

Introduction : Questioning Digitalization

G. Urvoy-Keller

The French Citizen's Convention ...



The screenshot shows the homepage of the Convention Citoyenne pour le Climat website. At the top, there is a navigation bar with links for Home, Articles, Press corner, The 150 citizens, The Governance Committee, The guarantors, FAQ, and EN. Below the navigation bar is a main content area featuring a large green speech bubble logo with the text "Convention Citoyenne pour le Climat".

The Citizens' Convention on Climate, what is it?

For the first time, a panel representative of the diversity of French citizens, will be directly involved in the preparation of the law.

The Citizen's Convention on Climate, an unprecedented democratic experiment in France, aims to give citizens a voice to accelerate the fight against climate change. Its mandate is to define a series of measures that will allow to achieve a reduction of at least 40% in greenhouse gas emissions by 2030 (compared to 1990) in a spirit of social justice.



Proposed to delay 5G deployment, assess its relevance compared to FTTH

→ Encourager l'innovation et le développement des nouvelles technologies plus vertueuses contribuant à la réduction de l'énergie carbonée ;

→ Sortir de « l'innovation pour l'innovation », sans prise en compte de l'impact écologique et carbone, ni même de l'utilité pour la population. Par exemple, le passage de la 4G vers la 5G générerait plus de 30 % de consommation d'énergie carbonée en plus, sans réelle utilité (pas de plus-value pour notre bien-être). L'innovation doit être vertueuse pour sortir du carbone ;

Internet de chaque particulier dans un immeuble ,

- Dans une logique d'écoconception des services, nous proposons d'évaluer les avantages et les inconvénients de la 5G par rapport à la fibre avant et non après avoir accordé les licences pour son développement mais aussi d'initier/conseiller à l'utilisation de la solution la moins impactante pour l'environnement. Instaurer un moratoire sur la mise en place de la 5G en attendant les résultats de l'évaluation de la 5G sur la santé et le climat.

And our president answered

Les Echos

À la une Idées Économie Politique Entreprises Finance - Marchés Bourse Monde Election US Tech-Médias Start-up Régions Patrimoine Travailler mieux Le Mag W-E



Publicité

Macron défend la 5G contre « le modèle Amish » de la gauche

Recevant ce lundi soir à l'Elysée des entrepreneurs de la « French tech », le chef de l'Etat s'est moqué des 70 élus écologistes et de gauche, dont Yannick Jadot et Jean-Luc Mélenchon, qui viennent de réclamer un moratoire sur la 5G.

 Ajouter à mes articles  Commenter  Partager  Environnement  Jean-Luc Mélenchon



The Ecoinfo group of CNRS proposed to get out of the flat subscription model



The header of the Ecoinfo website features a green leaf icon, the text "Ecoinfo" in a large serif font, and "POUR UNE INFORMATIQUE ÉCO-RÉSPONSABLE" in smaller text. To the right is a decorative banner with icons related to technology and environment like wind turbines, gears, and clouds. Below the banner are five menu items: SERVICES, THÉMATIQUES, COMMUNICATIONS, PUBLICATIONS (HAL), and LE GDS.

Consultation publique sur le futur des réseaux mobiles



De mai à septembre 2022, l'[ARCEP](#) (Autorité de régulation des communications électroniques, des postes et de la distribution de la presse en France) a lancé une consultation publique sur le futur des réseaux mobiles et notamment les questions relatives à la 5G et à l'attribution des fréquences. Cette consultation, intitulée « [Préparer le futur des réseaux mobiles](#) » était ouverte jusqu'au 23 septembre 2022.



Le [document](#) soumis à consultation comprenait 98 questions réparties en 4 catégories :

- 1) Favoriser l'innovation grâce à la 5G et ses évolutions
- 2) Des besoins spécifiques et émergents pour les acteurs verticaux
- 3) Besoins sociétaux et obligations des autorisations d'utilisation de fréquences
- 4) Questions spécifiques par bande de fréquence

And obtained as answered from Yan LeCun



Yann LeCun

@ylecun

...

Obscurantisme médiéval chez le groupe EcoInfo du CNRS:

"On ne pourra pas maîtriser la consommation énergétique et les impacts environnementaux des réseaux mobiles sans imposer une forme de limitation dans les usages."

Quoi?

1/

What is your digital footprint ?

