EU Commission proposed to cut greenhouse gas (GHG) emissions by at least 55% by 2030 ... & becoming climate neutral by 2050 (**economy**)
 - https://climate.ec.europa.eu/eu-action/european-green-deal/2030-climate-target-plan_en
- European Green **Digital** Coalition: “net-zero no later than 2040”
 - <https://digital-strategy.ec.europa.eu/en/policies/european-green-digital-coalition>
- International Energy Agency: “align **ICT** with climate-based targets”
 - <https://www.iea.org/reports/data-centres-and-data-transmission-networks>

Artists, Activists, Hackers

- Anatomy of AI <https://anatomyof.ai>
- AMRO: <https://www.radical-openness.org/>
- **APC** (etc) <https://www.apc.org/en/blog/shifting-priorities-planet-new-research-grounds-digital-rights-struggle-climate-and>
- Counter Cloud Action Day <https://diagram.institute/12o/>
- Digital Depletion Strike <https://multiplace.org/8m>
- <https://Rebellion.Global>
- <https://climateaction.tech/>
- Bits & Bäume <https://bits-und-baeume.org/en/>



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1860s - 1910s, England
 Statistician Florence Nightingale & physician Elizabeth Garrett Anderson, women's suffrage movement



© Cyro A. Silva CC BY 2.0

1920s, Brazil
 Biologists from National Museum, environmental protection



1960 - present, USA
 Science for the People collective, anti-war and social justice



© SR Nigeria



© SR Spain



© SR Turtle Island



© SR Panamá

2020s, Worldwide
 Scientist Rebellion, climate and ecological breakdown

Vesna Manojlovic @becha · 2 hours ago
 Eunice Newton Foote wrote a first paper (1856) on relationship between carbon dioxide and the earth's climate <https://archive.vn/DPhg2>



ALT: Eunice Newton Foote. (Victorial Press Ltd./Alamy)

1860

1890

1920

1950

1980

2010

2018 - present, Argentina
 Biologist Esteban Servat, social struggles and environmental abuse



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© Orren Jack Turner CC0 1.0

1957, USA & Europe
 Nobel winners' Russell-Einstein Manifesto, abolition of atomic weapons and war



© NASA CC0 1.0

1988 - present, USA
 Climatologist James Hansen, climate change



© Stefan Müller CC BY 2.0



scientist rebellion_

Layer 9

Political Demands for Digitalisation & DeGrowth

Three requirements must be met for digitalisation to work for sustainability:

- The social and environmental impacts of producing and operating **digital devices, infrastructures and data centres** must be reduced. To make a difference in the short term, this report presents a combined strategy for digital sufficiency, repairability, circularity, and efficiency.
- The growth-oriented **business models of Big Tech companies** must be controlled and eventually replaced by business models that are oriented towards the common good. This report points out three policy pathways that can initiate this transition.
- The governance of **data and artificial intelligence** needs to actively pursue an information-based circular economy. This report shows which new institutions are required, and which policies can put data and AI in the service of sustainability.

- <https://digitalization-for-sustainability.com/digital-reset/>

Political Demands, Bits & Bäume 2022

1. Digitisation within the planetary boundaries
2. Global justice and regional self-determination
3. Redistribution of technological design power, democracy and participation
4. Fair digitisation, sustainable technology design and social issues
5. Protection of digital infrastructure and IT security

<https://bits-und-baeume.org/konferenz-2022/forderungen/#heading>

RIPE Meeting Talks

- RIPE81 (October 2020): Sustainable ICT **Procurement**, Michael Oghia,
 - <https://ripe81.ripe.net/programme/meeting-plan/bof/#mon14>
- RIPE84 (May 2022): Towards a **Fossil Free** Internet, Chris Adams, Green Web Foundation
 - <https://ripe84.ripe.net/archives/video/751/>
- RIPE85 (October 2022): 13 Propositions for a Burning World, Tobias Fiebig, MPI INF, and Doris Aschenbrenner, Aalen University
 - <https://ripe85.ripe.net/archives/video/877/>

Take part in RIPE / NCC Communities

- Join RIPE meetings
 - Twice a year, hybrid; ~1000 participants; network operators et.al -> RIPE88: **May 2024, Krakow**
 - Academic cooperation funding & Fellowship available : ripe.net/raci
 - Become WG-chair or volunteer on the Programme Committee
- Join other events organised by RIPE NCC
 - Regional meetings / Training courses & on-line education / Hackathons
- Join RIPE Working Groups
 - mailing lists / online meetings / in-person meetings
- <https://forum.ripe.net>

