Karma Metrix®
Energy Efficient Website

ESG Big Tech 2023 Observatory

How much do American Big Tech companies impact the environment?

1 Introduction to digital sustainability

Useful elements for the digital sustainability journey



60%

the number of users who are completely unaware that internet browsing generates CO2 emissions

Source: Sharethrough "Consumer Understanding of Internet Carbon Emissions", May 2022

What do consumers expect from companies?

55%

of them believe that brands have a **more important role than governments** in creating a better future.

havas, meaningful brands report 2021

What is Karma Metrix



Karma Metrix is the **1st digital sustainability journey**, chosen by top brands, that measures, compares and improves the **environmental impact** of a website.

The **measurement** uses an innovative, patented algorithm, that considers many **«on-page» elements** on web pages affecting energy efficiency.

Every analyzed page is compared with a **benchmark**.

Improvements come after the identification of energy efficiency areas on website pages.

Already chosen by:



























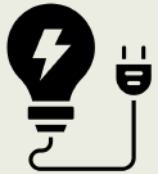






How much does digital pollute?

According to the Global Carbon Project, if the internet were a country, it would be:



The **3rd largest country by electricity consumption**



The **4th largest country by CO2 emissions**

How does the Web impact on climate change



5-15%*
(on CO2e
emissions)

2%*
(on CO2e
emissions)

83-93%*
(on CO2e
emissions)

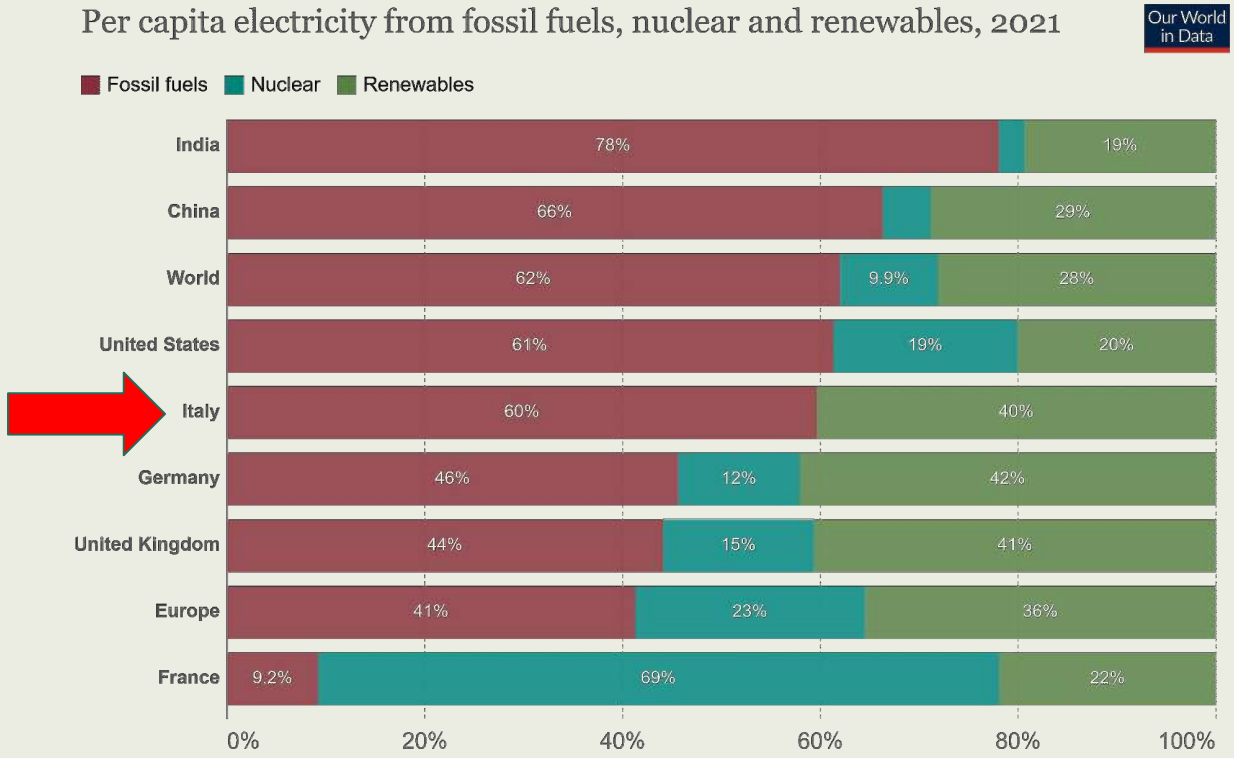
Internet causes CO2 emissions, both for the inefficient way websites are created and due to the fossil fuels used to produce energy. Energy is mainly used to feed**:**

- Server machines and network infrastructures;
- Cooling systems in data centers;
- The devices used by users.

* Average distribution calculated on the total emitted CO2e. These are ranges of average values that vary based on different factors related to the digital supply chain.

How do we produce electrical energy?

In the world, **62% of electrical energy is produced from fossil fuels**



Source: Our World in Data based on BP Statistical Review of World Energy & Ember

OurWorldInData.org/electricity-mix • CC BY

CO2 equivalent

It is a measure used to **compare emissions from various greenhouse gases**, which are then equated to carbon dioxide (CO2).

It helps us understand **how harmful a gas is to the environment** compared to the more well-known carbon dioxide (CO2).

For example, **the emission of 1 kg of methane is equivalent to the emission of 25 kg of CO2.**



Compensation isn’t enough

In 2021, **51 billion tons of CO2** were emitted.

To compensate them all, we should plant **about 2.4 trillion trees**.
...We would need a space of 42,5 millions km2: **about 2,5 times the whole Russia**.



2 Sustainability of Big Tech: co2e emissions

Observatory data overview

Big Tech: perimeter of analysis

Compared to the 1st edition, the Observatory is evolving: in the analysis of sustainability reports, **Microsoft replaces Netflix**.

Therefore, we have analyzed the sustainability reports of:

1. Amazon
2. Apple
3. Alphabet (Google & co.)
4. Meta (Facebook & co.)
5. Microsoft



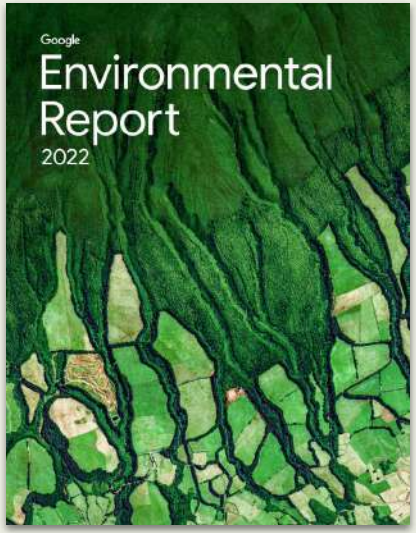
Big Tech environmental reports



Amazon Sustainability Report 2021



Microsoft Sustainability Report 2021



Google Sustainability Report 2022



Meta Sustainability Report 2021



Apple Sustainability Report 2021

Sustainability Investigation Focus

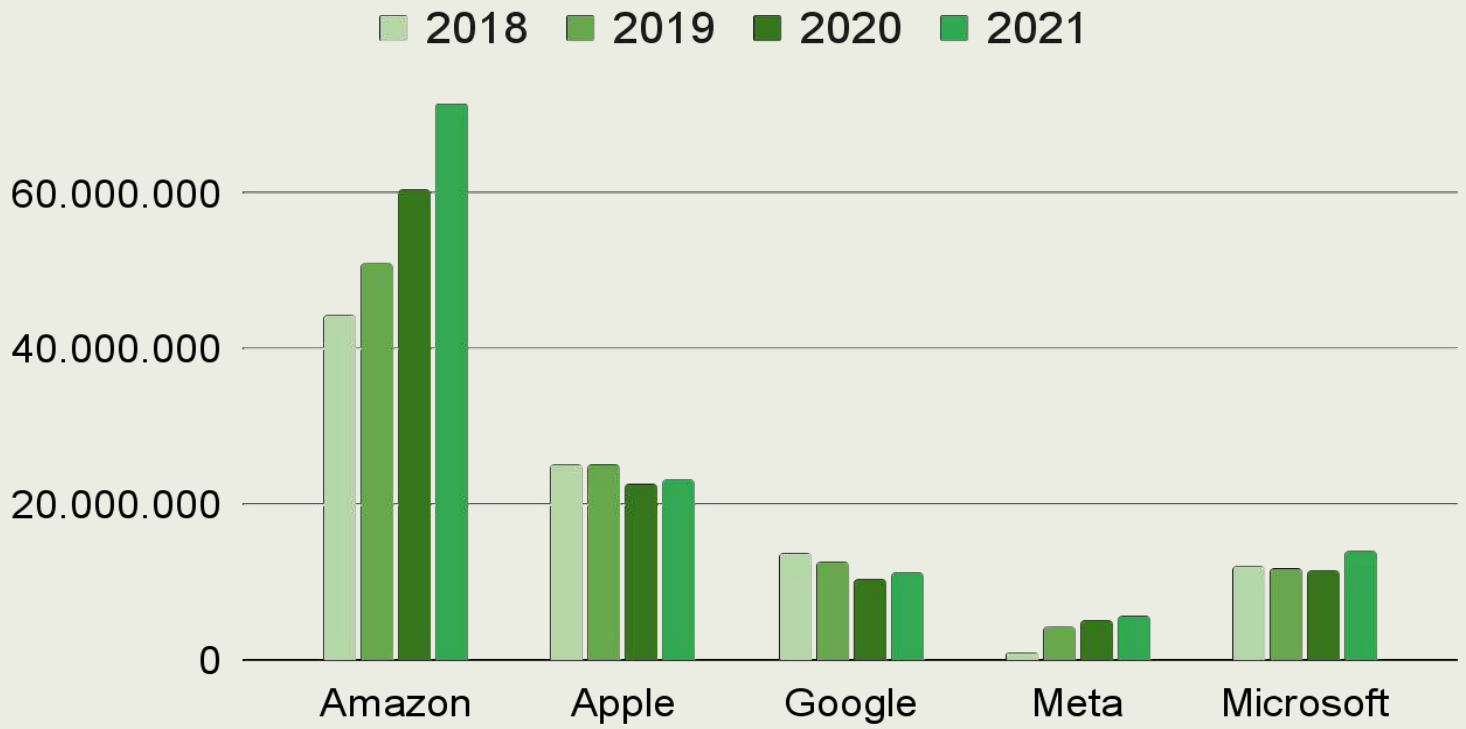
For each of the 5 Big Tech companies under analysis, we have:

