Karma Metrix
Energy Efficient Website

Sustainability in Big Tech

Global Carbon Project assumes, that Internet is the 4th Country by CO2 emissions in the world. With a view to World Environment Day, Karma Metrix presents a detailed analysis of the FAANG (Facebook, Apple, Amazon, Netflix, Google) sustainability reports.

26/5/2022

Karma Metrix is a brand of AvantGrade.com

In partnership with micri altavia.disko plef

Agenda

Karma Metrix
Energy Efficient Website

1. *Introduzione*
2. *FAANG Sustainability (Aggregate)*
3. *ESG reports analysis by corporate*
4. *Calculate Websites Sustainability*

Does Internet pollutes?

Karma Metrix
Energy Efficient Website

Global Carbon Project assumes, that if Internet were a Country, it would be ***the 4th Country by CO2 emissions in the world****!*

Some examples:

1,7 grams of CO2	Emissions for a single web search
28-63 grams of CO2	Emissions for a gigabyte on the Internet
1-5 tons of CO2	Yearly emissions for one server
1% of global demand	Energetic consumption of data centers

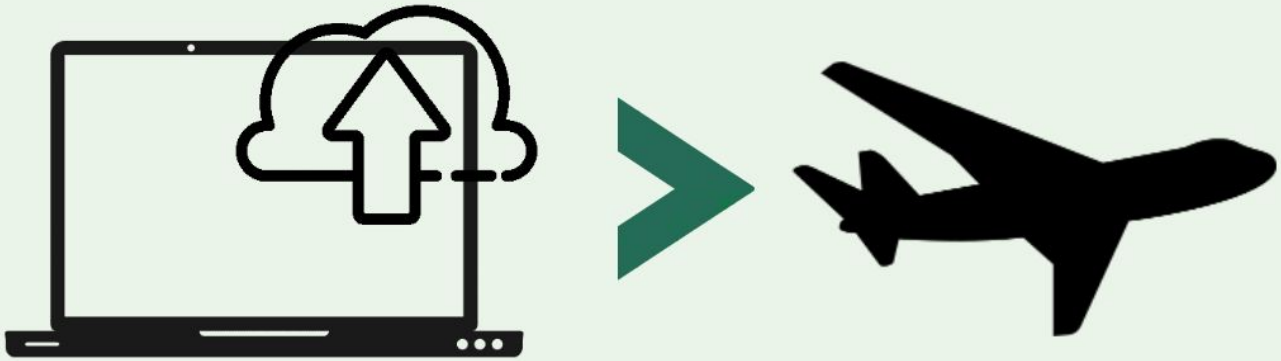
fonti: https://www.globalcarbonproject.org/,
https://www.corriere.it/dataroom-milena-gabanelli/emissioni-co2-l-impatto-internet-cloud-streaming-riscaldamento-globale-come-ingannano-big-web/7bf27d6a-34c8-11ec-893f-6c22220c83f9-va.shtml

…more than air traffic.

Karma Metrix
Energy Efficient Website

Digital sector weights around 3,7% on global CO2 emissions.

(air traffic weights 2% on total).

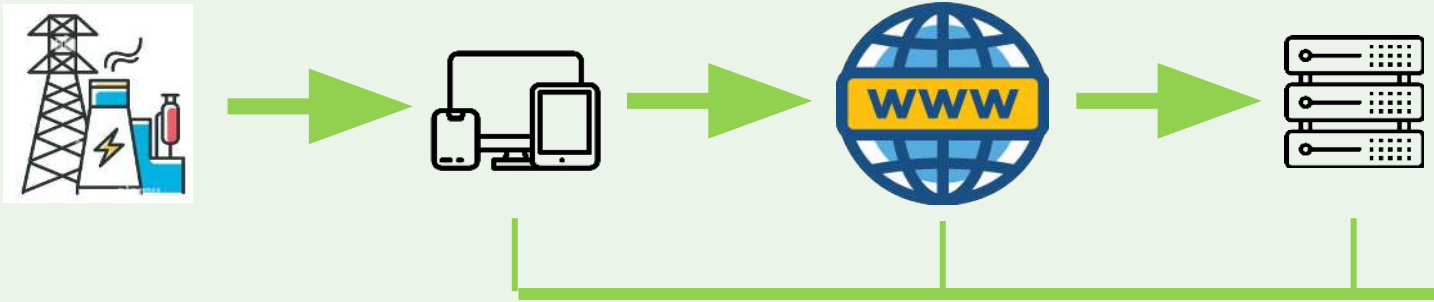


https://www.corriere.it/pianeta2020/cards/emissioni-co2-internet-quanto-inquina-mandare-mail-o-messaggi-whatsapp/emissioni-co2-digitale_principale.shtml

*estimated between 1,4% e 5,9%

Why do websites pollute?

Karma Metrix
Energy Efficient Website



Internet *emette* ***emissioni di CO2****, both for the inefficient way websites are created and managed, 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.*

Agenda

Karma Metrix
Energy Efficient Website

1. *Introduzione*
2. *FAANG Sustainability (Aggregate)*
3. *ESG reports analysis by corporate*
4. *Calculate Websites Sustainability*

FAANG

Acronym referring to the five most popular and best-performing American technology companies

F acebook

A mazon

A pple

N etflix

G oogle

Sustainability reports

Focus on sustainability reports

Karma Metrix
Energy Efficient Website

For every FAANG company we:

1. analysed last 3 years **sustainability reports** (as available at 2022/04/29);

2. have isolated the values of **energy consumed and CO2 produced** for each year;

3. **Benchmarked** by comparing the energy consumption of FAANGs with entire Countries.

