Building the Web in a Climate Emergency

Chris Adams, The Green Web Foundation
thegreenwebfoundation.org/frontconference

Front Conference 2021 - @mrchrisadams

Hi!
I'm Chris.

Co-director, The Green Web Foundation
Organiser, ClimateAction.tech
Co-Editor, Branch Magazine

thegreenwebfoundation.org/frontconference

Front Conference 2021 - @mrchrisadams

Hello there, Front conference. Thank you for having me here in Zurich.

As the slide suggests, my name is Chris, and I am one of the directors of the green web foundation, an NGO that exists to work towards an entirely fossil free internet by 2030.

I've spent the last 15 years working for a string of wacky environmental data themed startups, and the last three years helping run an online community, climateAction.tech. Which, as the name also suggests, is a community for climateAction amongst techies.

I'll try my best to talk clearly and slowly in the time I have with you, but if you miss anything I see, this deck should also be online at the link you see on the screen now, with a full transcript of what I say today.

What we'll cover together...

1. We're in a Climate Emergency
2. What we can do as web technologists
3. GOLD - a way to think about greening tech

Front Conference 2021 - @mrchrisadams

In the limited time I have with you, I'm going to try to cover these three topics.

We'll spend a bit of time talking about climate emergencies, how we got here, and how to handle the mental toll that being in one can have.

Next we'll talk about some of the levers we have as professionally mobile technologists.

Finally, because I don't always get to speak to an audience this knowledgeable, I want to ask for your help refining a model I am developing to integrate an awareness of climate into our work.

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Are you sitting comfortably? OK, off we go!

Climate Science 101

Professor Kimberley Nichols
@KA_Nicholas

bit.ly/climate-science-101

Front Conference 2021 - @mrchrisadams

1. It's warming.
2. It's us.
3. We're sure.
4. It's bad.
5. We can fix it.

OK, this is your first tweetable slide.

I'm not sure if we still take photos of slides at conferences, because it's been ages since I've been to an actual conference. But the link you see here is to a thread on twitter from Professor Kimberley Nicholas, an actual climate scientist who I really respect. If you follow the link, you'll see a thread explaining this mantra point by point, with a boatload of references. I also finished her book yesterday which I can highly recommend.

Ayway, I'm sharing this as a TLDR with you, because previously when I'd give talks about the state of the climate, I'd usually spend a bunch of time trying to explain that climate is a problem, and show a bunch of stats and numbers. These days, you only need to turn on the news to see these climate impacts, like the sea being on fire, or videos about towns being washed away in climate related floods. These are spectacular, but not so useful for action. So I'll hope you'll be ok with me sharing this mantra instead.

The earth is warming.
Yes, it's us.
Yes, we're sure.
Yes, it's bad.
BUT we can fix it.

A model to help you work through it

1	2	3	4	5
Ignorance	Avoidance	Doom	All the feels	Purpose

It's warming.   It's us.   We're sure.   It's bad.   We can fix it.

"Radical Climate Acceptance" by Professor Kimberley Nicholas - @KA_Nicholas

In addition, I've found this model she shares really helpful for how we internalise news about our changing climate.

Has anyone here heard of the 5 cycles of grief before, when you hear bad news? Y'know... denial, bargaining, anger, depression, acceptance?

This is a little bit like that. Engaging with the subject of our changing climate can be emotionally exhausting. But knowing there's a process people work through, and stages you might recognise you're in, or see others in is useful.

A model to help you work through it

1	2	3	4	5
Ignorance	Avoidance	Doom	All the feels	Purpose

It's warming.   It's us.   We're sure.

It's bad.

We can fix it.

"Radical Climate Acceptance" by Professor Kimberley Nicholas - @KA_Nicholas

We might start with ignorance around the subject. There are various valid reasons this might be the case – not least because historically, climate has been a subject that's been really poorly covered in the media.

A model to help you work through it

1	2	3	4	5
Ignorance	**Avoidance**	Doom	All the feels	Purpose

It's warming.   It's us.   We're sure.   It's bad.   We can fix it.

"Radical Climate Acceptance" by Professor Kimberley Nicholas - @KA_Nicholas

Next, when we have learned more about the changes, we might find them uncomfortable and distressing to think about. A lot of us might resort to avoidance. We might avoid talking about it with others, especially at work or family gatherings.

A model to help you work through it

1	2	**3**	4	5
Ignorance	Avoidance	**Doom**	All the feels	Purpose

It's warming.   It's us.   We're sure.   It's bad.   We can fix it.

"Radical Climate Acceptance" by Professor Kimberley Nicholas - @KA_Nicholas

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Next, when we do learn more, it's easy to slip into a pretty depressed state, doom:

"oh jeez, we're done for. Why even try to change anything? Let's just make the most of the time we DO have".

While I can see how we get into this state, it's important to understand that is a form of denial and retreat.
Broadly speaking, only certain groups, who are often white, and in the global north, get to be all OK DOOMER about climate, while not being all that exposed to the climate crisis like this.
There are so many people who are exposed to these impacts already, and are still managing to keep doing their best to help each other, and find time to act on climate. I think that's a better example to look to, if they can do it, and they're already having a harder time than me, then it makes me think I can put time and effort into acting on climate too.

A model to help you work through it

| 1 Ignorance | 2 Avoidance | 3 Doom | **4 All the feels** | 5 Purpose |

It's warming. It's us. We're sure.   It's bad.   We can fix it.

"Radical Climate Acceptance" by Professor Kimberley Nicholas - @KA_Nicholas

With help and support from others, you might get through to the next stage – all the feels.

How do I talk to children about this? What kind of changes would we need to face the scale of the challenges before me? There's so much to question! What kind of society do I dare hope for now? Does what I am learning about climate mean I am bad person?

This is a pretty overwhelming stage, and we're not really taught how to navigate this kind of uncertainty. I think it takes some bravery to face it all.

It's important to realise this as you go through this whole process - you don't need to be perfect to starting acting or even engaging with the subject, but you do need to be brave.

A model to help you work through it

1	2	3	4	5
Ignorance	Avoidance	Doom	All the feels	**Purpose**

It's warming.   It's us.   We're sure.   It's bad.   We can fix it.

"Radical Climate Acceptance" by Professor Kimberley Nicholas - @KA_Nicholas

This all the feels step eventually gives way to purpose. You learn to harness the emotions you have, and you see the need for action. You decide to sound the alarm, and do something.

We are in a climate emergency.

1940 jurisdictions, and local governments, covering 826 million people have declared climate emergencies so far.
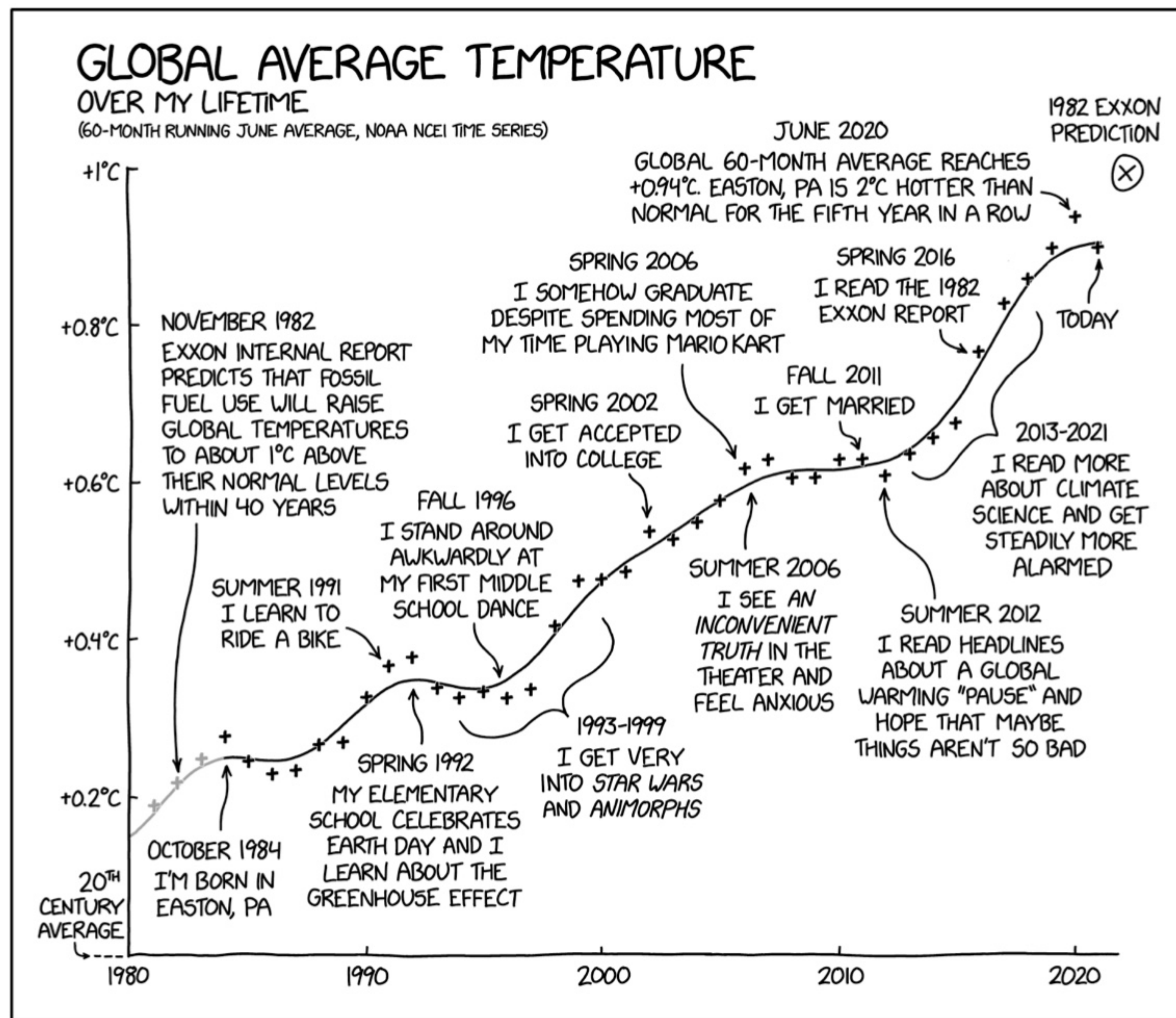
When you get here, you'll find you're in good company. Hundreds of governments, cities and companies are sounding the alarm, and declaring climate emergencies, and starting to act. You're not alone.

We are in a climate emergency. largely because we keep burning fossil fuels, instead of finding a path off them.

It's important to know that one of the reasons we're in an emergency, that we often forget, is that we're here because we keep burning fossil fuels, instead of finding a way off.

This isn't an accident.