1. Examined the **sustainability reports** published in the last 4 years (ata updated as of 01/05/2023);

2. Within the reports themselves, we have isolated the values of **energy consumption and CO2e emissions** for each year;

3. Conducted **benchmarking** by comparing the energy consumption of Big Tech with entire nations.

Big Tech: CO2e Emissions Trends in Tons



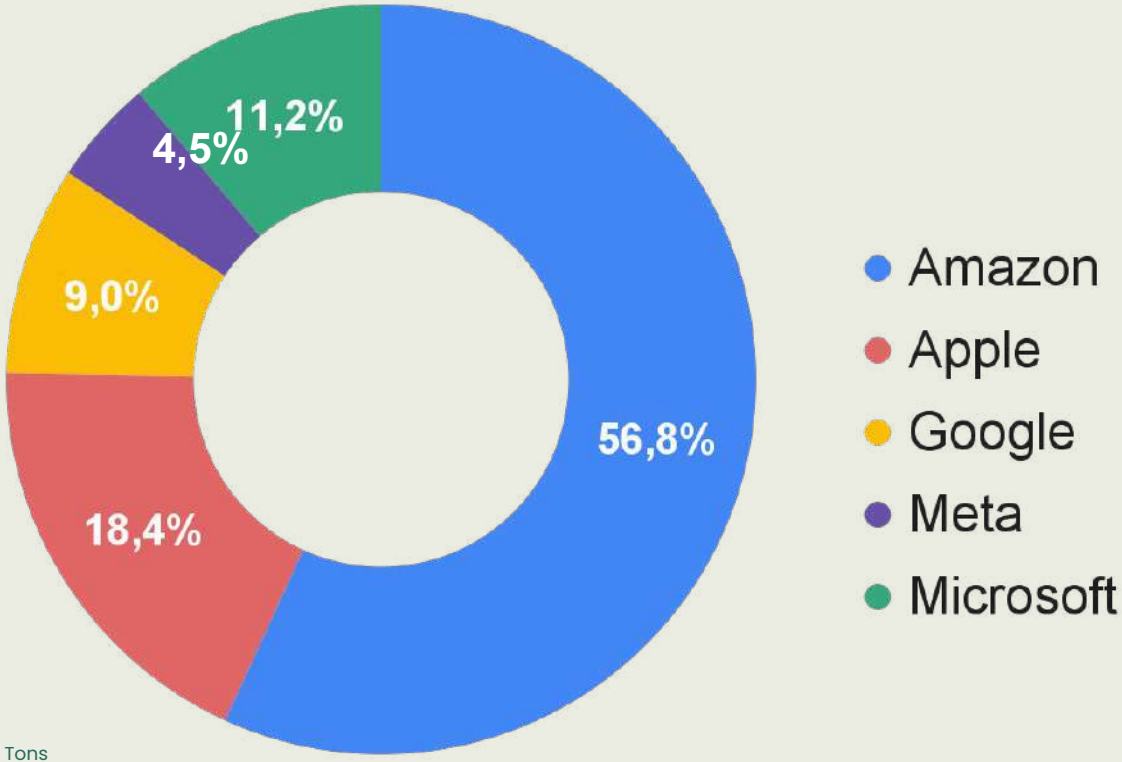
Data in CO2e Tons
The CO2e mentioned refers to the total gross CO2e emissions emitted by the companies. Compensated emissions are not taken into account.

Big Tech: CO2e Emissions in Tons

Company	2018	2019	2020	2021	2021 vs 2020
Amazon	44.400.000	51.170.000	60.640.000	71.540.000	**18%**
Apple	25.200.000	25.100.000	22.600.000	23.200.000	**3%**
Google	13.648.224	12.529.953	10.326.109	11.371.205	**10%**
Meta	1.008.000	4.330.000	5.129.000	5.709.000	**11%**
Microsoft	12.027.000	11.859.000	11.585.000	14.073.000	**21%**
Total	**96.283.224**	**104.988.953**	**110.280.109**	**125.893.205**	**14%**

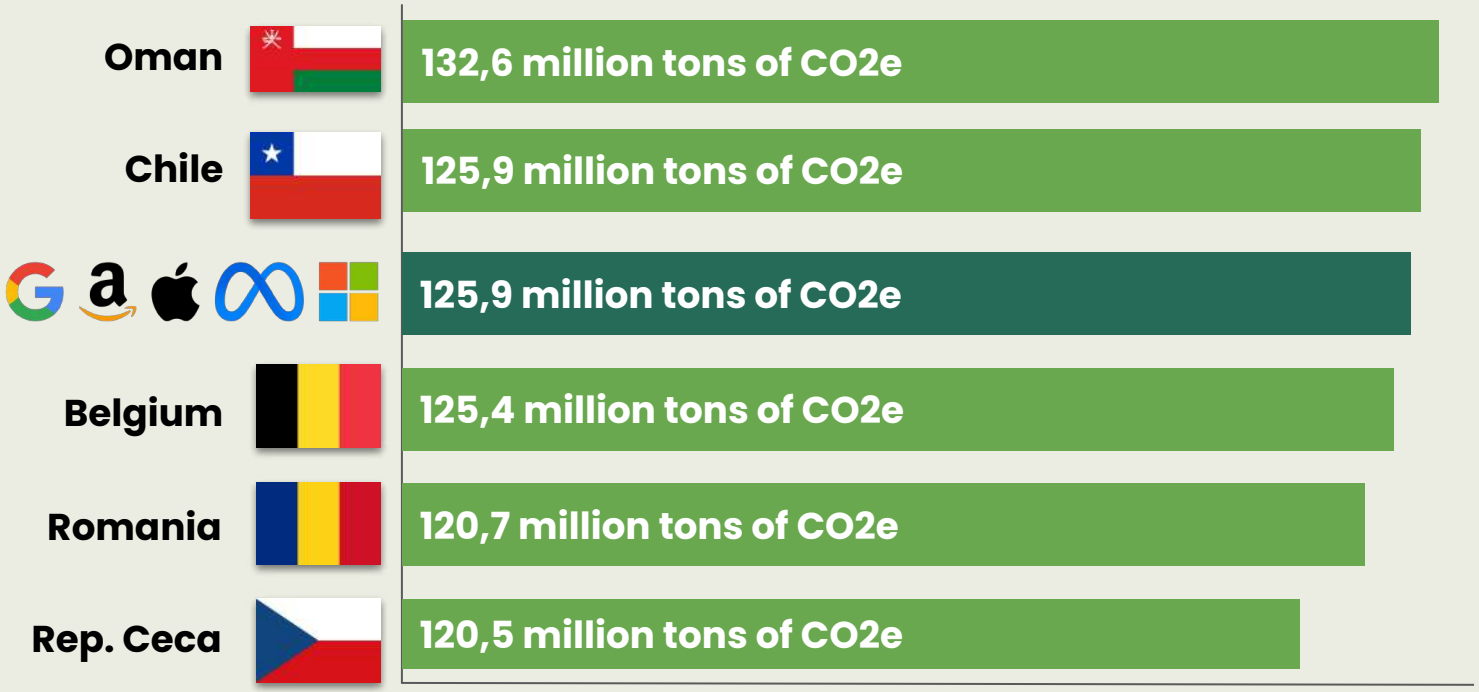
Data in CO2e Tons
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126 million tons of CO2e emitted in 2021



Data in CO2e Tons
The CO2e mentioned refers to the total gross CO2e emissions emitted by the companies. Compensated emissions are not taken into account.

