Climate Change & Tech, Good and Bad Bedfellows

Tech, Mapping, Emissions and The Future

Paul Johnston

Fun Art by JDHancock.com
Climate Change & Tech, Good and Bad Bedfellows

Tech, Mapping, Emissions and The Future

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Fun Art by JDHancock.com
Hurricane Dorian

- 185mph winds
- =1st Strongest Atlantic Storm
- 70,000 left homeless (Bah.)
- 60+ dead, 400+ missing
- $8+ Billion damage

Photo and data: [https://en.wikipedia.org/wiki/Hurricane_Dorian](https://en.wikipedia.org/wiki/Hurricane_Dorian)
Typhoon Hagibis

- 140mph winds
- Worst storm in 60 years
- Almost 1000mm of rain in 24hrs
- 40 dead, 16 missing, 6m affected
- Typhoon “season” lasts longer

Data: BBC News and Al Jazeera
[https://twitter.com/Tom__Scott/status/1183408521389445120](https://twitter.com/Tom__Scott/status/1183408521389445120)
Cyclone Idai

- Madagascar, Mozambique, Malawi, Zimbabwe
- 125mph winds
- 2nd Deadliest in Indian Ocean
- 1300+ dead, 2000+ missing, 3m affected
- $2 Billion in damage

Photo and data: https://en.wikipedia.org/wiki/Cyclone_Idai
All of these “extreme weather events” happened in 2019
Storms Ciara and Dennis

- February 2020 - 1 week apart
- >£400m in damage in UK alone
- Ciara: Cat. 5 “Atmospheric River”
  - “Exceptional”
- Dennis: Bomb Cyclone

Subtropical Storm Kurumi

- January 2020
- Highest daily rainfall in Belo Horizonte in 110 years
- Flooding and landslides killed 30 and evacuated 2,600 people

Data: https://www.theguardian.com/world/2020/jan/29/brazil-counts-cost-highest-recorded-rainfall-110-years
All of these “extreme weather events” happened in 2020
Climate Change leads to ocean warming which leads to:

- Stronger storms
- Slower storms
- Larger storms
- More rainfall
- Moving more slowly

Note: it doesn’t lead to more storms

From:
https://skepticalscience.com/Where-is-global-warming-going.html

Figure 1: components of global warming for the period 1993 to 2003 calculated from IPCC AR4 5.2.2.3.
Wildfires are more likely

- Rising global temperatures
- Heatwaves more likely
- Associated droughts in some regions
- Australian wildfires “far worse than any prediction”

Data: https://www.bbc.co.uk/news/science-environment-51590080
Australian extremes

- Record Australian drought
- Followed by heaviest rainfall in Sydney for 30 years

Data:
https://en.wikipedia.org/wiki/Drought_in_Australia#late_2016%E2%80%93late_2019 and
https://www.bbc.co.uk/news/world-australia-51439175
“Extreme Weather” is becoming the new normal
Paul Johnston
CXO Consultant and Advisor
Tech and Sustainability
Interim CTO
Community Energy Director
ex-AWS
Climate Activist

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To fix Climate Change, stop being a techie and start being a human
“Extreme Weather” is becoming the new normal
...and this is affecting tech too
Data Centres taken out by Sandy

- More than 8 DCs in New York City
- Basements flooded
- Diesel pumps ran out of fuel

Data:
Wildfires take O’Reilly offline

- Power outages caused shutdown
- Building was in evacuation zone
- Staff had to leave the area

Data:
https://www.vice.com/en_us/article/7x5j8z/the-california-wildfires-knocked-a-big-company-website-offline

The California Wildfires Knocked a Big Company Website Offline

O’Reilly Media’s website went offline “due to the fires and power outages in California,” an unsettling reminder that the internet isn’t immune from the ripple effects of the climate crisis and corporate negligence.
Climate Change:
One more reason to be in the cloud ;)
But…

The IPCC?
Paris?
1.5 degrees?
IPCC:
“Intergovernmental Panel on Climate Change”
Panel that assesses the science related to Climate Change
195 Member Governments
Paris Agreement: 2015

Aim is to keep the global temperature rise by 2100 to well below 2 degrees* and pursue efforts to limit to 1.5 degrees*

*above pre-industrial temperatures
IPCC special report on the impacts of global warming of 1.5°C
October 2018

Includes illustrative pathways for reaching 1.5°C… “12 years”

https://www.ipcc.ch/sr15/
So... how are we doing?
We’re on course for 3.2 degrees

- Need 7.6% drop per year in emissions for next 10 years to hit 1.5 degrees
- UN update February 2020

Story: https://www.wired.co.uk/article/climate-crisis-temperature-target-paris-agreement

It's time to say goodbye to our most ambitious climate target ever

For the last four years, avoiding 1.5 degrees of warming has been at the top of the climate agenda. But the goal is already out of reach. Where do we go next?
“Our collective failure to act early and hard on climate change means we now must deliver deep cuts to emissions”, said Inger Andersen, UNEP’s Executive Director.

