

# Building digital services in a climate emergency

The levers we have on climate, and how we can use them

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GREENWEBFOUNDATION.ORG

Chris  
Adams

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2023.11.10  
BrandFestival

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# Hello!

I'm Chris. My background:

**Loco2** - Low CO2 Travel in Europe by train

**A.M.E.E (Avoid Mass Extinction Engine)** - CO2 calculation as an API

**Spend Network** - direct public spending for net zero

**Green Web Foundation** - make the web green

**Green Software Foundation** - Policy WG chair

**Branch Magazine** - climate / tech magazine

**Environment Variables** - podcast on green software



**Contact:** [chris@thegreenwebfoundation.org](mailto:chris@thegreenwebfoundation.org) | [@mrchrissadams](https://twitter.com/mrchrissadams)

# What we'll cover today

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1. Why the digital world is a physical one too
2. A framework to think about digital sustainability  
- *Consumption, Intensity, Direction*
3. Applying the framework with some examples to learn from





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**Why a digital  
world is a  
physical one too**

**1**



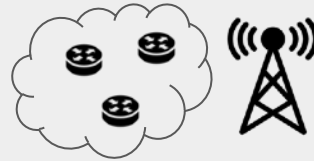
# Digital services and their supply chain

## End user device usage



Powering end user devices - laptops, workstations, smartphones and tablets

## Network transfer



Powering core networks, mobile networks, on-premise wifi and fixed routers

## Datacentre usage



Powering and cooling servers

## Production and disposal



Energy usage from making all of the above - processing raw silicon and other raw materials into integrated circuits, batteries, metal casings, etc



Credit: Photo by Kevin Webb

# How big is tech's carbon footprint?

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Estimates vary, but between 2% and 4% of global carbon emissions is safe to use.





Credit: Photo by Skyler Smith on Unsplash





Credit: Photo by Andy Li on Unsplash

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The internet is the biggest machine in the world, and today, it mostly runs on fossil fuels.

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# Can we change this?



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A framework to think about  
digital sustainability:  
*Consumption, Intensity,  
Direction*

1



# A model for thinking about digital sustainability - **CID**

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## **Consumption**

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Can I change how much we need?

## **Intensity**

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Can I change how much harm is done?

## **Direction**

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Can I change where we are headed?

# A model for thinking about digital sustainability - **CID**

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## **Consumption**

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Can I change how much we need?

## Intensity

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## Direction

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Can I change where we are headed?