Big Tech: 51st country in the world for CO2e emissions



https://edgar.jrc.ec.europa.eu/dataset_ghg70
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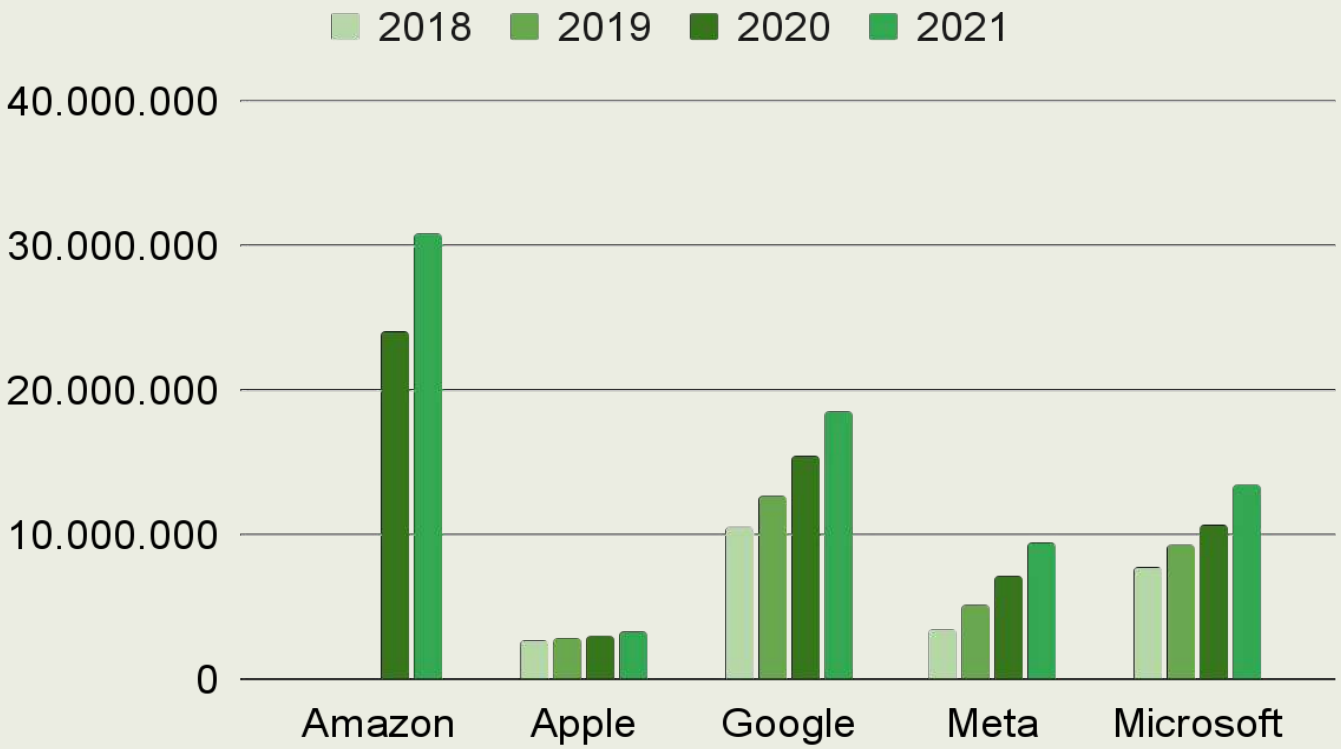
2 Sustainability of Big Tech: energy consumption

Observatory data overview

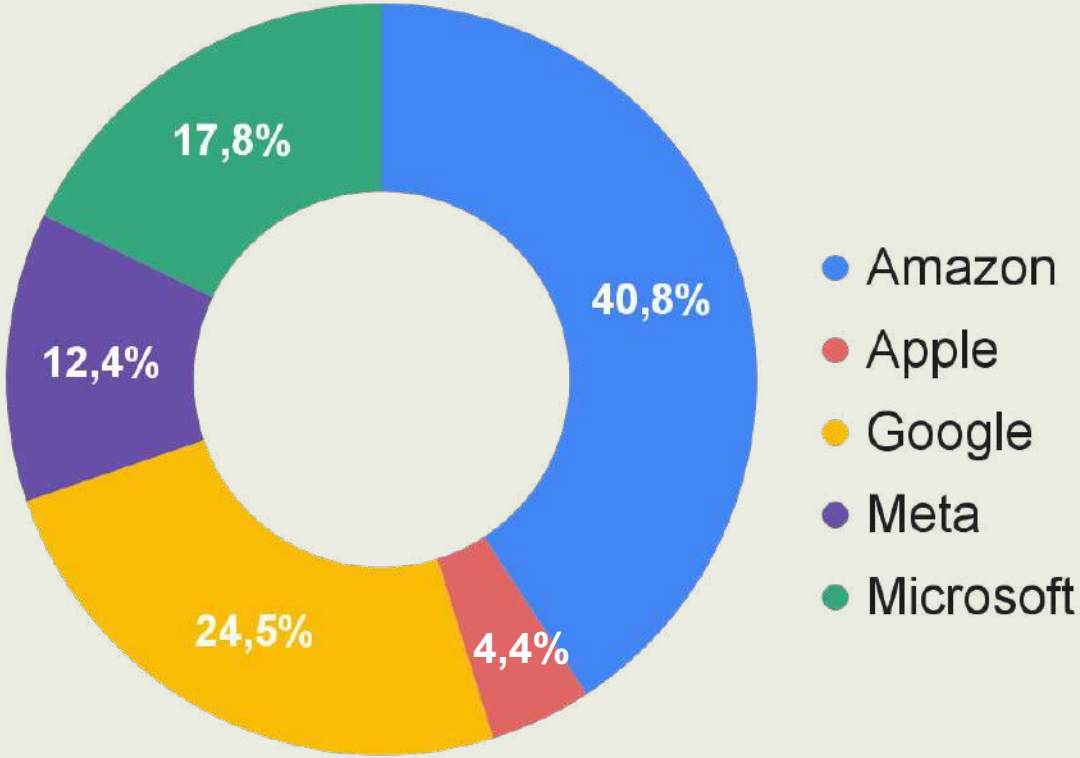
Big Tech: energy consumption in MWh

Company	2018	2019	2020	2021	Delta 20-21
Amazon	nd	nd	24.000.000	30.880.000	**29%**
Apple	2.676.460	2.889.680	3.019.170	3.330.280	**10%**
Google	10.572.485	12.749.458	15.439.538	18.571.659	**20%**
Meta	3.427.000	5.140.000	7.170.000	9.421.000	**31%**
Microsoft	7.781.383	9.249.361	10.757.166	13.481.863	**25%**
Total	**24.457.328**	**30.028.499**	**60.385.874**	**75.684.802**	**25%**

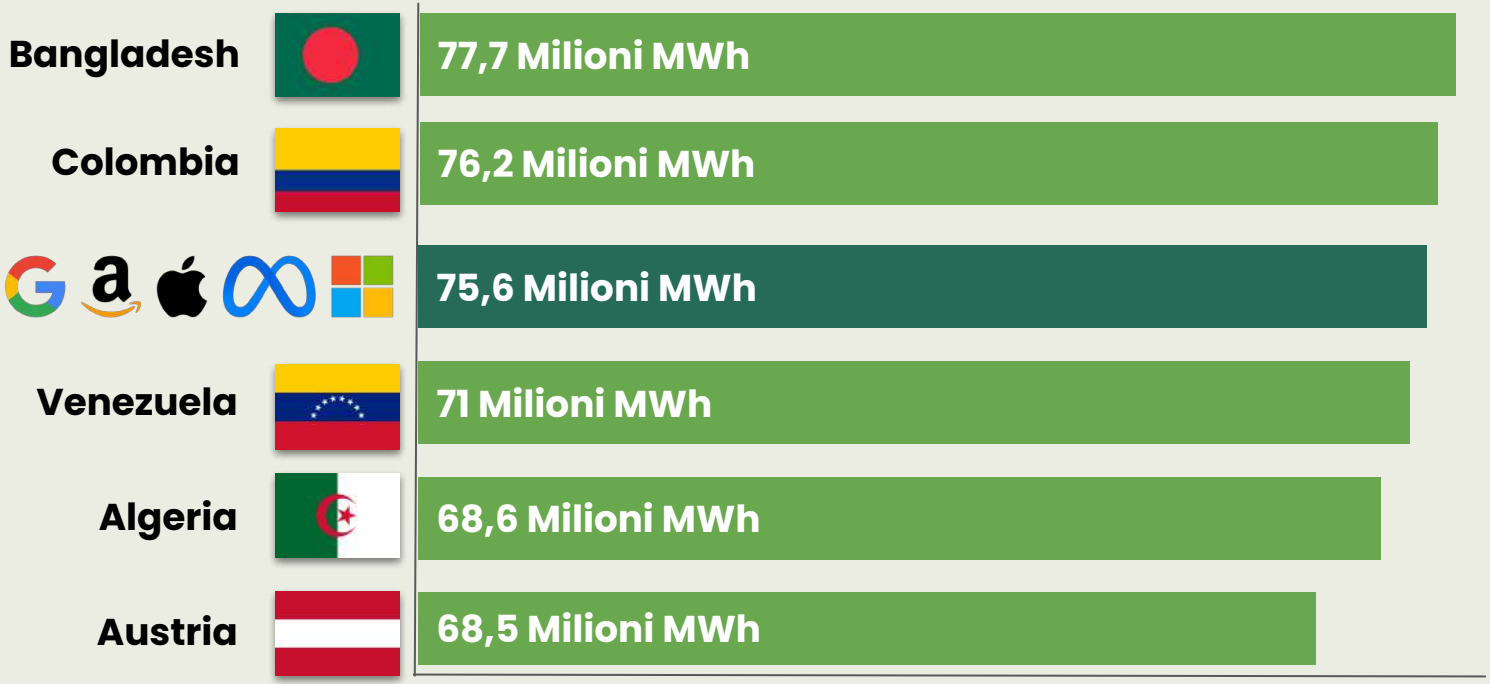
Big Tech: energy consumption trends in MWh



Energy consumption: 75.6 millions of MWh



Big Tech: 51st country in the world by energy consumption



Energy consumption increase 2020 vs 2021



World
+5,7%

Big Tech
+25%

2030: Big Tech in the Top 15 Most Energy-Consuming Countries

If the growth rates remained the same (which will be tough with AI...), the 5 Big Tech companies would go from their current 42nd position to **being the 14th country in the world by 2030 in terms of energy consumption.**

Country	2021	Countries ranking in 2021	Countries ranking in 2023	Countries ranking in 2030
Big Tech	75.684.802	42	34	14