GLOBAL AVERAGE TEMPERATURE
OVER MY LIFETIME
(60-MONTH RUNNING JUNE AVERAGE, NOAA NCEI TIME SERIES)

What's a tech conference without an XKCD cartoon these days?
This was released recently, and it's helpful for understanding this "not an accident" point.
Some groups have known about climate change for absolutely ages - longer than many of us have been alive. Check the date to the left of this chart, and then check the prediction one the top right.
Some groups have decided that it's better for business to delay action on climate, and sow doubt and uncertainty over the decades instead.

XKCD cartoon: https://xkcd.com/2500/

Keith McCoy, Senior Director, Federal Relations, Exxonmobil

This hasn't stopped. Earlier this year, Greenpeace caught out a senior employee at Exxon Mobil, posing as a group looking to hire him as a lobbyist. They basically ended up with an hour long, speed confession in high definition on a recorded zoom call, where he explained a bunch of the tactics they use, and what impact they've had. He even ended up on camera talking about what they're doing right now, in 2021 to sabotage the political process and slow down action.

OK, quiz time. I won't try a playing this video, but what do you think the answer is to this rhetorical question here?

Did they aggressively fight against some of the science on climate?

For more, I'd really recommend the climate town channel, and the recent video about this - it's funny, informative and definitely worth your time.

Climate Town Video: https://www.youtube.com/watch?v=Evy2EgoveuE

Predatory Delay

"the blocking or slowing of needed change, in order to make money off unsustainable, unjust systems in the meantime."

Alex Steffen

There's a useful term for this kind of activity – a bit like how dark patterns became a useful term to talk about bad UX practices that work against the interests of our users, Predatory Delay is a term to describe this behaviour.

The blocking of slowing of needed in change, to make money off unsustainable, in just systems in the meantime.
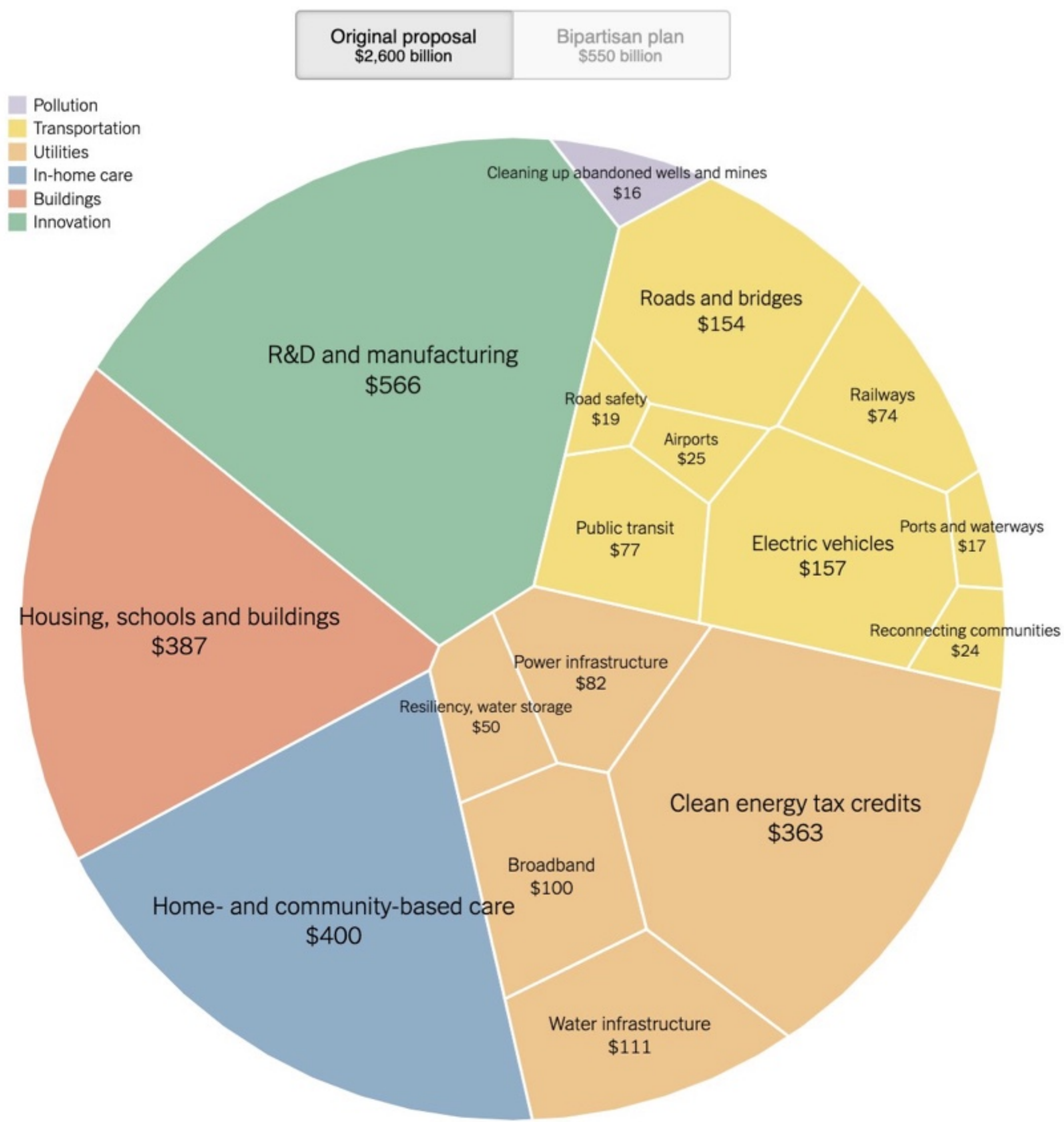
New York times - The Infrastructure Plan: What's In and What's Out

Predatory delay is what does this to climate Action. Earlier this year, the US government was going to pass a historic infrastructure bill. It was going to fund loads of investment in areas key for climate action. These would be good for humanity, but bad for fossil fuel companies.

Almost 2.6 trillion dollars of funding for investment, research and development, and in general help to move to clean energy was proposed.

But after loads of aggressive lobbying, well... what you see on the right gives an idea of what predatory delay looks like in the political process.

New York Times - What's in and what's out:
https://www.nytimes.com/interactive/2021/07/28/upshot/infrastructure-breakdown.html

Recap

We're in a climate emergency. Things are on fire.

You're not alone, and many folk are bringing buckets of water to help.

Predatory delay, and fossil fuels.

Others are bringing buckets of petrol.

You *don't* need to be perfect to engage.

You *do* need to be brave, but there is help out there to get you through the harder parts.

So here's our recap.

We're in a climate emergency, and our house is on fire. You're not alone in caring, and there is a growing movement for climate Action, who are working to put it out.

Sadly, there are others that benefit from you staying disengaged, or stuck in a doom state, and they're working to keep you there so they can still make tonnes of money. To continue our fire metaphor, they're bringing buckets full of petrol instead of bringing buckets of water.

You don't need to be perfect to engage, and there's help out there.

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Ok, now we've figured out we need to do something, what can we do?

What can techies do ?

What we can do as web technologists

Engage as members of society

Engage as professionals - embed the values of protecting life in our work.

I think there's two ways I'd suggest, in this order.

First, I think we can engage as members of society - if you're at this conference, you're probably earning above median wages in your country and part of a professionally mobile group. You can do a lot in terms of offering your money, time and skills, and probably in that order.

Secondly, I think it's worth embedding the principles around climate Action in our work. I say this as I think we can point to examples of where we have seen similar ideas work on the web before.

Engage as members of society

Show up for the folks putting the work in already.

So, first of all, remember there's a movement, and there are lots of people putting the work in because they're scared and need your help.

Fridays for future is an example - Fridays for future is a global movement of schoolchildren who every Friday protest for grown ups like us to work act on the climate crisis. They do this because most of them are too young to vote, and they don't have the power get things changed by themselves.

Kids like Greta and the folks you see here turning up each week have done so much to change perception. But they's not all they've been doing.

Germany

'Historic' German ruling says climate goals not tough enough

Judges order government to strengthen legislation before end of next year to protect future generations

Kate Connolly *in Berlin*

Thu 29 Apr 2021 16.44 BST

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⤴
1,365

▲ Environmental activist Luisa Neubauer, one of the complainants, said the court's decision was 'a huge win for the climate movement'. Photograph: David Young/AP

Germany's supreme constitutional court has ruled that the government's climate protection measures are insufficient to protect future generations, after a complaint brought by environmentalist groups.

In a groundbreaking ruling, the judges of the Karlsruhe court, Germany's highest, said the government now had until the end of next year to improve its Climate Protection Act, passed in 2019, and to ensure it met 2030

They've been able to change perception around climate enough to start influencing the public discourse, and it's important to understand that they've been using the law to buttress these changes in how we feel about climate. They're getting the actual laws changed too.

This is Lisa Neubauer, a bit like the German equivalent to Greta - her and a group of children essentially argued earlier this year that government had a duty to care to children as citizens of the country. They argued that Government inaction was infringing their human rights, and they won a massive court case earlier this year.

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Daily Briefing 06.05.2021 ✎

Today's climate and energy headlines

PREVIOUS DAY

NEXT DAY

DAILY BRIEFING   Germany to pull forward target date for climate neutrality to 2045

DAILY BRIEFING | May 6. 2021. 🕐 10:44am

Germany to pull forward target date for climate neutrality to 2045

Today's climate and energy headlines:

- Germany to pull forward target date for climate neutrality to 2045

- Curbing global warming to 1.5C would halve sea level rise from ice melt – study

Privacy - Terms

This had a huge impact - they got the law changed to compel the government to act with more urgency on climate. They got national targets of the fourth largest economy on earth brought 5 years ahead of to get to net zero!

And you don't just see this in Germany. I love this photo - it's Milleudefense - to the Dutch equivalent of friends of the earth.

This is what it looks like when bunch of normal people win a landmark lawsuit against a multinational oil company. They used a similar argument, that Shell Oil, through their actions, are violating the human rights of future generations of people in the Netherlands to live and have families.

And in May this year, the supreme court in the Netherlands essentially said yes, that's correct. It's unjust for a company to be allowed to do that. The supreme court pretty much pointed to the science and pretty much said "sudo cut emissions" - ordering the company change their entire corporate strategy over the next ten years. We didn't know we could even do this before, and this sets a massive precedent.

We're starting to see wins like this, but this late in the day, winning too slowly is the same as losing.

More here: https://en.milieudefensie.nl/news/yeah-milieudefensie-wins-revolutionary-lawsuit-shell-forced-to-go-green

Engage as professionals

Embed the values of respecting and protecting life in our work.

So one thing is to support these people already who are running up, protesting, and campaigning and working as hard as they are.