- Do the test on¹ :
<https://impactco2.fr/outils/usagenumerique>
- Report your value on : <https://framaforms.org/your-digital-footprint-1728466636>

1. There is a switch button to EN

- What did you measure with the test ? Usage or production ?
- How do you reconcile usage and production, i.e. align them on a yearly basis ?
- What seems to dominate in between prod and usage ?
- How do you distinguish personal and professional² CO₂ emissions ?
- The average CO₂ emissions of a French citizen is around 9 tons per year. Which fraction does ICT represent ?

2. Student is a job !

We are going to discuss, in this course, the importance of ICT to tackle the climate crisis.

To frame this debate, I need to know :

- what are the (important or not) applications of AI ?
- what is your definition of Progress (in general) ?
- which link do you make between progress and digitalization ?

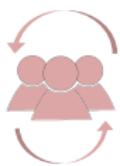
Take 15 min to fill : <https://mypads2.framapad.org/p/questionning-digitalization-jw3hxb9aw>

IPCC analysis of digitalization

Rapports du GIEC 2021-2022



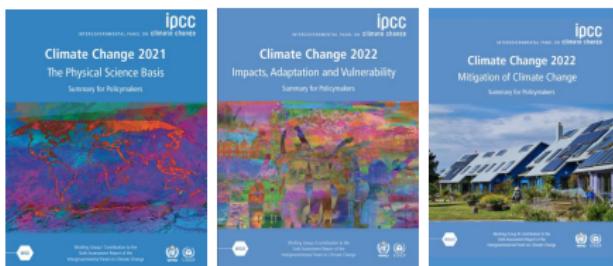
782 auteurs principaux
1 546 contributeurs



200 000+ commentaires

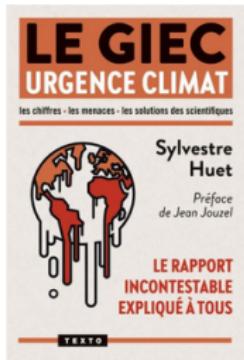


> 66 000 publications



www.ipcc.ch

- An initiative of G7 countries : Canada, France, Germany, Italy, Japan, the United Kingdom and the United States
- Their motivation is ambiguous according to S. Huet :
 - The climate change points directly towards fossil energies, which is the basis of their economy
 - They promoted a hybrid model : the UNEP endorses IPCC bureau but the latter picks external scientific experts. Better than a pure UN based model
 - They banned prescriptive capability to IPCC



Strengths :

- Working at UN level enables to neutralize conflicting interests
 - Fossil producers want to protect their investments
 - EU wants to reduce its dependency on fossil fuels and needs political arguments
 - Small islands and poor countries, which are low historical emitters, want compensations
- Net effects : no country ever voted against the Summary for Policy Makers

Weaknesses :

- No prescriptive power ⇒ signing does not commit to anything

- Working Group I : The Physical Science Basis of Climate Change
 - Climate experts, physicians, etc
 - Sound science
- Working Group II with Climate Change Impacts, Adaptation and Vulnerability
 - Mix of many scientific domains : meteorology, climatology, oceanography, biology, ecology, politic science, economy
 - interdisciplinarity is a complex exercise
 - A number of domain experts focus on local and current issue, e.g. experts in food supply focus on local area and not on the long term.
 - ⇒ it took some time to reach maturity

- Working Group III with Mitigation of Climate Change.
 - Key domains : Engineering, economy, politics
 - Engineering domain is not used to project in the long term
 - A clear minority of researchers in economy work on climate change

[PDF] Why does the economics of climate change matter so much, and why has the engagement of economists been so weak