# Carbon Dioxide Emission Scenarios for 1.5 °C of Warming

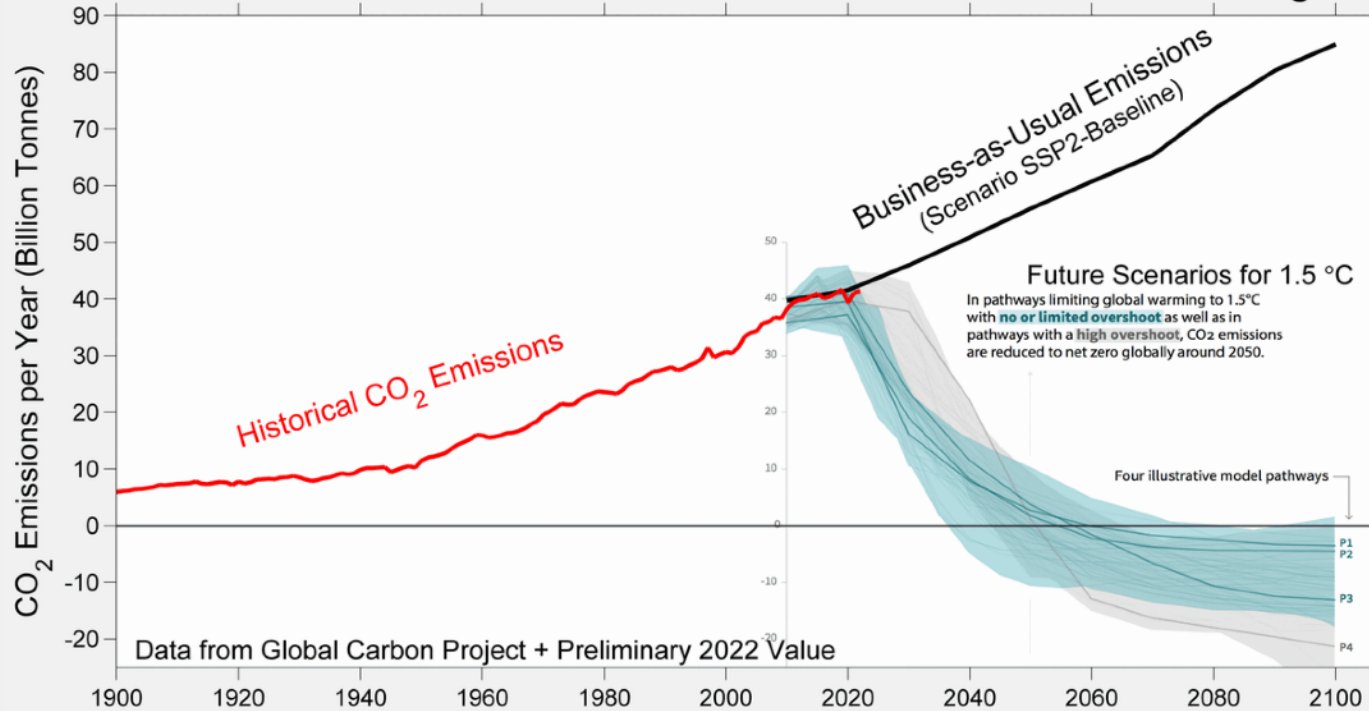


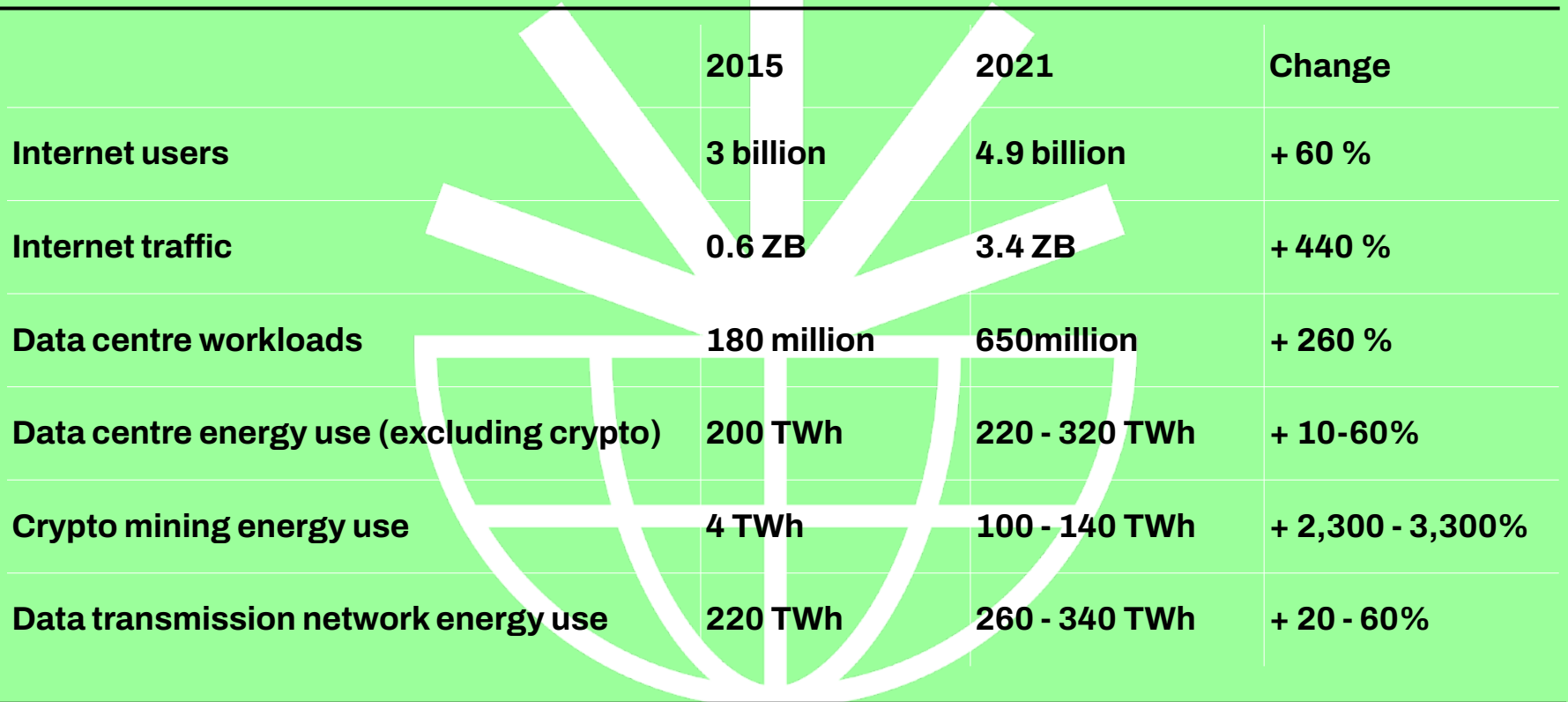
Image: Dr. Robert Rohde / Data: Global Carbon Project & IPCC

“ the Paris Agreement will require the information and communication technology (ICT) industry to reduce greenhouse gas (GHG) emissions by 45 per cent from 2020 to 2030