The other is to embed the values of respect and protecting life in our work itself. I say that because we have had some success before here.

Lessons we can learn from other movements

Inclusive design, and the power of POUR in the accessibility movement.

There's still along way to do in the accessibility movement, but I'd argue that fact that we are even talking about accessibility as much as we do now is a positive sign. We have concepts like inclusive design that we didn't have before, and increasingly, we talk about sites that are inaccessible as sites that are not good sites, or even sites that are broken.

Perceivable

Operable

Understandable

Robust

I think ideas like POUR have helped.

For a site to be accessible it has to be:

Perceivable: can I use the site without only being able to perceive the content with my eyes?
Operable: can I use the site without only being able to use a mouse or touch screen?
Understandable: can I make sense of the language without being an industry insider?
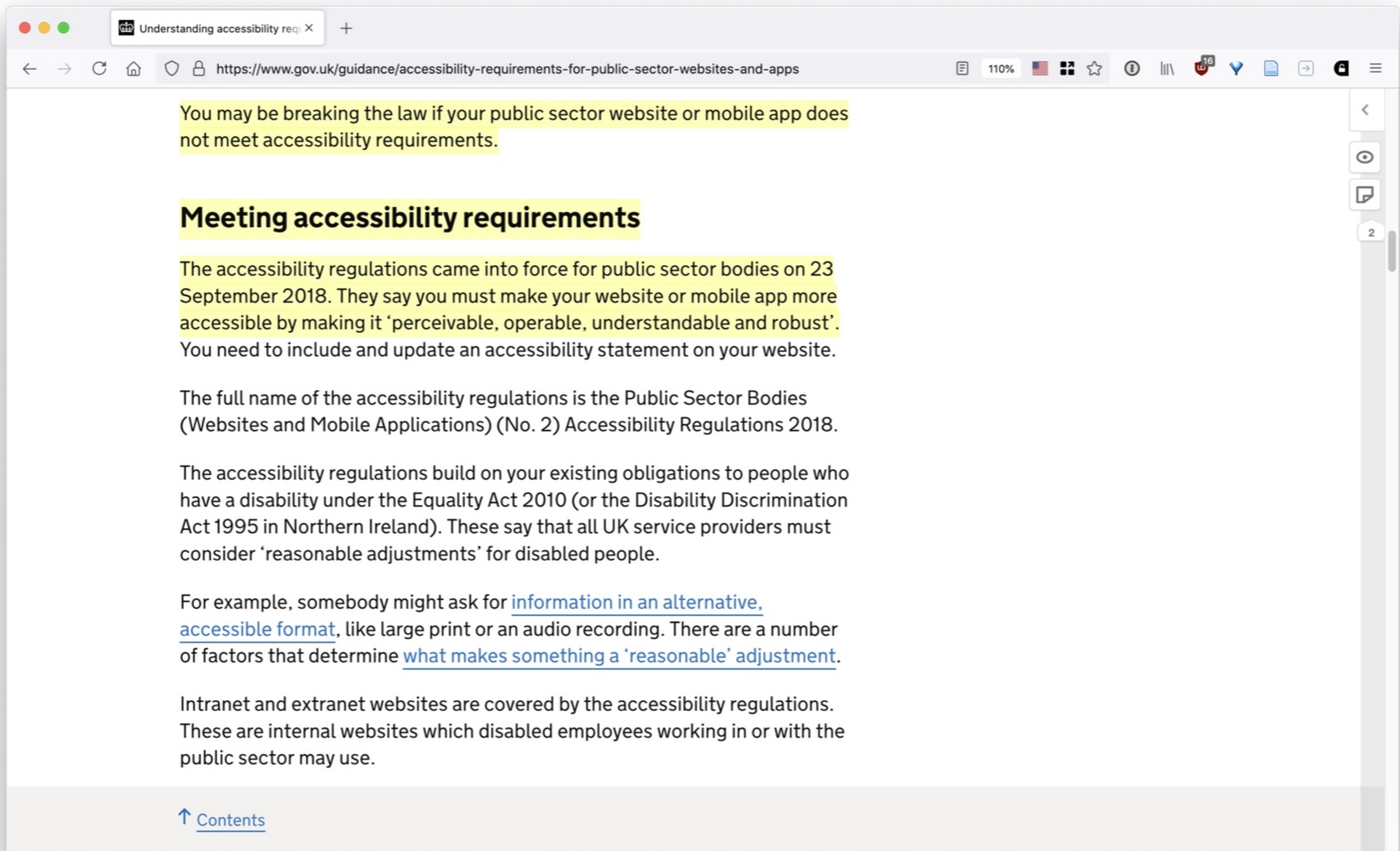Robust: can I still make use of the site in less than ideal conditions?

POUR: https://www.w3.org/WAI/WCAG21/Understanding/intro#understanding-the-four-principles-of-accessibility

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Guidance

Understanding accessibility requirements for public sector bodies

Help your team understand why they need to meet the website and mobile app accessibility regulations.

From: **Central Digital and Data Office**
Published 9 May 2018
Last updated 8 April 2021 — See all updates

Contents

These form the web content authoring guidelines or the WCAG. Their existence makes it easier for people to write laws to make this the minimum standard people need to meet for a site to be considered working.

GDS guidance: https://www.gov.uk/guidance/accessibility-requirements-for-public-sector-websites-and-apps

You may be breaking the law if your public sector website or mobile app does not meet accessibility requirements.

Meeting accessibility requirements

The accessibility regulations came into force for public sector bodies on 23 September 2018. They say you must make your website or mobile app more accessible by making it 'perceivable, operable, understandable and robust'. You need to include and update an accessibility statement on your website.

The full name of the accessibility regulations is the Public Sector Bodies (Websites and Mobile Applications) (No. 2) Accessibility Regulations 2018.

The accessibility regulations build on your existing obligations to people who have a disability under the Equality Act 2010 (or the Disability Discrimination Act 1995 in Northern Ireland). These say that all UK service providers must consider 'reasonable adjustments' for disabled people.

For example, somebody might ask for information in an alternative, accessible format, like large print or an audio recording. There are a number of factors that determine what makes something a 'reasonable' adjustment.

Intranet and extranet websites are covered by the accessibility regulations. These are internal websites which disabled employees working in or with the public sector may use.

↑ Contents

Having laws like make it easier to argue keep the web open to the greatest number of people.
Having shorthand terms like POUR to refer to make it easier to assess and direct teams to keep sites inclusive.

As an example, this is the guidance from the UK's government digital service - they're explicit about needing this now, and even refer to POUR.

GDS guidance: https://www.gov.uk/guidance/accessibility-requirements-for-public-sector-websites-and-apps

POLITICS

Supreme Court hands victory to blind man who sued Domino's over site accessibility

PUBLISHED MON, OCT 7 2019·9:40 AM EDT | UPDATED TUE, OCT 8 2019·6:31 PM EDT

Tucker Higgins
@IN/TUCKER-HIGGINS-5B162295/
@TUCKERHIGGINS

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KEY POINTS

- The Supreme Court denied a petition from pizza giant Domino's on Monday to hear whether its website is required to be accessible to the disabled, leaving in place a lower court decision against the company.

- The case was originally brought by a blind man named Guillermo Robles, who sued the pizza chain after he was unable to order food on Domino's website and mobile app despite using screen-reading software.

- The decision not to grant the case is a loss for the company and a win for disability advocates, who have argued that if businesses do not have to maintain accessible

TRENDING NOW

1. GM to invest more than $2 billion in U.S. manufacturing to increase electric vehicle production

2. Biden's tax plan could boost tax rates to 62% for some New Yorkers and Californians, studies

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And increasingly, this spills over to the private sector too.

Yes, there is still a long way to go, but there are levers available that were not there before.

Having accessibility guidelines like this made it easier to argue that large companies make accessible products when spending money.

For Amazon to win a 30m dollar contract with New York public library a few years back in 2015, they had to make the Kindle measurably more accessible, as an explicit condition of the winning.

Dominos sued over site site accessibility: https://www.cnbc.com/2019/10/07/dominos-supreme-court.html
Amazon contract tied to accessibility: https://www.edweek.org/teaching-learning/accessibility-concerns-delay-30m-amazon-e-book-contract-in-n-y-c/2015/08

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I see ideas like POUR as fundamentally about respecting people, and avoiding harm through thoughtless design decisions, and this is the framing I think can work for embedding similar sensibilities around climate into how we work.

Inspired by POUR and the WCAG, I want to share a model, because I'm hoping someone will come forward and help me work this over the next 12 months. I think we need GOLD.

Green
Open
Lean
Distributed

GOLD stands for

Green
Open
Lean
Distributed

Let's look at these in detail

Green

Open

Lean

Distributed

Green energy, and greener material inputs

For running computers

For making computers

Green means green energy and green inputs.

As we see, we need energy to run computers, but also for making computers.

Fossil energy versus green, non-fossil energy

Gas
Coal
Wind
Solar

You don't have control over what others feed into the grid.

If you know the mix going into the grid, you can at least account for it.

Every time we use the internet for example, even if we don't mean to, we're burning fossil fuels, because the internet if the biggest machine in the world and it largely runs on coal still.

We really need to stop this - in 2021 we don't need to build the web with fossil fuels, any more than we need to build houses with toxic material like asbestos.