CO2 FAANG 2018-20

CO2 emissions comparison (Tons of CO2e)

Karma Metrix
Energy Efficient Website

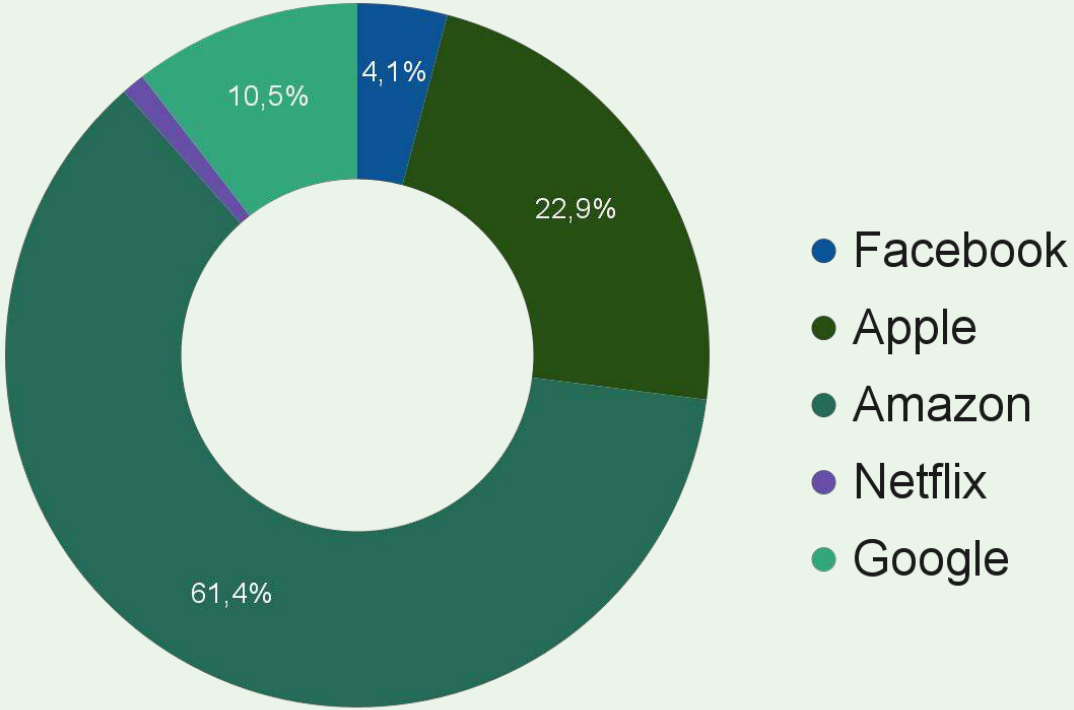
Company	2018	2019	2020	Delta 18-20
Facebook	1.008.000	4.330.000	4.067.000	**303%**
Apple	25.200.000	25.100.000	22.600.000	**-10%**
Amazon	44.400.000	51.170.000	60.640.000	**37%**
Netflix		1.244.711	1.051.564	**23%**
Google	13.648.224	12.529.953	10.326.109	**-24%**
Total	**84.256.224**	**94.374.664**	**98.684.673**	**17%**

Comparison 2018 - 2020, considering only Facebook, Apple and Google and Amazon which have complete data in the three years. Netflix's impact (absent in the comparison) is minimal.

The CO2 indicated does not take into account any compensation of the companies.

FAANG - Comparison

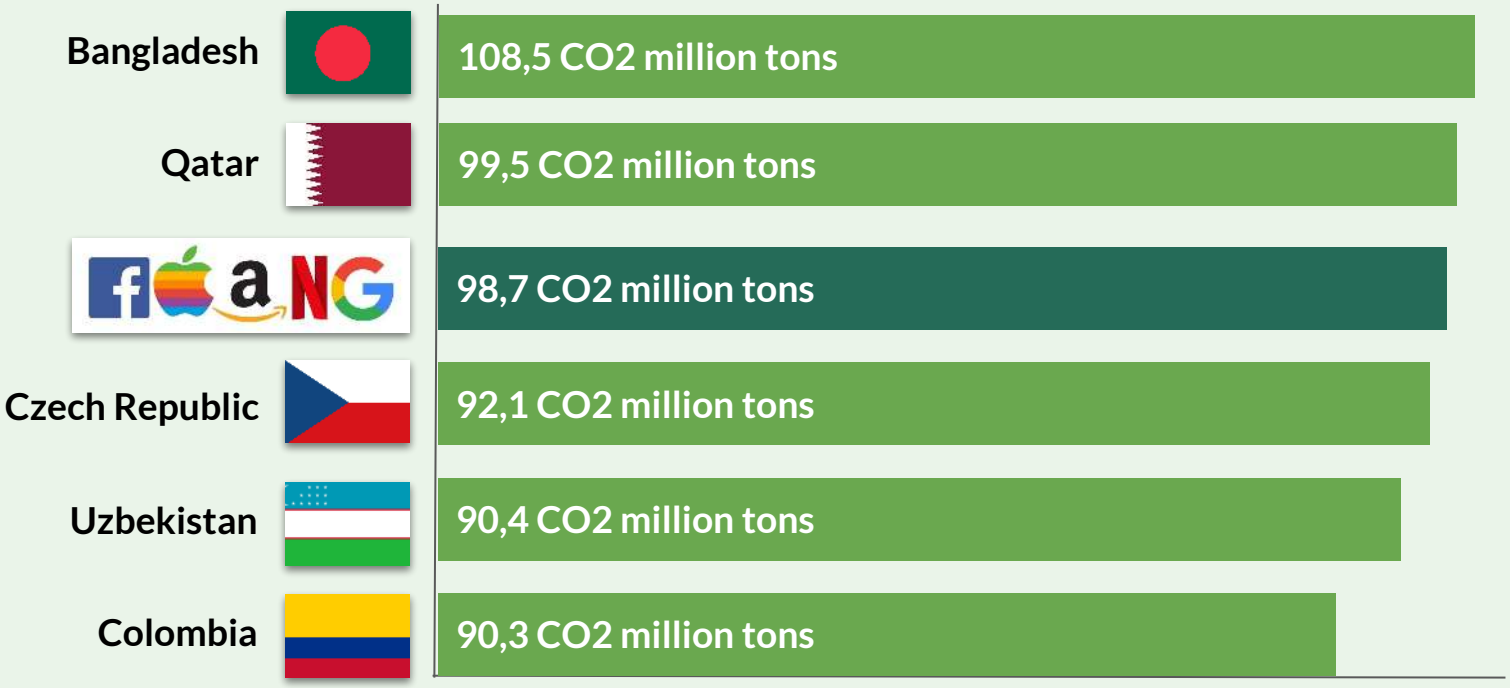
CO2 emissions comparison (Tons of CO2e)



The CO2 indicated does not take into account any compensation of the companies.

Benchmark CO2 emissions 2020

Karma Metrix
Energy Efficient Website



https://edgar.jrc.ec.europa.eu/report_2021
The CO2 indicated does not take into account any compensation of the companies.

