Building digital services in a climate emergency

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

GREENWEBFOUNDATION.ORG

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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

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What we'll cover today

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

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?

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

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

Can we change this?

1

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

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

Consumption

Can I change how much we need?

Intensity

Can I change how much harm is done?

Direction

Can I change where we are headed?

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

Consumption	Intensity	Direction
Can I change how much we need?	Can I change how much harm is done?	Can I change where we are headed?

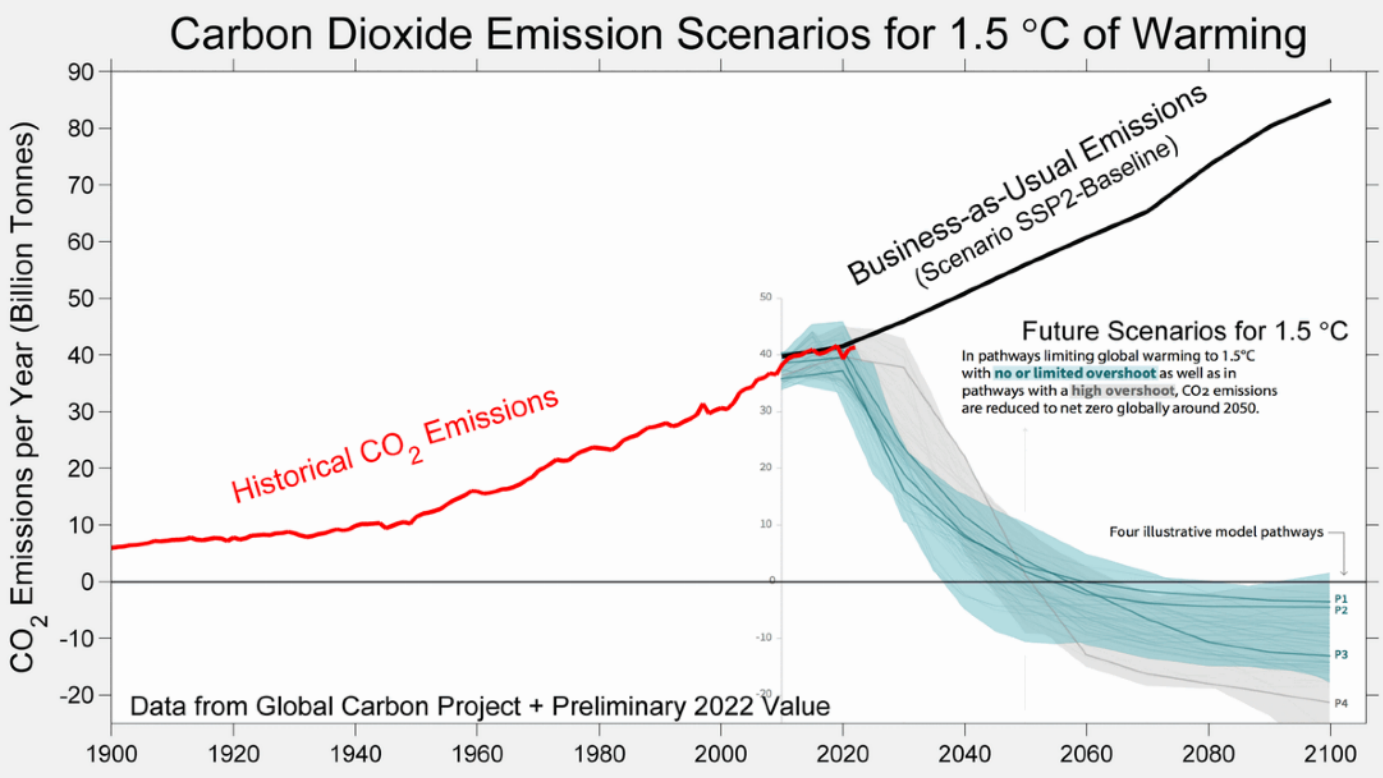


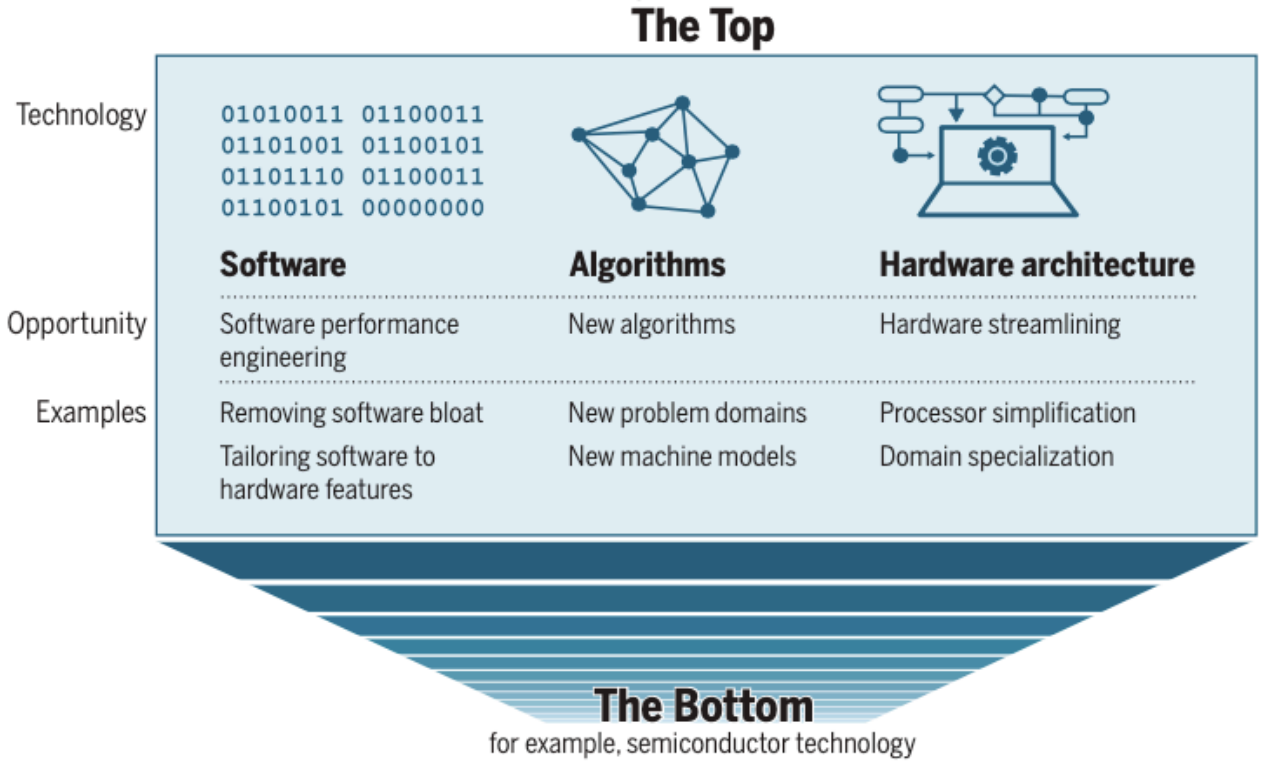
Image: Dr. Robert Rohde / Data: Global Carbon Project & IPCC

> 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

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?