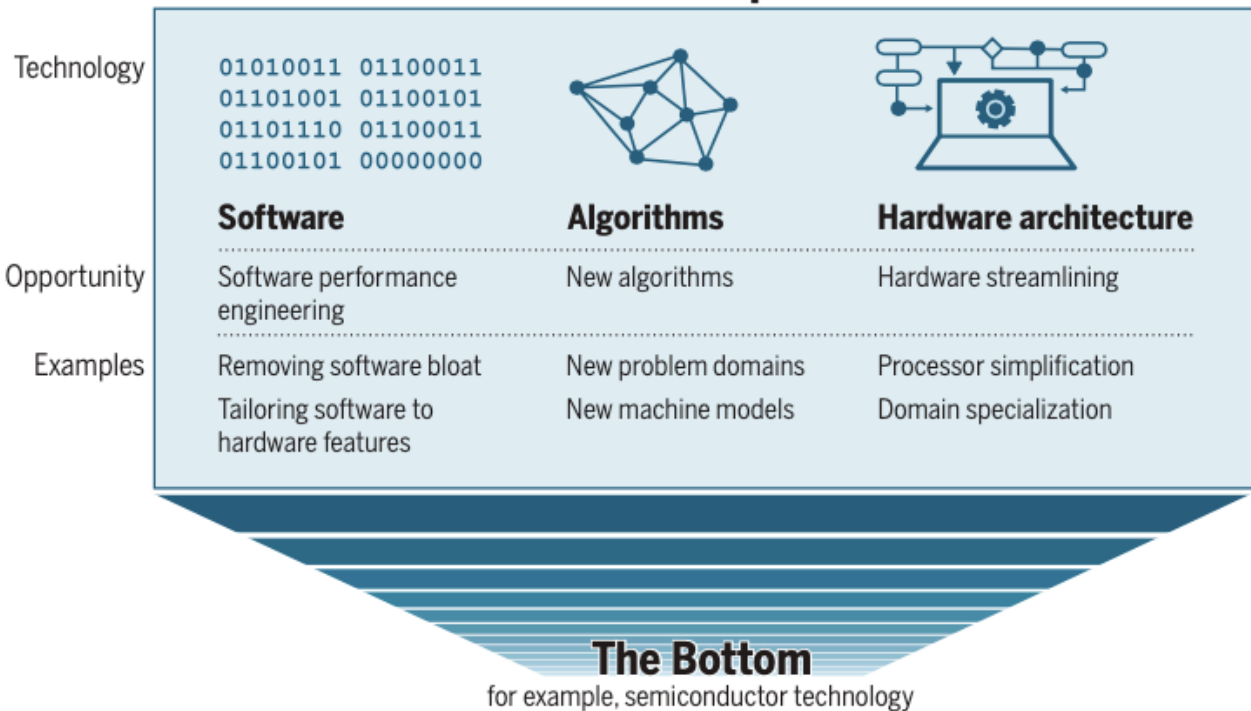
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2020 - ITU, GeSI, GSMA & SBTi set science-based pathway in line with Paris Agreement - ICT industry to reduce greenhouse gas emissions by 45 per cent by 2030

# How are we doing so far?



## The Top



**Performance gains after Moore's law ends.** In the post-Moore era, improvements in computing power will increasingly come from technologies at the "Top" of the computing stack, not from those at the "Bottom", reversing the historical trend.

# A model for thinking about digital sustainability - **CID**

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## **Consumption**

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# High carbon intensity

Mining coal, burning it to create steam, to turn turbines to generate electricity.

Typical carbon intensity:  
~ 1001g CO<sub>2</sub>eq / kWh





# Lower carbon intensity

Harvesting energy to generate power directly.

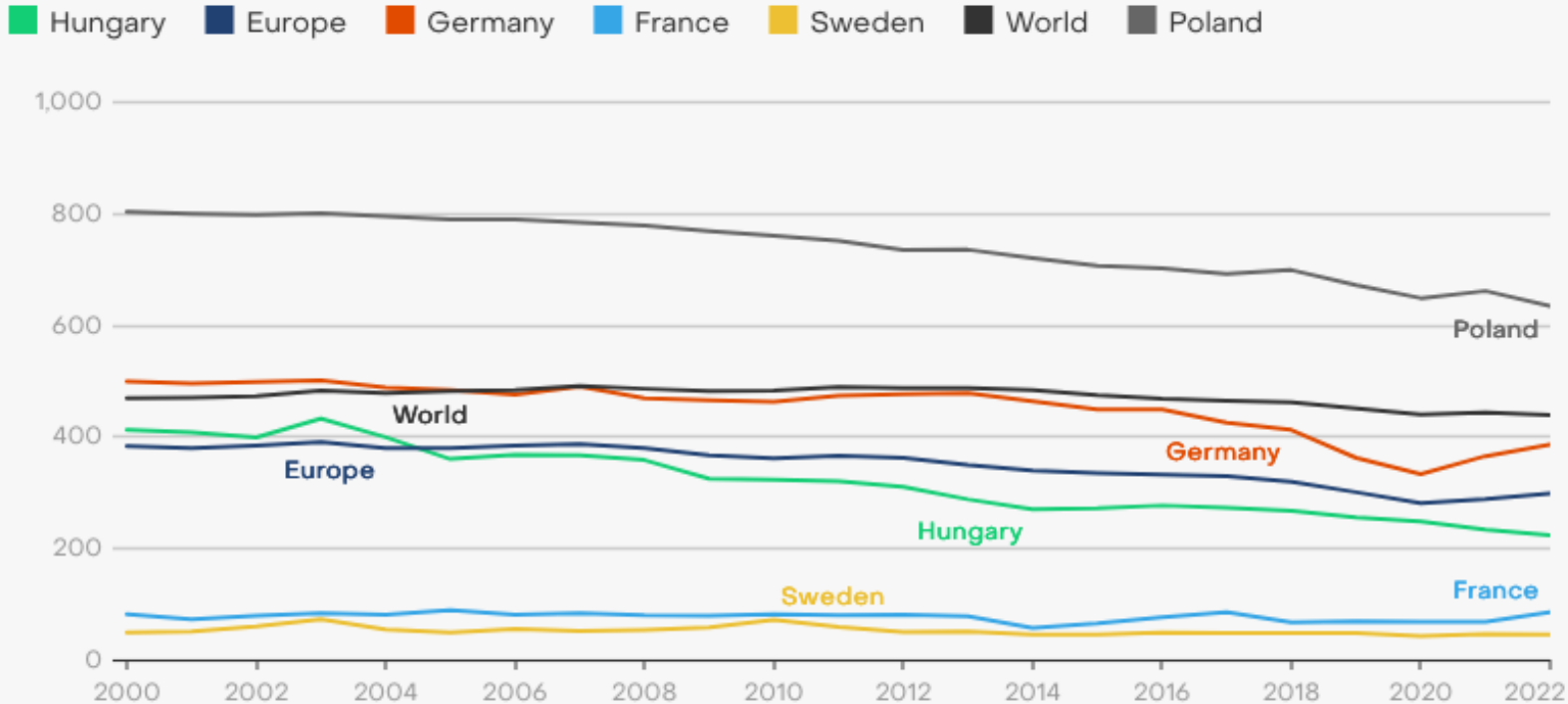
Typical carbon intensity:  
~ 57g CO<sub>2</sub>eq / kWh

