The Full Lifecycle

Sustain RG, IETF 122

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Background

- We often see people estimating the impact of ICT in terms of energy consumption of the system
- In the short term, this is the key, to get the growth stopped
- In the long term, another concern is then the key

- Still, important is to look at the full lifecycle, already today

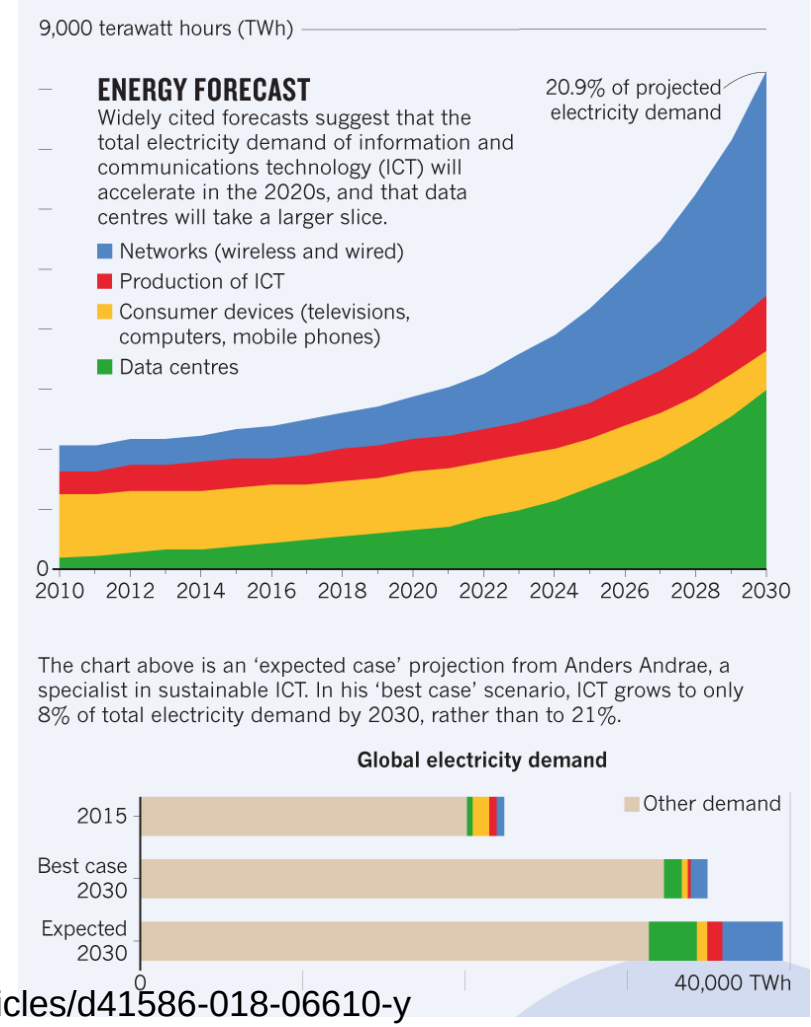
The short term

Why care about networks ?

Energy consumption is shifting from consumers to both networks and data centres

Data centres consume the same as networks?

(Was the growth of AI seen years ago ?)



https://www.nature.com/articles/d41586-018-06610-y

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All estimates talk about the world, incl.

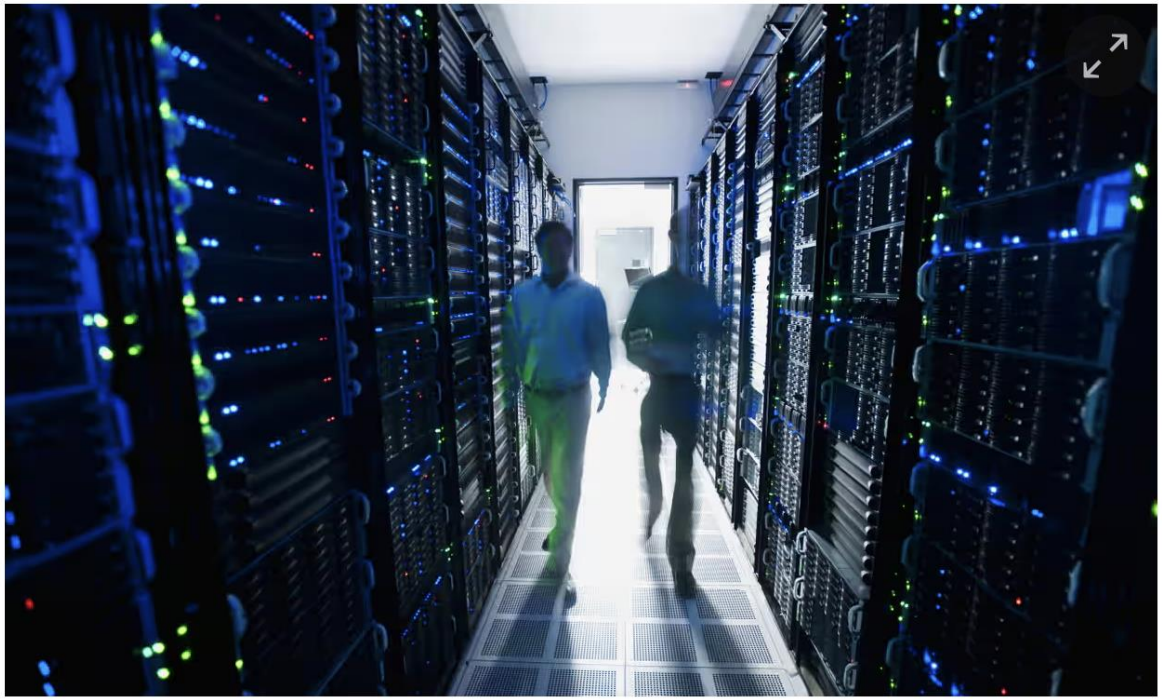
developed and developing countries

+networks
+end user devices

https://www.theguardian.com/world/article/2024/jul/23/ireland-datacentres-overtake-electricity-use-of-all-homes-combined-figures-show

Ireland's datacentres overtake electricity use of all urban homes combined

Statistics raise concerns that rise in demand for data processing driven by AI could derail climate targets



Datacentres supporting tech hubs used 21% of Ireland's electricity last year, an increase 20% on 2022 – all homes used 18%. Photograph: Erik Isakson/Getty Images/Tetra images RF

2024 United States Data Center Energy Usage Report

https://eta-publications.lbl.gov/sites/default/files/2024-12/lbnl-2024-united-states-data-center-energy-usage-report.pdf