A Oswald, N Stern

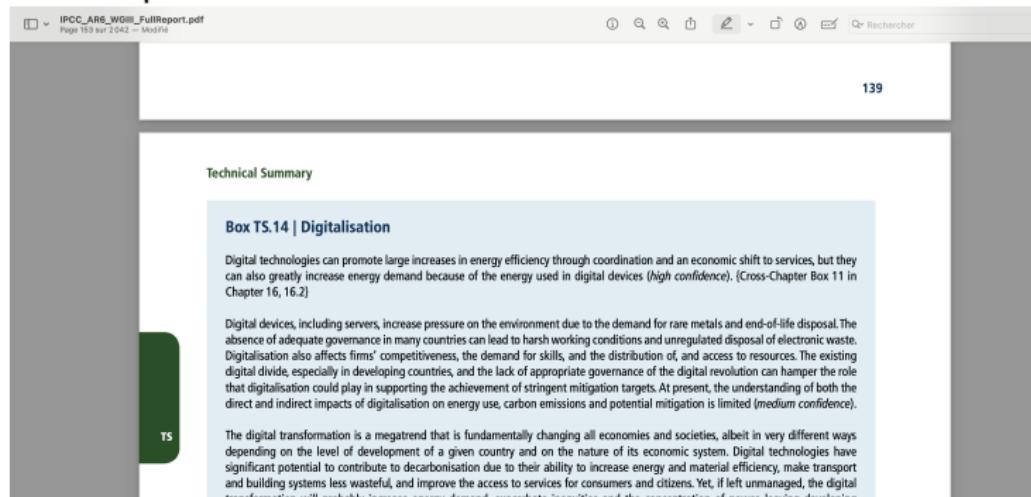
Royal Economic Society Newsletter, 2019 · andrewoswald.com

Abstract

We point out in this paper that academic economists have contributed disturbingly little to discussions about climate change. We suggest that economists are failing the world--and their own grandchildren. As one example, the Quarterly Journal of Economics, which is currently the most-cited journal in the field of Economics, has never published an article on climate change. Various other bibliometric data, for a range of economics journals, are presented in the paper. We argue that some form of intervention is now urgently required--by editors and senior professors--to break out of the dismal prevailing Nash equilibrium. Otherwise history will judge our profession harshly.

- Working Group III with Mitigation of Climate Change. cntd
 - Ultra liberal economists want no state intervention which is deemed inefficient
 - When it comes to politics, the question "in which society do we want to live" receives a variety of answers
 - ⇒ it is complex to reach consensus and reports reflect the internal debates

- Mostly addressed in Working Group 3
- Let us see what the IPCC says about digitalization by diving into last WG3 report



IPCC_AR6_WGIII_FullReport.pdf
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Technical Summary

Box TS.14 | Digitalisation

Digital technologies can promote large increases in energy efficiency through coordination and an economic shift to services, but they can also greatly increase energy demand because of the energy used in digital devices (*high confidence*). [Cross-Chapter Box 11 in Chapter 16, 16.2.]

Digital devices, including servers, increase pressure on the environment due to the demand for rare metals and end-of-life disposal. The absence of adequate governance in many countries can lead to harsh working conditions and unregulated disposal of electronic waste. Digitalisation also affects firms' competitiveness, the demand for skills, and the distribution of, and access to resources. The existing digital divide, especially in developing countries, and the lack of appropriate governance of the digital revolution can hamper the role that digitalisation could play in supporting the achievement of stringent mitigation targets. At present, the understanding of both the direct and indirect impacts of digitalisation on energy use, carbon emissions and potential mitigation is limited (*medium confidence*).

The digital transformation is a megatrend that is fundamentally changing all economies and societies, albeit in very different ways depending on the level of development of a given country and on the nature of its economic system. Digital technologies have significant potential to contribute to decarbonisation due to their ability to increase energy and material efficiency, make transport and building systems less wasteful, and improve the access to services for consumers and citizens. Yet, if left unmanaged, the digital transformation will nonetheless increase energy demand, exacerbate inequality and the concentration of power, leaving developing

A set of questions that should guide us in the course.

- Digital technologies can promote large increases in energy efficiency through coordination and an economic shift to services, but they can also greatly increase energy demand because of the energy used in digital devices (high confidence). Cross-Chapter Box 11 in Chapter 16, 16.2
 - Energy efficiency does not mean less energy consumed ?
- Digital devices, including servers, increase pressure on the environment due to the demand for rare metals and end-of-life disposal. The absence of adequate governance in many countries can lead to harsh working conditions and unregulated disposal of electronic waste.
 - Look at mining industry ? Need for Governance ?

A set of questions that should guide us in the course.