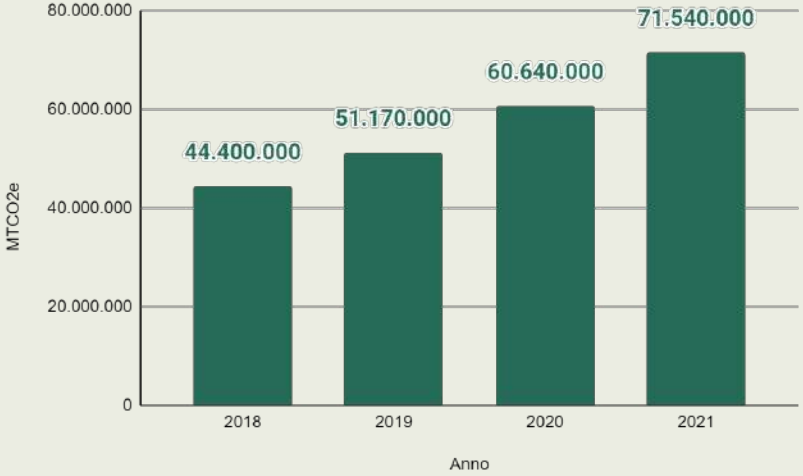
3 ESG reports analysis

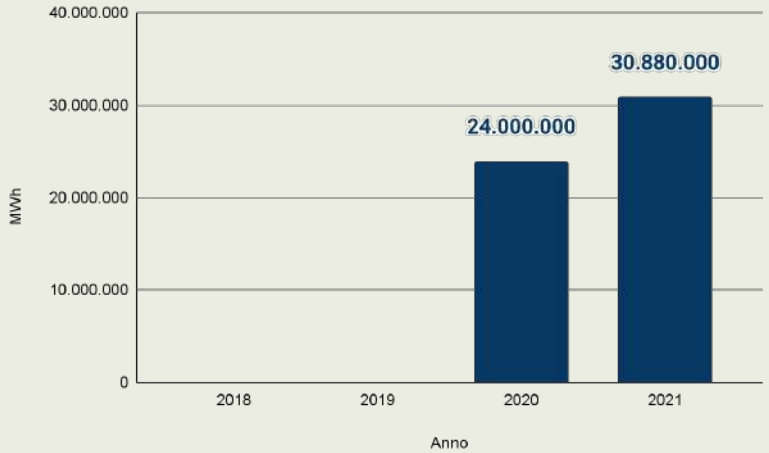
Companies details

Amazon

Anno	CO2e emissions
2018	44.400.000
2019	51.170.000
2020	60.640.000
2021	71.540.000

Anno	MWh energy consumption
2018	nd
2019	nd
2020	24.000.000
2021	30.880.000





Amazon sustainability projects around the world



Focus on emissions reduction from transportation

COMMITMENT

Reduce our packaging and decarbonize our transportation fleet

Improving Our Packaging →



38% reduction in per-shipment packaging weight since 2015

1.5 million tons of packaging eliminated since 2015

More than **100 million packages** delivered to our customers' doorsteps using **zero-emission vehicles** in 2021

Read our update regarding Shipment Zero.

https://sustainability.aboutamazon.com/our-approach/goals-and-progress

And about the supply chain? A bit vague…

Environmental Protection

We're committed to sourcing products and services that do not cause unnecessary environmental harm, and work with industry experts on ways to understand the environmental impact of our products.

We're a member of the Sustainable Apparel Coalition, an industrywide group of leading apparel and footwear brands, retailers, manufacturers, NGOs, academic experts, and government organizations working to reduce the environmental and social impacts of apparel products around the world.

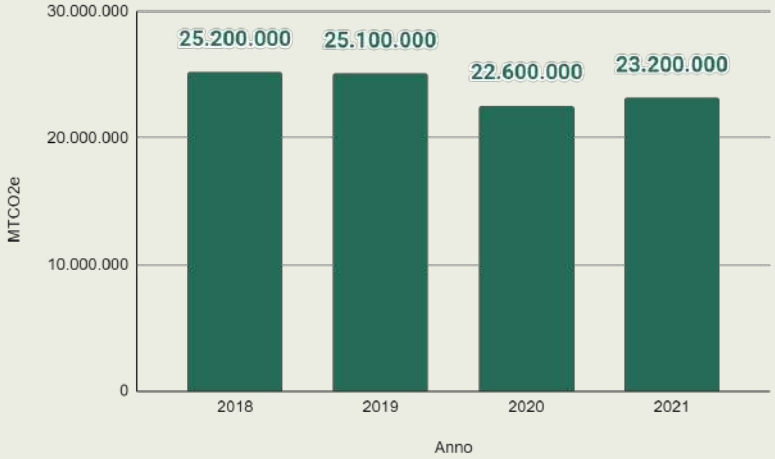
We encourage our Amazon-branded suppliers to evaluate their practices using the Coalition's Higg Index, a tool to help manufacturers measure the social and environmental performance of their facilities. We're committed to driving adoption of this assessment and helping our suppliers understand their environmental impacts. Our aim is to work with industry partners and our suppliers to understand their environmental footprint and set goals to reduce environmental impacts.

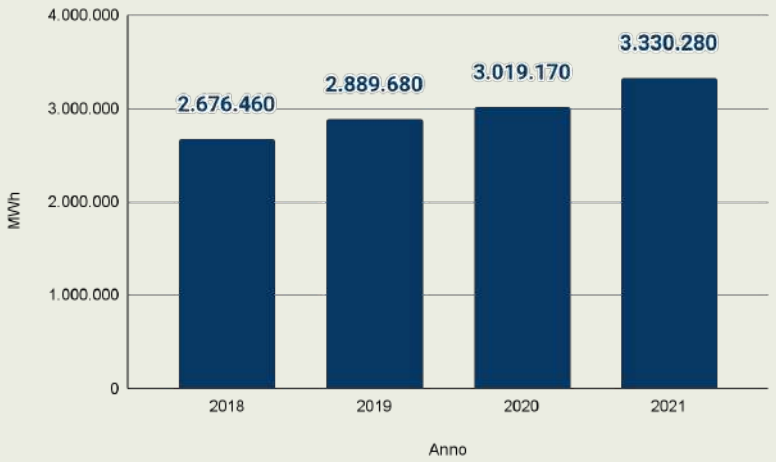
https://sustainability.aboutamazon.com/society/supply-chain/supply-chain-commitments

Apple

Anno	CO2e emissions
2018	25.200.000
2019	25.100.000
2020	22.600.000
2021	23.200.000

Anno	MWh energy consumption
2018	2.676.460
2019	2.889.680
2020	3.019.170
2021	3.330.280





Apple

Apple aims to reduce emissions by 75%

Our 10-year Climate Roadmap is addressing Apple's carbon footprint through five pillars:



Low-carbon design
We will design products and manufacturing processes to be less carbon-intensive through thoughtful material selection, increased material efficiency, and greater product energy efficiency.



Energy efficiency
We will increase energy efficiency at our facilities and in our supply chain by finding opportunities, such as retrofitting, to reduce energy use.



Renewable electricity
We will maintain our use of 100 percent renewable electricity for our facilities and transition our entire supply chain to 100 percent clean, renewable sources of electricity.



Direct emissions abatement
We will reduce direct greenhouse gas emissions in our facilities and our supply chain through process innovation, emissions abatement, and the use of non-fossil-based low-carbon fuels.



Carbon removal
Working in parallel with our emissions reduction efforts, we will scale up investments in carbon removal projects, including nature-based solutions that protect and restore ecosystems around the world.

>75% EMISSIONS REDUCTION

<25% OF FOOTPRINT

Apple

Karma Metrix
Energy Efficient Website

Energy Efficiency of Products and Recycled Materials



Product energy efficiency



Over the course of a year, Mac Studio will use up to **1000 KILOWATT-HOURS** less energy than a high-end PC desktop.[11]



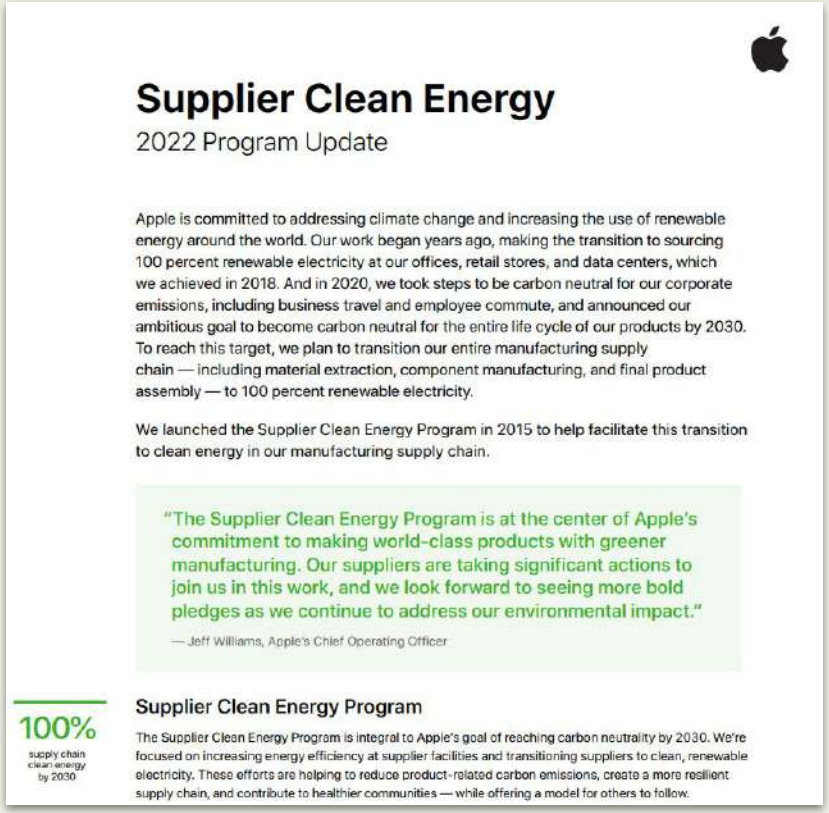
Mac mini uses up to **60 PERCENT** less energy while in active use than the previous generation, thanks to the use of Apple silicon.[12]



iPhone 13 uses **54 PERCENT** less energy than the U.S. Department of Energy requirements for battery charger systems.[13]

Supplier Clean Energy Program

Apple has set a goal to have its entire **supply chain powered by renewable energy** by 2030



Supplier Clean Energy

2022 Program Update

Apple is committed to addressing climate change and increasing the use of renewable energy around the world. Our work began years ago, making the transition to sourcing 100 percent renewable electricity at our offices, retail stores, and data centers, which we achieved in 2018. And in 2020, we took steps to be carbon neutral for our corporate emissions, including business travel and employee commute, and announced our ambitious goal to become carbon neutral for the entire life cycle of our products by 2030. To reach this target, we plan to transition our entire manufacturing supply chain — including material extraction, component manufacturing, and final product assembly — to 100 percent renewable electricity.