Accounting for fossil fuel energy
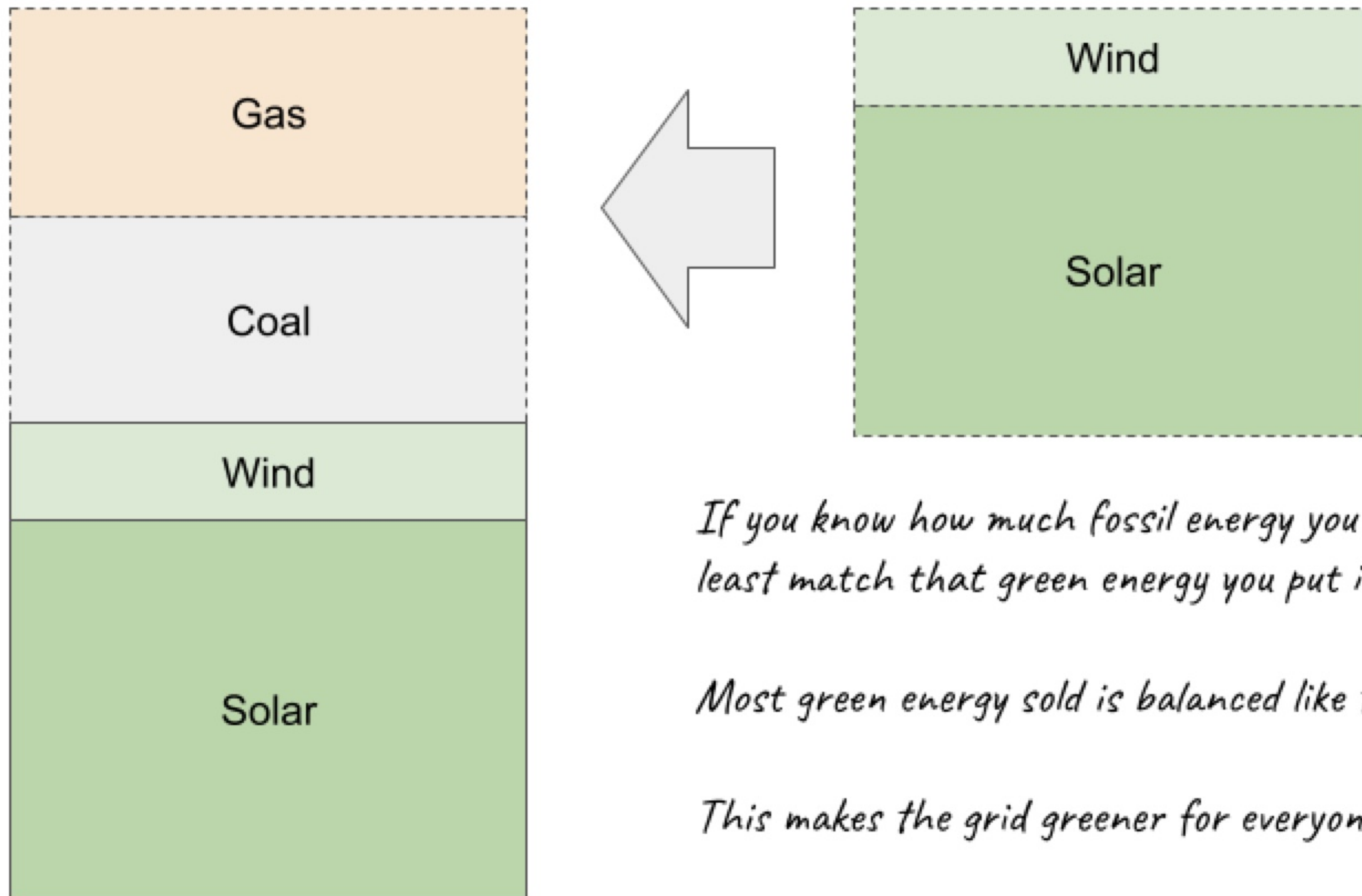
If you know how much fossil energy you have used, you can at least match that green energy you put into the grid.

Most green energy sold is balanced like this a yearly basis.

This makes the grid greener for everyone over time.

When we use websites or digital infrastructure using green energy, it doesn't mean a website is always running on green power 24/7. What it currently means is that at least as much money is going into the grid as was used by the grid over a give time period - usually a year.

Over time, this makes the entire energy grid greener for everyone.

My NGO, the green web foundation provides free datasets listing which websites run on green energy, and we also expose this information over an API. This is what makes it possible for website carbon to see if you're using bog standard energy, or green energy when they check your site for example.

Website Carbon: https://www.websitecarbon.com/
The green web foundation API: https://www.thegreenwebfoundation.org/green-web-feed/

Green

Open

Lean

Distributed

Open data, open source, transparency

Open here is about an approach, as opposed to being about just open source

Climate Impact by Area
Ranked by carbon intensity of electricity consumed
(gCO₂eq/kWh)

Search areas

1	🇪🇸	**El Hierro** Spain
2	🇬🇧	**Orkney Islands** Great Britain
3	🇳🇿	**South Island** New Zealand
4	🇨🇦	**Yukon** Canada
5	🇳🇴	**Southwest Norway** Norway
6	🇨🇦	**Ontario** Canada
7	🇳🇴	**North Norway** Norway
8	🇸🇻	**El Salvador**
9	🇳🇴	**Middle Norway** Norway
10	🇳🇴	**Southeast Norway** Norway
11	🇺🇾	**Uruguay**
12	🇩🇰	**Bornholm** Denmark
13	🇳🇴	**West Norway** Norway
14	🇦🇺	**Tasmania** Australia

This project is Open Source (see data sources).
Contribute by adding your territory.

Found bugs or have ideas? Report them here.

Like the visualization? We'd love your feedback!

Anything unclear? Check out our frequently asked questions.

☐ color blind mode

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electricityMap **Live · API · Blog**

production consumption ⓘ

Poland

733g 8% 7%

Carbon Intensity   Low-carbon   Renewable

built by ◯ **Tomorrow**

Carbon intensity (gCO₂eq/kWh)

0   400   800
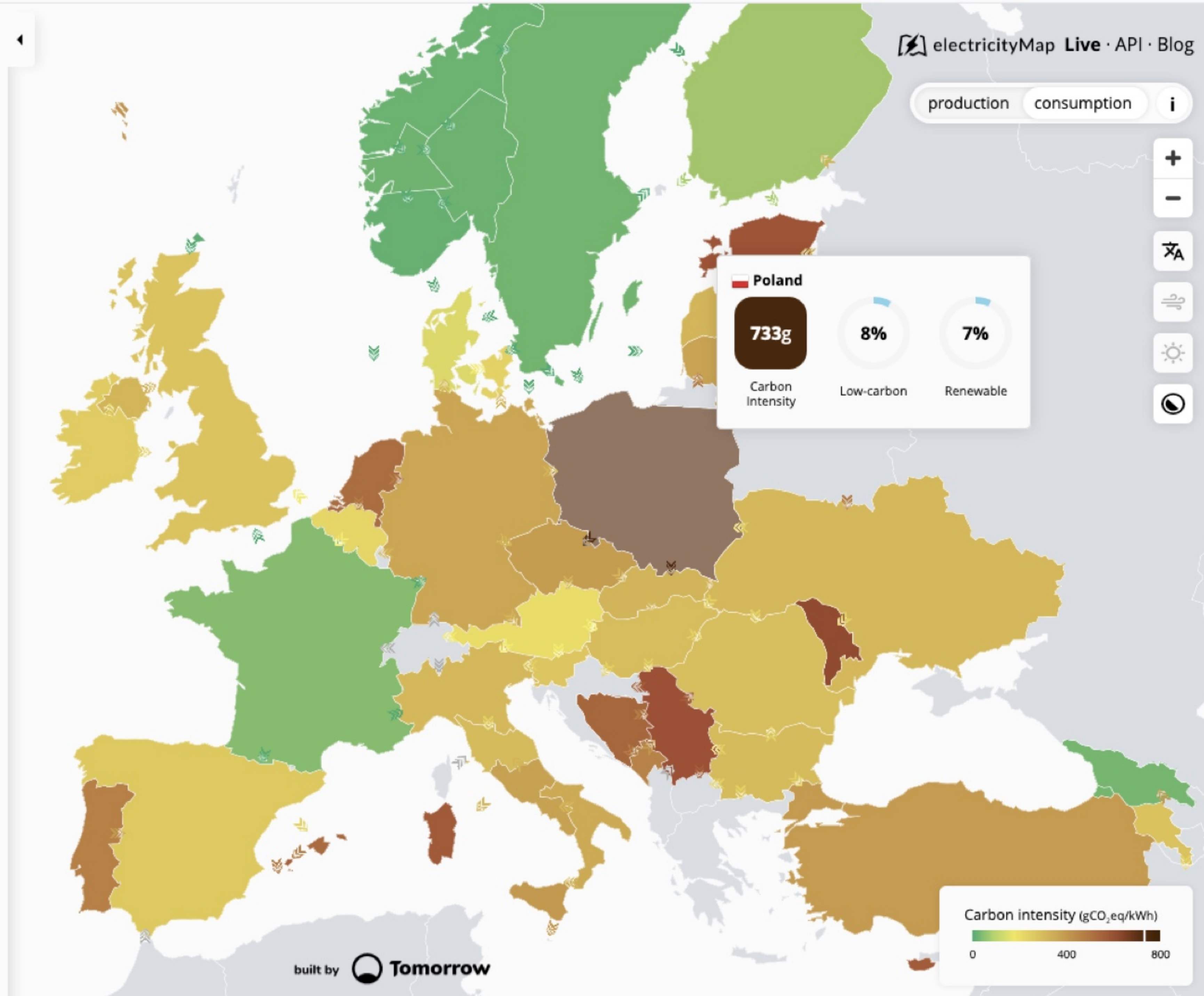
If you want to figure out what the greenest country is to run servers, you can look at electricity map, an open source project, to see. They show in real-time how green each grid is and they make this information available over an API. Google use this info to work out where to dispatch massive complicated computing jobs now for the lowest carbon footprint, and so can you.

Electricity map: https://www.electricitymap.org/

This is an open compute datacentre

Open allows for new ways of thinking about digital infrastructure too.

What you're looking at here is the heat exchanging part of a new datacentre in the Netherlands, using open compute servers.

The open compute project is an initiative by a number of big companies like Facebook and Microsoft to build open source server components, for a more efficient industry.

But because they're open, there are some cool ideas by start-ups in this field as well now.