Energy FAANG : 2018 -20

Energy Consumption comparison (MWh)

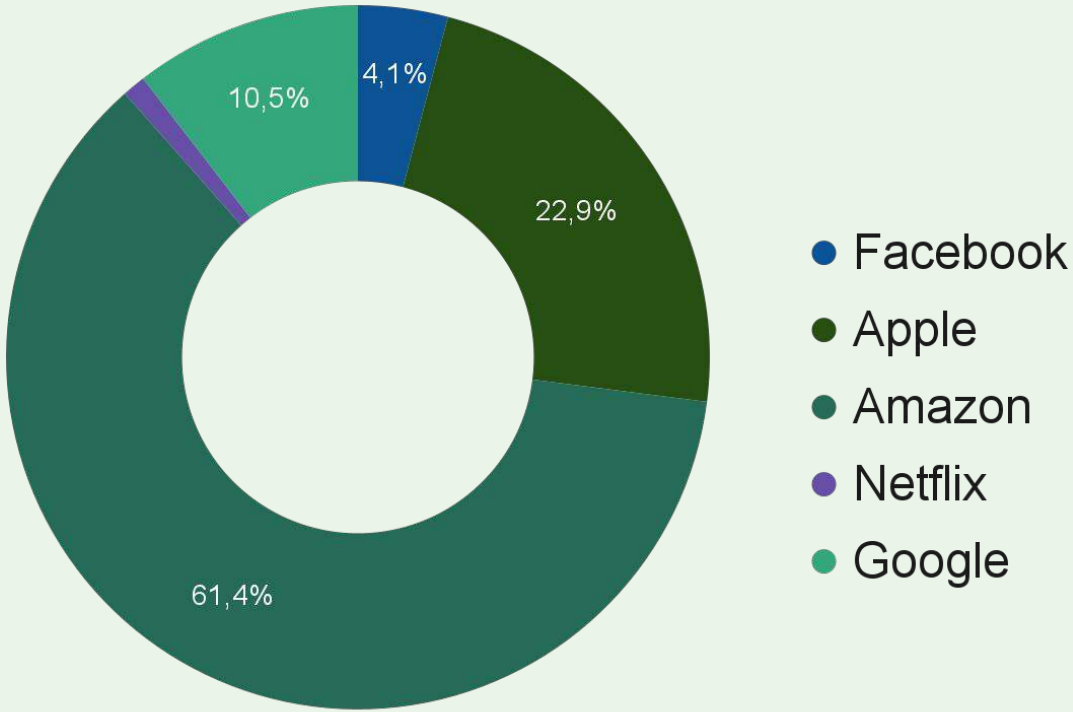
Karma Metrix
Energy Efficient Website

Company	2018	2019	2020	Delta 18-20
Facebook	3.427.000	5.140.000	7.170.000	**109%**
Apple	2.676.460	2.889.680	3.019.170	**13%**
Amazon	nd	nd	24.000.000	**nd**
Netflix		81.136	94.285	**93%**
Google	10.572.485	12.749.458	15.439.538	**46%**
Total	**16,67 M**	**20,86 M**	**49,72 M**	**54%**

Comparison 2018 - 2020, considering only Facebook, Apple and Google, which have complete data in the three years.
If we also consider Netflix and Amazon, the increase in energy consumed is equal to 198%.

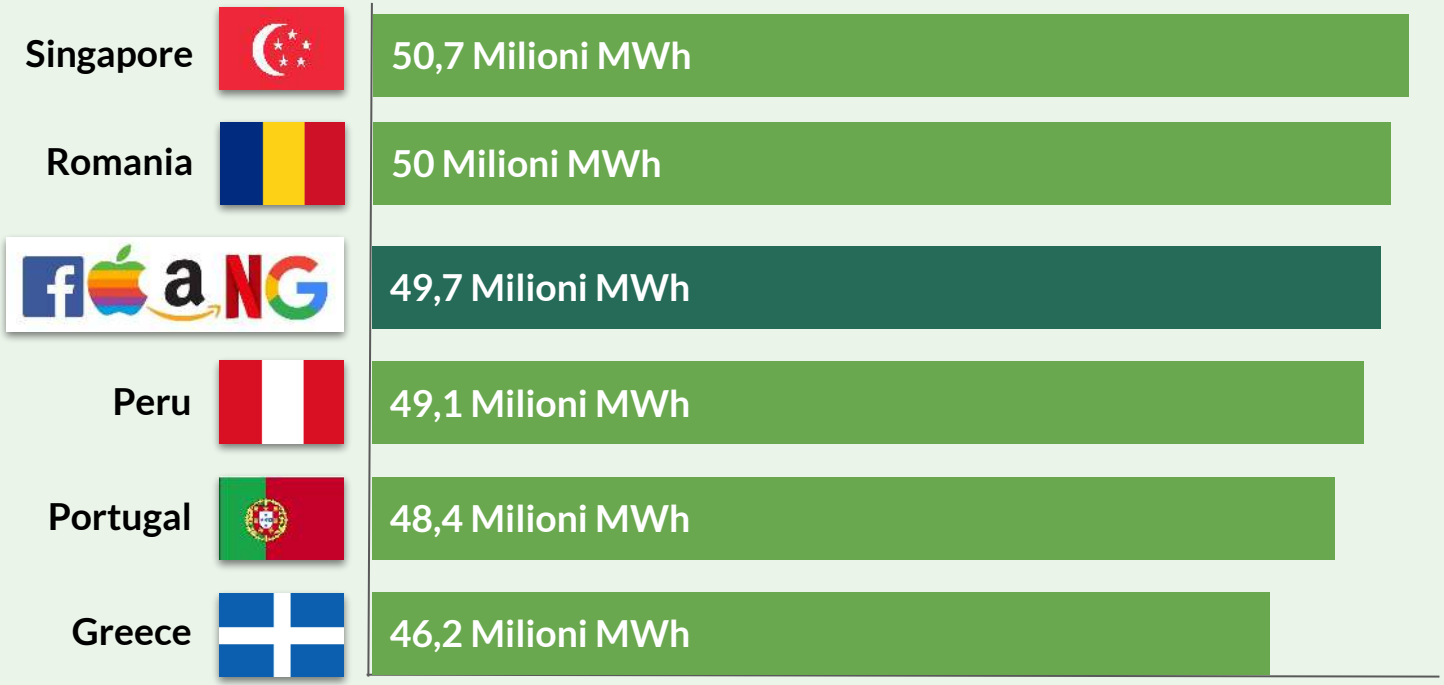
Energia FAANG - Comparison

Energy Consumption comparison (MWh)