We launched the Supplier Clean Energy Program in 2015 to help facilitate this transition to clean energy in our manufacturing supply chain.

"The Supplier Clean Energy Program is at the center of Apple's commitment to making world-class products with greener manufacturing. Our suppliers are taking significant actions to join us in this work, and we look forward to seeing more bold pledges as we continue to address our environmental impact."

— Jeff Williams, Apple's Chief Operating Officer

100%

supply chain clean energy by 2030

Supplier Clean Energy Program

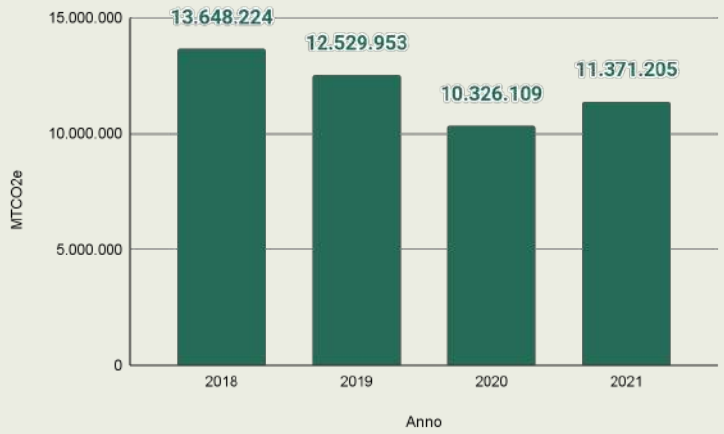
The Supplier Clean Energy Program is integral to Apple's goal of reaching carbon neutrality by 2030. We're focused on increasing energy efficiency at supplier facilities and transitioning suppliers to clean, renewable electricity. These efforts are helping to reduce product-related carbon emissions, create a more resilient supply chain, and contribute to healthier communities — while offering a model for others to follow.

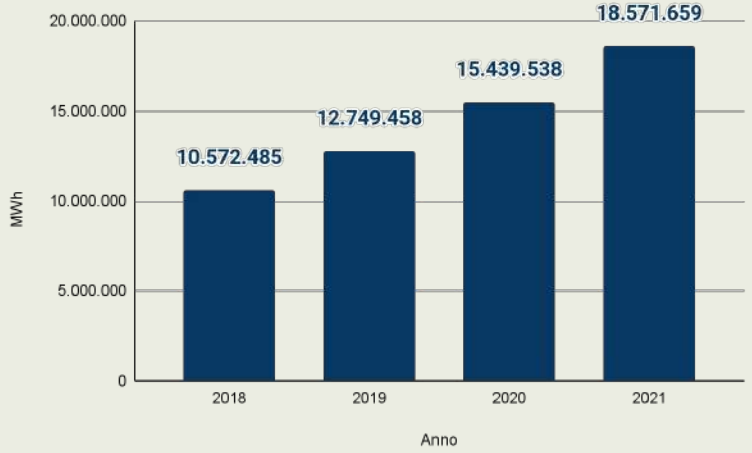
https://www.apple.com/environment/pdf/Apple_Supplier_Clean_Energy_Program_Update_2022.pdf

Google

Anno	CO2e emissions
2018	13.648.224
2019	12.529.953
2020	10.326.109
2021	11.371.205

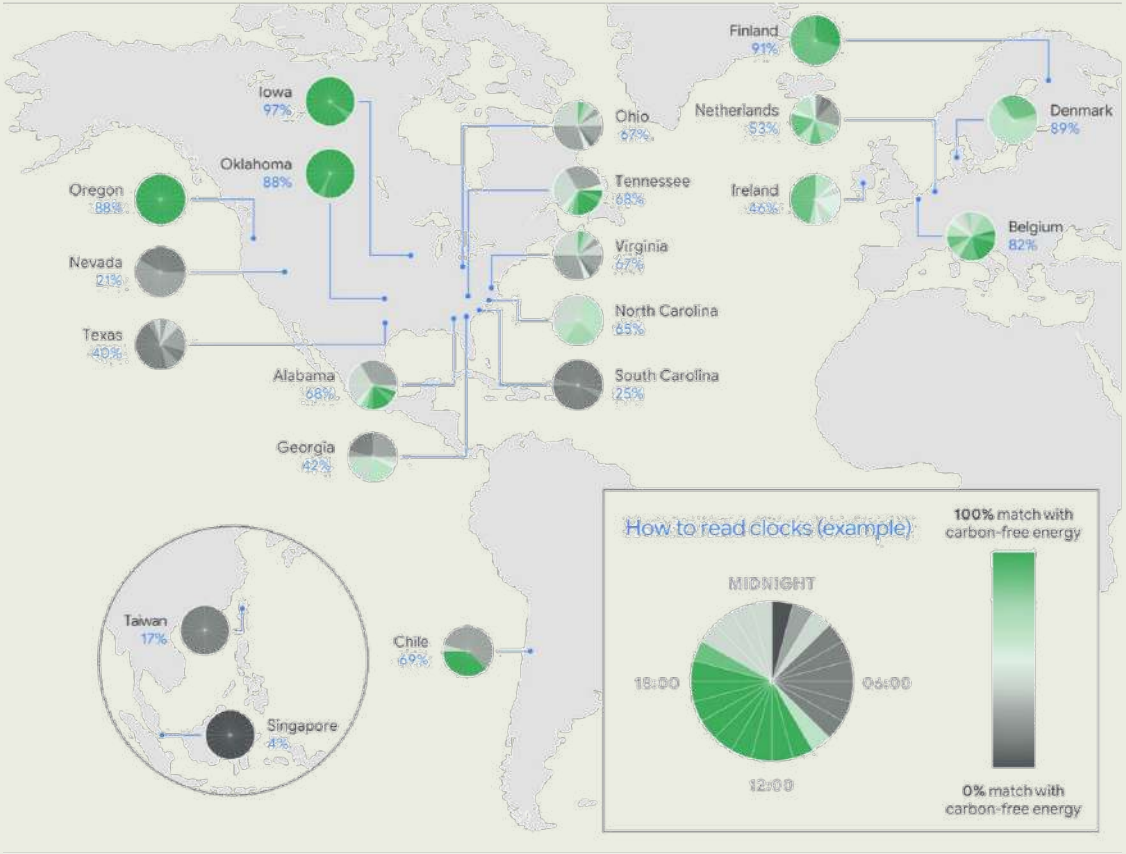
Anno	MWh energy consumption
2018	10.572.485
2019	12.749.458
2020	15.439.538
2021	18.571.659





Goal: 100% carbon-free energy by 2030

In 2021, Google reached approximately **60% carbon-free energy** usage for its data centers.



Suppliers sustainability

Google's commitment to reducing Scope 3 emissions involves over 700 initiatives, outlined in a dedicated sustainability report focused on suppliers.



https://www.gstatic.com/gumdrop/sustainability/google-2022-supplier-responsibility-report.pdf

Google

Digital sustainability = servers efficiency

DESIGNING EFFICIENT DATA CENTERS

Energy

2x
as energy efficient

On average, a Google data center is twice as energy efficient as a typical enterprise data center.[1]

5x
as much computing power

Compared with five years ago, we now deliver around five times as much computing power with the same amount of electrical power.

1.10
average annual PUE

In 2021, the average annual PUE[2] for our global fleet of data centers was 1.10, compared with the industry average of 1.57[3]—meaning that Google data centers use about six times less overhead energy.

Google reveals water consumption of data centers

- 1.7 million liters per day per data center
- 4.3 billion gallons per year = 16.3 billion liters

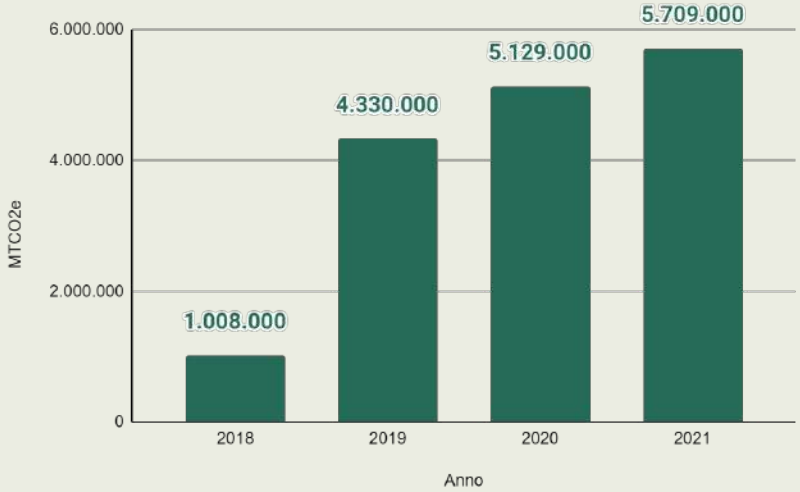
The amount of water consumption is equivalent to the annual consumption of approximately 182,000 Italians.