	2015	2021	Change
Internet users	3 billion	4.9 billion	+ 60 %
Internet traffic	0.6 ZB	3.4 ZB	+ 440 %
Data centre workloads	180 million	650million	+ 260 %
Data centre energy use (excluding crypto)	200 TWh	220 - 320 TWh	+ 10-60%
Crypto mining energy use	4 TWh	100 - 140 TWh	+ 2,300 - 3,300%
Data transmission network energy use	220 TWh	260 - 340 TWh	+ 20 - 60%



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**

Consumption	**Intensity**	Direction
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High carbon intensity

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

Typical carbon intensity:

~ 1001g CO2eq / KWh

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

Lower carbon intensity

Harvesting energy to generate power directly.

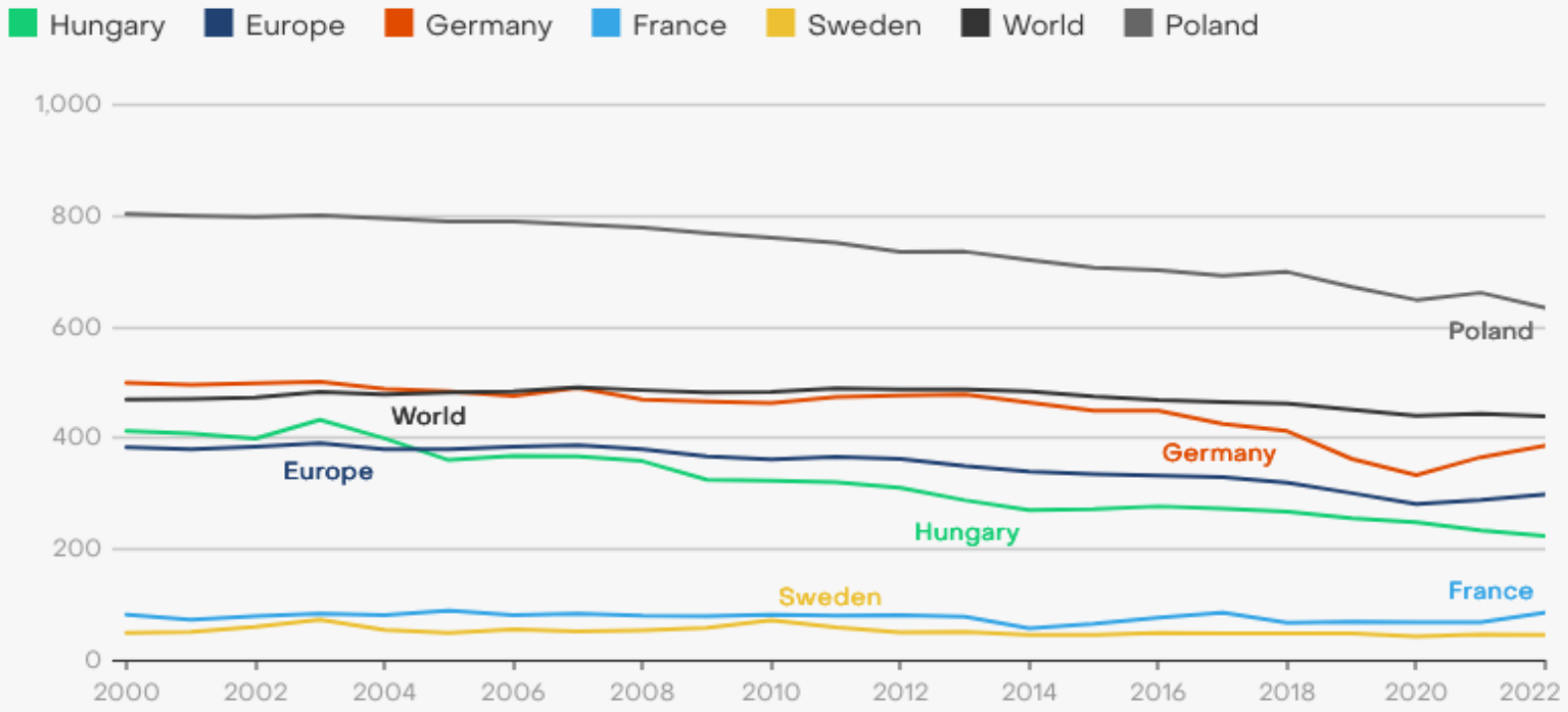
Typical carbon intensity:

~ 57g CO2eq / KWh

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

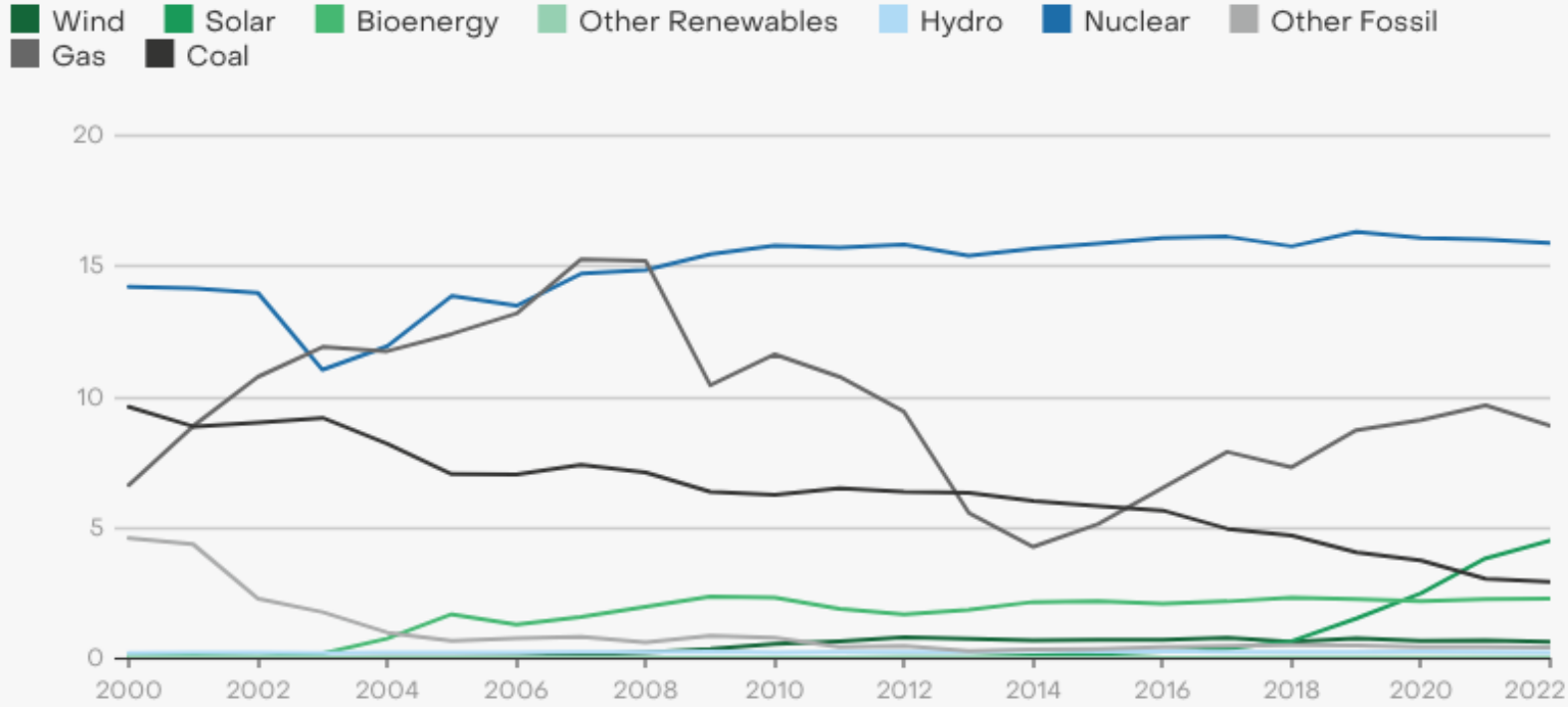
Emissions intensity

gCO2e per kWh



Hungary electricity generation by source

Terawatt hours



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

Consumption	Intensity	**Direction**
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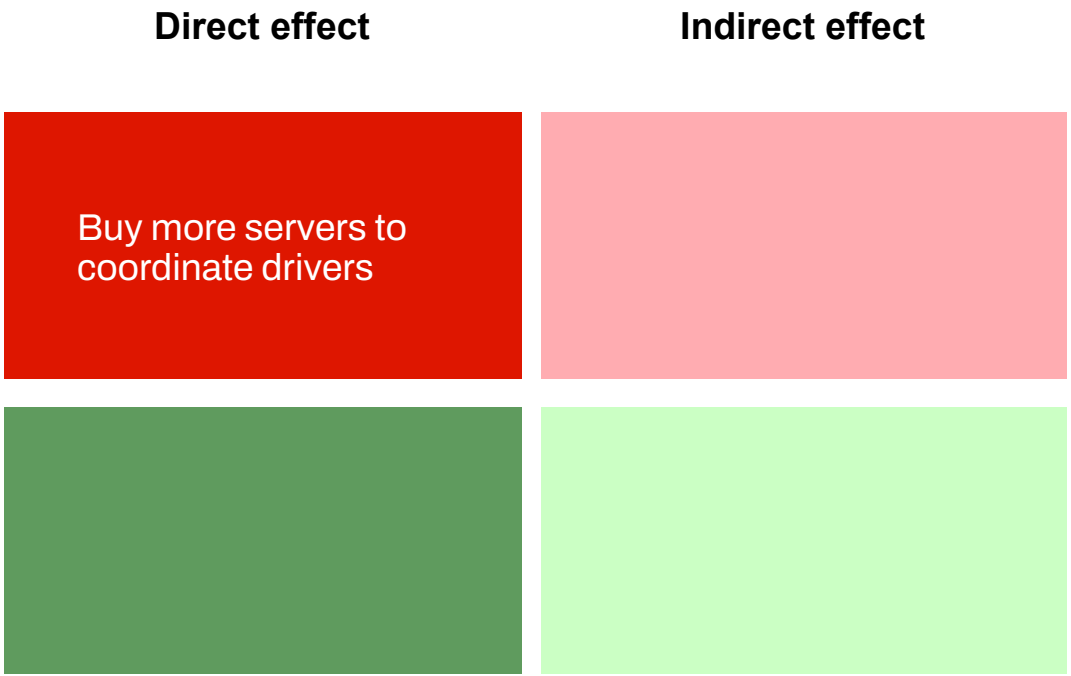
Digital as a lever on climate

	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.

Source: Original paper - Assessing Energy and Climate Effects of Digitalization: Methodological Challenges and Key Recommendations

Ride hailing as an example



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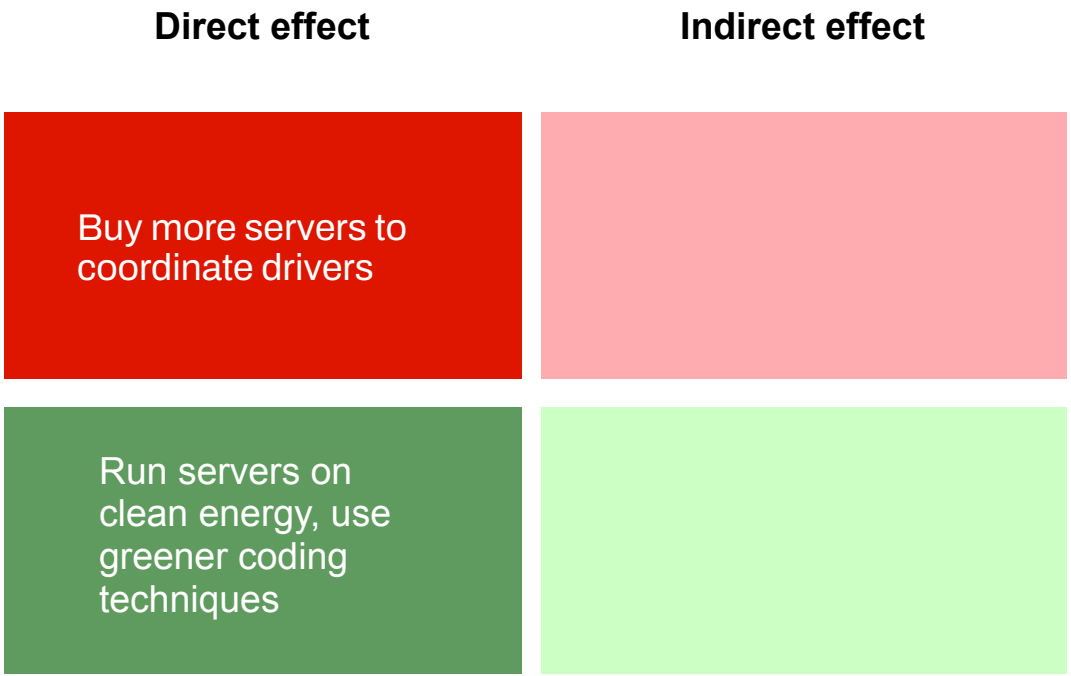