[Address Policy Working Group](#)

[Anti-Abuse Working Group](#)

[Connect Working Group](#)

[Cooperation Working Group](#)

[Database Working Group](#)

[DNS Working Group](#)

[Internet of Things Working Group](#)

[IPv6 Working Group](#)

[MAT Working Group](#)

[Open Source Working Group](#)

[RIPE NCC Services Working Group](#)

[Routing Working Group](#)

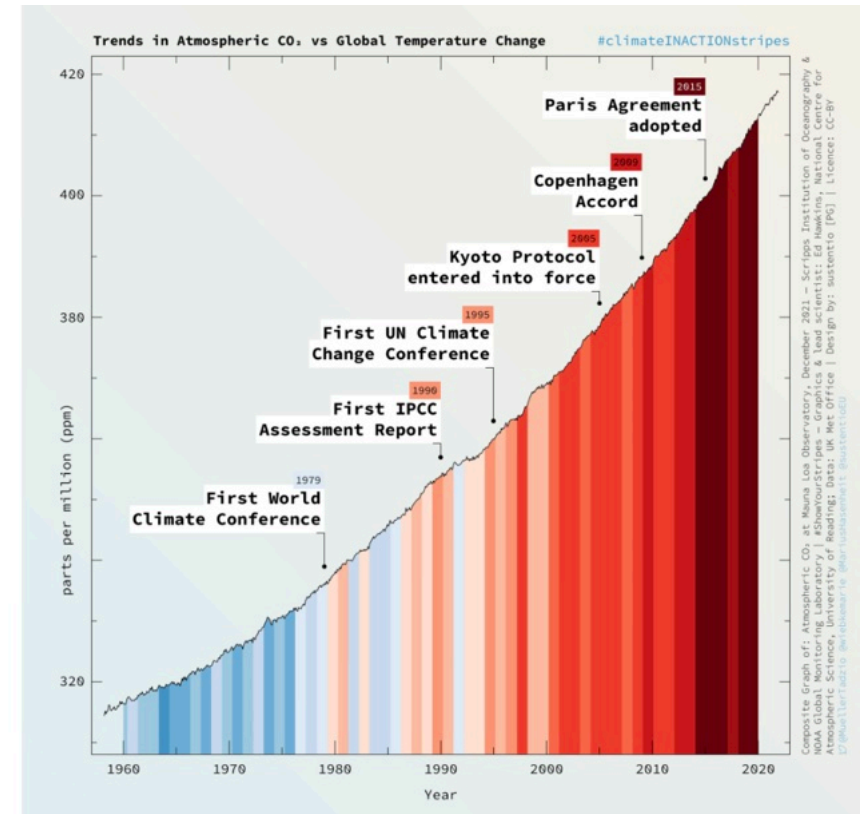
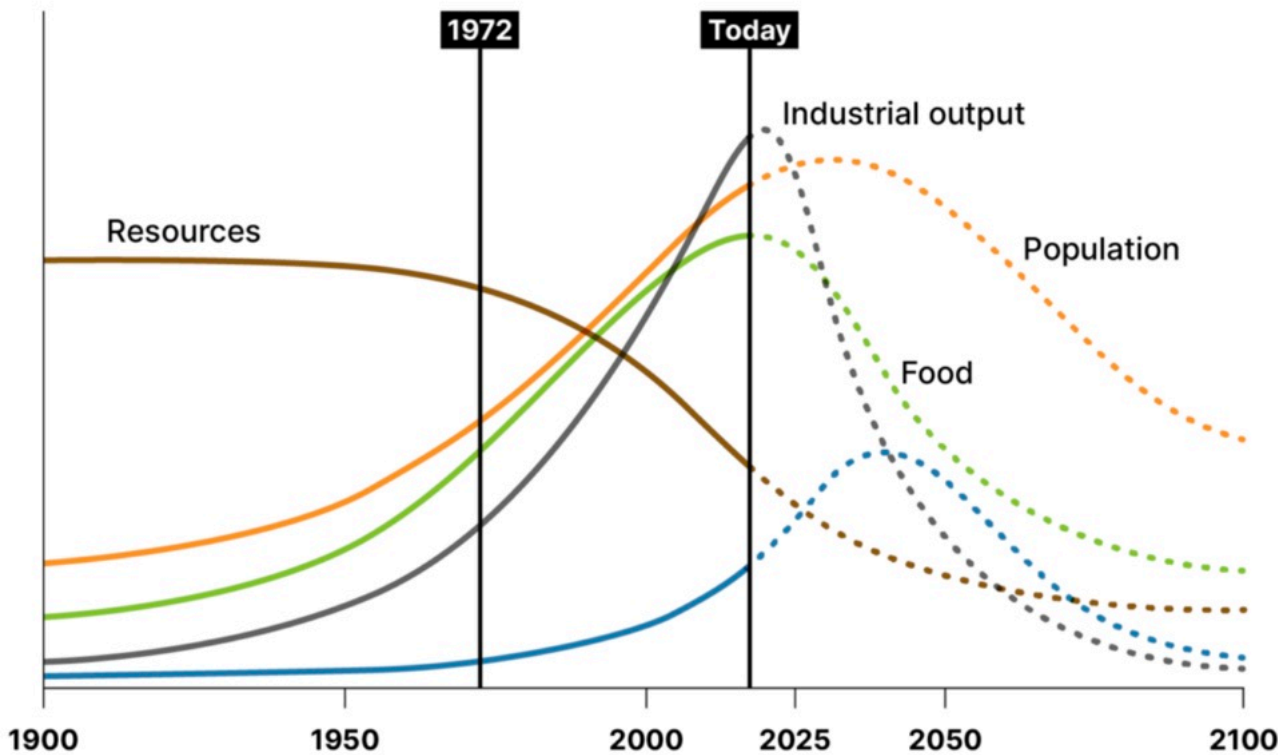
Calls for Actions