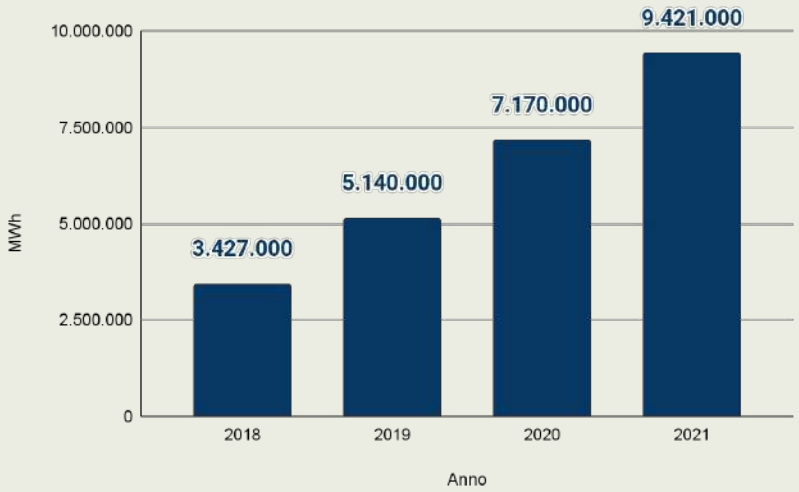


Meta

Anno	CO2e emissions
2018	1.008.000
2019	4.330.000
2020	5.129.000
2021	5.709.000

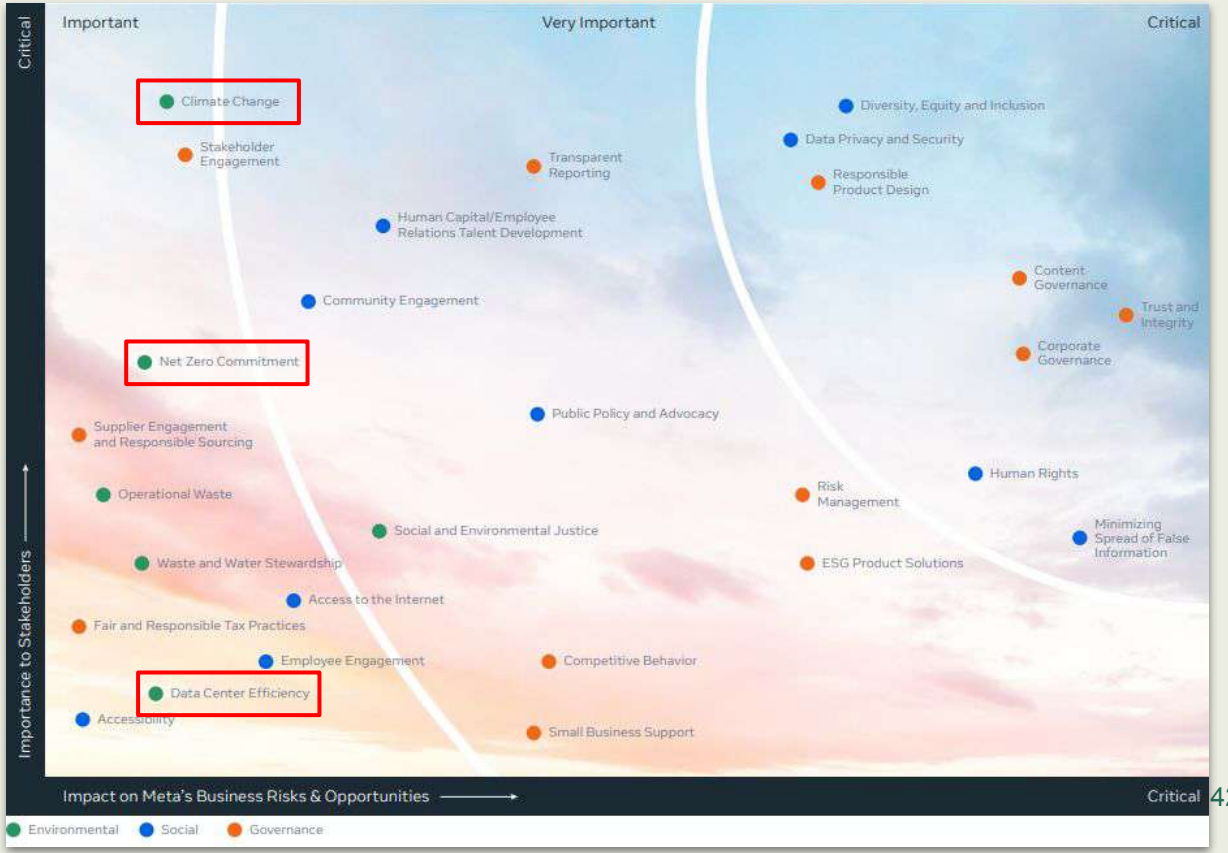
Anno	MWh energy consumption
2018	3.427.000
2019	5.140.000
2020	7.170.000
2021	9.421.000





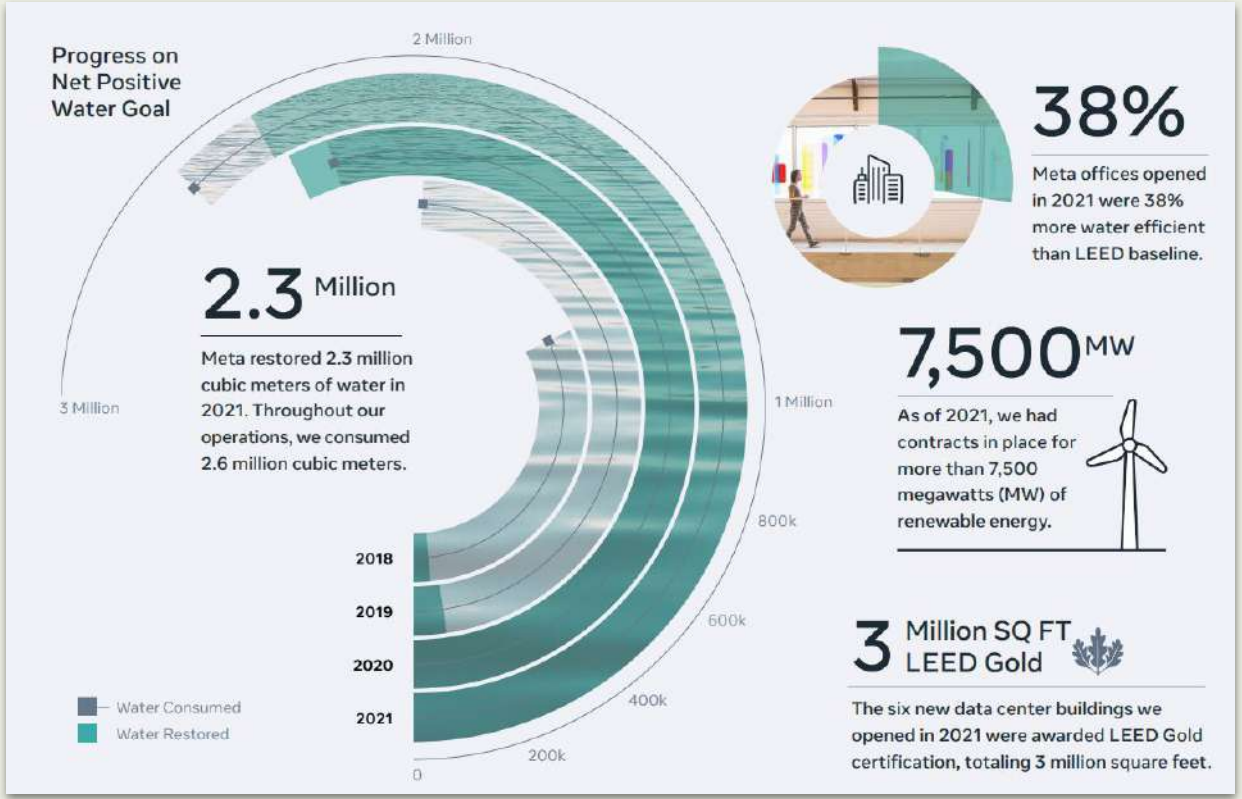
Environment at the bottom of Meta's ESG agenda

Net Zero, Climate Change, and Data Center Efficiency: Environmental objectives are **at the bottom of Meta's ESG priorities**