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Ride hailing as an example

	Direct effect	Indirect effect
Increase emissions	Buy more servers to coordinate drivers	
Reduce emissions	Run servers on clean energy, use greener coding techniques	Reduce need to own cars. Fewer cars need to be built.

Source: Original paper - Assessing Energy and Climate Effects of Digitalization: Methodological Challenges and Key Recommendations

Ride hailing as an example

	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.

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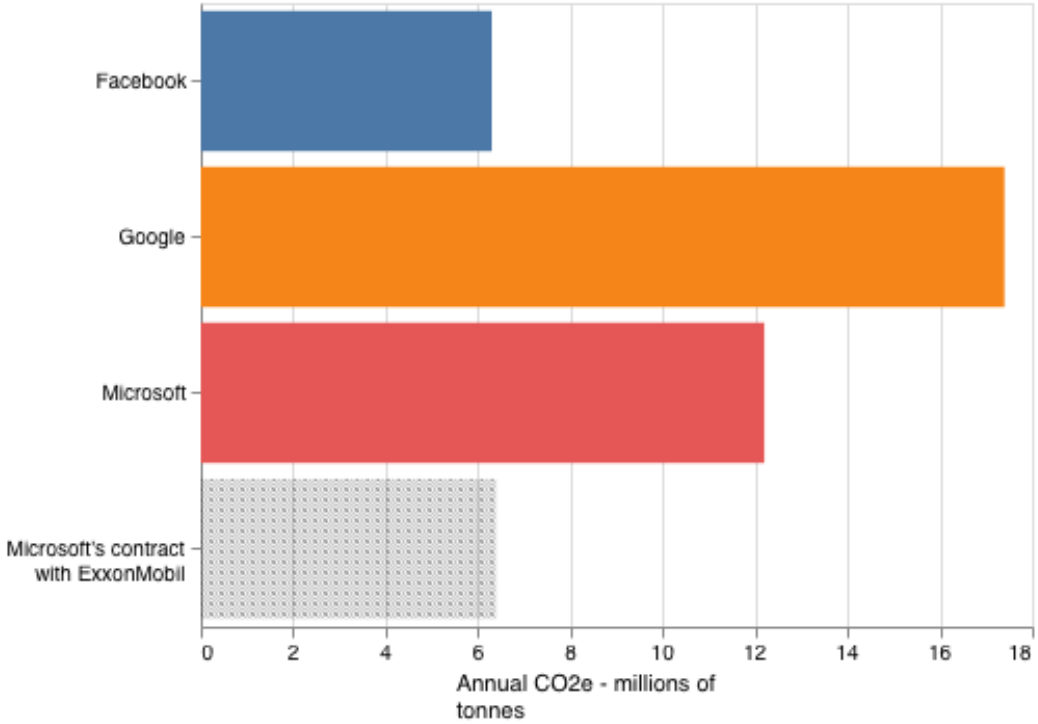
What's the carbon footprint of that oil and gas contract?

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



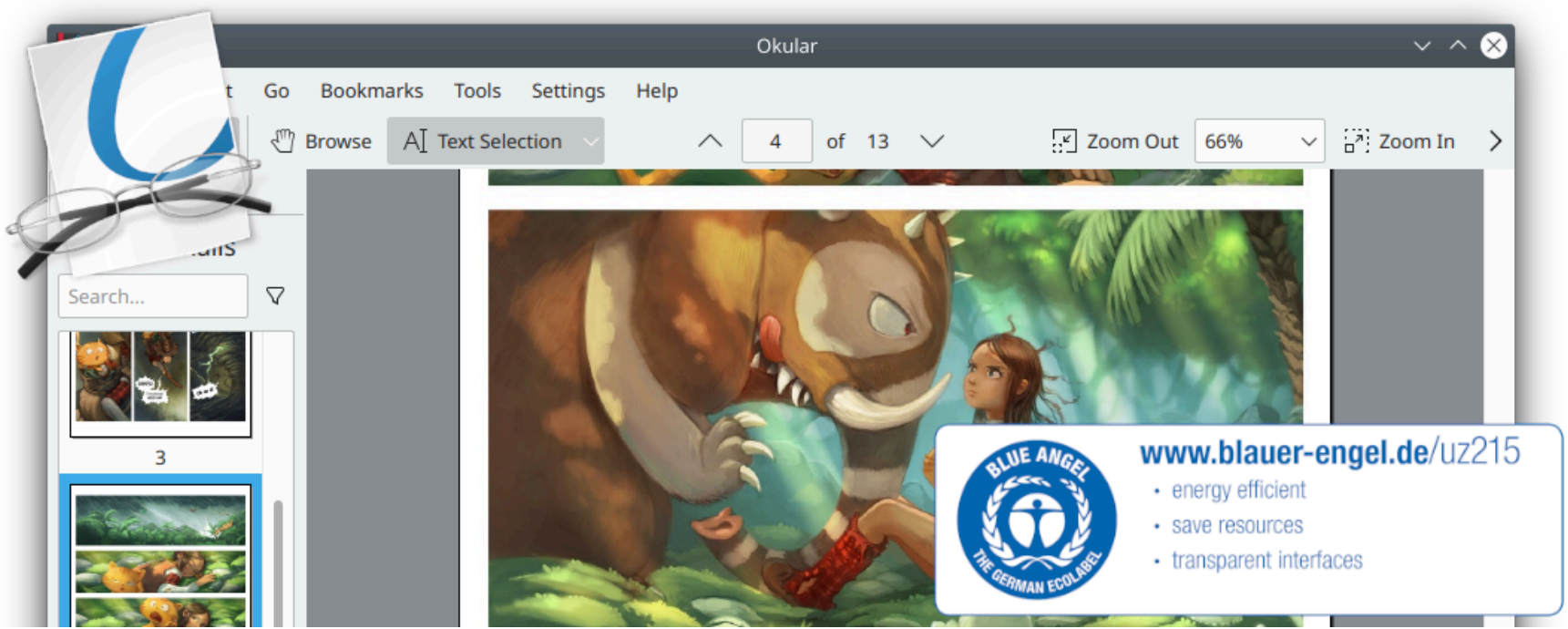
Using the framework to think about actions we might take