Open Compute: https://www.opencompute.org/wiki/Server/ODSA
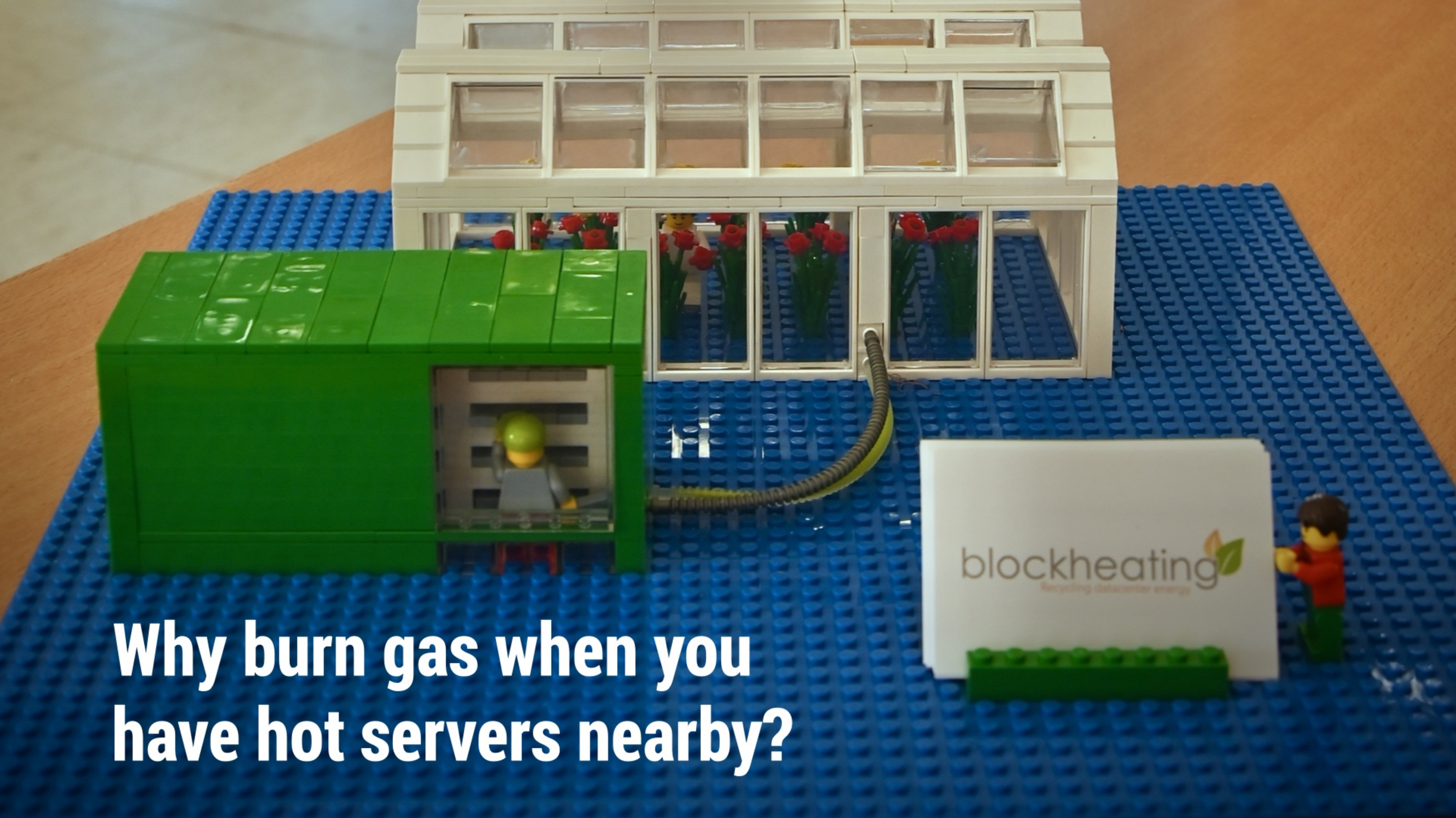
Why burn gas when you have hot servers nearby?

Block heating is one such company.

Rather than having massive out of town datacentres where all the excess heat from running computers is wasted, and where loads of energy is spent trying to move the heat out and vent it into the sky, they do something different.

Instead, they use end-of-life, recycled servers from the same big tech companies, put them in shipping containers, and then connect these shipping containers to green houses that grow crops like tomatoes and cucumbers.

To get green houses hot enough for tomatoes to grow well, gardeners typically burn fossil fuels to heat them. This lets them use the heat from the computers instead.

This is cool - it uses the waste heat from the servers productively, turning what was a problem, into something valuable for someone else. Also, using recycled servers saves them from landfill - and extends the useful life of hardware.

Blockheating: https://www.blockheating.com/

Green

Open

Lean

Distributed

Optimise for carbon emissions

Lean is a recognition that all energy has a cost in terms for climate pollution, so efficiency is important.

Stats for 2019 compared to 2010:

12x as much traffic

7.5x the workloads

~1x the energy usage

Global data centre energy demand by data centre type, 2010-2022

This is somewhere where we've seen some success already.
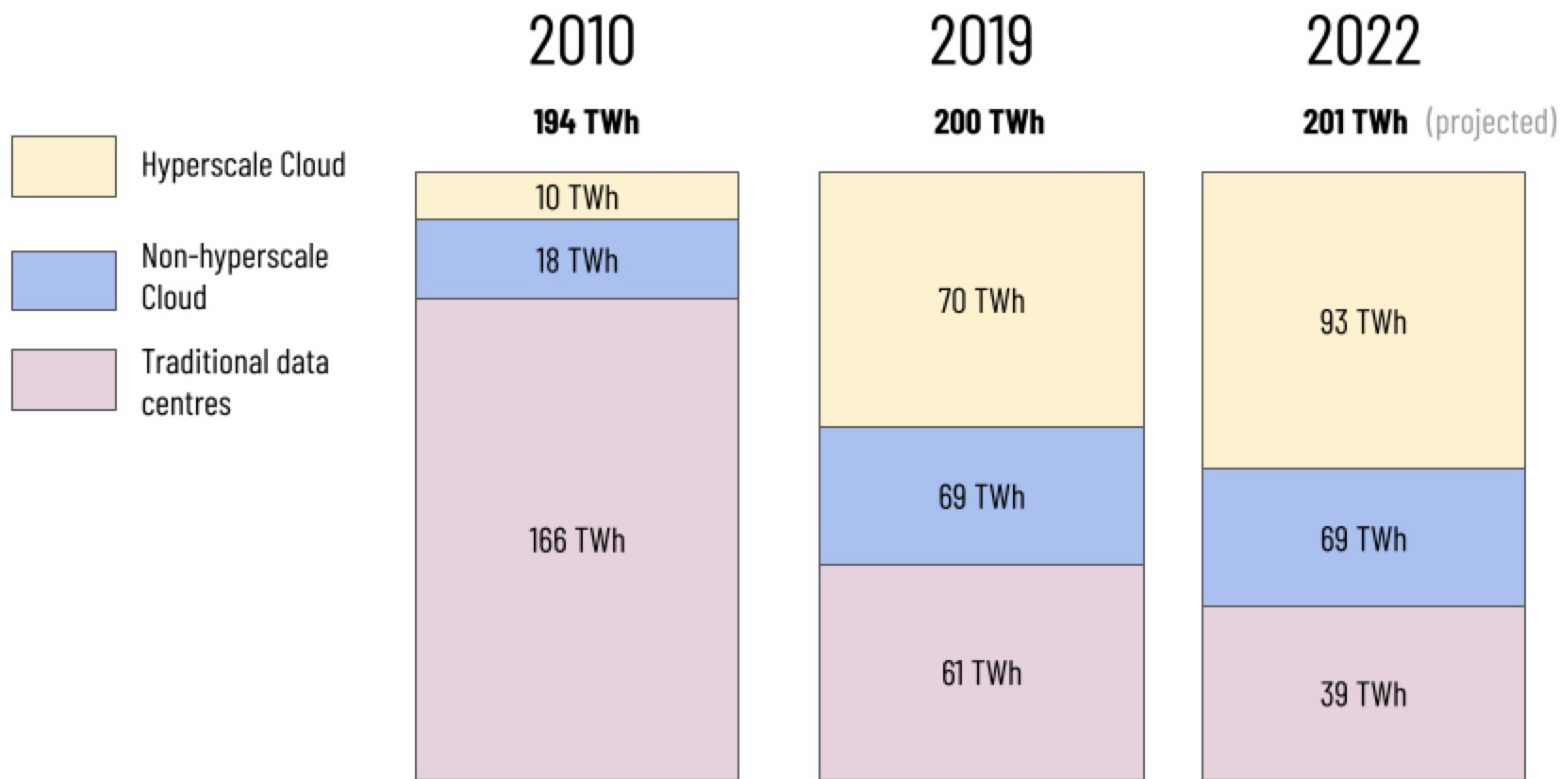
Over the last ten years, if we look at the energy usage for what we might refer as the engines of the tech sector, the millions of servers in datacenter globally - you'll see that it has as largely stayed the same, despite explosion in in use.

Datacentre power usage:
https://www.iea.org/data-and-statistics/charts/global-data-centre-energy-demand-by-data-centre-type-2010-2022

	2010	2019	2022
	194 TWh	**200 TWh**	**201 TWh** (projected)

Legend:
- Hyperscale Cloud
- Non-hyperscale Cloud
- Traditional data centres

2010 (194 TWh)
- Hyperscale Cloud: 10 TWh
- Non-hyperscale Cloud: 18 TWh
- Traditional data centres: 166 TWh

2019 (200 TWh)
- Hyperscale Cloud: 70 TWh
- Non-hyperscale Cloud: 69 TWh
- Traditional data centres: 61 TWh

2022 (201 TWh projected)
- Hyperscale Cloud: 93 TWh
- Non-hyperscale Cloud: 69 TWh
- Traditional data centres: 39 TWh

Source - IEA, Global data centre energy demand by data centre type, 2010-2022, IEA, Paris

This is largely because we've been moving away from a large number of traditional datacentres, and towards smaller numbers of much more efficient, hyper scale style datacentres.

These days, you can make the claim that the carbon footprint of the tech sector is roughly comparable to the entire shipping sector, or if you prefer, countries like Germany or Canada.

Centralising the web like this has its own issues obviously, but from a climate point of view, having less climate pollution per unit of compute is largely a win.

Figure 4: Distribution of ICT's carbon footprint (2015)

Legend: ■ Embodied emissions ■ Operation

Category	
User devices	Embodied ~195, Operation to ~400 Mt CO2-eq
Networks	Embodied ~20, Operation to ~180 Mt CO2-eq
Data centers	Embodied ~20, Operation to ~160 Mt CO2-eq