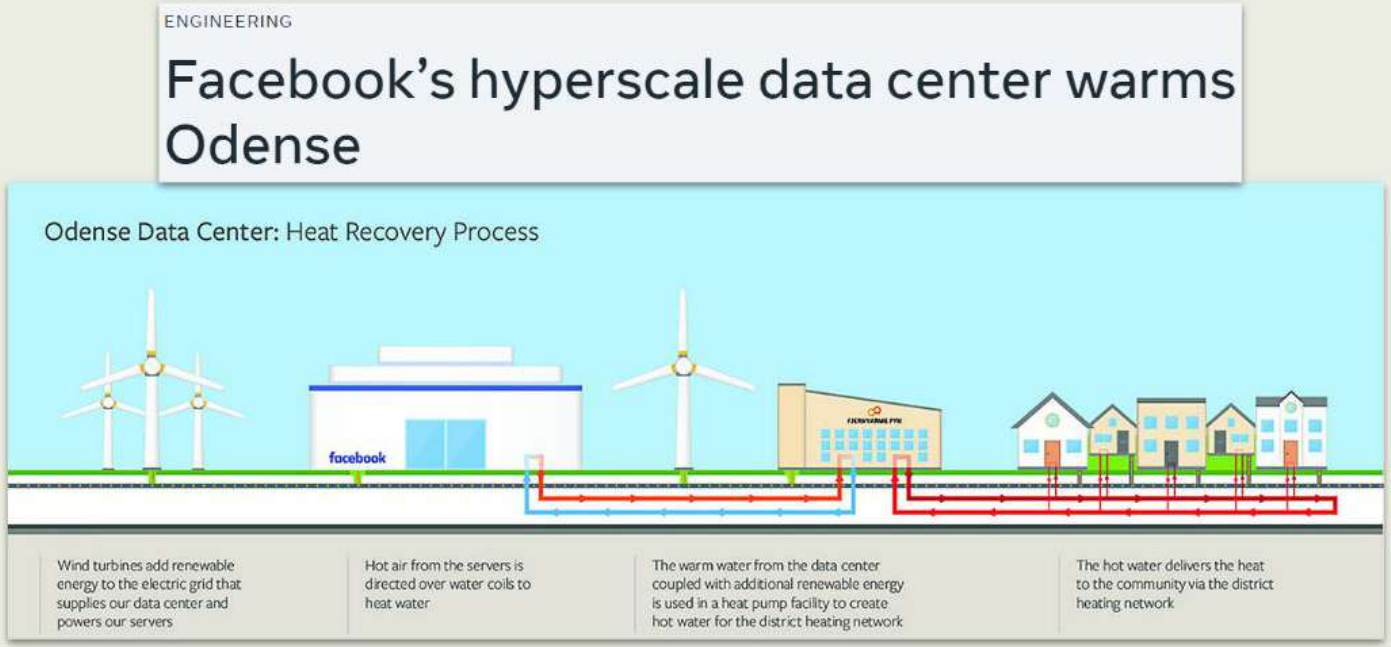
Meta's significant effort in water recovery

Out of 2.6 billion liters, Meta has recovered 2.3 billion liters, representing an **88% recovery rate.** Meta's goal is to become **Water Positive by 2030**.



Circular economy: utilizing waste heat

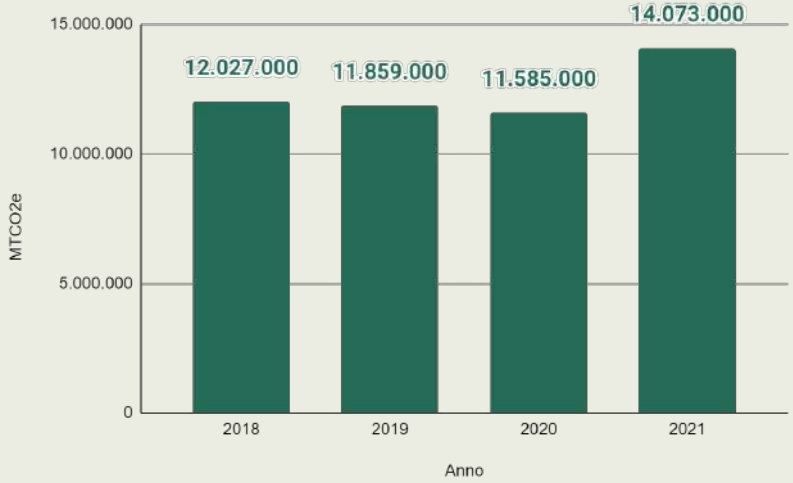
In Denmark, Meta utilizes the heat generated by the data center to provide hot water and heating to the city of Odense.

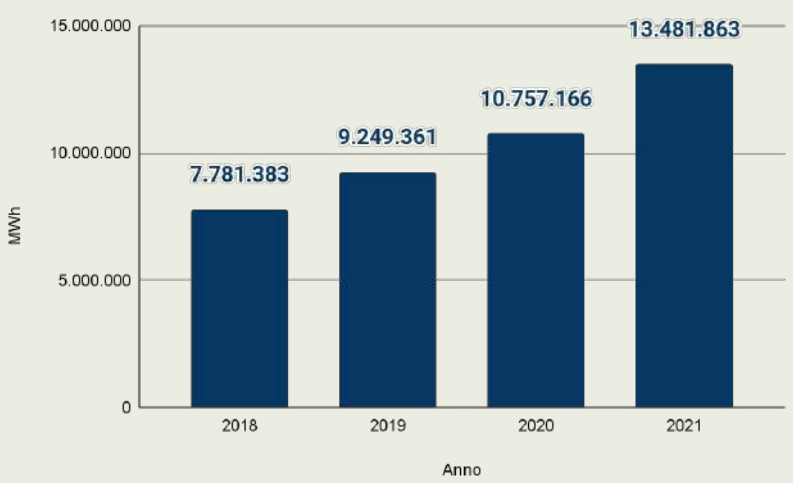


Microsoft

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Anno	MWh energy consumption
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2021	13.481.863

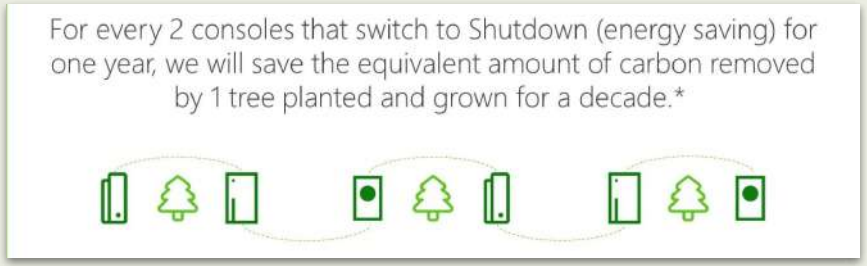




Sustainability of gaming

Microsoft is the first Big Tech company that also focuses on the gaming industry, **a market worth over $200 billion.**





Microsoft is also mindful of water consumption

Like other Big Tech companies, Microsoft also pays attention to water consumption, aiming to **zero out its water footprint by 2030.**



Less water-intensive data centers

Microsoft is **changing the cooling systems** in its data centers from air to water

This is because, as demands grow, **the need for water exceeds available resources**.



HOME › NEWS › CLOUD & HYPERSCALE

Microsoft to swap water for air cooling at campus in Phoenix, Arizona

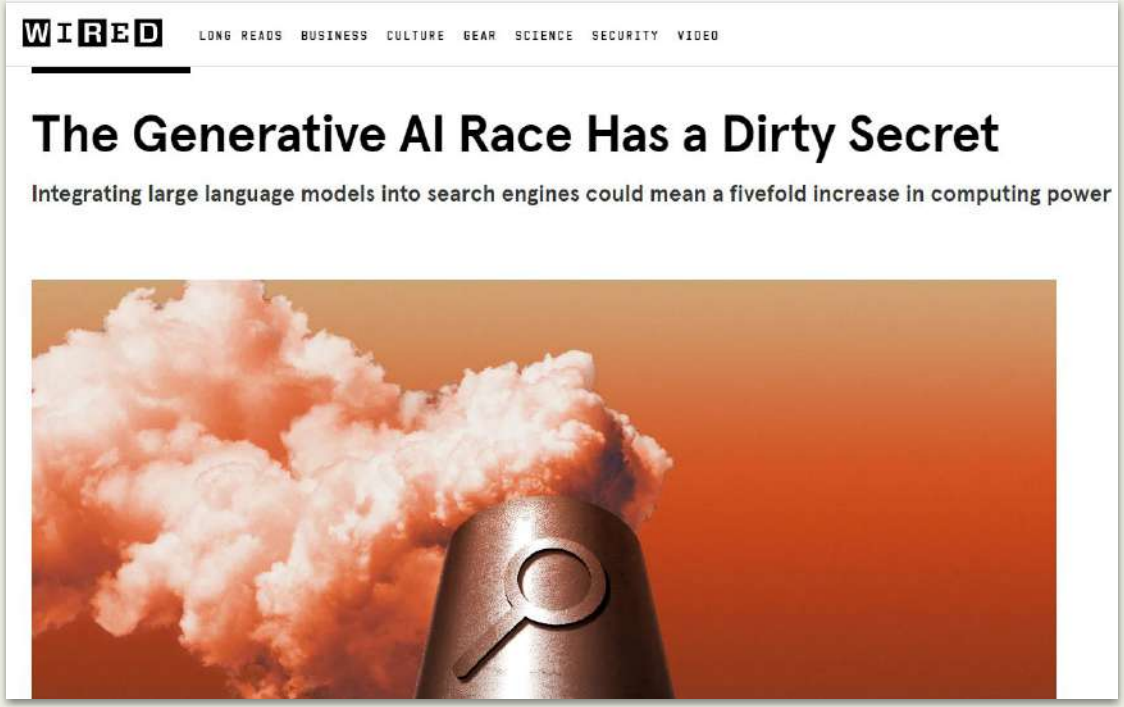
Company making switch as city's infrastructure can't handle more wastewater

March 16, 2023 By: Dan Swinhoe Have your say

Microsoft has agreed to switch cooling systems for future data centers in the Goodyear area of Phoenix, Arizona.

The company is switching from a water-cooled to air-cooled solution for future buildings at its Goodyear campus as the City is currently unable to handle more wastewater and is unable to make the site's water potable.