Source: NREL: Life Cycle Emissions Factors for Electricity Generation Technologies



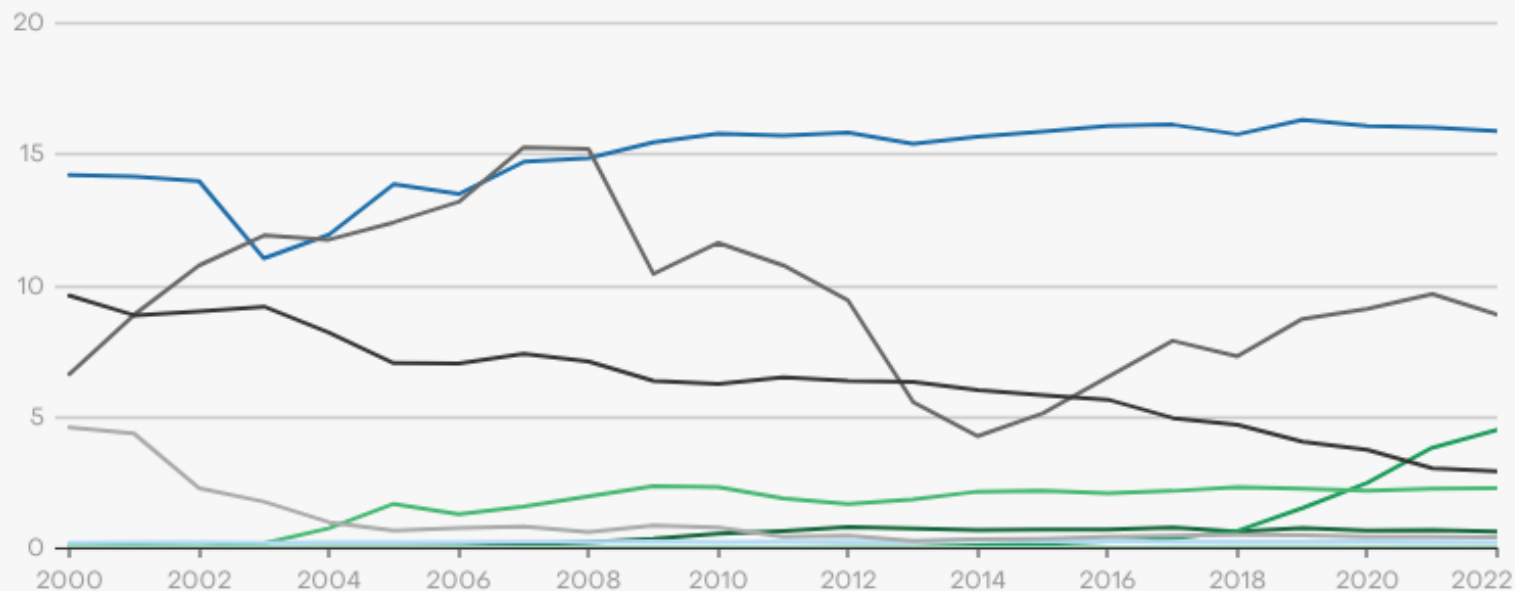
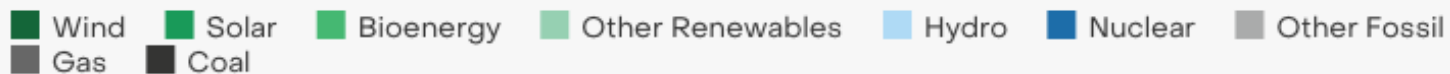
# Emissions intensity

gCO<sub>2</sub>e per kWh



# Hungary electricity generation by source

Terawatt hours



# A model for thinking about digital sustainability - **CID**

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## Consumption

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# Digital as a lever on climate

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Direct effect

Indirect effect

**Increase emissions**

Use more digital services, do more work

Induce polluting activity, invest in and support polluters

**Reduce emissions**

Use cleaner services, use digital more efficiently

Induce sustainable activity, fund carbon removal etc.

# Ride hailing as an example

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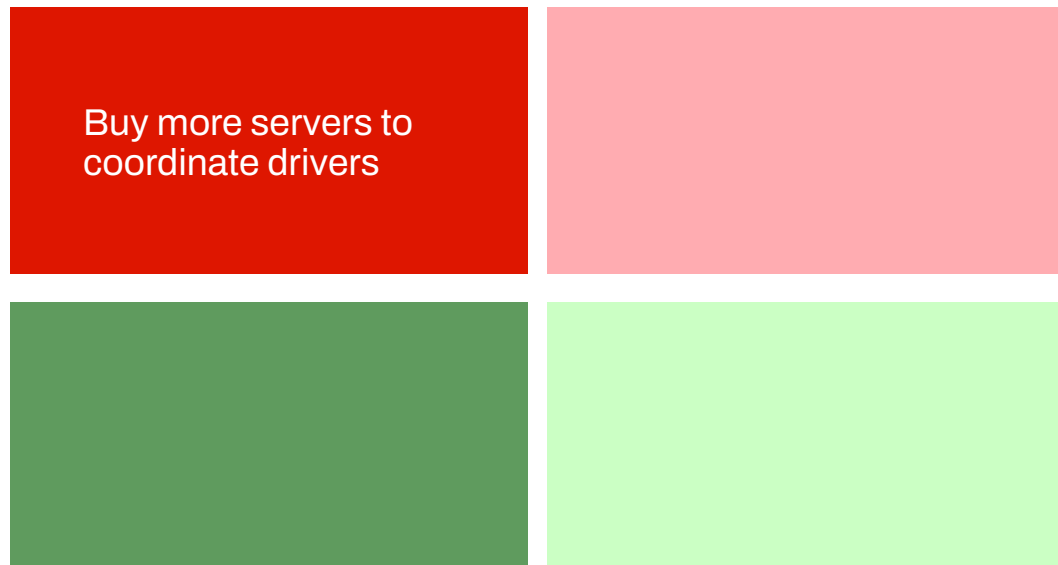
Direct effect