2

Consumption

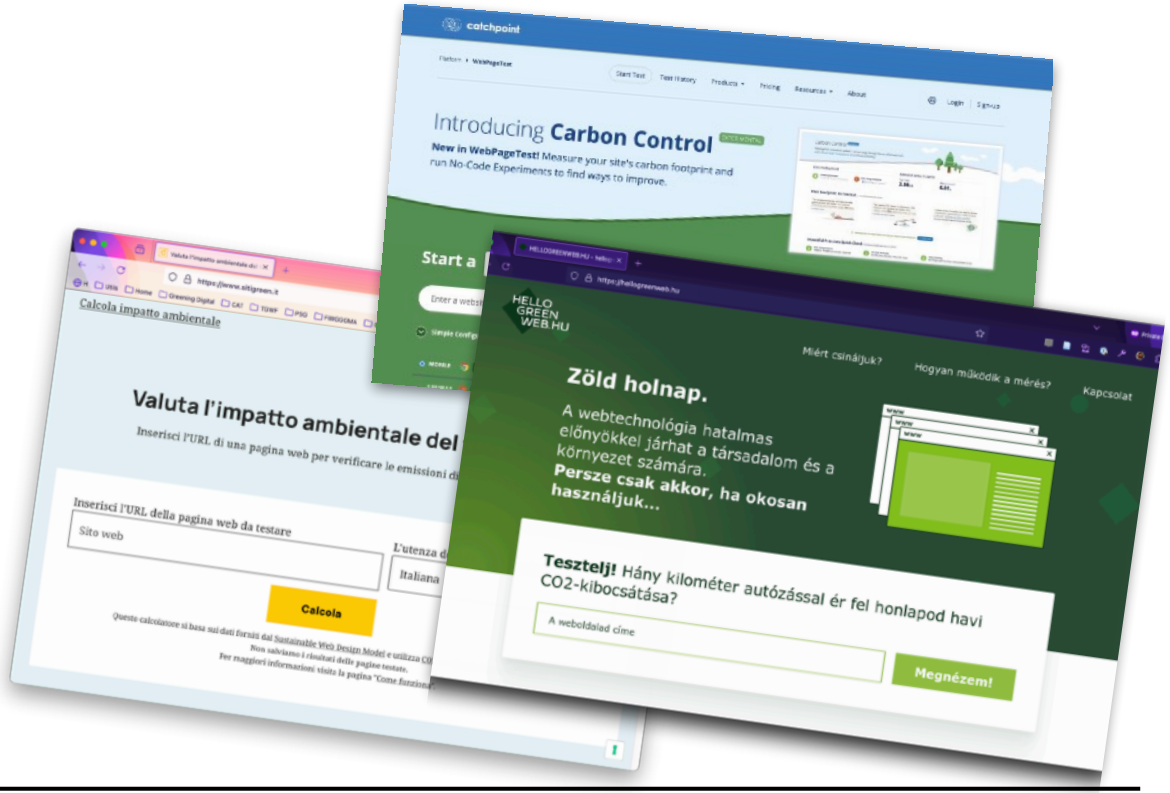
Can I change how much we need?

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.