In December 2020, countries are expected to significantly step up their climate commitments at the UN Climate Conference - COP26 - due to be held in Glasgow.

However, the urgency of the situation means, said Ms. Anderson, that they cannot wait another year: “they – and every city, region, business and individual – need to act now”.

4C World

“Uninsurable” - AXA

https://www.greenbiz.com/article/axa-4c-warming-makes-world-uninsurable

Insurance giant AXA has announced a quadrupling of its 2020 green investment target from $3.53 billion to $14.13 billion as the company’s CEO warned more than 4 degrees Celsius of warming this century would make the world “uninsurable.”

Launching at the One Planet Summit in Paris, Axa unveiled this week a raft of climate policy moves that also will see it further reduce its exposure to fossil fuel assets.
Major Investors are Divesting from Fossil Fuels

https://www.blackrock.com/corporate/investor-relations/larry-fin k-ceo-letter

Dear CEO,

As an asset manager, BlackRock invests on behalf of others, and I am writing to you as an advisor and fiduciary to these clients. The money we manage is not our own. It belongs to people in dozens of countries trying to finance long-term goals like retirement. And we have a deep responsibility to these institutions and individuals – who are shareholders in your company and thousands of others – to promote long-term value.

Climate change has become a defining factor in companies’ long-term prospects. Last September, when millions of people took to the streets to demand action on climate change, many of them emphasized the significant and lasting impact that it will have on economic growth and...
Climate Change is already here
Change to our way of life is coming

(although what that change will be…?)
For many*, it’s already changed

* mainly in the developing world
But what has this got to do with tech?
Tech has started to get all “Climate-y”
Not the product launch I would have predicted, but a product launch nonetheless. Introducing My Climate Journey!

medium.com/@jjacobs22/my-

My climate journey: it's a thing.
When I wrote about the difficult decision to shut down Two Way Labs before it even got out of the gates, I mentioned how I was longing

medium.com
I'm interested in talking to people who are doing ambitious work to address climate change, using GitHub.

If this applies to you, or someone you know, please get in touch: forms.gle/hyshsHDq4Leb16…

Climate Change on GitHub
We are interested in hearing from people who are working on ambitious projects to address climate change, using GitHub. Please get in touch!

docs.google.com
bryan schreier
@schreier

We @Sequoia are actively investing in Climate Tech and Sustainability (more to come). Why? Because it is both our responsibility and a huge business opportunity (h/t @karaswisher). We’d love to hear from more Climate Tech entrepreneurs:

climate@sequoiacap.com

1,130  9:58 PM - Jan 23, 2020

250 people are talking about this
But are we on the right side?
Technology often seems so **POSITIVE**

But sometimes we should probably ask...
Are we the baddies?

That Mitchell and Webb Look
“The sad truth is that most evil is done by people who never make up their minds to be good or evil.”

Hannah Arendt
Who Is Ultimately Most Responsible for Code That Accomplishes Something Unethical?

<table>
<thead>
<tr>
<th>Option</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper management at the company/organization</td>
<td>57.5%</td>
</tr>
<tr>
<td>The person who came up with the idea</td>
<td>22.8%</td>
</tr>
<tr>
<td>The developer who wrote it</td>
<td>19.7%</td>
</tr>
</tbody>
</table>

64,540 responses

Most developers feel that management is ultimately most accountable for unethical results of code. Just under 20% of respondents said that a developer who writes code used for unethical purposes is most responsible.

Often tech people are ethically “Utilitarian”

An action should maximise happiness & wellbeing for that person and everyone affected
Utilitarianism can lead to unintended consequences especially for third parties*

*it’s worth reading some philosophy and ethics
Utilitarianism:

“Kill one to harvest organs for five”

twitter.com/johnsnolan
Which is why a shift towards employee activism around Climate Change in tech is notable
Employees of big companies joined the #ClimateStrike

Photo: https://twitter.com/AMZNforClimate/status/1176496508771950593
A typical AWS employee banner at the #ClimateStrike

Photo:
https://twitter.com/AMZNforClimate/status/1176496508771950593
Data centres produce about as much greenhouse gas as aviation.
Aviation is bad!