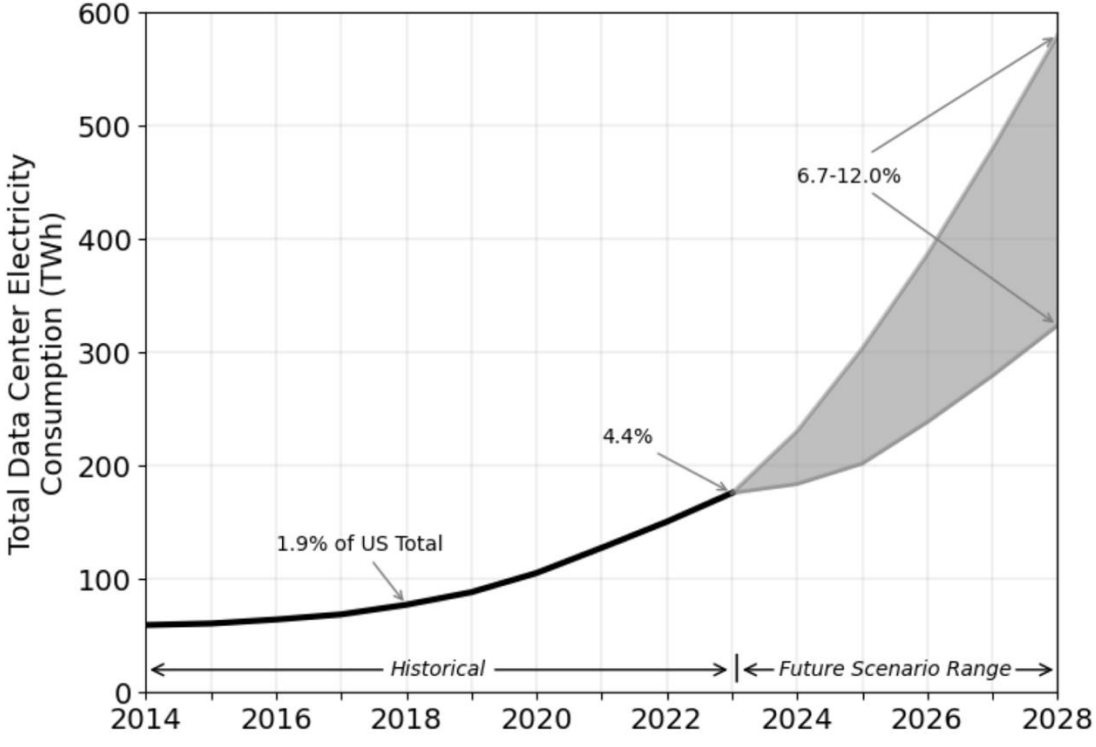
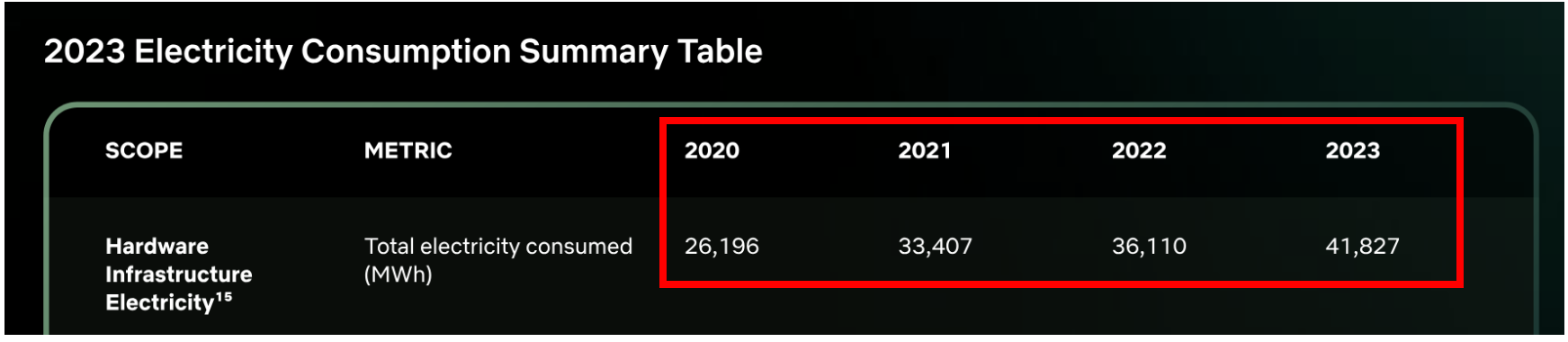


Figure ES-1. Total U.S. data center electricity use from 2014 through 2028.

Netflix Environmental Social Governance Report 2024



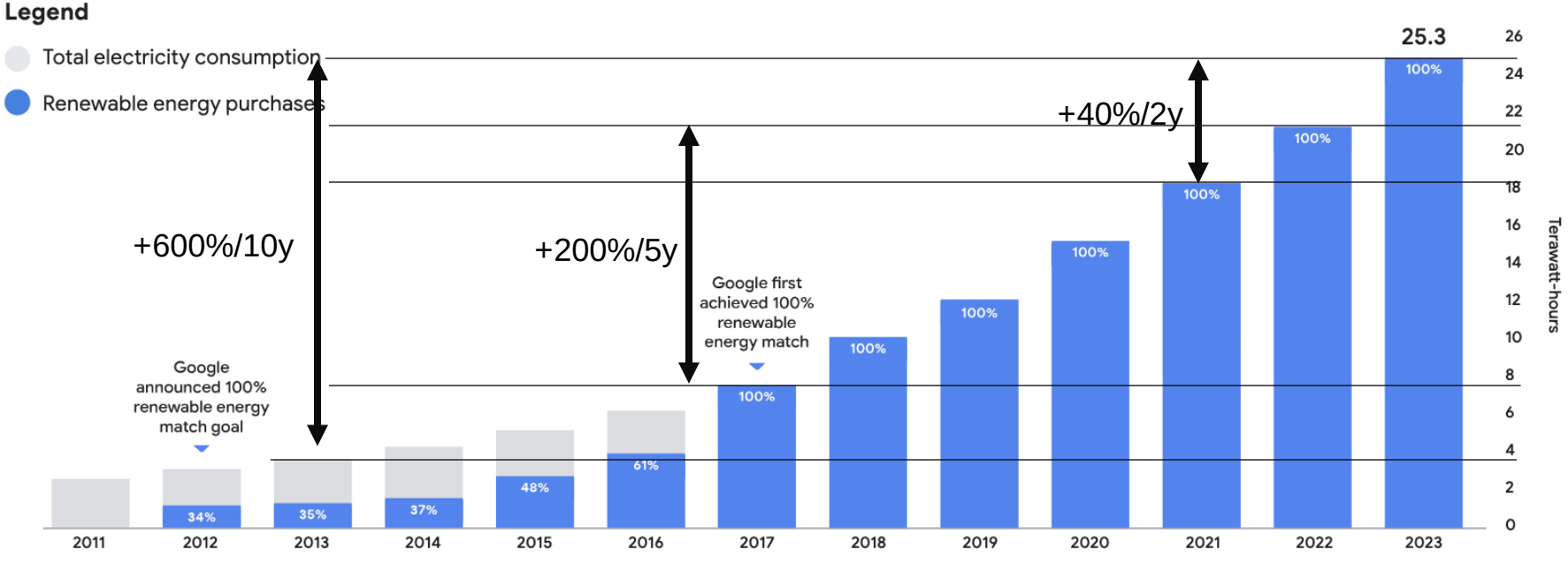
2023 Electricity Consumption Summary Table