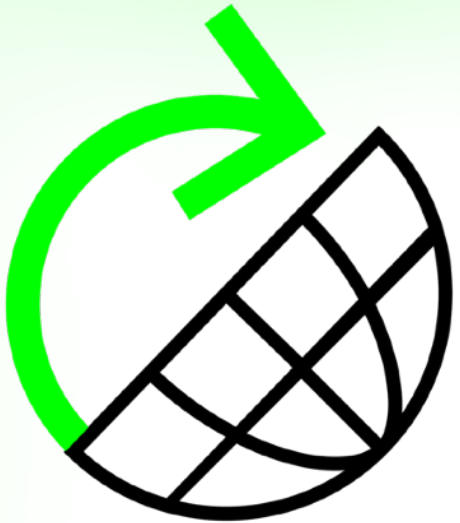


Intensity

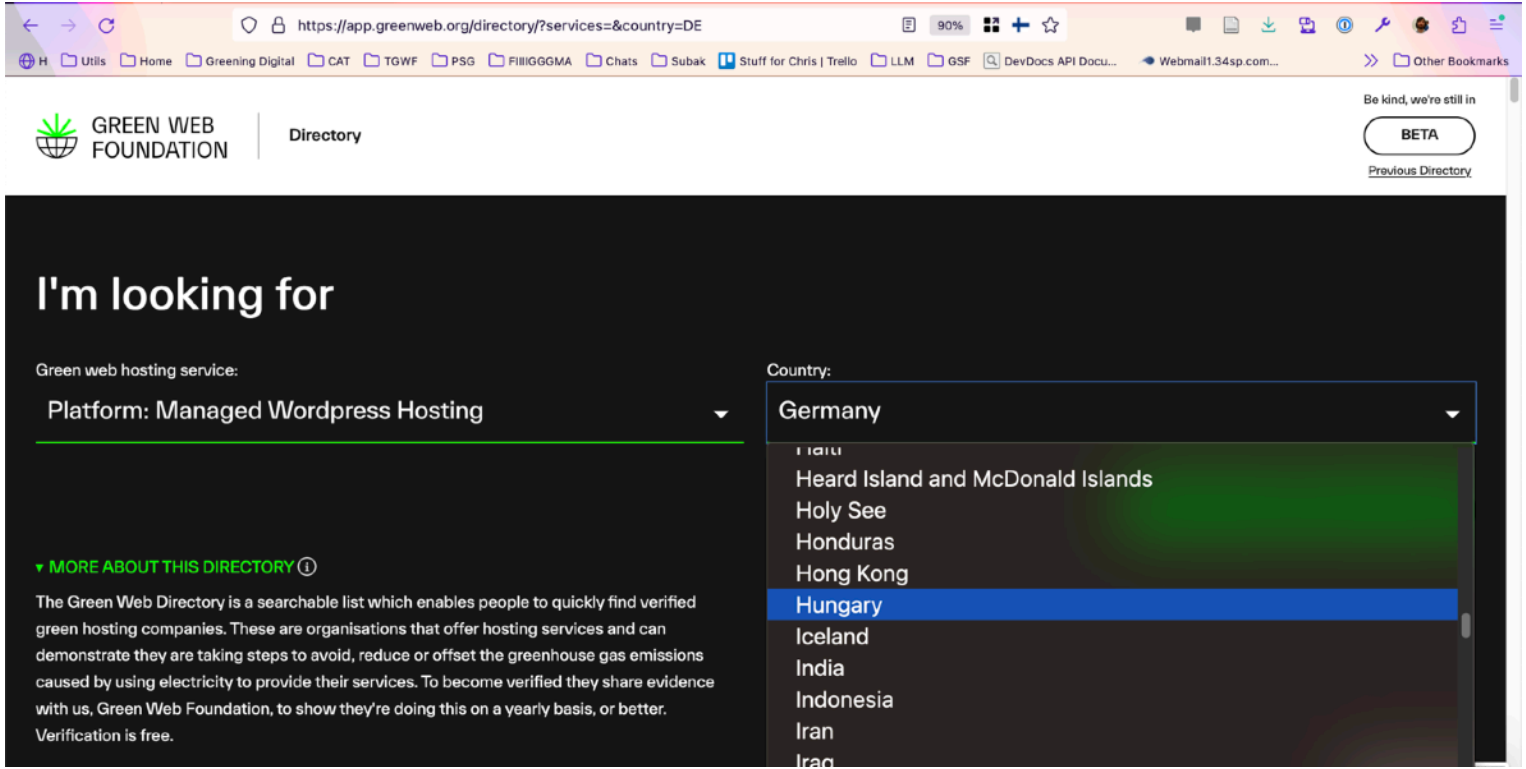
Can I change how much harm is done?

Common strategies for improving carbon intensity of digital services

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

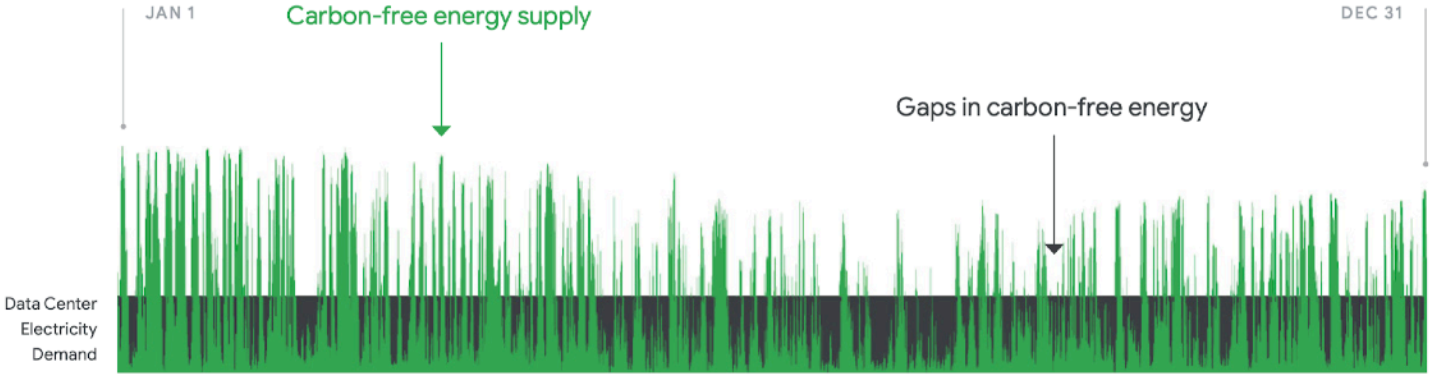


Green energy - annual vs hourly

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.

Direction

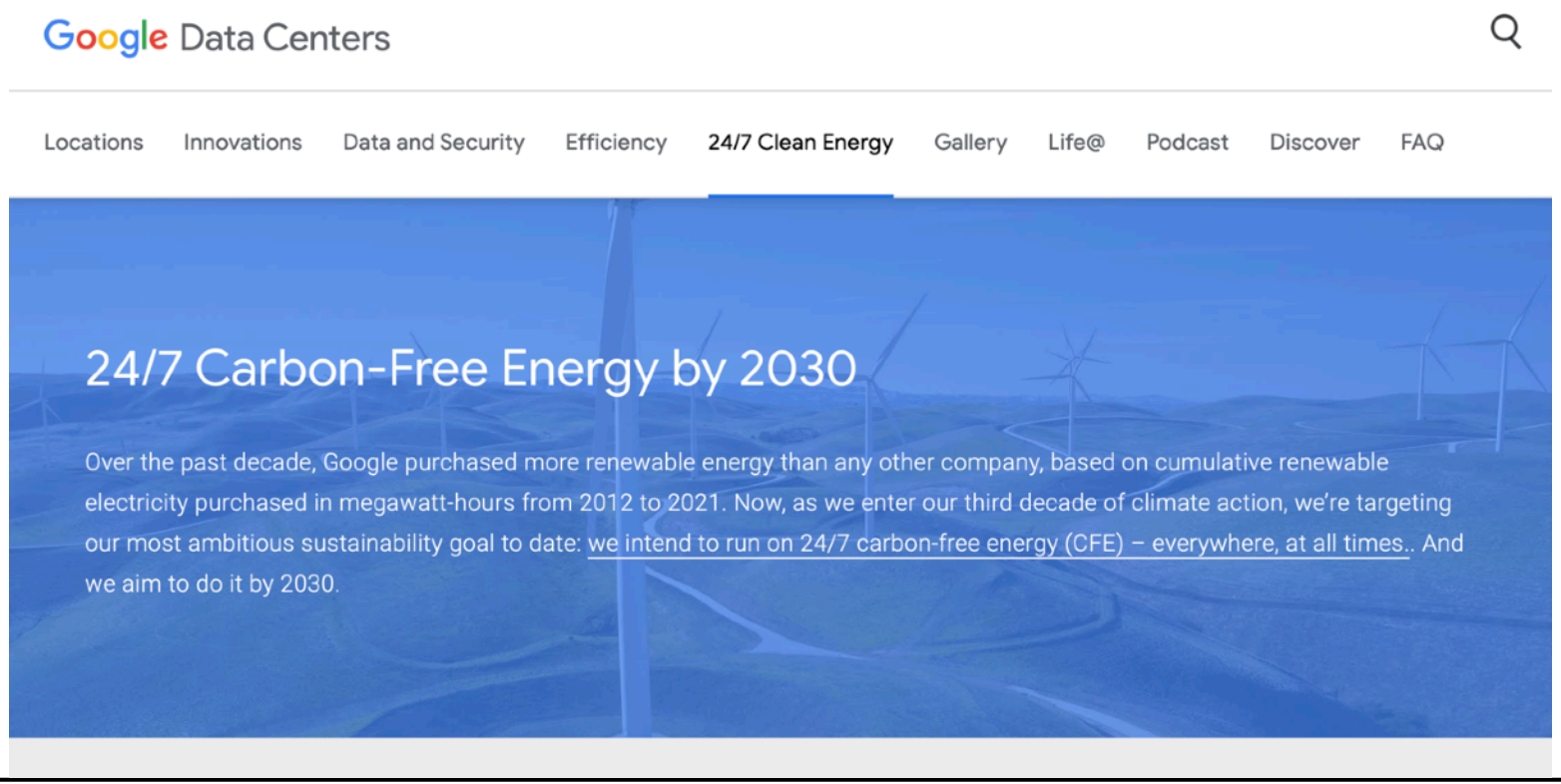
Can I change where we are headed?