- Digital technologies have significant potential to contribute to decarbonisation due to their ability to increase energy and material efficiency, make transport and building systems less wasteful, and improve the access to services for consumers and citizens. Yet, if left unmanaged, the digital transformation will probably increase energy demand,
 - It can help but needs to be guided

Counting and distributing carbon emissions

- All social entities ...
 - States
 - Companies
 - Individuals
- ... share this attribution problem

State level

- Local emissions
- imported goods
- exported goods

Individuals

- work-home commuting : this is company responsibility ? What if you decide to live really far ?
- teleworking : should heating at home be attributed to your company

Companies

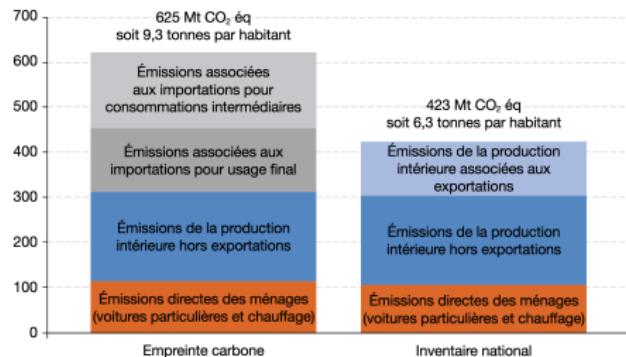
- production only or usage also

Case of France :

- local emissions
- footprint : remove exportation and add importation

COMPARAISON DE L'EMPREINTE CARBONE DE LA FRANCE ET DE L'INVENTAIRE NATIONAL EN 2019

En Mt CO₂ éq



Note : l'empreinte et l'inventaire (voir glossaire) portent sur les trois principaux GES (CO₂, CH₄, N₂O) hors UTCATF. En raison d'une comptabilisation différente du transport international selon les approches, les sous-totaux (émissions des ménages et émissions de la production intérieure) de l'empreinte et de l'inventaire ne sont pas identiques.

Champ : périmètre Kyoto (métropole et outre-mer appartenant à l'UE).

Sources : Citepa ; AIE, EDGAR-JRC ; FAO ; Douanes ; Eurostat ; Insee. Traitement : SDES, 2023

Greenhouse Gas (GHG) Protocol

- AMD, Apple, Facebook, Google, Huawei, Intel, and Microsoft publish annual sustainability reports using the GHG Protocol
- Reference article :

Chasing Carbon: The Elusive Environmental Footprint of Computing

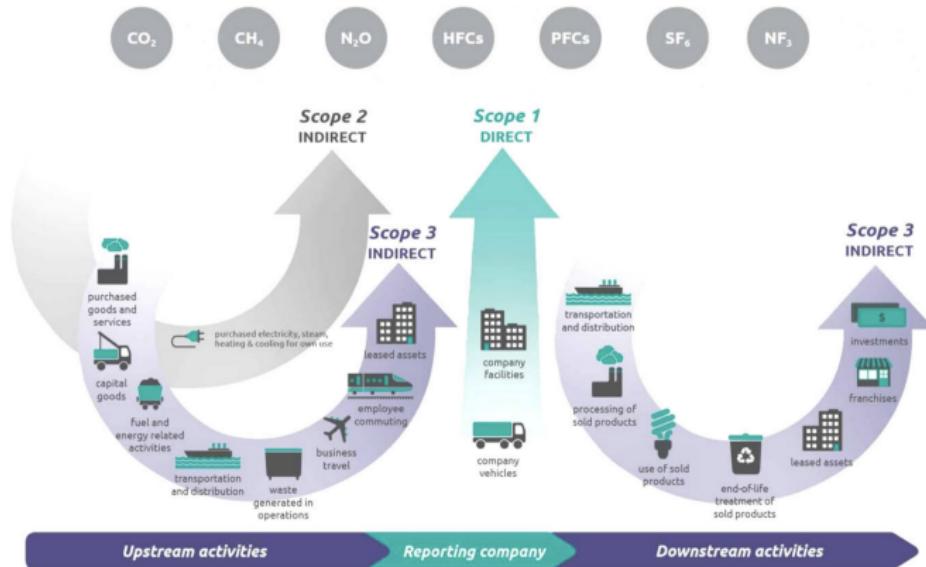
Udit Gupta^{1,2}, Young Geun Kim³, Sylvia Lee², Jordan Tse²,
Hsien-Hsin S. Lee², Gu-Yeon Wei¹, David Brooks¹, Carole-Jean Wu²

¹Harvard University, ²Facebook Inc., ³Arizona State University

ugupta@g.harvard.edu carolejeanwu@fb.com

Three scopes in Greenhouse Gas (GHG) Protocol

- Scope 1 : emissions come from fuel combustion (e.g., diesel, natural gas, and gasoline), refrigerants in offices and data centers, transportation, and the use of chemicals and gases in semiconductor manufacturing
- Scope 2 emissions come from purchased energy and heat powering semiconductor fabs, offices, and data-center operation.
- Scope 3 emissions come from all other activities, including the full upstream and downstream supply chain. They often comprise employee business travel, commuting, logistics, and capital goods.