Benchmark energy consumption 2020

Karma Metrix
Energy Efficient Website

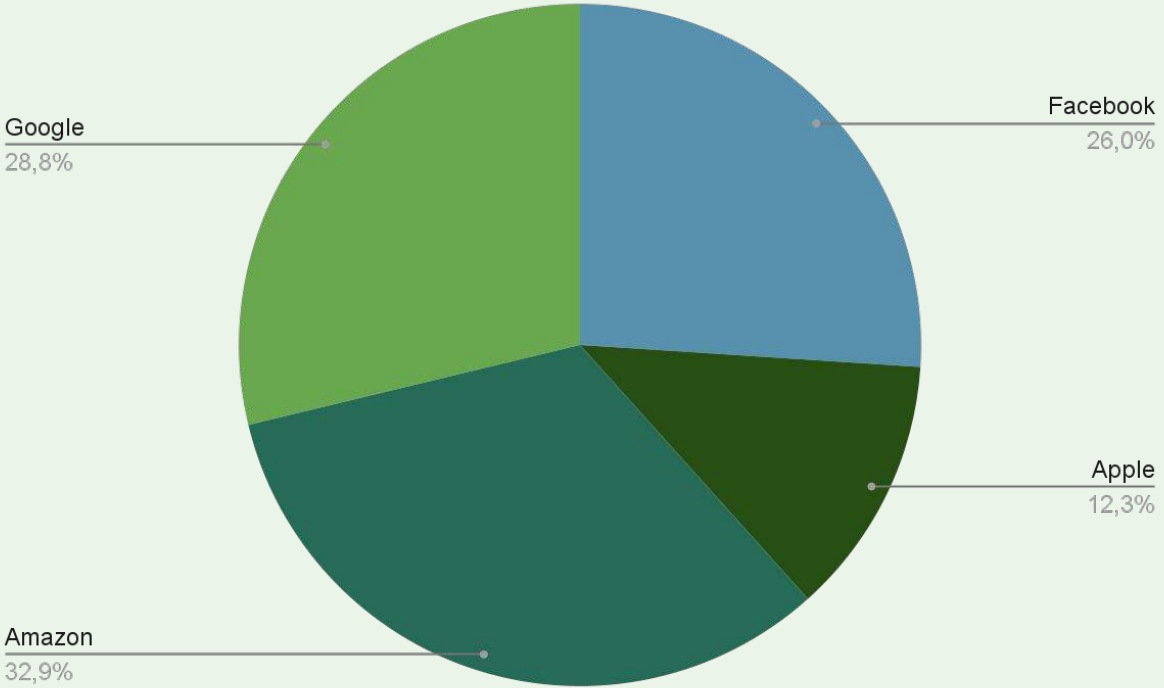


https://countryeconomy.com/energy-and-environment/electricity-consumption

73 data centers

Karma Metrix
Energy Efficient Website

- 19 Facebook
- 9 Apple
- 24 amazon
- 0 Netflix
- 21 Google



Fonte: https://map.datacente.rs/

Agenda

Karma Metrix
Energy Efficient Website

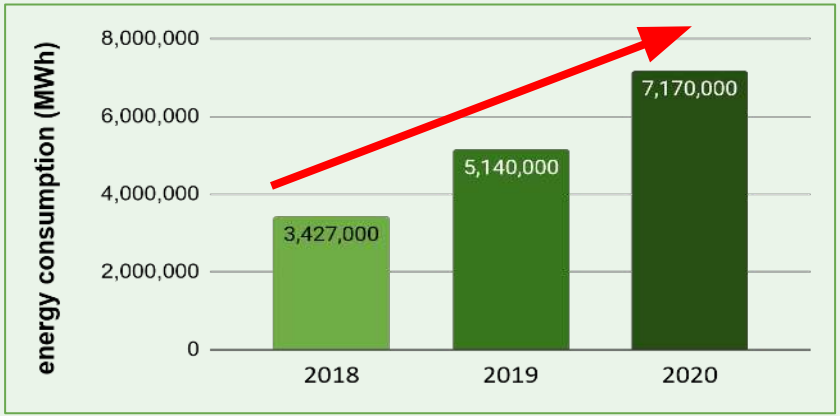
1. *Introduzione*
2. *FAANG Sustainability (Aggregate)*
3. *ESG reports analysis by corporate*
4. *Calculate Websites Sustainability*

FAANG - FACEBOOK (META)

Karma Metrix
Energy Efficient Website

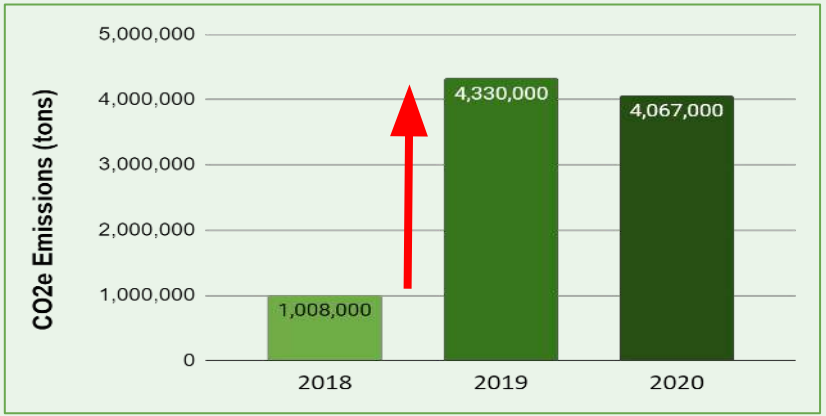
Energy Consumption *2018 - 2019 - 2020*
(Data centers + Offices)

Year	energy consumption (MWh)
2018	3.427.000 MWh
2019	5.140.000 MWh
2020	7.170.000 MWh



MTCO2e *emissions 2018 - 2019 - 2020*
(scope 1, 2, 3)

Year	MTCO2e
2018	1.008.000 Tons CO2e
2019	4.330.000 Tons CO2e
2020	4.067.000 Tons CO2e



Metaverso: 2 new data centers

Karma Metrix
Energy Efficient Website

- Kuna data center (north USA, Idaho) will measure **9 hectares**
- Construction will end by **2025**
- Facebook promised to invest **$50 million in a new water and sewer system** for the city