✈

LHR → JFK → LHR

More than 3 tonnes CO2 per person

Photo: twitter.com/profraywills/status/1046231254075465728
Cloud is more efficient than Data Centres
Jevons Paradox

Efficient Clouds means more usage

So Cloud must be powered in a Sustainable way
Example: AI

Easier to create models so we make more use of them and more of them… but the carbon footprint is not small

Quick Aside: AI and ethics

China is using AI to regulate citizens to limit movement due to coronavirus

Quick aside: Efficient DCs

Jessie Frazelle wrote a great blog about this last week.

https://blog.jessfraz.com/post/power-to-the-people/

Power to the People

Wednesday, February 26, 2020

When you upload photos to Instagram, back up your phone to “the cloud”, send an email through GMail, or save a document in a storage application like Dropbox or Google Drive, your data is being saved in a data center. These data centers are airplane hangar-sized warehouses, packed to the brim with racks of servers and cooling mechanisms. Depending on the application you are using you are likely hitting one of Facebook’s, Google’s, Amazon’s, or Microsoft’s data centers. Aside from those major players, which we will call the “hyperscalers”, many other companies run their own data centers or rent space from a colocation center to house their server racks.

Most of the hyperscalers have made massive strides to get a “carbon neutral” footprint for their data centers. Google, Amazon, and Microsoft...
So how good are the major cloud providers at being “green”? 
Good News: Google Cloud and Azure are pretty sustainable (100% offset)

Bad News: AWS are not (50% “in 2018”)

Data centre ethics whitepaper 2018 updated 2020

<table>
<thead>
<tr>
<th>Cloud</th>
<th>Rating</th>
<th>Sustainable Servers?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Google</td>
<td>A-</td>
<td>100% with offsets today, with commitment to ‘real time matching’ (i.e. no carbon release)</td>
</tr>
<tr>
<td>Azure</td>
<td>A-</td>
<td>100% with offsets and energy certificates today, with commitment to be carbon negative by 2030</td>
</tr>
<tr>
<td>AWS</td>
<td>C-</td>
<td>100% with offsets only in four public regions today, elsewhere unknown with estimates in the less than 30-50% range. New commitment to carbon neutrality by 2030 and carbon zero (no carbon release) by 2040. The rating here would be higher but for the continuing lack of transparency on energy usage.</td>
</tr>
<tr>
<td>Oracle</td>
<td>C-</td>
<td>100% with offsets in a few regions &lt;30% overall</td>
</tr>
<tr>
<td>IBM</td>
<td>C-</td>
<td>~50% overall</td>
</tr>
<tr>
<td>Alibaba</td>
<td>D-</td>
<td>Unknown but China a major market, and not known what energy is purchased</td>
</tr>
</tbody>
</table>
Microsoft will be carbon negative by 2030

Jan 16, 2020  |  Brad Smith - President

https://blogs.microsoft.com/blog/2020/01/16/microsoft-will-be-carbon-negative-by-2030/

Jeff Bezos launches $10 billion Bezos Earth Fund, kicking off his own effort to fight climate change

BY ALAN BOYLE on February 17, 2020 at 10:33 am

More Than 350 Employees Risk Their Jobs to Call Out Amazon's Climate Failures

FUEL THE FUTURE

Millions of customers choose the cloud with the most functionality, innovation, and experience.

aws is how

www.BUILDOn.aws
Amazon are in the Top 200 emitters of GHG worldwide
Greenwash!?
Tech has some real problems it needs to solve
Offsets

(make all the bad climate stuff magically disappear right?)
We have a global “Carbon Budget” and we have to

REDUCE EMISSIONS BY A LOT

And almost certainly take Carbon out of the atmosphere too
Limiting warming to 1.5°C is increasingly difficult without large-scale negative emissions.

Pathway to 1.5°C given cumulative emissions through 2019.

Pathway to 1.5°C given cumulative emissions in 2000.

Offsets are a leaky planetary patch while we try to come up with a permanent fix.
So... what can I do?
More “extreme weather” events…

Big companies being “green”…

“Cloud” and Carbon Budgets…

This is all going to  
“change the landscape”
To fix Climate Change, stop being a techie and start being a human
Waste Hierarchy

Most Important  →  Reduce

Reuse

Recycle  ←  Least Important

Most
Important

Least
Important
Waste Hierarchy

- Don’t build it!
- Most Important
- Reduce
- Reuse
- Recycle
- Least Important

Most Important -> Reduce -> Reuse -> Recycle
Sources of emissions*

Electricity 25%
Agriculture 24%
Manufacturing 21%
Transportation 14%
Buildings 6%

*approximately
Sources of emissions*

Electricity 25%
Agriculture 24%
Manufacturing 21%
Transportation 14%
Buildings 6%

*approximately
More “extreme weather” events…

Big companies being “green”…

“Cloud” and Carbon Budgets…

This is all going to “change the landscape”
So what useful tools are there?
Wardley Maps
A useful strategy tool
Free book online

This is the story of my journey, from a bumbling and confused CEO lost in the headlights of change to having a vague idea of what I was doing. I say vague because I’m not going to make grand claims to the techniques that I discuss in this book. It is enough to say that I have found them useful over the last decade whether in finding opportunity, removing waste, helping to organise a team of people or determining the strategy for a company. Will they help you? That depends upon the context that you’re operating in but since the techniques don’t take long to learn then I’ll leave it up to the

medium.com/wardleymaps
Let’s have a nice “Cup of Tea”

and think about this...
Genesis

Custom Built

Product (+Rental)