- **Join** existing communities & mailins lists & events
 - <https://wiki.techinc.nl/Sustainability#Communities>
 - [https://wiki.techinc.nl/Sustainability#Mailing Lists](https://wiki.techinc.nl/Sustainability#Mailing_Lists)
 - <https://wiki.techinc.nl/Sustainability#Events>
- **Work together** on reducing environmental impact
- **Act** in solidarity with marginalised groups, frontline populations, endangered ecosystems

Towards Climate Justice

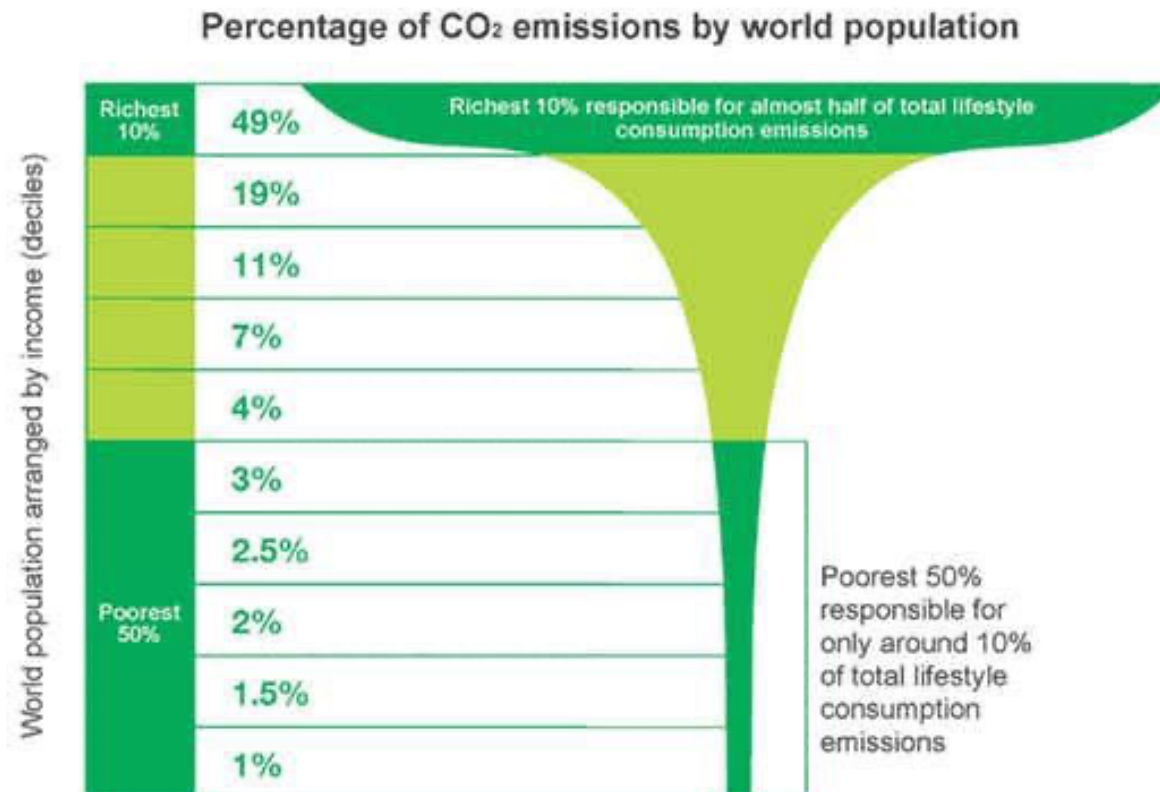
Global Emissions, Global Problems

- “Limits to Growth” (1972), “Earth4All” (2022) & IPCC (2023)
 - by “Club Of Rome” (Donella Meadows et.al.)



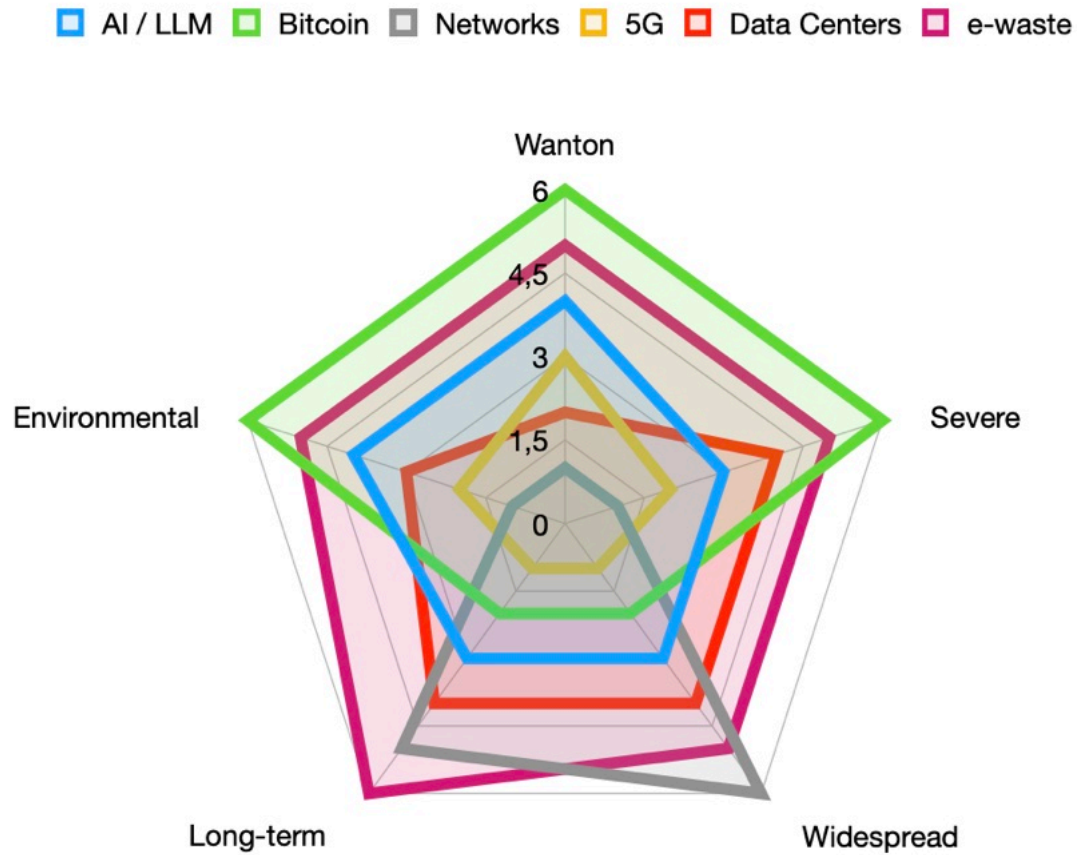
Inequalities: North vs South

Figure 1: Global income deciles and associated lifestyle consumption emissions



Source: Oxfam

Computing is Ecocide



[https://wiki.techinc.nl/User:Becha/AI is ecocide](https://wiki.techinc.nl/User:Becha/AI_is_ecocide)