Facebook to build large $800 million data center in Kuna

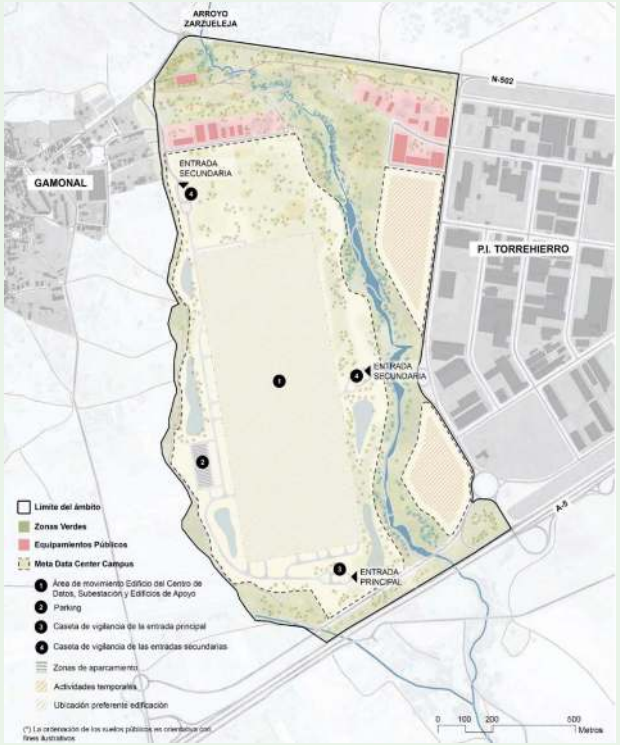
https://boisedev.com/news/2022/02/16/meta-facebook-datacenter/

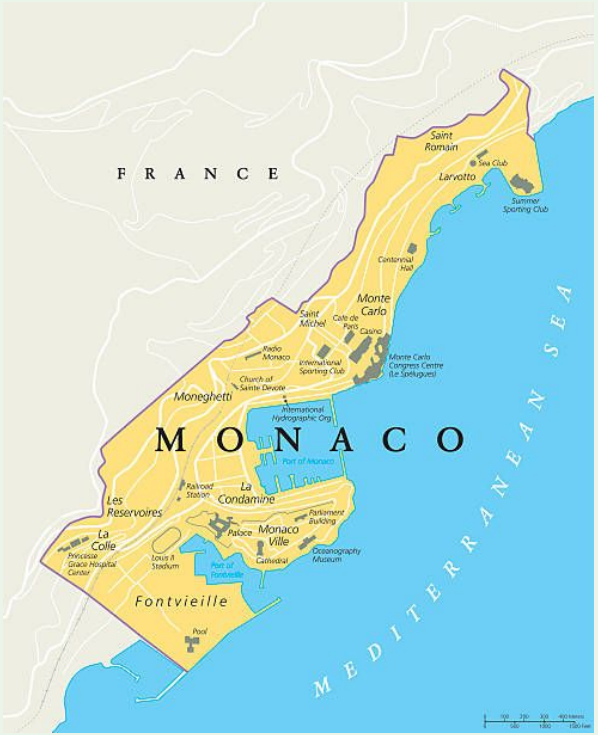
1 data center in Spain

Karma Metrix
Energy Efficient Website

- The new data center near Madrid prevede will cost **one billion Euros.**

- It will be built on a land large **192 hectares**… more or less like **Monaco**





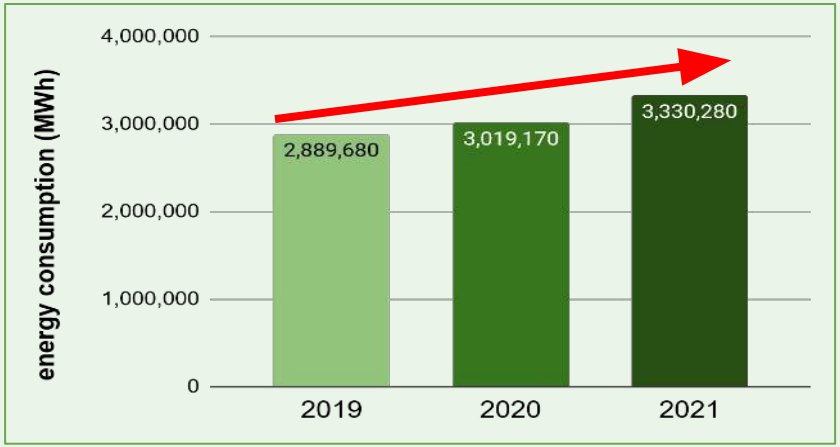
https://www.crn.com/news/data-center/facebook-s-meta-to-build-1b-data-center-for-metaverse

FAANG - APPLE

Karma Metrix
Energy Efficient Website

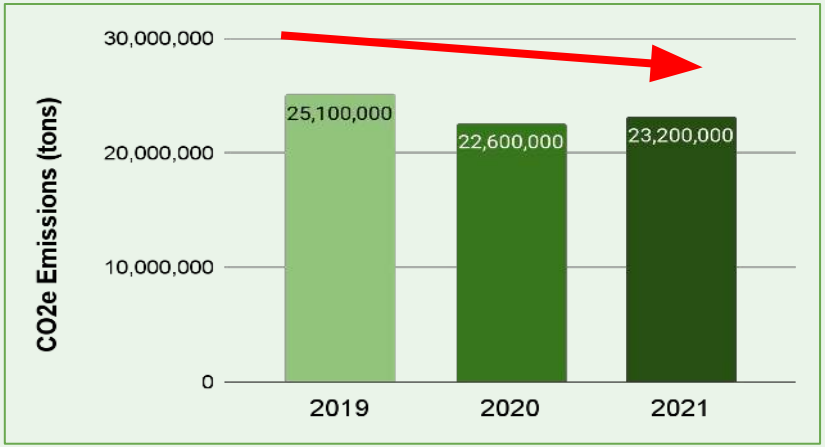
Energy Consumption *2019 - 2020 - 2021*
(Electricity + Fuels)

Year	Energy Consumption (MWh)
2019	2.889.680 MWh
2020	3.019.170 MWh
2021	3.330.380 MWh



MTCO2e *emissions 2019 - 2020 - 2021*
(scope 1, 2, 3)

Year	MTCO2e
2019	25.100.000 Tons CO2e
2020	22.600.000 Tons CO2e
2021	23.200.000 Tons CO2e



APPLE emissions decrease: why?

Karma Metrix
Energy Efficient Website

- Since 2015 Supplier Clean Energy Program helps suppliers in energy transition towards renewable production. **In 2021 it allowed to spare the emission of 14 million tons CO2**.

- Apple created a **200 million dollars "Recovery Fund"**, for investments in climate projects.