SCOPE	METRIC	2020	2021	2022	2023
Hardware Infrastructure Electricity[15]	Total electricity consumed (MWh)	26,196	33,407	36,110	41,827

+60% in 3 years

Google Environmental Report 2024

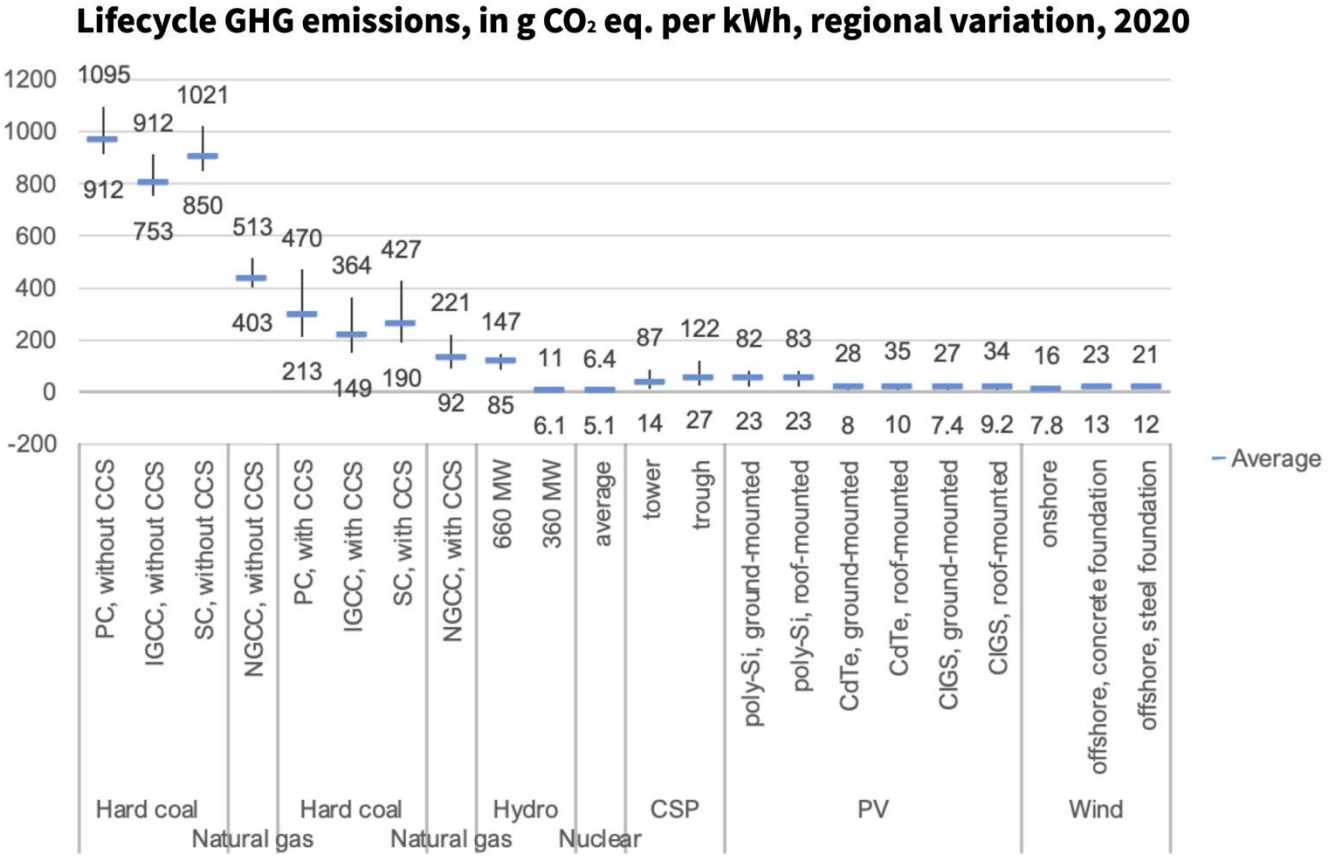
FIGURE 17 **Renewable energy purchasing compared with total electricity**



Typically, companies talk about renewable energy and “offsetting”

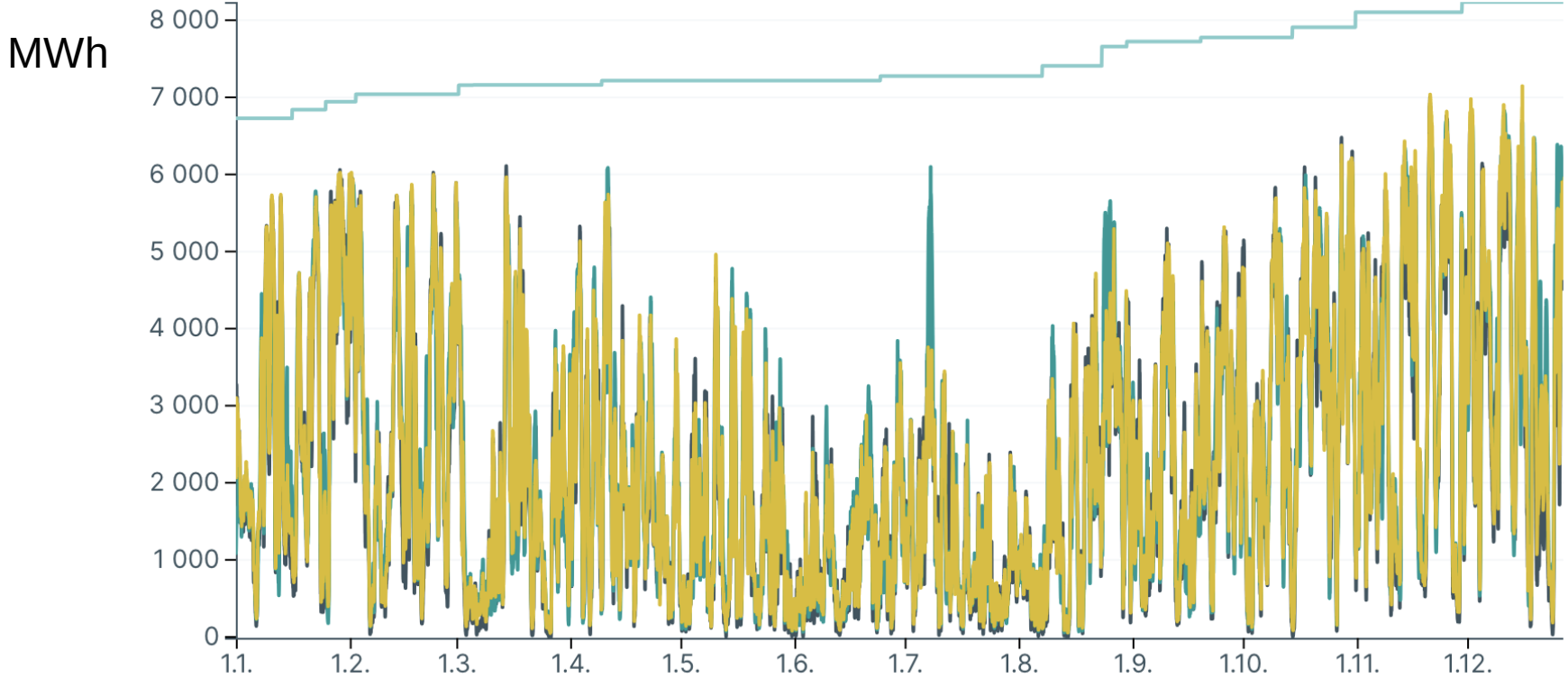
Lifecycle emissions of electricity production (UNECE)