X-axis: 0, 100, 200, 300, 400, 500 — Mt CO2-eq
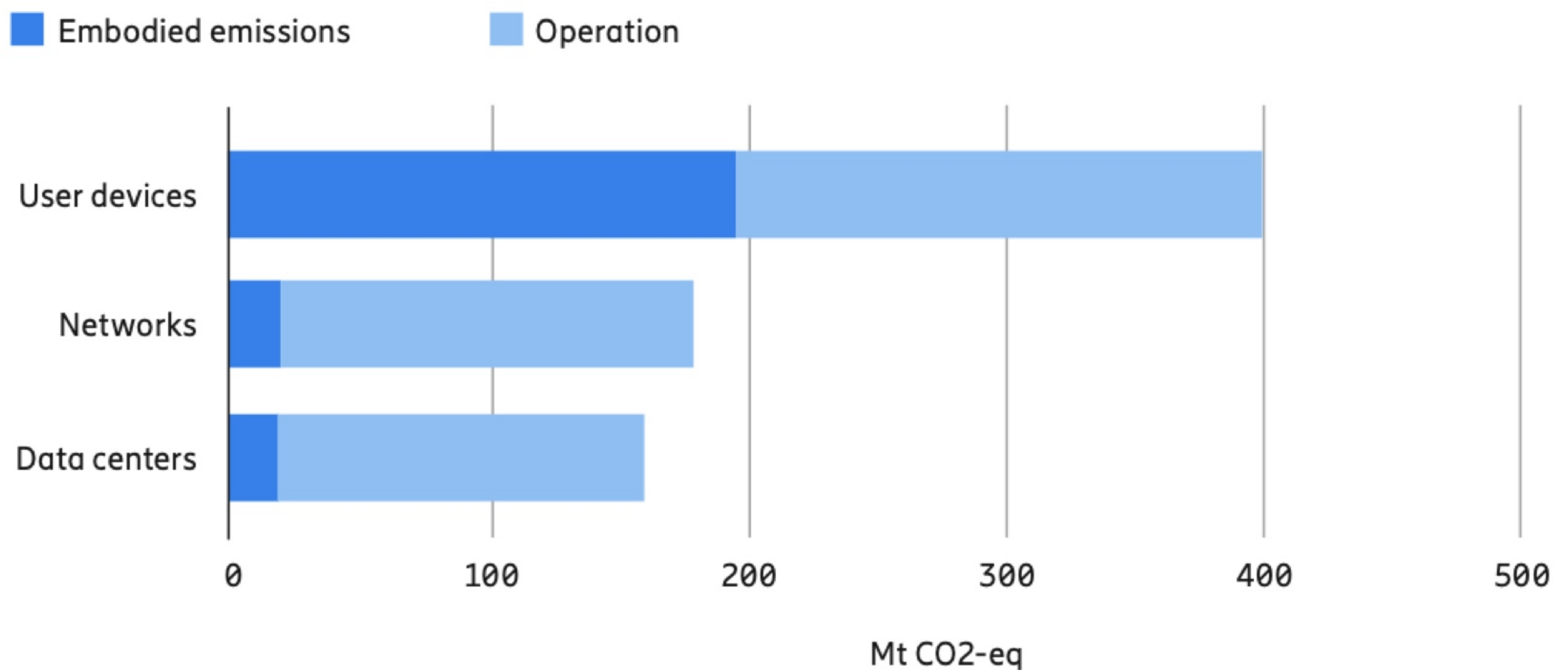
However, as we mentioned before it's not just running computers that causes carbon emissions.

Making computers involves turning sand into computer chips - a very energy intensive process, and we should be aware of these embodied emissions that come from making them.

This chart here shows that because servers are running 24/7, their running costs make up a larger share of their footprint.

But for user devices, it's the other way around. Because making every new computer is so energy intensive, we care more about needing to make fewer computers, and make them live longer as a way to avoid climate pollution.

ICT carbon footprint report from Nokia:
https://www.ericsson.com/en/reports-and-papers/industrylab/reports/a-quick-guide-to-your-digital-carbon-footprint

Back to laptops we can open up again.

This is why I'm quite excited about a new wave of laptops which are being designed from the outset of be repairable, like the framework laptop pictured here.

It's basically the fairphone of laptops - with an open design, and emphasis on user repair.

Making a laptop last a couple of years longer can reduce the carbon footprint over it's lifetime by around 25%, so this is a positive step.

Framework: https://frame.work/laptop-diy-edition

Green

Open

Lean

Distributed

Move work through time and space to avoid carbon emissions

Finally, D stands for distributed.

We can use the internet to move work through time and space to use avoid pollution.

Let's see how.

Can baking wait?

We recommend baking when more than a third of Britain's electricity is coming from wind, solar and hydro power – right now, between **15:00 - 15:30**, it's **17% ***
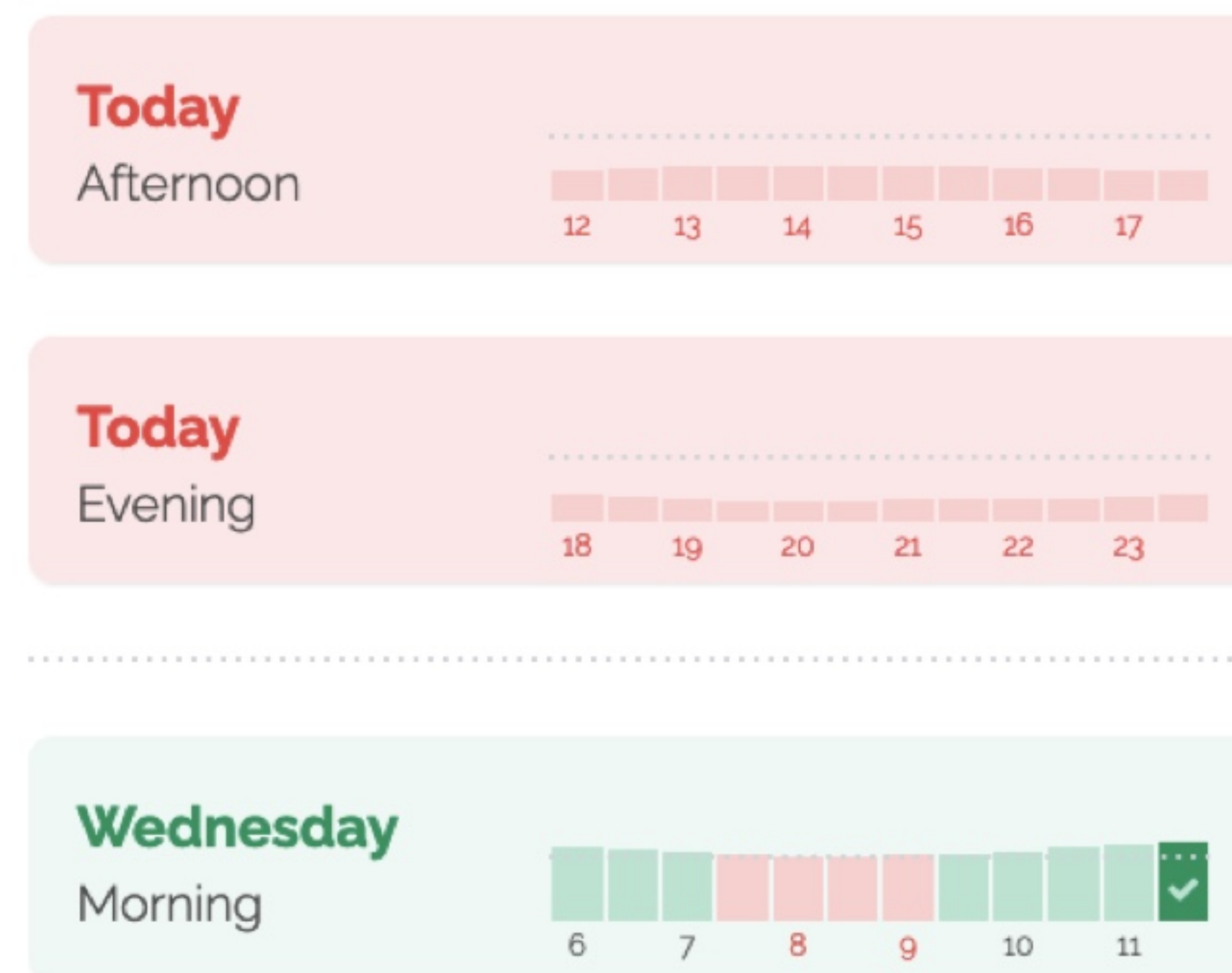
Follow the **forecast on Twitter** or ask - **Alexa**, should I bake?

* the UK average in 2019 was 33.0%

The baking forecast

Here's the baking forecast for **29th - 2nd October**

Show only the good times to bake

Today
Afternoon

12   13   14   15   16   17

Today
Evening

18   19   20   21   22   23

Wednesday
Morning

6   7   8   9   10   11

If you're in the UK, you might have heard of the baking forecast.

It's a cool project that looks at how energy on the grid is being generated, and because baking uses loads of electricity, shows you how to bake greener.

For example, it tells you when it's a green time to bake, when loads of wind and solar is powering the grid, or when it's not a good time to bake, when most of the power comes from fossil fuels.

You can get a forecast to plan for the greenest delicious baked goods.

Baking Forecast: https://twitter.com/baking4cast/

Mostly renewables on the grid:
serve full set of rich images and media elements
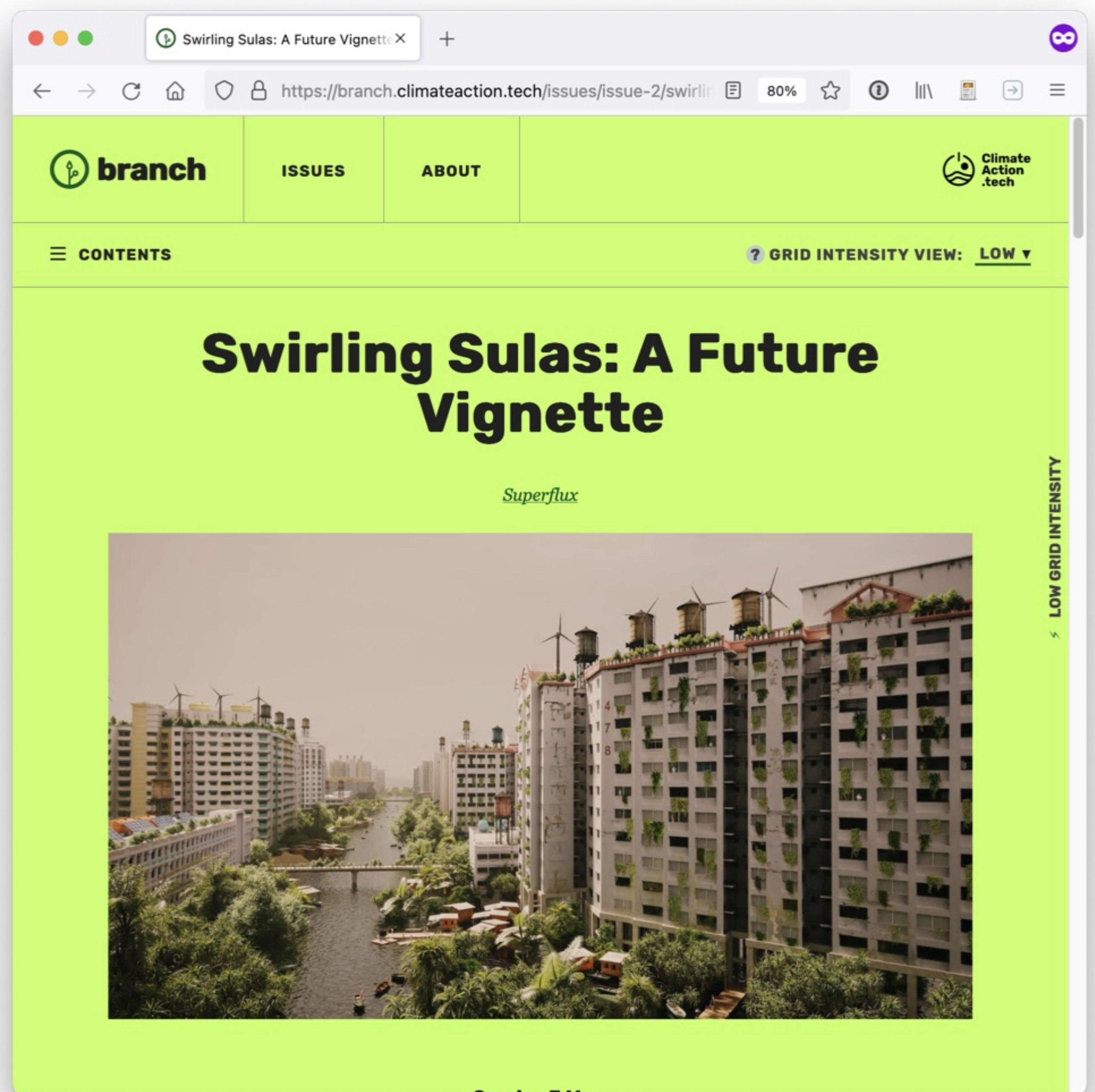
I'm one of the editors of branch magazine, and we do a similar thing with the web itself.