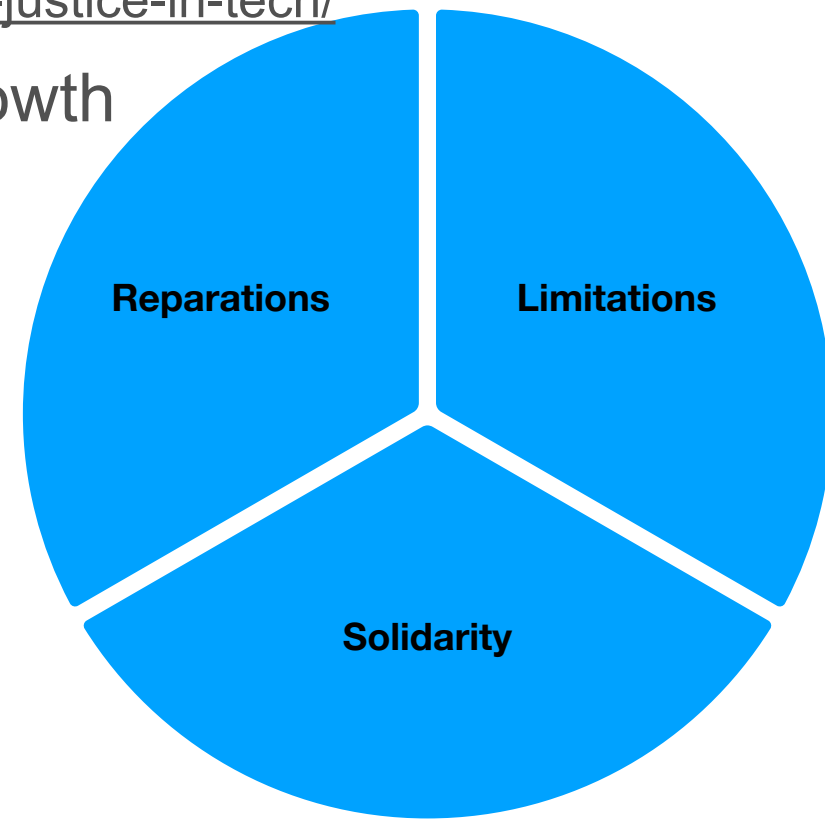
Data Feminism, Data Justice

Table 2.1: From data ethics to data justice

Concepts That Secure Power	Concepts That Challenge Power
Because they locate the source of the problem in individuals or technical systems	Because they acknowledge structural power differentials and work toward dismantling them
Ethics	Justice
Bias	Oppression
Fairness	Equity
Accountability	Co-liberation
Transparency	Reflexivity
Understanding algorithms	Understanding history, culture, and context

Climate Justice in Tech (Principles)

- “Towards Climate **Justice** in Tech”
 - <https://labs.ripe.net/author/becha/towards-climate-justice-in-tech/>
- **Limiting** extractivism & decreasing growth
- **Reparations**: giving back to the most affected communities
- Acting in **solidarity** with the frontline communities & centering marginalised groups; mutual aid



Inspiring Examples

- Reduce, Repair, Repurpose, Recycle (equipment)
- Community Networks, Mesh, Low-power networking, disaster-recovery net
- Decolonising the Internet, Feminist Internet, Solar Internet
- Low-tech, Slow tech, Retro-tech, Green Tech, Appropriate Technology
- Counter Computings: Frugal-, Convivial-, Benign-, Permacomputing
 - [https://wiki.techinc.nl/Sustainability#Alternative Computings](https://wiki.techinc.nl/Sustainability#Alternative_Computings)
- Self-hosting, federation, decentralised networks

Urgency, Degrowth, Rebellion

- “Environmental Impact of the Internet” at RIPE86, Rotterdam, May 2023

RIPE86

My Personal Rebel!

- Alisa in January 2004, RIPE 47, Amsterdam
- Alisa in 2022, XR action against private jets

- <https://labs.ripe.net/author/becha/environmental-impact-of-internet-urgency-de-growth-rebellion>
- <https://ripe86.ripe.net/archives/video/1001/>
- <https://wiki.techinc.nl/File:Xs-vesna-e-impact-ripe86-short-and-long.pdf>

Extra Slides

IETF Recommendations*

- For the corporations & communities:
 - **reduce by 7.6% / year on all metrics** (emissions, materials, water, energy...)
- **Create NZE-WG**
 - **“Net Zero Emissions” Working Group**
- **Add “Sustainability Considerations” section to every ietf-draft, RFC, BCP**

* *personal opinion*

What should we not do?