- **100% recycled gold, tin and rare hear elements in smartphone components.**

FAANG - AMAZON

Karma Metrix
Energy Efficient Website

***Energy Consumption** 2018 - 2019 - 2020*

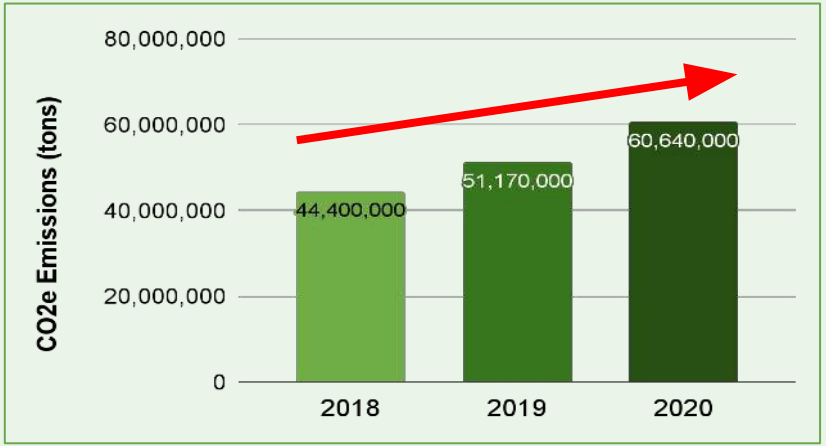
Year	Energy Consumption (MWh)
2018	n/d
2019	n/d
2020	24.000.000 MWh

***MTCO2e** emissions 2018 - 2019 - 2020 (scope 1, 2, 3)*

Year	MTCO2e
2018	44.400.000 Tons CO2e
2019	51.170.000 Tons CO2e
2020	60.640.000 Tons CO2e

Renewable Energy by the Numbers

Amazon's renewable energy projects helped power the 24 million MWh of electricity consumed by Amazon in 2020 and led to a 4% reduction in our carbon emissions from purchased electricity from 2019 to 2020.



FAANG - AMAZON

Karma Metrix
Energy Efficient Website

- **Amazon has the highest CO2 emissions increase.** That's because, unlike the others, it has a stronger component of **physical logistics**, as well as IT (Amazon Web Services)..

- Amazon claims to produce 65% of its needs from renewable sources, but **without providing data on energy consumption** in its 2020 sustainability report.

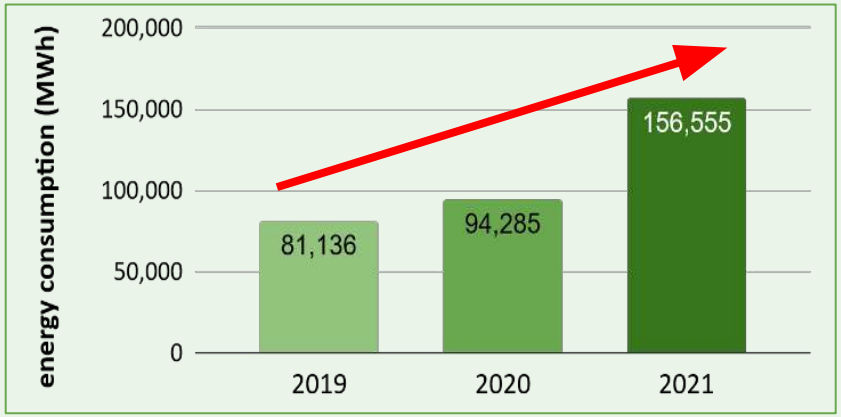
- The goal is to reach **100% of energy from renewable sources by 2025** (in some cases by purchasing it).

FAANG - NETFLIX

Karma Metrix
Energy Efficient Website

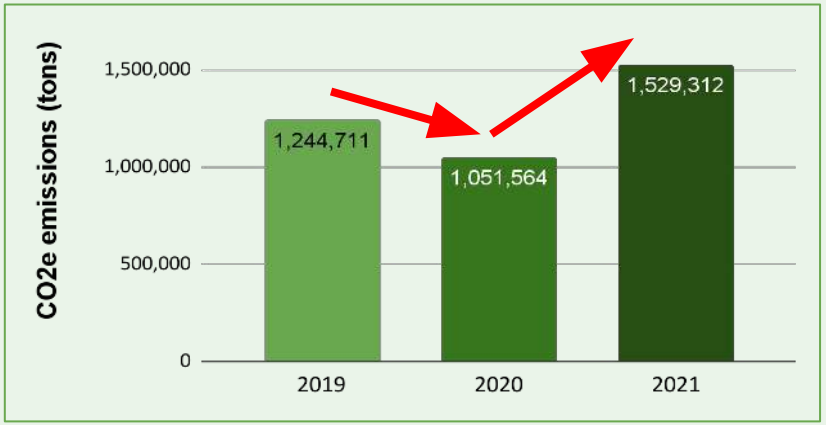
Energy Consumption *2019 - 2020 - 2021*
(fuel, natural gas, electricity, heating)

Year	Energy Consumption (MWh)
2019	81.136 MWh
2020	94.285 MWh
2021	156.555 MWh



MTCO2e *emissions 2019 - 2020 - 2021*
*(**totale scope 1, 2, 3**)*

Year	MTCO2e
2019	1.244.711 Tons CO2e
2020	1.051.564 Tons CO2e
2021	1.529.312 Tons CO2e



FAANG - NETFLIX

Karma Metrix
Energy Efficient Website

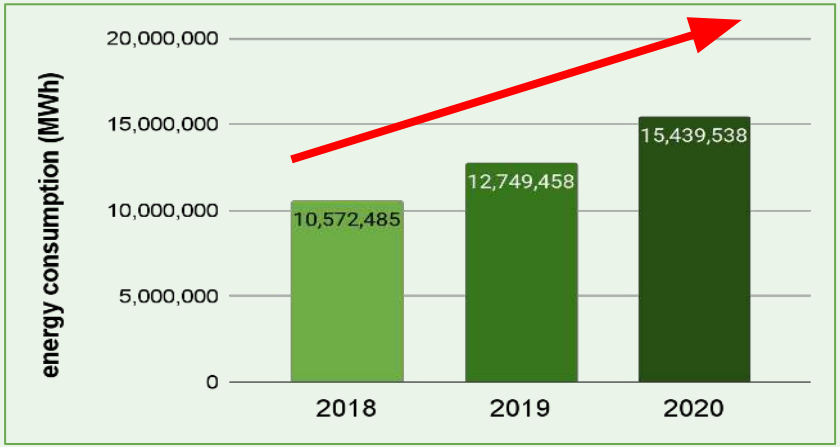
- Netflix of the 5 is the one with the most limited weight (it is the only one that has no data center)
- It co-founded the **Sustainable Aviation Buyers Alliance,** with the mission to accelerate the path to carbon-neutral air transport
- In collaboration with COP26, it has published many films and documentaries on sustainability (but not the digital one!)
- “CO2 Rebound of the Pandemic” effect: between 2020 and 2021 the footprint deriving from Scope 1 increased due to the restart and increase in the films and TV series production.