When we know the grid powering our servers is green, and we think it'll be a green time to serve webpages, we send our our full-fat, rich web experience down the pipe to our users.

Branch: https://twitter.com/baking4cast/

Lots of fossil fuels on the grid:

scale back design elements to stay inside carbon budget
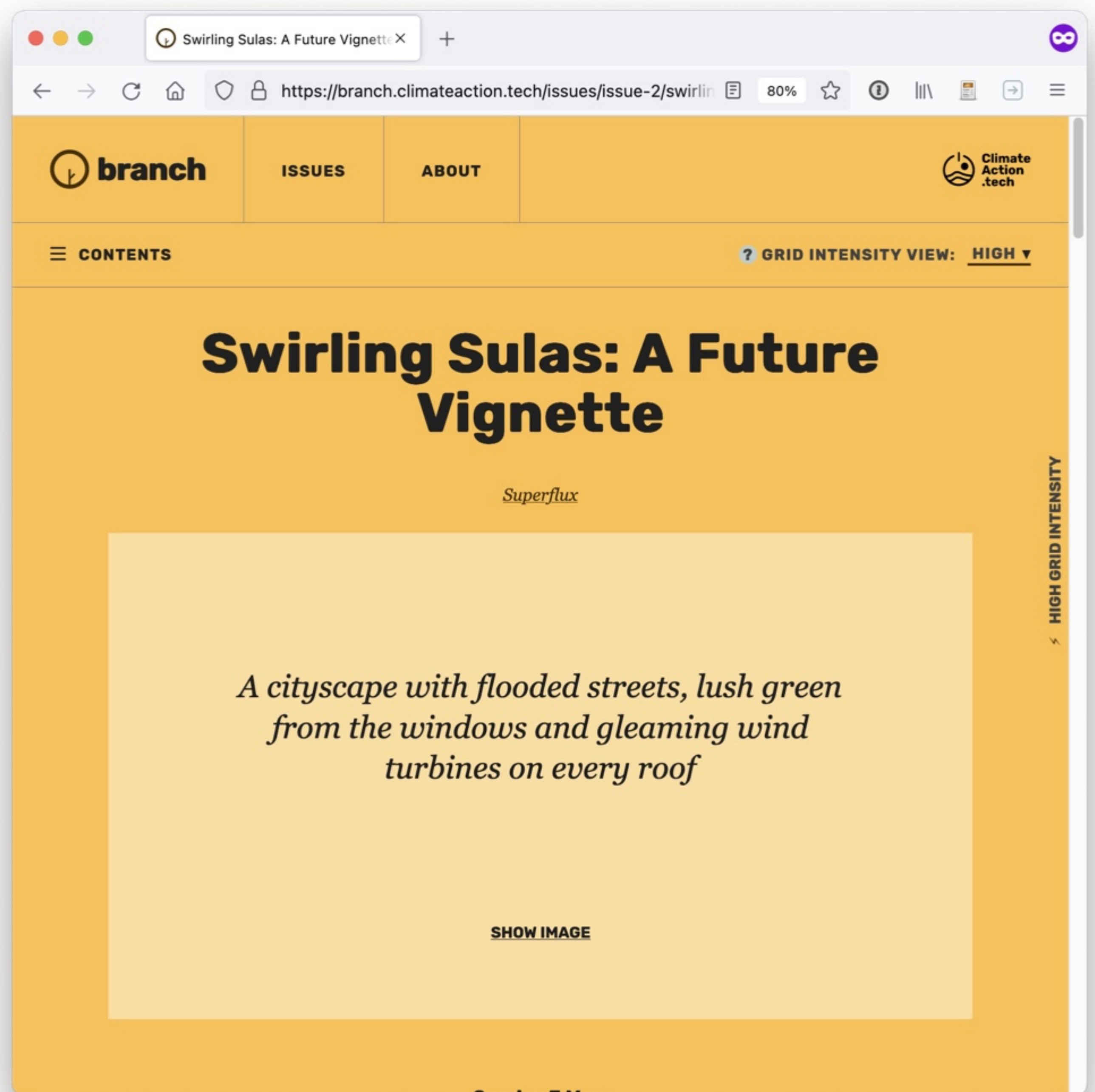
However, when we know there are lots of fossil fuels on the grid, we know doing that will result in higher carbon emissions from doing so.

So, in addition to having a page weight budget to stay inside, we have a carbon budget for our pages too. We adapt the design to fall back to the lighter weight, images-free version. You can still access the same content, but we don't default to showing it now.

This also forces us to think about the alt text from the get go, which is good for accessibility anyway.

In the next issue we want to experiment with web workers to pull down content when we know energy is cheap and green - this is an example of shifting work through time when working on the web.
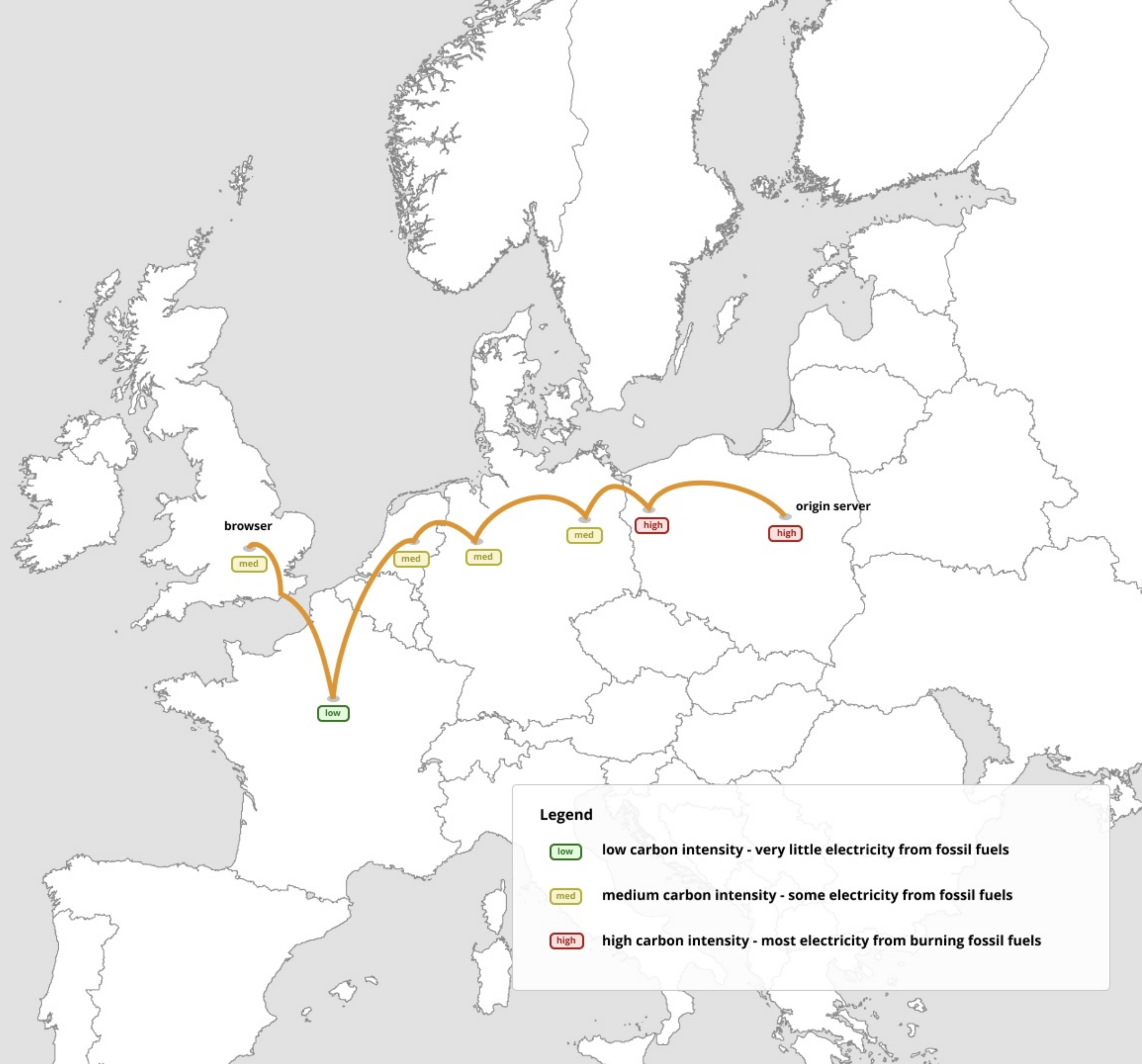
When we fetch data from servers, we rely on routers to route it to the next 'hop' along the way, as well as from the origin server.

This adds up - data transfer for the internet uses around 250 TWh of electricity each year - this is more than Spain uses!

Also when routes pass through areas where electricity mainly comes from burning fossil fuels, we have a higher carbon footprint for this transfer.

Because most electricity globally is still generated by burning fossil fuels, these emissions are hard to avoid with the design of the current internet.

browser

origin server

med   high   high

med   med   med

low

Legend

low   low carbon intensity - very little electricity from fossil fuels

med   medium carbon intensity - some electricity from fossil fuels

high   high carbon intensity - most electricity from burning fossil fuels

The example we just saw was showing how we can also move work through time.

We also saw earlier with electricity map that we can move server workloads where they are greener - that's a good example of moving work through space to another part of the world where energy is green.

But you can move work through space AND time too with open source, next generation networking architecture like SCION. Let's imagine we're in London, connecting to a website in Poland.