- Use systems that are energy inefficient
 - Proof of work, old hardware, inefficient algorithms and protocols (computation a
- Use bad energy sources
 - Fossil fuels
 - Energy sources that are not green, renewable, clean....
 - Large greenhouse gas emissions and air pollution
- Luxury consumerism
- Systems that produce a lot of non-recyclable e-waste
- Systems with wasteful over-consumption of water, land, minerals
- Digital colonialism
 - Use of resources, export of e-waste for “recycling”
- Predatory systems that have a negative impact on society
 - Crypto-assets
- Use nonsense numbers that do not add up
- Send too many ACKs.
- Fly, use ICT systems instead

International Reduction Goals

- International Energy Agency: “align ICT with climate-based targets”
 - <https://www.iea.org/reports/data-centres-and-data-transmission-networks>
- **Setting the NZE targets!** <https://sciencebasedtargets.org/net-zero/>
- ITU in 2020: “reduce ICT GHG emissions by 45% by 2030”
 - <https://www.itu.int/en/mediacentre/Pages/PR04-2020-ICT-industry-to-reduce-greenhouse-gas-emissions-by-45-percent-by-2030.aspx>
 - <https://www.itu.int/rec/T-REC-L/en>

ITU Standards for ICT Sustainability

- <https://www.itu.int/rec/T-REC-L/en>

L.1460	Connect 2020 greenhouse gases emissions - Guidelines
L.1470	Greenhouse gas emissions trajectories for the information and communication technology sector compatible with
L.1471	Guidance and criteria for information and communication technology organizations on setting Net Zero target
L.1480	Enabling the Net Zero transition: Assessing how the use of information and communication technology solutions can reduce greenhouse gas emissions of other sectors
L.1481	Guidance on how to address Connect2030 targets on net abatement
L.1500	Framework for information and communication technologies and adaptation to the effects of climate change
L.1501	Best practices on how countries can utilize ICTs to adapt to the effects of climate change
L.1502	Adapting information and communication technology infrastructure to the effects of climate change

Regulatory BCP

- Redirecting Technologies for the Deep Sustainability Transformation, TU Berlin
 - <https://doi.org/10.14279/depositonce-16187.2>
 - <https://digitalization-for-sustainability.com/digital-reset/>
- A Telco Sustainability Reality Check: December 2022
 - <https://go.abiresearch.com/lp-telco-sustainability-reality-check>
 - human-centered decision-making will continue to evaluate the challenges and opportunities of addressing the climate crisis, working together with technology to drive reductions of global carbon emissions, water use, and waste.

Measuring Telcos' Sustainability

- “Ranking of ten leading telecom operators for sustainability.” : Sustainability Index by ABI Research (Q1 2022)
 - <https://www.abiresearch.com/press/deutsche-telekom-telefonica-vodafone-and-kpn-are-leaders-in-abi-researchs-telco-operators-sustainability-index/>
- “How five of the world’s biggest telecom operators deal with their greenhouse gas emissions” (February 2023) * AT&T, Verizon, NTT, China Mobile and Deutsche Telekom.
 - <https://telecoms.com/opinion/how-five-of-the-worlds-biggest-operators-deal-with-their-greenhouse-gas-emissions/>
- Carbon reporting regulations are rising. Small businesses need to keep up.
 - <https://app.wedonthavetime.org/posts/5fa28ad9-11b7-47e9-9926-913ff1f915ab>

Measuring Networking Emissions

- Green Networking Metrics <https://datatracker.ietf.org/doc/html/draft-cx-green-metrics>
- Quantum Internet hackathon 2022: measuring sustainability <https://github.com/becha42/ClimateJustice/blob/main/ReportHackathon2022.md>
- “Big business climate pledges must be measured” (audited)
 - <https://genevasolutions.news/climate-environment/peter-bakker-big-business-climate-pledges-must-be-measured>

Reducing Use & Emissions of Devices

- "The Rare Metals War: The Dark Side of Clean Energy and Digital Technologies", Guillaume Pitron <https://www.nhbs.com/the-rare-metals-war-book>
- "An Ontology Of Electronic Waste" Maurits Fennis
 - <https://theanarchistlibrary.org/library/an-ontology-of-electronic-waste>
- Prefer: https://en.wikipedia.org/wiki/Low-power_electronics
- (reducing) Emissions From Computing Onboard Autonomous Vehicles <https://ieeexplore.ieee.org/document/9942310>

- <https://www.apc.org/en/project/technology-environmental-justice-and-sustainability>