Source : Stenzel, A., Waichman, I. Supply-chain data sharing for scope 3 emissions. *npj Clim. Action* 2, 7 (2023).

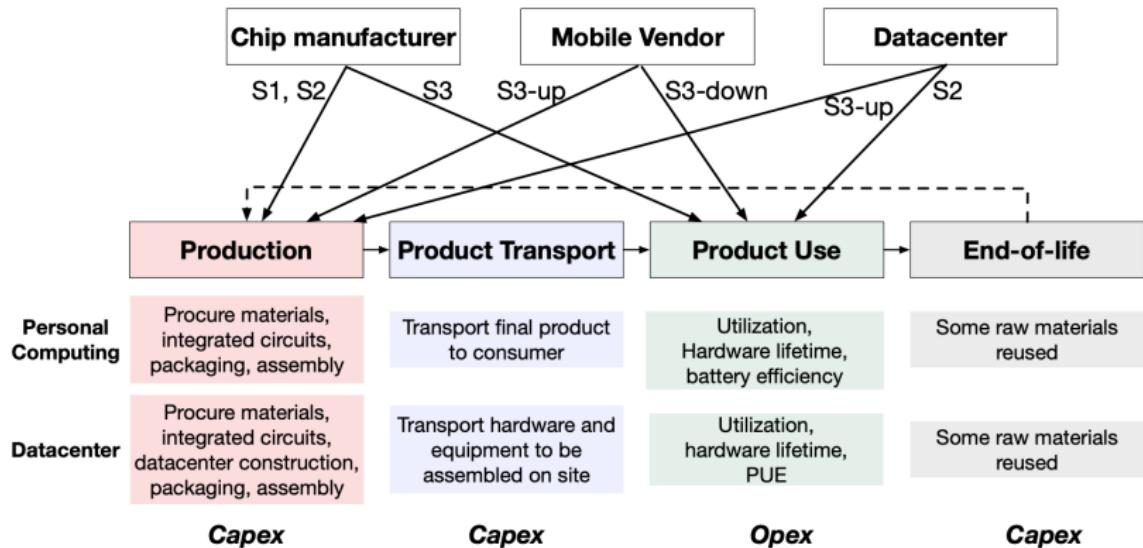
<https://doi.org/10.1038/s44168-023-00032-x>

Technology company	Scope 1	Scope 2	Scope 3
Chip manufacturer	Burning PFCs, chemicals, gases	Energy for fabrication	Raw materials, hardware use
Mobile-device vendor	Natural gas, diesel	Energy for offices	Chip manufacturing, hardware use
Data-center operator	Natural gas, diesel	Energy for data centers	Server-hardware manufacturing, construction