Figure 1 Lifecycle greenhouse gas emission ranges for the assessed technologies

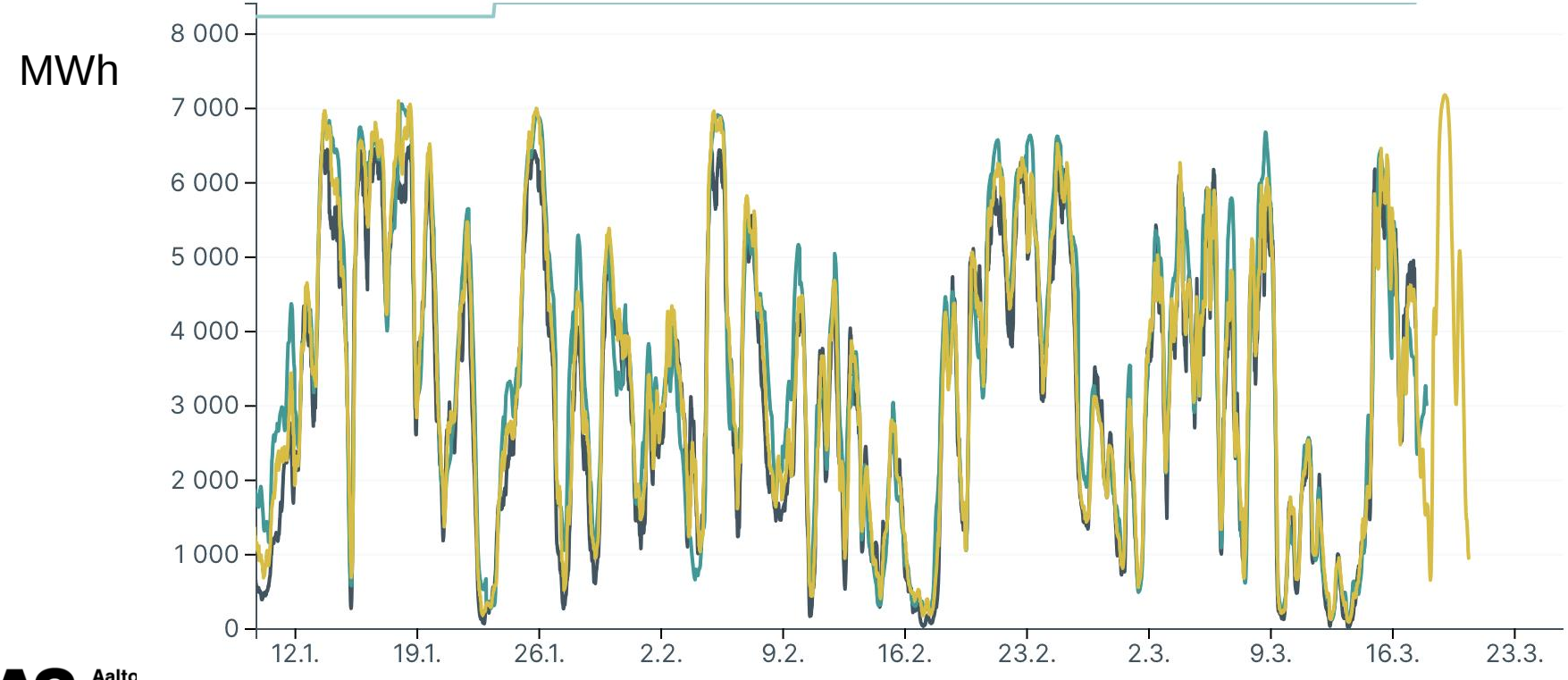


https://unece.org/sites/default/files/2022-04/LCA_3_FINAL%20March%202022.pdf

Wind energy production, Finland 2024



Finland, Wind, 2025



In the short term

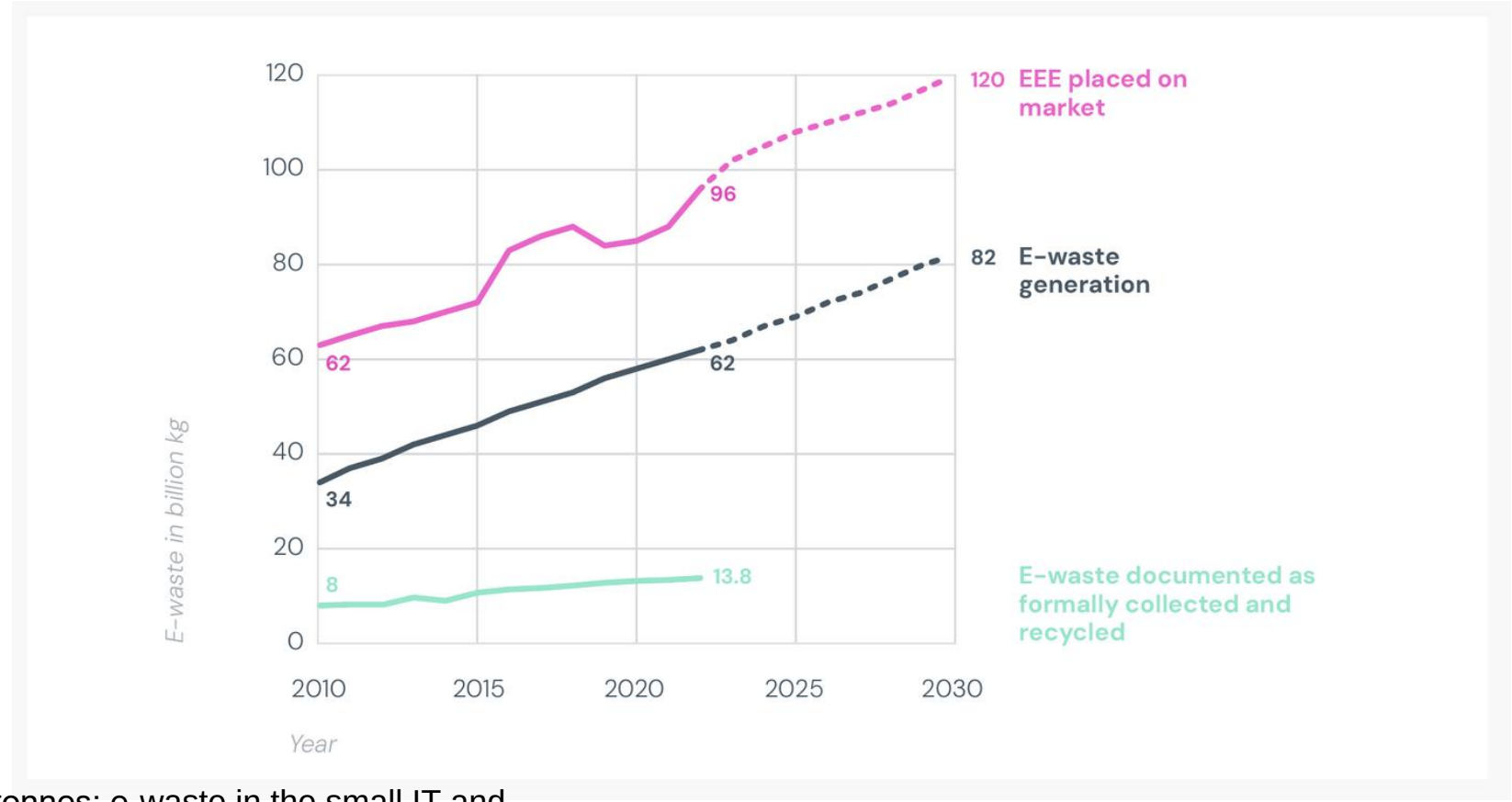