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Buy more servers to  
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# Ride hailing as an example

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Run servers on  
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# Ride hailing as an example

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Direct effect

Indirect effect

Increase  
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Buy more servers to  
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Reduce  
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Run servers on  
clean energy, use  
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techniques

Reduce need to own cars.  
Fewer cars need to be built.



# Ride hailing as an example

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## Direct effect

## Indirect effect

**Increase emissions**

Buy more servers to coordinate drivers

Cheap and convenient ride hailing means more miles driven in total.

Kills off alternatives to cars

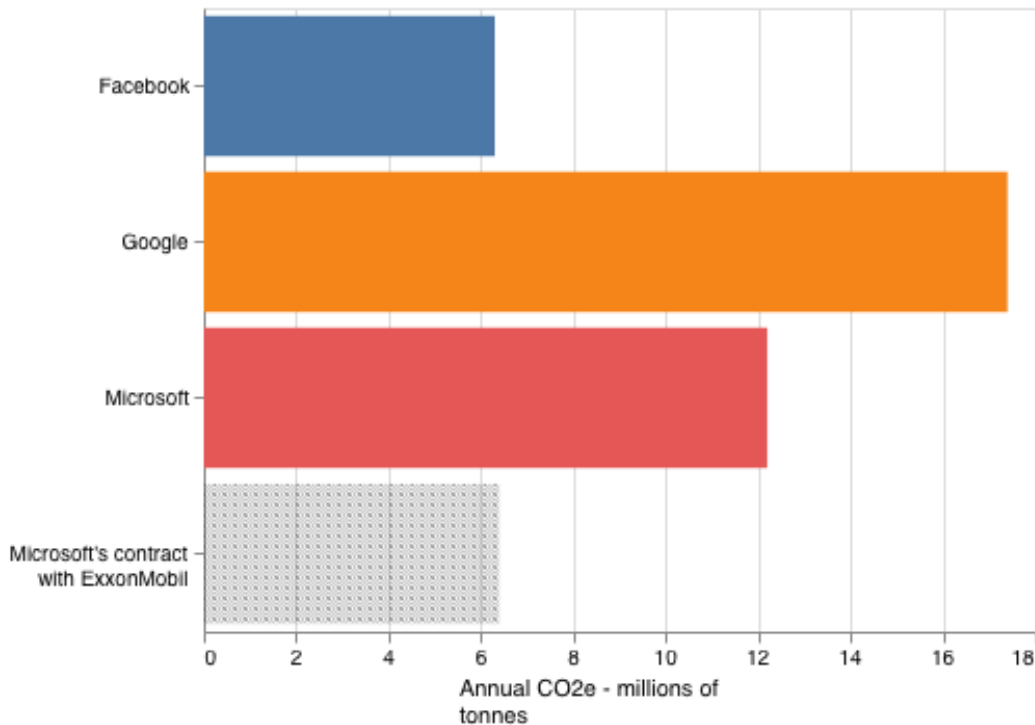
**Reduce emissions**

Run servers on clean energy, use greener coding techniques

Reduce need to own cars.  
Fewer cars need to be built.

## What's the carbon footprint of that oil and gas contract?

Reported corporate emissions for 2019, compared to estimated annual emissions from single oil and gas contract





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Using the framework  
to think about actions  
we might take