“

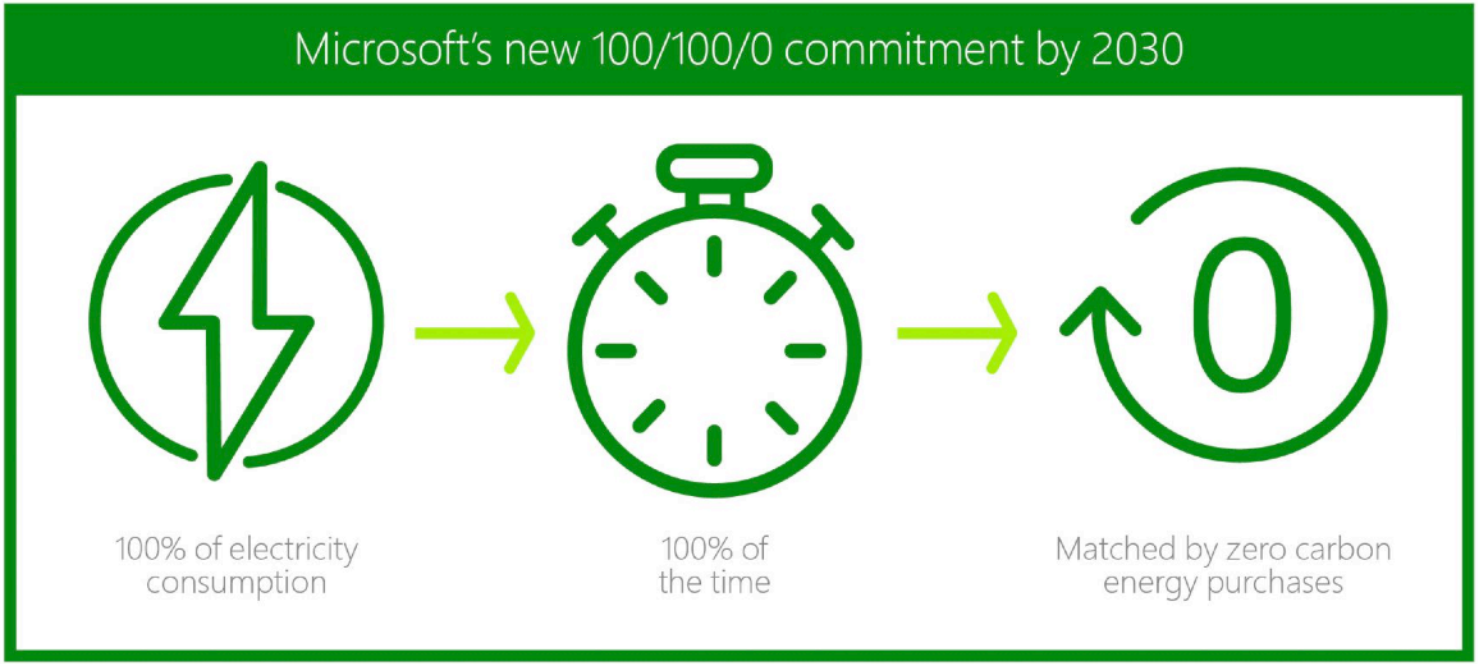
The Green Web Foundation is working towards a fossil-free internet by 2030.

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

Ambitious corporate targets (cont)



Ambitious corporate targets (cont)



Building targets into your governance

Source: https://www.peninsulacleanenergy.com/wp-content/uploads/2021/11/Whitepaper-OUR-PATH-TO-247-RENEWABLE-ENERGY-BY-2025.pdf