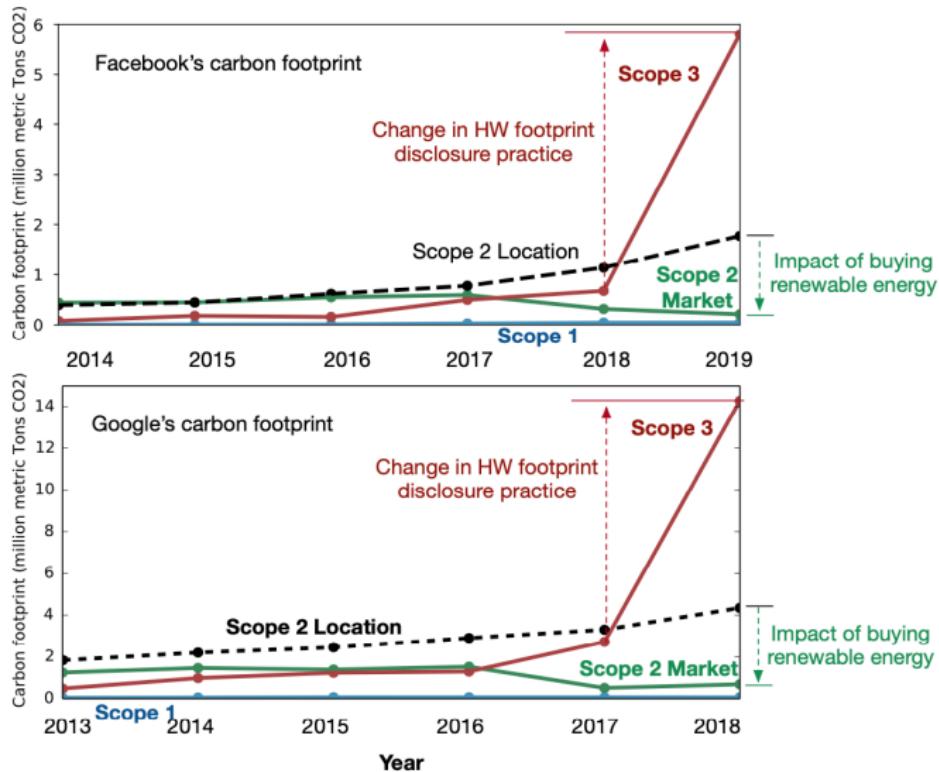
- Scope 1 : fuel combustion, refrigerants in offices and data centers, transportation, and the use of chemicals and gases in semiconductor manufacturing.
 - Small for mobile operator and DC and large for semiconductor, e.g. half for TSMC (largest chip manufacturer)
 - E.g., TSMC reports that nearly 30% of emissions from manufacturing 12- inch wafers are due to PFCs, chemicals, and gases
- Scope 2 emissions important in semiconductor fabs and data centers.
 - Semiconductor :
 - Much of these emissions come from burning perfluorocarbons (PFCs), chemicals, and gases.
 - Energy consumption, for instance, produces over 63% of the emissions from manufacturing 12-inch wafers at TSMC

- Scope 2 (cntd).
 - Data center :
 - depend on the geographic location and energy grid.
 - purchasing renewable energy (e.g., solar and wind) to reduce GHG emissions. ⇒ **why for this sector and not industry, electric vehicles... ?**
- Scope 3 :
 - Scope of your responsibility
 - "My scope 3 is someone else scope"

"My scope 3 is someone else scope 2"



Focus on Data Centers Owners



- Scope 1 (opex) emissions come from facility use of refrigerants, natural gas, and diesel ;
- Scope 2 (opex) emissions come from purchased electricity ;
- Scope 3 (capex) emissions come from the supply chain, including employee travel, construction, and hardware manufacturing

Is Scope 3 dominated by hardware purchase ?

The hardware purchase indeed dominates :

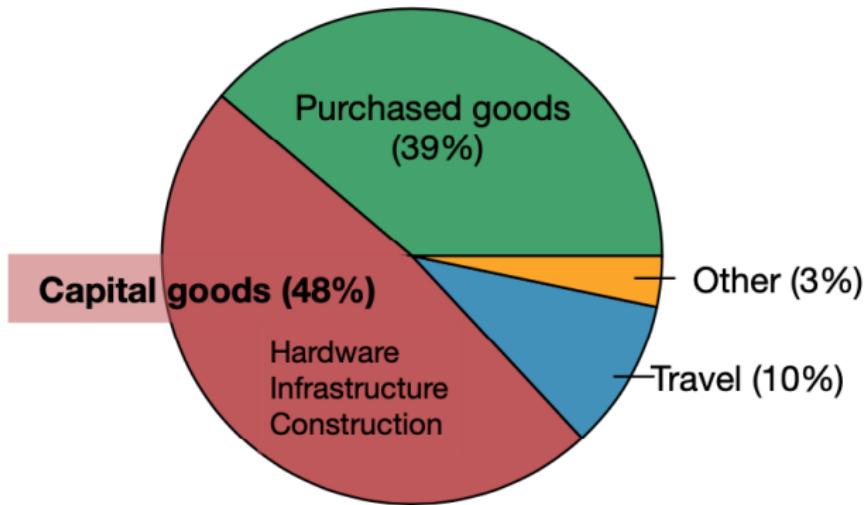
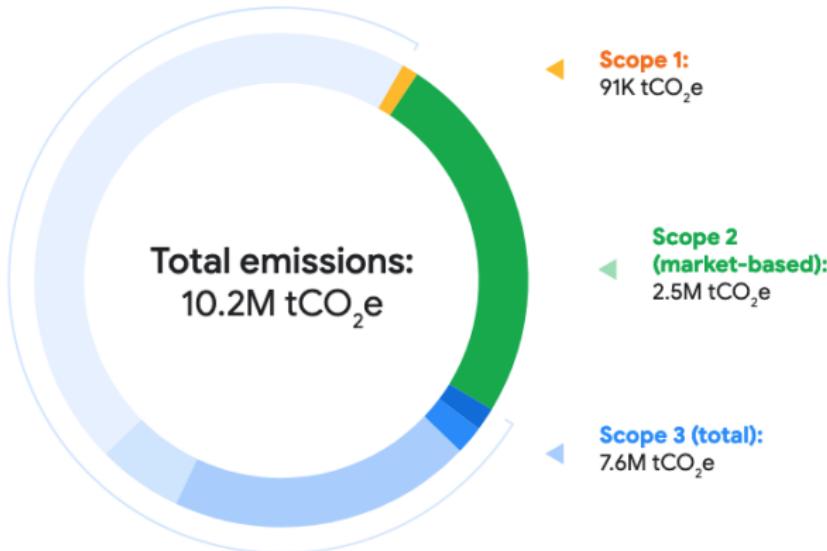