2

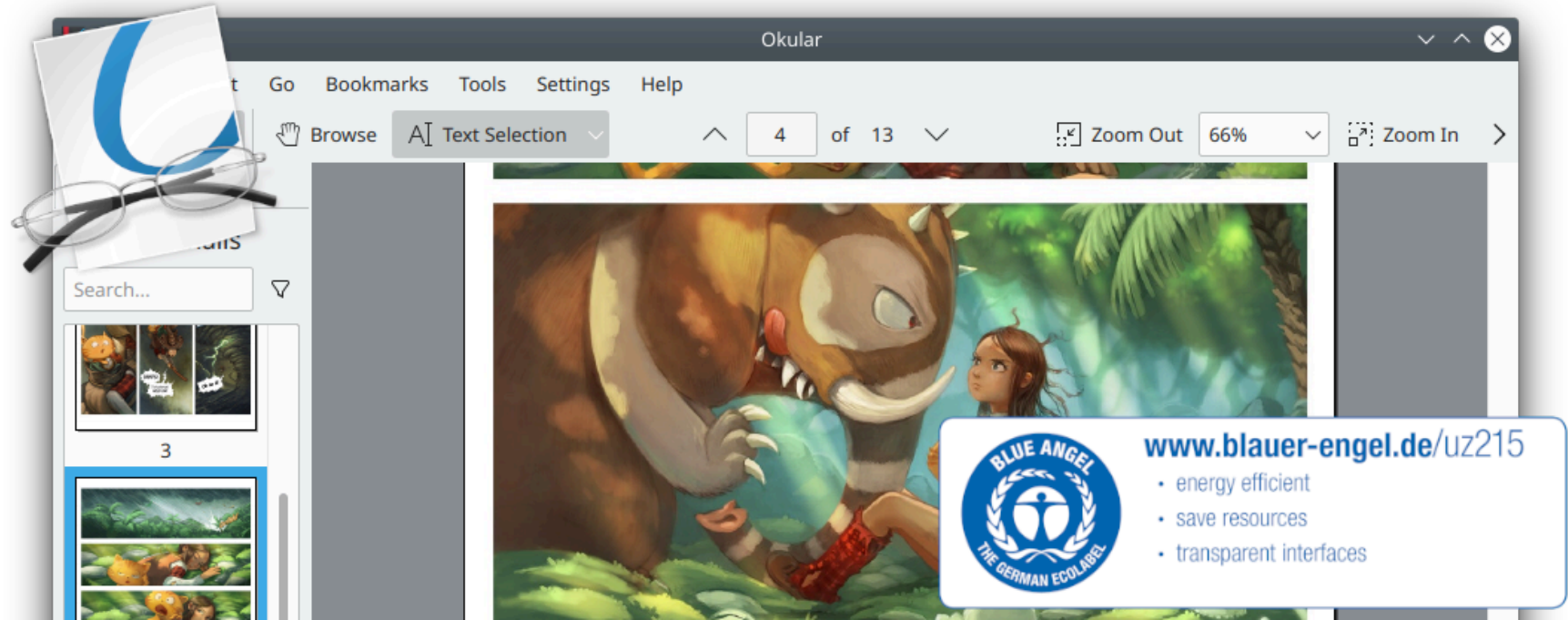


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# Consumption

Can I change how  
much we need?

# Emerging sustainable software standards



# Measuring carbon with CO2.js

We publish CO2.js, an open source software library to help make sustainability calculations transparent, consistent and compatible in software.





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# Intensity

Can I change how  
much harm is done?

# Common strategies for improving carbon intensity of digital services

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1. **spatial migration:** move workloads *through space* to where more clean energy is on the grid
2. **temporal migration:** move workloads *through time* to when more clean energy is on the grid





# Move work through space

The screenshot shows a web browser window with the URL <https://app.greenweb.org/directory/?services=&country=DE>. The page header includes the Green Web Foundation logo and the word "Directory". A "BETA" badge is visible in the top right corner, along with the text "Be kind, we're still in" and a link to "Previous Directory".

The main content area features a search section titled "I'm looking for". Under "Green web hosting service:", the "Platform: Managed Wordpress Hosting" dropdown is selected. Under "Country:", the "Hungary" dropdown is open, showing a list of countries including Germany, Heard Island and McDonald Islands, Holy See, Honduras, Hong Kong, Hungary (highlighted), Iceland, India, Indonesia, Iran, and Iraq.

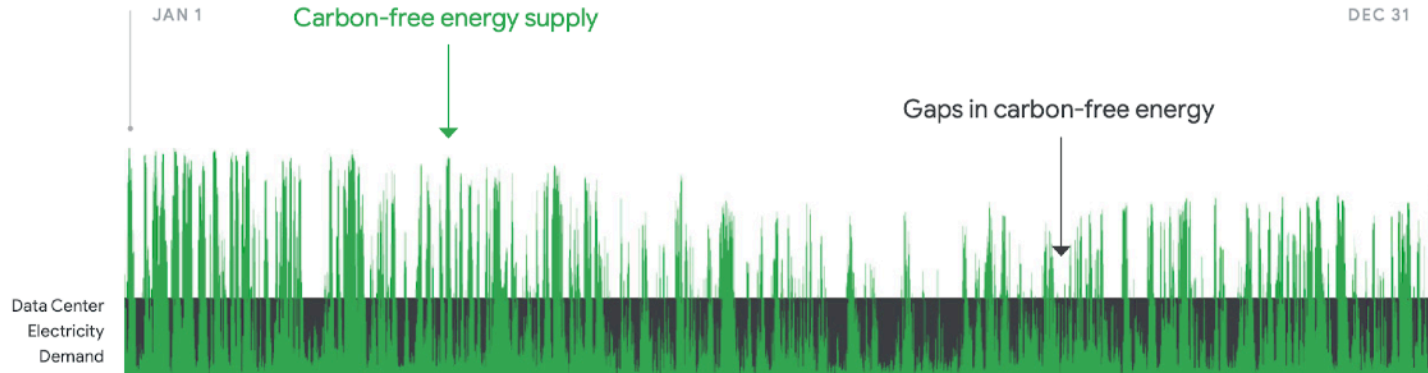
Below the search filters, there is a section titled "▼ MORE ABOUT THIS DIRECTORY ⓘ". The text reads: "The Green Web Directory is a searchable list which enables people to quickly find verified green hosting companies. These are organisations that offer hosting services and can demonstrate they are taking steps to avoid, reduce or offset the greenhouse gas emissions caused by using electricity to provide their services. To become verified they share evidence with us, Green Web Foundation, to show they're doing this on a yearly basis, or better. Verification is free."

# Green energy - annual vs hourly

FIG. 2

## Hourly carbon-free energy performance at an example data center

While Google buys large amounts of wind and solar power (symbolized by green spikes below), these resources are variable, meaning that our data centers still sometimes rely on carbon-based resources.