- Could the ICT sector be more flexible in electricity usage ?
- Change the service performance and quality based on available renewable energy ?
- Smart phones: when battery is low, enters a low-power mode

- In general, we must stop this constant growth.

The long term

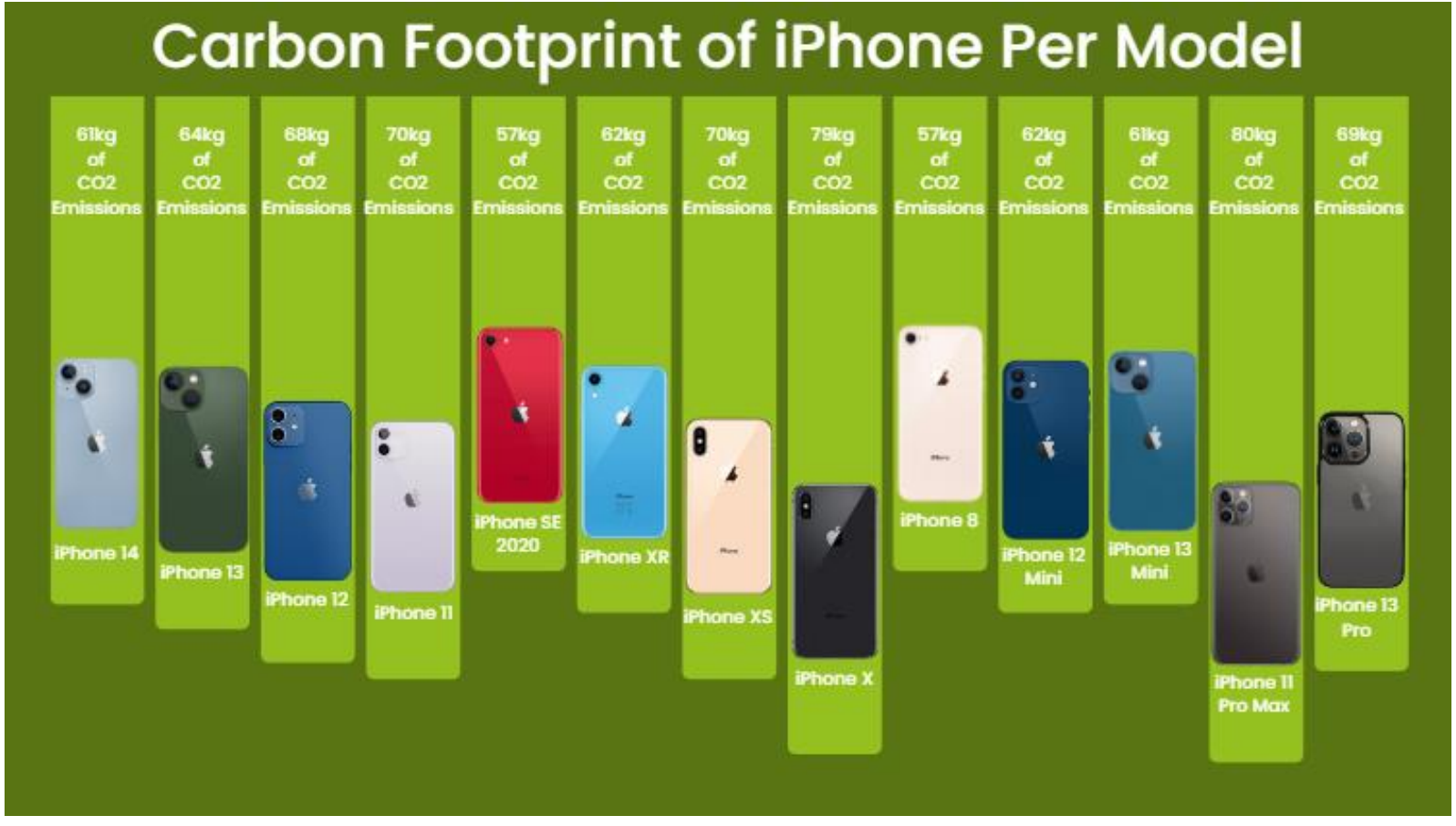
Where does the increased energy consumption come from ?