Fig. 12. Breakdown of Facebook's 2019 Scope 3 carbon emissions. Capital goods (e.g., hardware, infrastructure, and construction) account for up to 48% of the annual total.

- Let us check the latest report of Google (2023)
- Still a clear dominance of Scope 3



- Hardware purchase hidden in Scope 3 (apparently)

Scope	tCO ₂ e	%
Scope 1	91,200	1%
Scope 2 (market-based)	2,492,200	24%
Scope 3 Business travel	211,000	2%
Scope 3 Employee commuting (including teleworking)	151,000	2%
Scope 3 Capital goods	2,096,000	21%
Scope 3 Upstream transportation and distribution	556,000	5%
Scope 3 Other categories	4,586,000	45%
Scope 3 (total)	7,600,000	75%
Total emissions	10,183,400	100%

Operational emissions: 2.95M tCO₂e

- Carbon footprint is not only about carbon but in face Green House Gases $\Rightarrow \text{CO}_2\text{e}$
- Illustration with TSMC

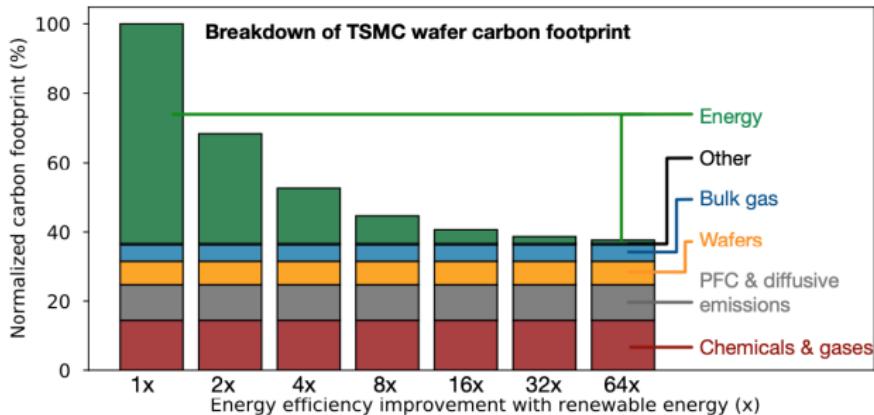


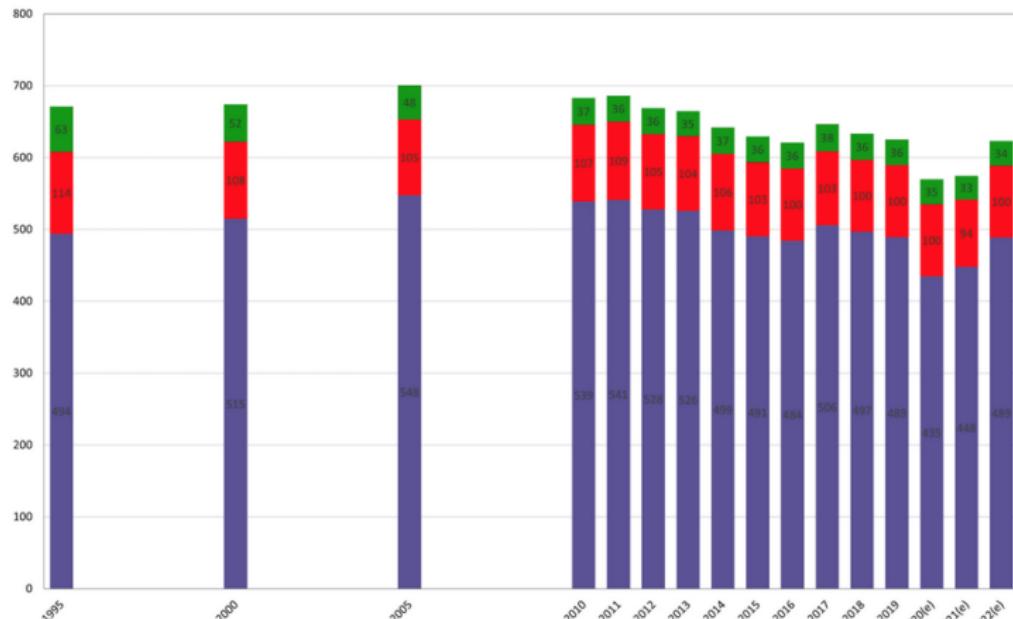
Fig. 14. Carbon-emissions breakdown for TSMC wafer manufacturing. Renewable energy provides up to a $64\times$ reduction in emissions from electricity, and overall emissions for wafers