# Move work through time

If you know when energy is cleaner, then you can choose to charge things when the energy is cleaner too.

Apple do this with phones now, but you can do this with anything that uses electricity.





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# Direction

Can I change where  
we are headed?

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The Green Web Foundation is working towards a fossil-free internet by 2030.

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The internet should be a global public good—healthy for the planet and for the people who use it.

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# Ambitious corporate targets (cont)

Google Data Centers

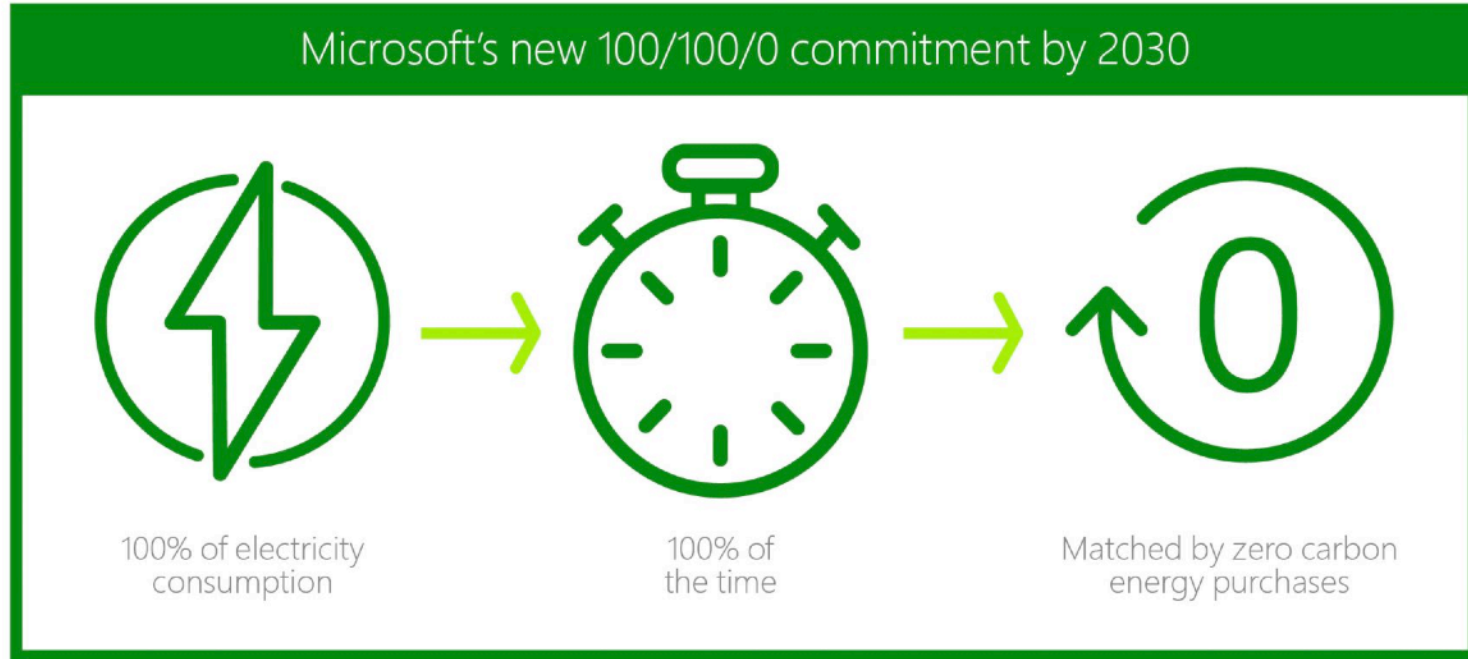


Locations Innovations Data and Security Efficiency **24/7 Clean Energy** Gallery Life@ Podcast Discover FAQ

## 24/7 Carbon-Free Energy by 2030

Over the past decade, Google purchased more renewable energy than any other company, based on cumulative renewable electricity purchased in megawatt-hours from 2012 to 2021. Now, as we enter our third decade of climate action, we're targeting our most ambitious sustainability goal to date: we intend to run on 24/7 carbon-free energy (CFE) – everywhere, at all times.. And we aim to do it by 2030.

# Ambitious corporate targets (cont)





# Building targets into your governance

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## OUR PATH TO 24/7 RENEWABLE ENERGY BY 2025