ChatGPT on Microsoft servers (azure)



WIRED LONG READS BUSINESS CULTURE GEAR SCIENCE SECURITY VIDEO

The Generative AI Race Has a Dirty Secret

Integrating large language models into search engines could mean a fivefold increase in computing power

https://www.wired.co.uk/article/the-generative-ai-search-race-has-a-dirty-secret
https://www.avantgrade.com/digital-marketing/microsoft-bing-sta-crescendo-grazie-a-chatgpt

Summary of Big Tech sustainability reports

1. **Energy consumption is increasing at a rate five times higher than global consumption.** This requires greater attention to energy efficiency in the digital operations of tech companies, which are becoming increasingly energy-consuming.
2. **Emissions from Big Tech are rising** (+30.8% in 4 years)**,** even for those (Apple, Google, Microsoft) working virtuously.
3. All Big Tech companies have improved their ESG reporting and are focu**sed on achieving the goal of zero emissions by 2030**.

Insights

1. The majority of emissions come from scope 3: it is crucial for companies to **work towards making the supply chain more sustainable**
2. **Water consumption and recovery** are increasingly central topics in reports, given their extensive use in data center cooling.
3. New sustainability challenges arise from a development that makes the **digital sector increasingly energy-consuming**: digitization, gaming, and especially **artificial intelligence**.

4 Website emissions

How to measure their sustainability with Karma Metrix

What is Karma Metrix



Karma Metrix is the **1st digital sustainability journey**, chosen by top brands, that measures, compares and improves the **environmental impact** of a website.

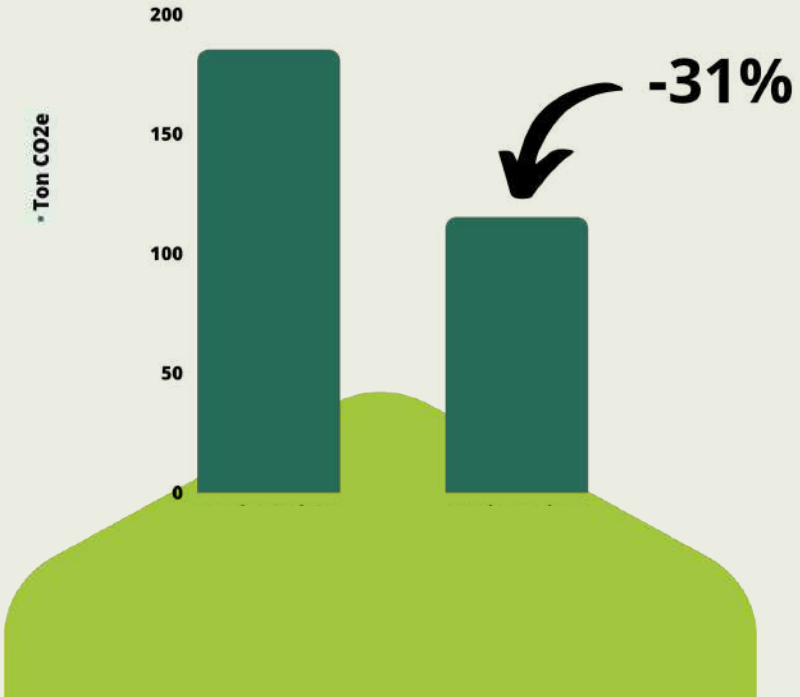
The **measurement** uses an innovative, patented algorithm, that considers many **«on-page» elements** on web pages affecting energy efficiency.

Every analyzed page is compared with a **benchmark**.

Improvements come after the identification of energy efficiency areas on website pages.

Impact of the sustainability journey: -31%

The path carried out with our customers sees an average **reduction in website emissions of 31%,** 4 to 6 months after the start of the sustainability journey.



Karma CO2 Assessment - Seal

Together with the measurement of emissions, the seal is released, which attests to the commitment made by the company.

- The seal is a digital badge, released by Karma Metrix
- It is valid for one year from the measurement.
- It proves the start and maintenance of a **digital sustainability path**
- It can be used on the company's website, in communication, and in sustainability reports



Valentino.com: 2.420 online mentions

Forbes

STYLE & BEAUTY

Valentino And Karma Metrix Come Together To Tackle Internet Pollution With An Energy Efficient Website

Allyson Portee Contributor ⓘ
I cover global luxury fashion, beauty and Haute Couture

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Sep 10, 2022, 02:41am EDT

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SUSTAINABILITY / ENVIRONMENT

Valentino Wants Its Website to Be Sustainable, Too

The luxury brand's website generates 2.56 grams of carbon dioxide emissions.

By MARTINO CARRERA
SEPTEMBER 7, 2022, 12:01AM



Valentino has partnered with Karma Metrix to assess its website's carbon dioxide emissions.
COURTESY OF VALENTINO

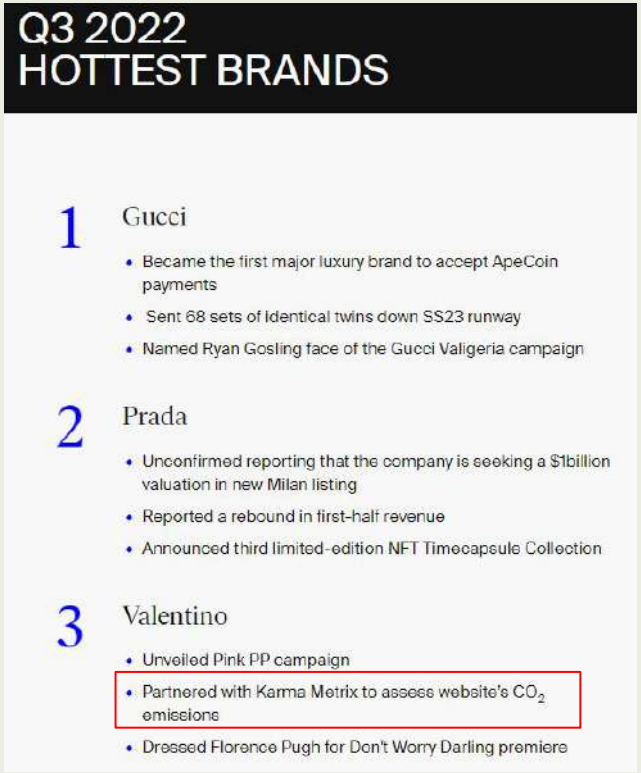
GREEN SITE: Valentino's commitment to a sustainable business is expanding to some of its digital operations.

The couture house detailed its partnership with Karma Metrix Energy Efficient Website, an Italy-based company that is part of the AvantGrade.com search

Karma Metrix: Valentino in Lyst's hottest brands

Lyst is the go-to fashion shopping app for **over 200 million users worldwide**.

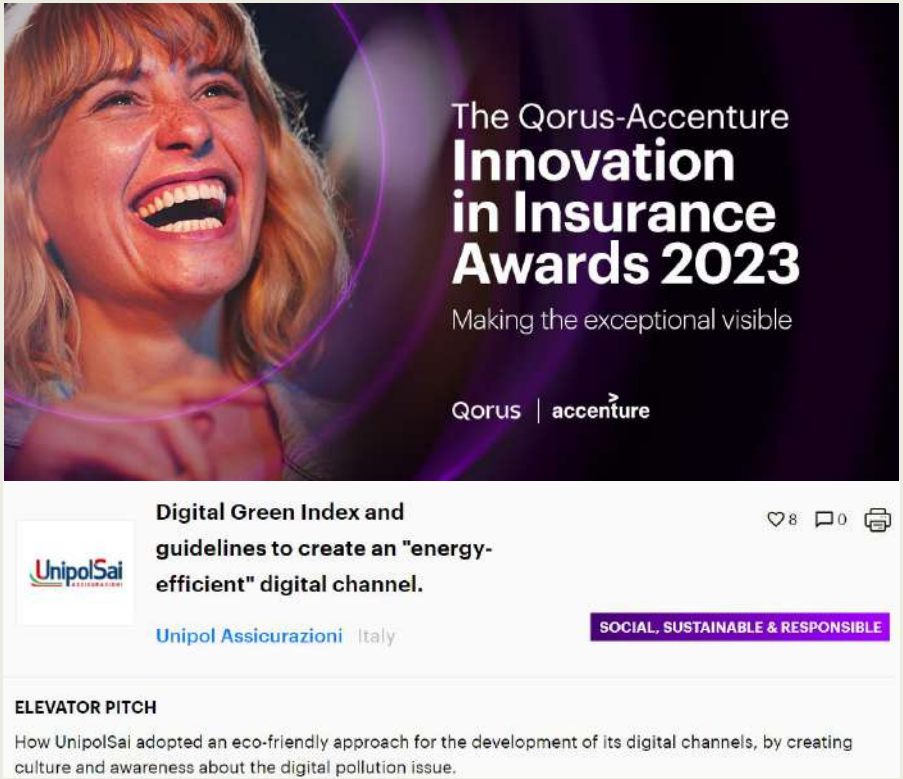
Valentino, together with Karma Metrix, has reached the **top 3 of Lyst's 2022 hottest brands**, thanks to its commitment to innovation in sustainability."



https://www.lyst.com/data/the-lyst-index/q322/

UnipolSai at Innovation in Insurance Awards 2023

The Unipol Group, thanks to its **digital sustainability journey with Karma Metrix**, is a candidate for the Innovation in Insurance Awards 2023



https://innovationininsurance.qorusglobal.com/digital-green-index-and-guidelines-create-energy-efficient-digital-channel

Lombardy Region: the first public administration to focus on digital sustainability

Lombardy Region has:

- Started its journey from the regione.lombardia.it portal in April 2021
- Continued the implementation of the guidelines provided by Karma Metrix
- Achieved a **58% reduction in emissions** based on measurements taken in October 2022



Contacts

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