FAANG - GOOGLE

Karma Metrix
Energy Efficient Website

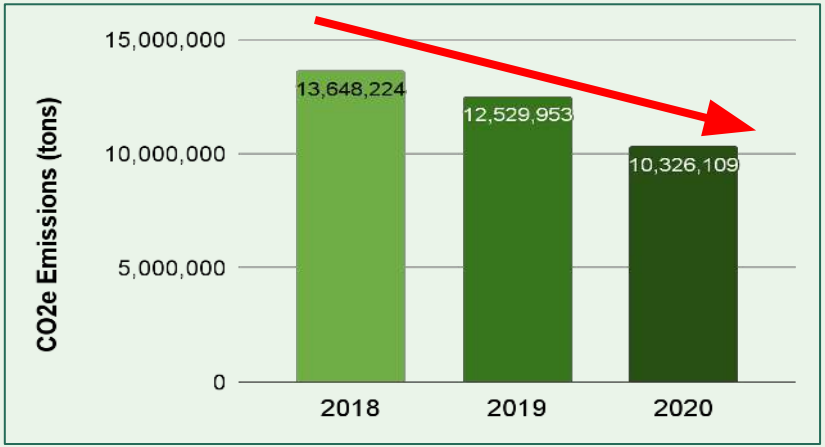
Energy Consumption *2018 - 2019 - 2020*
(fuel, natural gas, electricity, heating)

Anno	energia consumata (MWh)
2018	10.572.485 MWh
2019	12.749.458 MWh
2020	15.439.538 MWh



MTCO2e *emissions 2018 - 2019 - 2020*
(scope 1, 2, 3)

Anno	MTCO2e
2018	13.648.224 Tons CO2e
2019	12.529.953 Tons CO2e
2020	10.326.109 Tons CO2e



FAANG - GOOGLE

Karma Metrix
Energy Efficient Website

Energy consumption is growing, but Google's emissions are falling, thanks to:

- **3,3 billion dollars** of renewable energies investments between 2010 and 2020
- Carbon Neutral since 2007 and **full Carbon Footprint compensation since foundation).** Zero emissions goal before 2030
- Constantly improving the efficient management of sites indexed in search
- Extreme data center efficiency (also in terms of water consumption)

Google Dark Mode

Karma Metrix
Energy Efficient Website

The choice of colors has an impact on energy consumption!

The choice of colors has an impact on energy consumption!
Dark mode is a feature that allows you to display home page, toolbar, settings, search engine and some other pages with a black layout.

According to our estimates, using the “dark mode” can save up to 9% energy!

Website eco-sustainability: SEO factor

Karma Metrix
Energy Efficient Website

Google on Twitter stated that it has already tested variables to give greater visibility to the most eco-sustainable sites. Should we wait for new interesting algorithmic changes?

Sintesi Big tech - A

Karma Metrix
Energy Efficient Website

1. From the sustainability reports, it emerges that all 5 Big Techs are increasing their efforts, activities and reporting related to climate change.

2. All 5 big techs **increase energy consumption** (+54% on a like-for-like basis). Together they weigh as much as Romania in 2020

3. Thanks to the growth of renewable sources, CO2 emissions grow by 17%, with some **virtuous cases of reduction in emissions** (Apple and Google). Taken together they emit as much as Bangladesh or Czech Republic.

Sintesi Big Tech - B

Karma Metrix
Energy Efficient Website

4. **Apple and Google seem to be the most committed**, while Amazon (which appears to be the first for energy consumption and CO2 emissions) could increase the communication effort towards the market. The launch of the Facebook Metaverse appears to correlate with new large investments in data centers.

5. **Measuring and Saving** (as well as compensating): given that the transition to renewable sources is gradual and takes time, big techs are increasingly careful to take energy saving paths (and consequently reduce emissions).

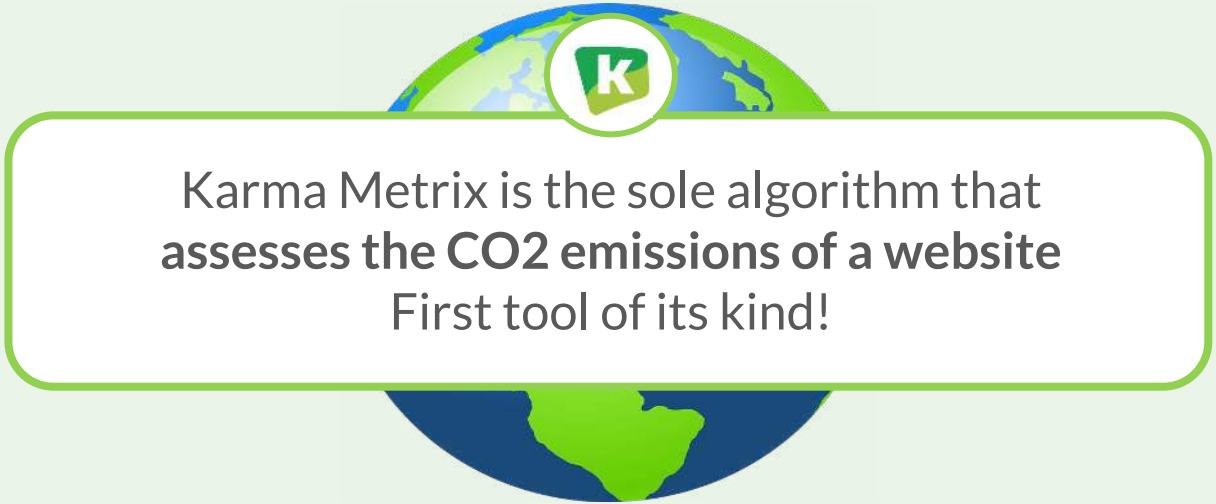
Agenda

Karma Metrix
Energy Efficient Website

1. *Introduzione*
2. *FAANG Sustainability (Aggregate)*
3. *ESG reports analysis by corporate*
4. *Calculate Websites Sustainability*

Cos'è Karma metrix

Karma Metrix
Energy Efficient Website



Karma Metrix is the sole algorithm that
assesses the CO2 emissions of a website
First tool of its kind!

Through the Karma Metrix algorithm it is possible to **carry out an analysis taking into consideration the "on-page" elements** of the website

The assessment leverages on **different web efficiency factors** and compares the results with a worldwide benchmark

Perché Karma Metrix

Karma Metrix
Energy Efficient Website

“Ogni azienda dovrebbe misurare e migliorare l’impatto ambientale del proprio sito web.