New hardware

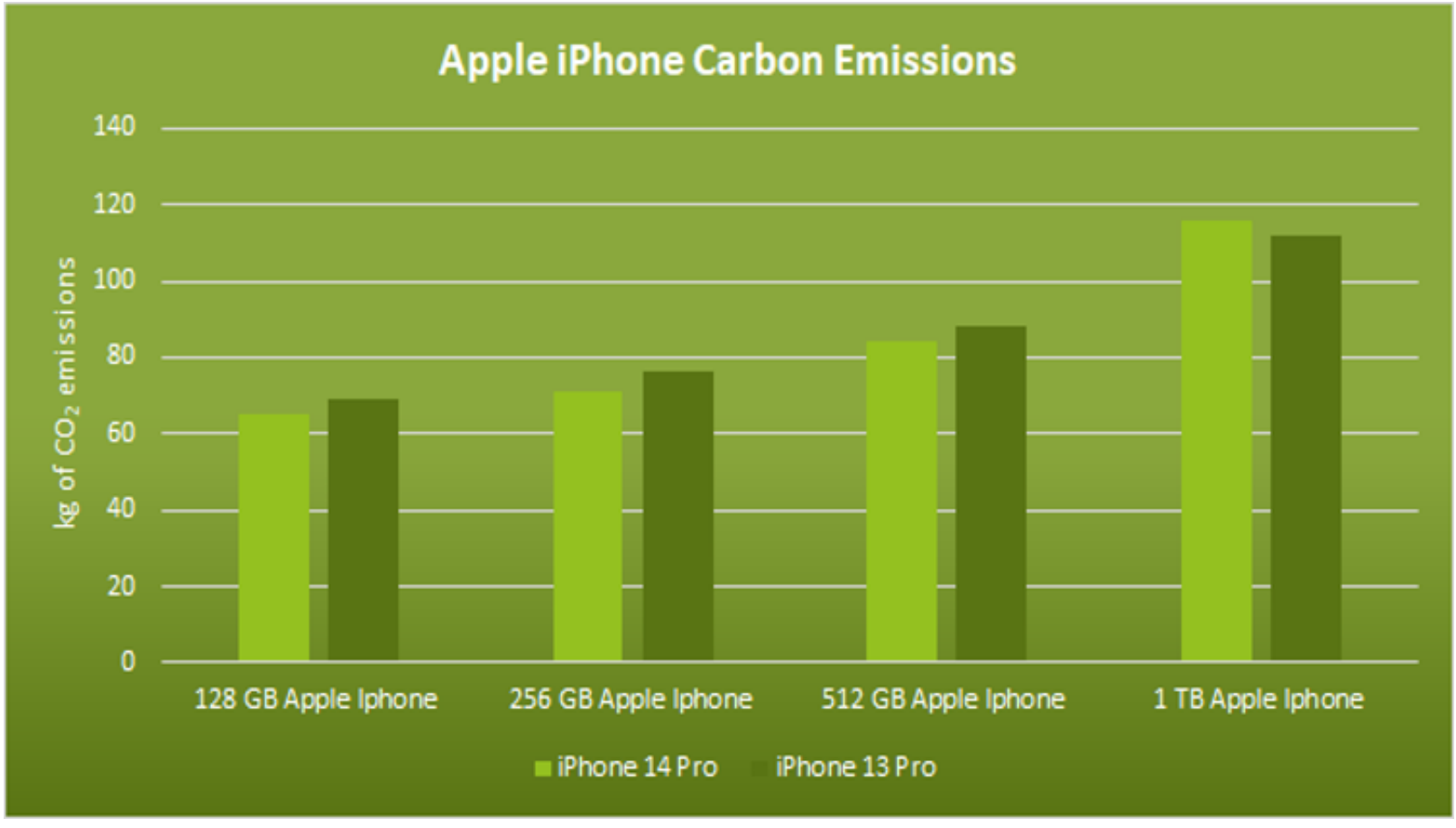


“4.6 million tonnes: e-waste in the small IT and telecommunication equipment category (e.g. laptops, mobile phones, GPS devices, routers), with only 22% documented collection and recycling rate”

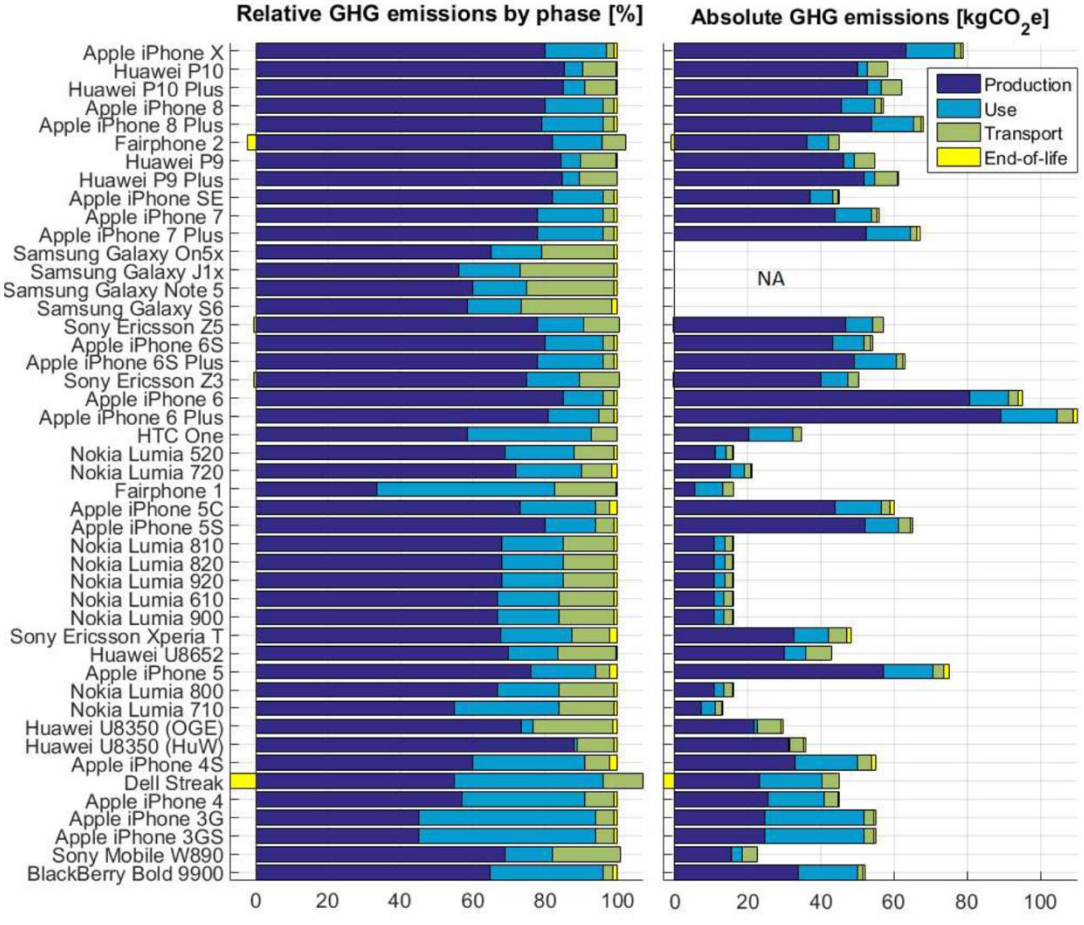
https://unitar.org/about/news-stories/press/global-e-waste-monitor-2024-electronic-waste-rising-five-times-faster-documented-e-waste-recycling