drops by $2.7\times$. Although the reduction will reduce the carbon output of manufacturing, consideration of capex-related emissions for mobile and data-center hardware will remain important.

Use of renewable energy

- This holds for countries also where dominating gases are CO₂, N₂O (Nitrous Oxyde) and NH₄ (methane)

L'empreinte carbone par type de substance entre 1995 et 2022

En Mt CO₂ eq



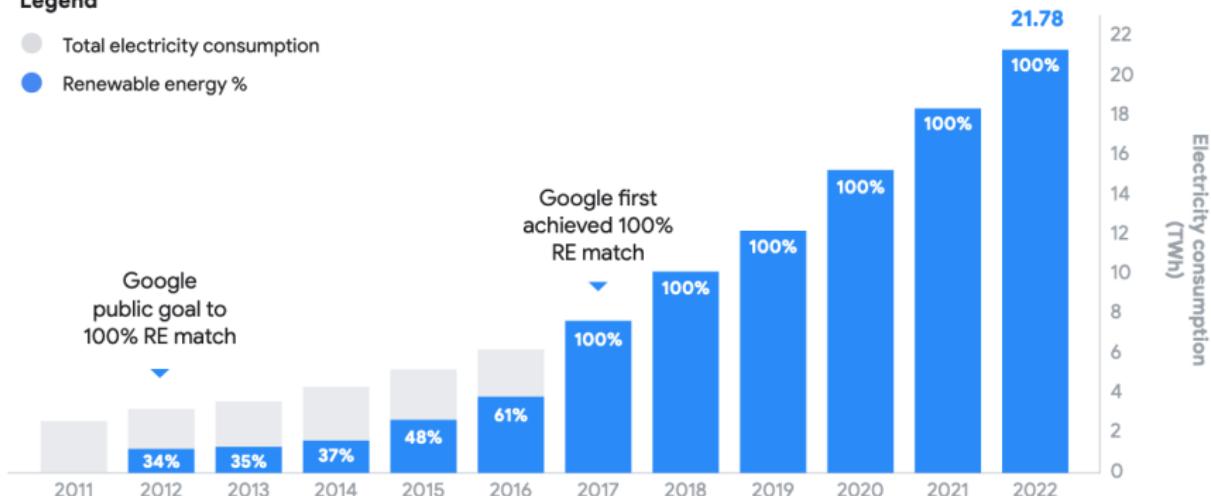
Use of renewable energy in DC

More and more renewable energy at Google .. but also more and more energy

Renewable energy purchasing compared with total electricity use

Legend

- Total electricity consumption
- Renewable energy %



Google
public goal to
100% RE match

Google first
achieved 100%
RE match



- ICT companies report their GHG emissions ⇒ let's dig in these reports (lab on Netflix)
- Hardware manufacturing bears a non compressible cost... even with renewable energy as $\text{GHG} \neq \text{CO}_2$
- Renewable energy help in DC but :
 - Market-based and not location-based (on site production)
 - Continual increase of energy usage that raises questions