# Digital as a lever on climate

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**Direct effect**

**Indirect effect**

**Increase emissions**

Use more digital services, do more work

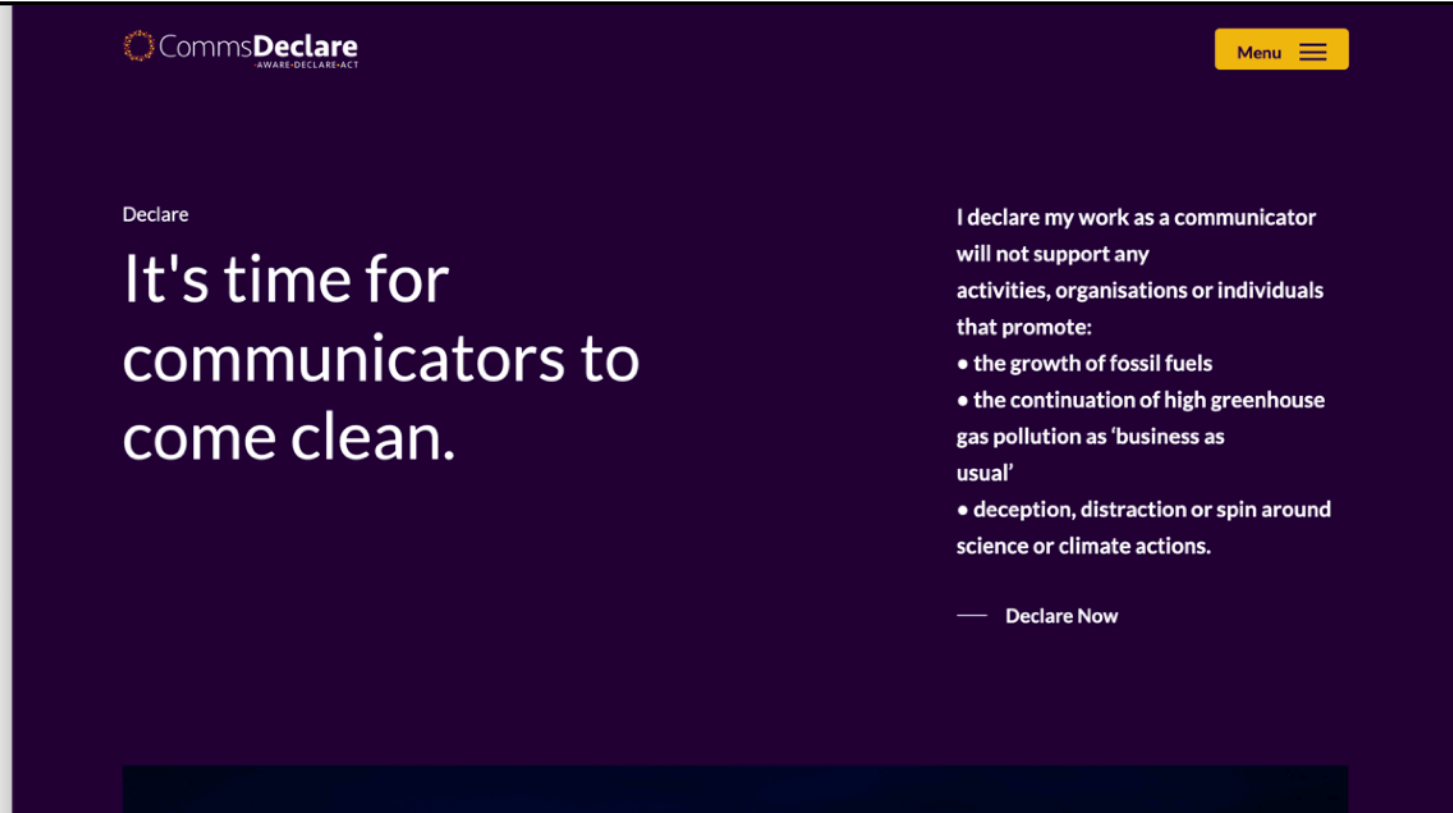
Induce polluting activity, invest in and support polluters

**Reduce emissions**

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# Publicly setting direction as a creative



The screenshot shows the CommsDeclare website interface. At the top left is the logo for CommsDeclare with the tagline 'AWARE-DECLARE-ACT'. At the top right is a yellow 'Menu' button with a hamburger icon. The main content area has a dark purple background. On the left, the word 'Declare' is written in small white text above a large white headline: 'It's time for communicators to come clean.' On the right, there is a white text block that reads: 'I declare my work as a communicator will not support any activities, organisations or individuals that promote:' followed by a bulleted list of three items: 'the growth of fossil fuels', 'the continuation of high greenhouse gas pollution as 'business as usual'', and 'deception, distraction or spin around science or climate actions.' Below the list is a white line and the text 'Declare Now'.

CommsDeclare  
AWARE-DECLARE-ACT

Menu

Declare

## It's time for communicators to come clean.

I declare my work as a communicator will not support any activities, organisations or individuals that promote:

- the growth of fossil fuels
- the continuation of high greenhouse gas pollution as 'business as usual'
- deception, distraction or spin around science or climate actions.

— Declare Now

# Sticks as well as carrots



F-List

## Polluter-friendly agencies

An agency is only as good as its clients. These agencies are helping companies involved in fossil fuels.

See the global 2023 F-list at [Clean Creatives](https://commsdeclare.org/declare/)

Exxon)

Anacta Strategies –

Glencore, Southern Oil

Atomic 212 – Origin,  
BHP

Atomix – Santos

Australian Public  
Affairs (Havas) –  
Santos, Imperial Oil  
and Gas

Barton Deakin (WPP) –  
Equinor, Nucoal,  
Santos, APA Group

Bastion – Alinta,  
Glencore, Australia Gas  
Industry Group

Jeanes **Menu** ☰

Associates – Victorian

Hydrogen & Ammonia  
Industries

JPG Advisory – NSW  
Minerals Council

JWS Research –  
APPEA, NSW Mining,  
Santos, Queensland  
Resources Council,  
Bravus, BHP, Minerals  
Council of Australia

Marketforce  
(Clemenger  
group/Omnicom) –  
Alinta

Marketforce North  
(Clemenger



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# RECAP

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# A model for thinking about digital sustainability - **CID**

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## **Consumption**

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# Finding a community to help you





# Thanks!

If you want know more: we publish open source code and open data in this field, and share our research on our blog and in open libraries in Zotero

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<https://www.thegreenwebfoundation.org/brand-festival-2023/>

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Chris Adams | [@mrchrissadams](https://twitter.com/mrchrissadams) / [@mrchrissadams@mastodon.social](https://mastodon.social/@mrchrissadams)

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[chris@thegreenwebfoundation.org](mailto:chris@thegreenwebfoundation.org)

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