- https://8billiontrees.com/carbon-offsets-credits/carbon-footprint-of-iphone/

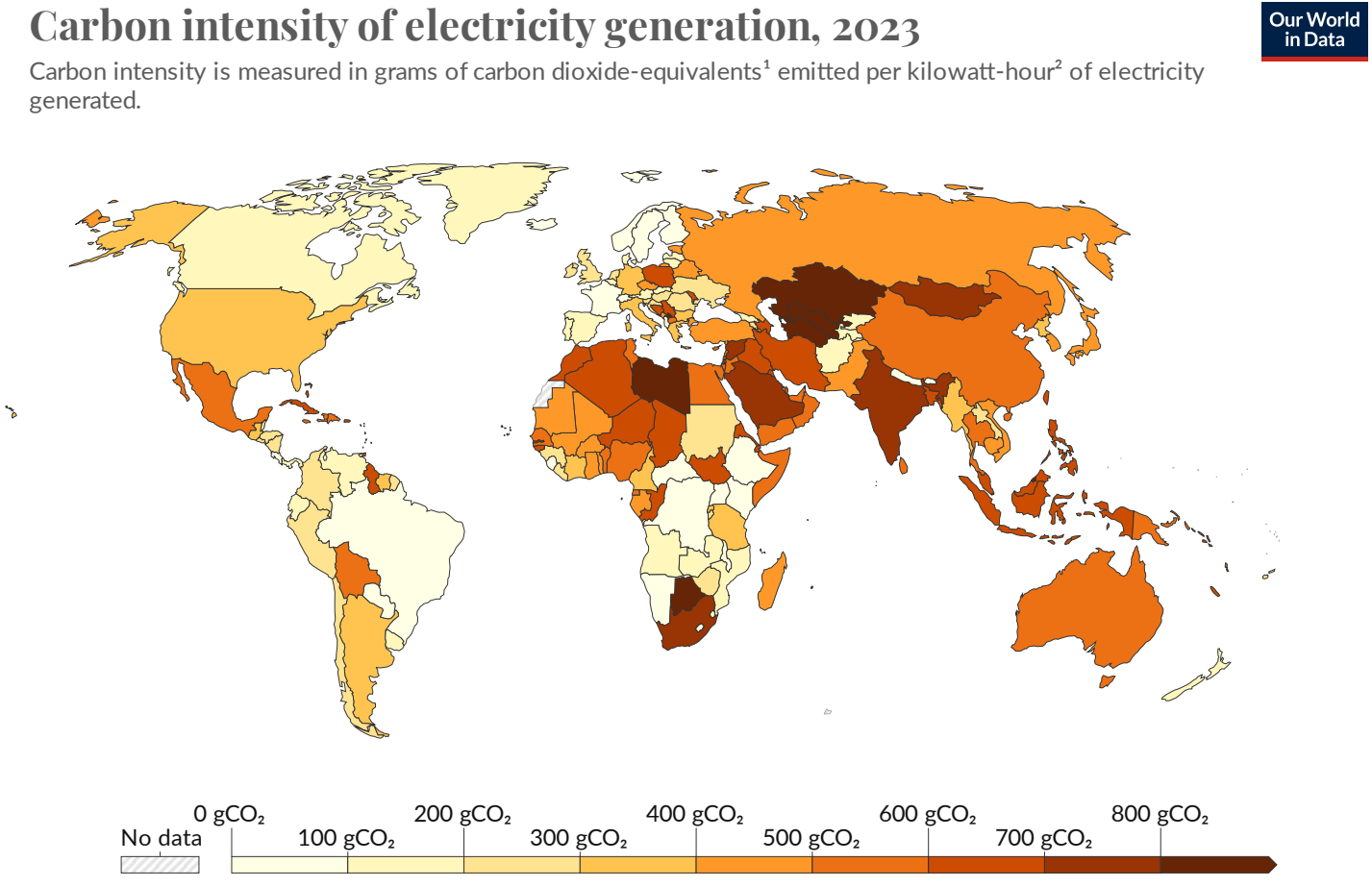

Apple iPhone Carbon Emissions
140
120
100
80
60
40
20
0
kg of CO_2 emissions
128 GB Apple Iphone
256 GB Apple Iphone
512 GB Apple Iphone
1 TB Apple Iphone
iPhone 14 Pro
iPhone 13 Pro