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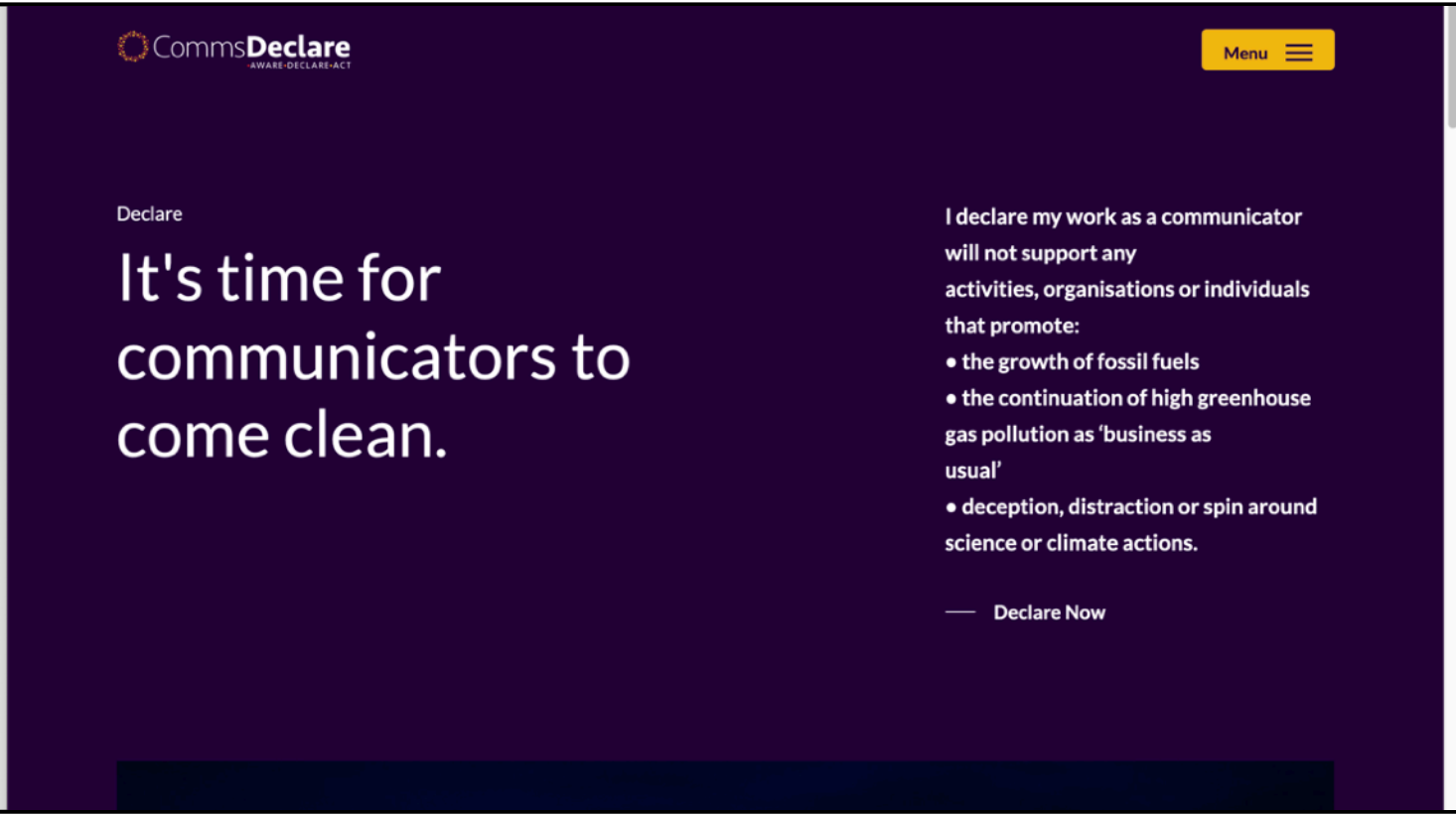
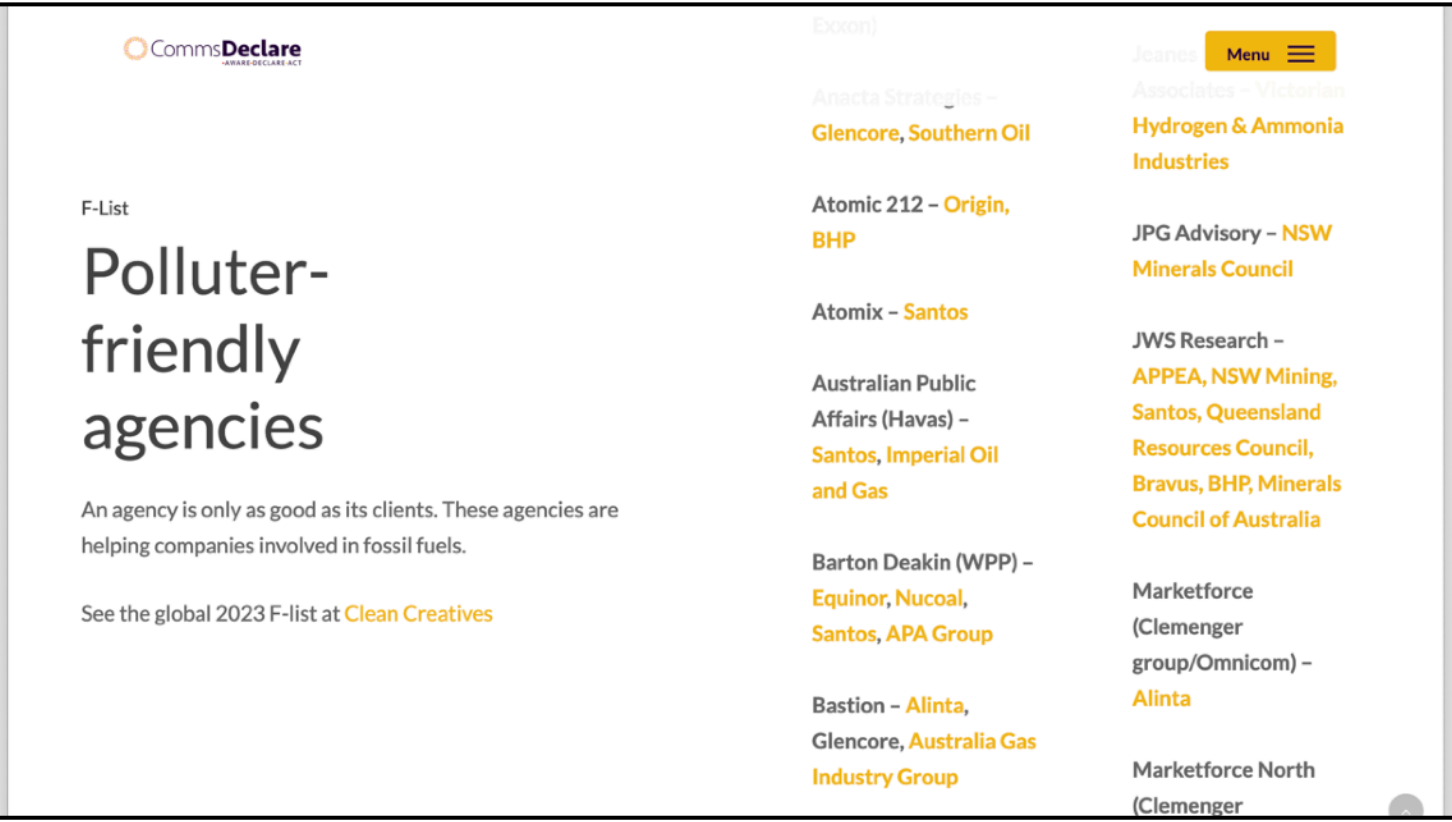
Publicly setting direction as a creative



Source: https://commsdeclare.org/declare/

Sticks as well as carrots



CommsDeclare
-AWARE-DECLARE-ACT

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

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

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

Source: https://commsdeclare.org/declare/

RECAP

4

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

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Finding a community to help you

Climate Action .tech

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

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

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