We have to hop across countries to make this connection. And every hop has a carbon footprint determined by how clean the grid is. France is full of nukes so it's relatively green, low carbon electricity, but Poland has lots of coal and broadly speaking is less green. Germany and England about in the middle, depending on the time of day.
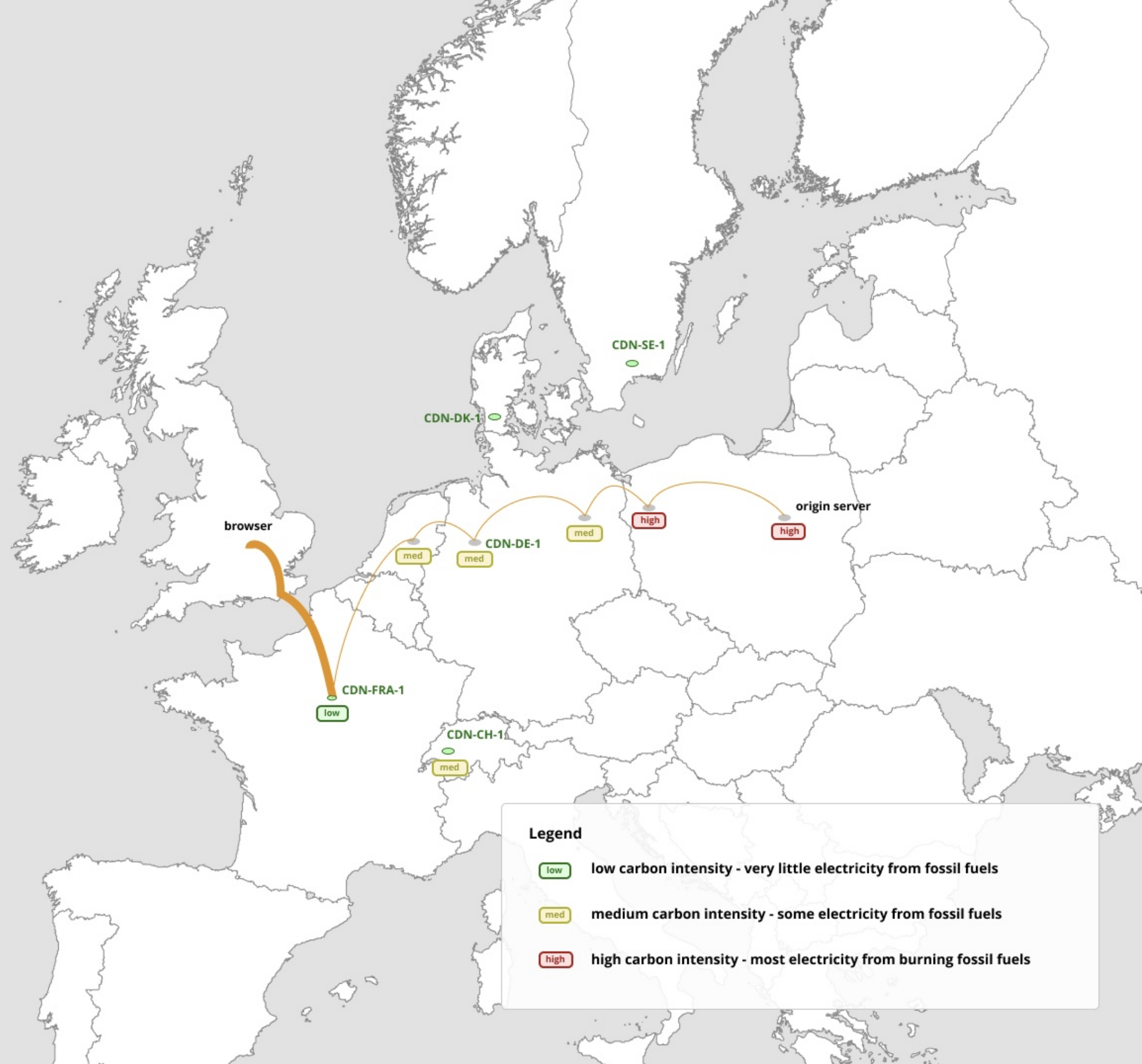
One way to reduce this is to use CDNs to serve the same content from a closer cache instead of fetching it from the origin each time.

This saves hops, and improves the user experience making it feel faster.

If the nodes serving most of the traffic are running where electricity is low carbon, we save carbon here too.

Even if we can't cache everything, we can still serve most of our traffic from greener sources reducing the overall emissions.

CDN-SE-1

CDN-DK-1

origin server

browser

med

high

high

CDN-DE-1

med

med

CDN-FRA-1

low

CDN-CH-1

med

Legend

low   low carbon intensity - very little electricity from fossil fuels

med   medium carbon intensity - some electricity from fossil fuels

high   high carbon intensity - most electricity from burning fossil fuels

One thing we can do, if we have a CDN, is serve traffic where it is closer, and ideally greener.

Let's imagine we have a CDN node in France instead of relying just on our server in Poland. Doing this lets us serve more traffic from a green grid as opposed do a dirty one, and from servers optimised for the task.

We might not be able to serve everything from France, but we can serve at least some of it, which means we only rely on going through the less green routes for a smaller amount of traffic.
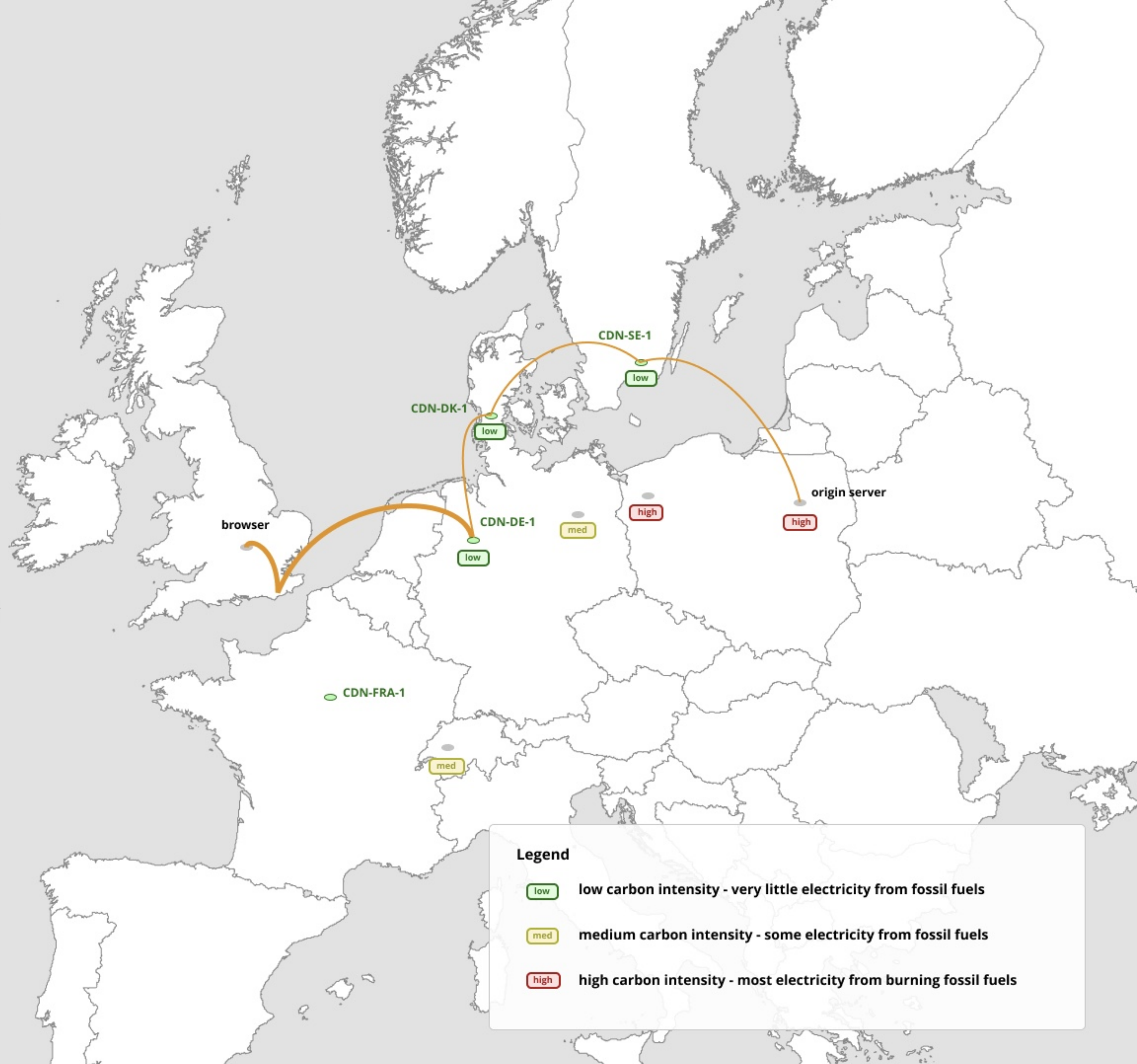
We **can and should** go further though.

If we know the carbon intensity of energy on the grid, we can tailor the way we serve traffic to match moments of over-supply on sunny or windy days, when energy is particularly cheap and green.

As long as the nodes are close enough, we can still serve quick responses, and save hops reducing the carbon footprint, but we also help actively balance the grid, making it easier to integrate more renewables into our energy system.

Even when some content can't be cached, we can still optimise for the greenest routes that serves the request in time.

Legend

low — low carbon intensity - very little electricity from fossil fuels

med — medium carbon intensity - some electricity from fossil fuels

high — high carbon intensity - most electricity from burning fossil fuels

However, if we build an awareness of how green the grid is into the internet itself, then it's possible to make routing decisions based on this information.

Let's assume that in the North of Europe, it's particularly windy that day. We can design for that, and route accordingly, resulting in a greener routing - like doing some low-carbon network trick shot.

This is not sci-fi, this is being worked on right now. SCION is an open source internet architecture, running in production around the world, that can support this kind of behaviour. It's designed and developed in Switzerland, entirely open source and I'm super excited about it.

SCION: https://www.scion-architecture.net/

Green
Open
Lean
Distributed

So that's gold.

Green
Open
Lean
Distributed

What we've covered together...

1. We're in a Climate Emergency
2. What we can do as web technologists
3. GOLD - a way to think about greening tech

thegreenwebfoundation.org/frontconference

Front Conference 2021 - @mrchrisadams

OK, so this is what we covered in the time we had together.

I know it was fast, and there is a transcript of everything I said on the page at the link below, with a boat loads of references and further notes.

Thanks!

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@mrchrisadams
@greenwebfound

ClimateAction.tech

Online community for
climate aware technologists

Finally, if this is interesting you, we're running a fellowship to build a freely available syllabus for incorporating these ideas into how we work. Visit the site to learn more.

This is how to stay in touch, and this is the online community I'm most active in.