More data

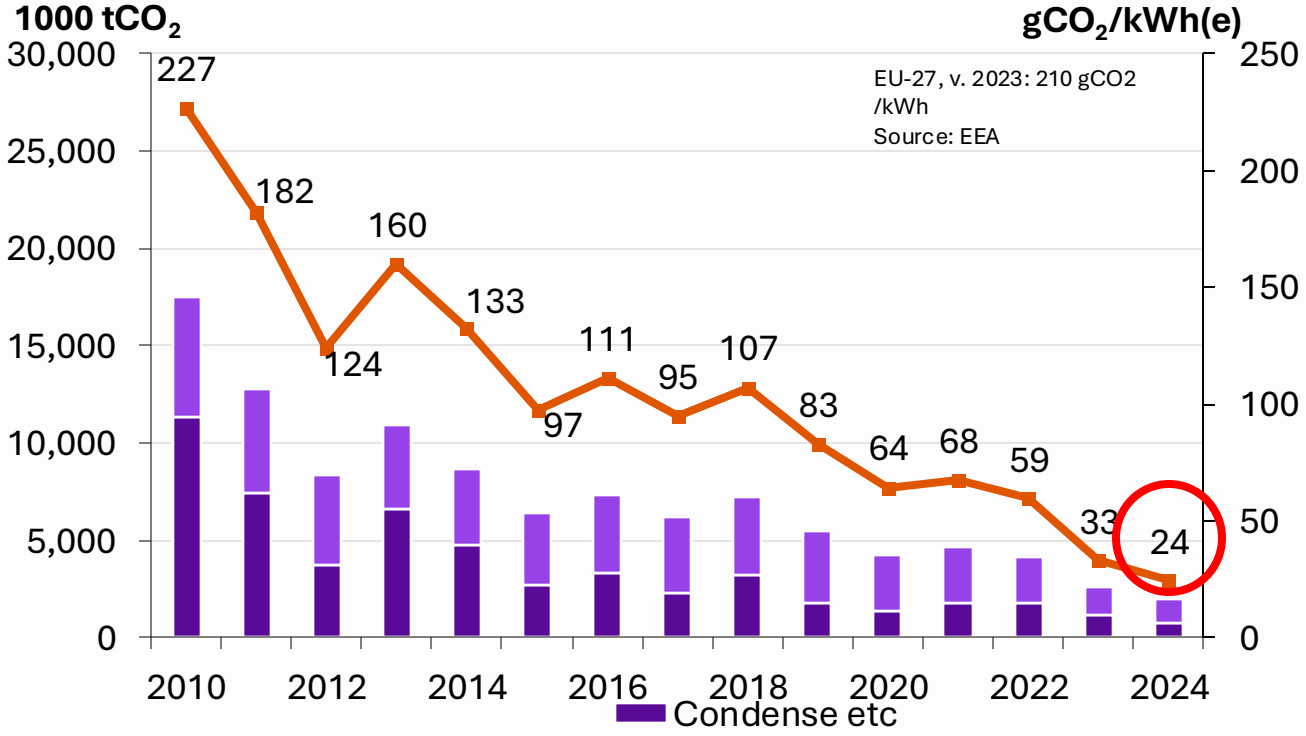


https://www.dora.lib4ri.ch/empa/islandora/object/empa%3A21474/datastream/PDF2/Niroomand-2020-Estimation_of_households%27_and_businesses%27-%28accepted_version%29.pdf

But what emission numbers ?



CO2-emissions of power generation have collapsed



CO2-emissions of power generation:

- 1.9 Mt in year 2024
- 2.6 Mt in year 2023
- 4.1 Mt in year 2022
- 6.4 Mt in year 2015
- 18 Mt in year 2010

- 2023 vs. 2022 -25 %
- Emissions -55 % in last 5 years
- Emissions -89 % vs 2010

https://energia.fi/en/statistics/statistics-on-electricity/

Some quick calculations

- **Smart phone charging: 1 kWh/month**
- **Manufacturing: 80 kg CO^2**
- **Device lifetime: 4 years**
- **CO^2 emissions, 4 years of usage:**
  - Finland, 24g: 1152g, LCA emissions share 1.4%
  - EU average, 242g: 11.6kg, LCA emissions share 12.7%

Emissions from a Dell server

- Manufacturing: 4283kg CO2e (R740, 2019)
- Using the server, 201-510W, w-avg 351W
- Lifetime 4 years
- CO^2 emissions, 4 years of usage:
  - Finland, 24g: 295kg, LCA emissions share 6.4 %
  - EU average, 242g: 744 kg, LCA emissions share 40.1%
- **Btw, same as 15’000km/year on an electric car in the cold Finland…**

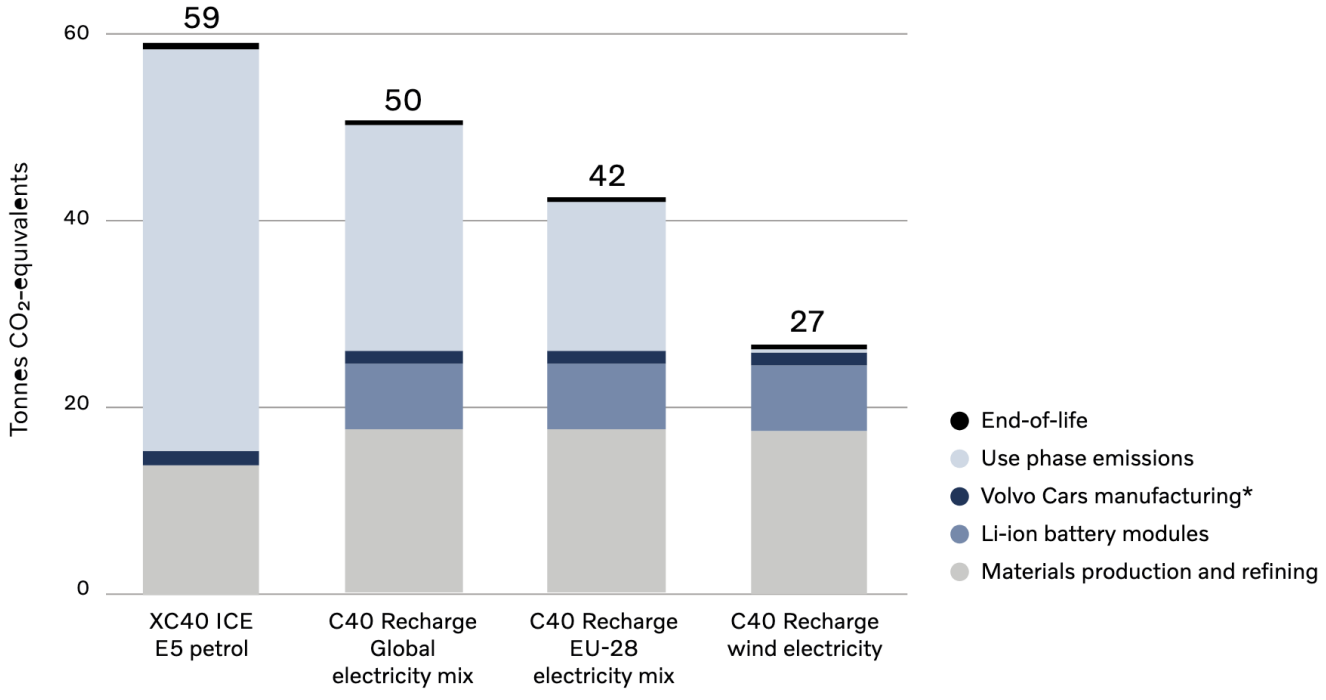
Table 4-2: Carbon footprint of main components of the Dell R740

Main Components	Global Warming Potential (GWP 100 years) [kg CO2e]
Chassis	34.1
Fans	11.1
3.84TB Solid State Drives	3373.5
400GB Solid State Drives	64.1
Mainboard	175.3
Packaging	1.9
PSU	31.3
PWB Mixed	591.8
Total	**4283.1**

Life Cycle Assessment of Dell R740

https://www.delltechnologies.com/asset/en-us/products/servers/technical-support/Full_LCA_Dell_R740.pdf

Volvo Footprint report for C40



** Volvo Cars manufacturing includes both factories as well as inbound and outbound logistics.*

Figure ii. Carbon footprint for C40 Recharge and XC40 ICE, with different electricity mixes.
Results are shown in tonnes CO_2-equivalents per functional unit (200,000km total distance, rounded values).

https://www.volvocars.com/assets/volvocm/globalpages/live/6298CA92D97B4769AAA54A1D1FABF81C/volvo_carbonfootprintreport_ec40.pdf

Summary

1. **In the short term, we really need to get the absolute energy consumption down, have more energy proportionality and also flexibility**
2. **The long term, as energy productions has less emissions, the main source of environmental issues is manufacturing and lifetime of ICT hardware**
    - Still if the rise of ICT electricity consumption continues, renewable energy will not be able solve the problem (LCA)
    - Note: recycling is not the answer