Immaginiamo un futuro in cui i direttori marketing, oltre a valutare l’estetica e UX del sito web, pensino anche ad aumentarne l’efficienza energetica .

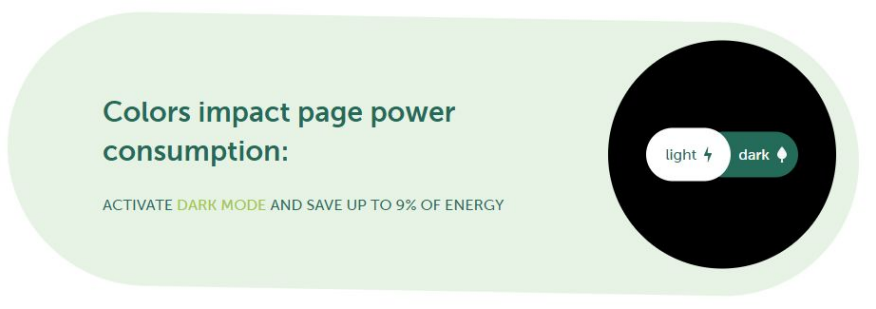
Karmametrix.com is born!

Karma Metrix
Energy Efficient Website

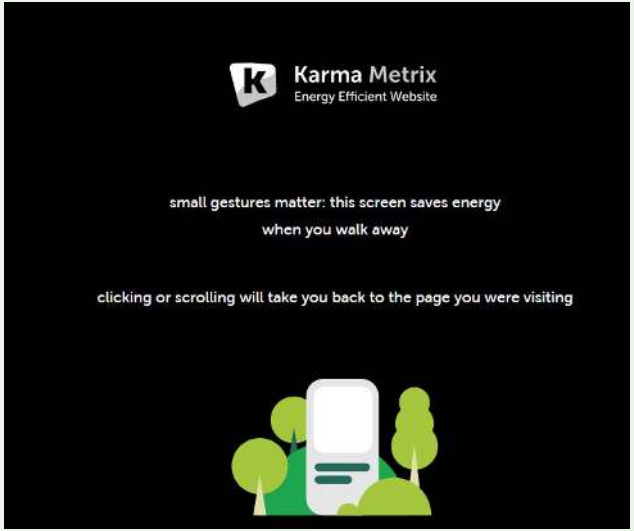
A website meant for eco-sustainability!

Karma Metrix
Energy Efficient Website

Dark Mode for energy saving



Energy saving mode after 40 seconds of inactivity



Karma companies

Karma Metrix
Energy Efficient Website

UnipolSai Assicurazioni | Allianz | Allianz Trade | Trenord | Iren | Banca Ifis

Sources: Sustainability reports

Karma Metrix
Energy Efficient Website

Facebook (Meta):
https://sustainability.fb.com/wp-content/uploads/2021/06/2020_FB_Sustainability-Report-3.pdf
https://sustainability.fb.com/wp-content/uploads/2020/12/FB_Sustainability-Report-2019.pdf
https://sustainability.fb.com/wp-content/uploads/2021/06/2020_FB_Sustainability-Data.pdf

Apple:
https://www.apple.com/environment/pdf/Apple_Environmental_Progress_Report_2022.pdf

Amazon:
https://sustainability.aboutamazon.com/pdfBuilderDownload?name=amazon-sustainability-2020-report
https://sustainability.aboutamazon.com/environment/sustainable-operations/renewable-energy?energyType=true

Netflix:
https://s22.q4cdn.com/959853165/files/doc_downloads/2020/02/0220_Netflix_EnvironmentalSocialGovernanceReport_FINAL.pdf
https://s22.q4cdn.com/959853165/files/doc_downloads/2021/03/2020-SASB-Report_FINAL.pdf
https://s22.q4cdn.com/959853165/files/doc_downloads/2022/03/30/2021-SASB-Report-FINAL.pdf

Google (Alphabet):
https://www.gstatic.com/gumdrop/sustainability/google-2021-environmental-report.pdf

Other sources

Karma Metrix
Energy Efficient Website

https://karmametrix.com/
https://www.eia.gov/international/data/world/electricity/electricity-consumption
https://www.citycarbonfootprints.info/
https://countryeconomy.com/energy-and-environment/electricity-consumption
https://www.globalcarbonproject.org/,
https://www.corriere.it/dataroom-milena-gabanelli/emissioni-co2-l-impatto-internet-cloud-streaming-riscaldamento-globale-come-ingannano-big-web/7bf27d6a-34c8-11ec-893f-6c22220c83f9-va.shtml
https://www.corriere.it/pianeta2020/cards/emissioni-co2-internet-quanto-inquina-mandare-mail-o-messaggi-whatsapp/emissioni-co2-digitale_principale.shtml
https://plana.earth/academy/what-are-scope-1-2-3-emissions/
https://www.indexmundi.com/map/
https://countryeconomy.com/energy-and-environment/electricity-consumption
https://www.google.com/about/datacenters/
https://www.google.com/about/datacenters/locations/
https://time.com/5814276/google-data-centers-water/#:~:text=in%20the%20booming%20cloud%2Dcomputing,this%20year.
https://datacenterfrontier.com/facebook-showcases-its-40-million-square-feet-of-global-data-centers/
https://time.com/5814276/google-data-centers-water/#:~:text=in%20the%20booming%20cloud%2Dcomputing,this%20year.
https://www.datacenters.com/facebook-data-center-locations
https://boisedev.com/news/2022/02/16/meta-facebook-datacenter/
https://www.crn.com/news/data-center/facebook-s-meta-to-build-1b-data-center-for-metaverse
https://datacenterfrontier.com/the-metaverse-will-need-a-lot-of-data-centers/
https://www.protocol.com/bulletins/amd-meta-facebook-chips
https://investor.fb.com/investor-news/press-release-details/2021/Facebook-Reports-Third-Quarter-2021-Results/default.aspx
https://sustainability.aboutamazon.com/environment/sustainable-operations/renewable-energy?energyType=true
https://edgar.jrc.ec.europa.eu/report_2021
https://www.gstatic.com/gumdrop/sustainability/google-water-stewardship.pdf

Karma Metrix - contacts

Karma Metrix
Energy Efficient Website

ADDRESS	Karma Metrix è un marchio di Xago Europe SA - Via San Gottardo, 61 6828 Balerna (Ticino) – Svizzera
PHONE	+41 (0) 916829583
WEBSITE	https://karmametrix.com
SOCIAL NETWORK	Linkedin: Karma Metrix Instagram: @karmametrix