Commodity (+Utility)

Uncharted

Visible

Invisible

BUSINESS

PUBLIC

CUP OF TEA

CUP

TEA

STAFF

HOT WATER

WATER

POWER

KETTLE

CUP

TEA

HOT WATER

WATER

POWER

KETTLE
Note: Emissions are highly abstracted in a mature oil-based economy
“Decoupling”

The term decoupling refers to breaking the link between “environmental bads” and “economic goods.” Decoupling environmental pressures from economic growth is one of the main objectives of the OECD Environmental Strategy for the First Decade of the 21st Century, adopted by OECD Environment Ministers in 2001.

Highly commodified
Low perceived value
Hard to displace
If emissions are “baked in”, can you do anything about it?
START WITH...
FINANCE METRICS
EMISSIONS: Power

Visible

Value Chain

Invisible

Evolution

Genesis

Custom Built

Product (+Rental)

Commodity (+Utility)

Uncharted

Industrialised

BUSINESS

PUBLIC

CUP OF TEA

CUP

STAFF

TEA

HOT WATER

WATER

POWER

KETTLE

+CUP

+8
EMISSIONS: Single Use Cup

- KETTLE
- HOT WATER
- TEA
- CUP
- STAFF
- BUSINESS
- PUBLIC
- POWER

Value Chain

Genesis

Custom Built

Product (+Rental)

Commodity (+Utility)

Visible

Uncharted

Industrialised

Evolution

POWER

WATER

HOT WATER

TEA

STAFF

CUP OF TEA

CUP

Invisible
EMISSIONS:
Tea

CUP OF TEA
+2

CUP

TEA
+5

STAFF

HOT WATER

WATER

POWER
+8

KETTLE

BUSINESS

PUBLIC

Commodity (+Utility)

Evolution

Value Chain

Visible

Uncharted

Invisible

Genesis

Custom Built

Product (+Rental)

Commodity (+Utility)
EMISSIONS: Kettle CAPEX

- POWER: +8.03
- HOT WATER: +1
- TEA: +0.5
- STAFF: +5
- CUP: +2

Value Chain

- Invisible: Genesis, Custom Built, Product (+Rental), Commodity (+Utility)
- Visible: BUSINESS, PUBLIC

Uncharted to Industrialised
REUSABLE CUPS + DISHWASHER

Value Chain

Genesis

Custom Built

Product (+Rental)

Commodity (+Utility)

Evolution

Uncharted

Visible

Invisible

BUSINESS

PUBLIC

CUP

CUP OF TEA

+0.25

TEA

+5

STAFF

+0.5

HOT WATER

+1.03

WATER

+1

POWER

+0.5

KETTLE

+0

HOT WATER

+0.03

REUSABLE CUPS

+0.25

DISHWASHER

+6.78
ETHICALLY SOURCED TEA
+ LOOSE LEAF
+ STRAINER
FREE PUBLIC TRANSPORT TICKETS FOR STAFF + ORDER AUTOMATION
"PLANT A TREE" TEA

Value Chain

Genesis  Custom Built  Product (+Rental)  Commodity (+Utility)  Evolution

Uncharted  Visible  Public  Industrialised

Invisible

BUSINESS  CUP OF TEA  CUP  TEA  STAFF  HOT WATER  TREE PLANTING ORG  WATER  KETTLE  POWER

(tree planting org - 5, tea +0.25, staff +0.25, hot water +3, water +0.5, kettle -0.99, power +0.01, water +0.51, electricity +0.01, tea +0.25, business -5)
Genesis
Custom Built
Product (+Rental)
Commodity (+Utility)

Uncharted
Visible

PLANET
BUSINESS
PUBLIC

Invisible
Value Chain

TREE PLANTING ORG
STAFF
HOT WATER
KETTLE
WATER
POWER

BUT...
IT'S AN OFFSET

+4.01
+0.25
+3
+0.25
+0.5
+0.01
+0.51
+4.01
-5
-5
-5
-5

CUP OF TEA
CUP
TEA
TEA

CUP
TEA
TEA

HOT WATER
WATER
WATER

WATER
WATER
WATER

POWER
POWER
POWER

+0
+0
+0
ANY “+” IS STILL GENERATING EMISSIONS
EMISSIONS REDUCTION METRICS

~ = -1

Visible

Value Chain

Invisible

Genesis

Custom Built

Product (+Rental)

Commodity (+Utility)

Evolution

Uncharted

PLANET

BUSINESS

PUBLIC

CUP OF TEA

CUP

TEA

STAFF

HOT WATER

WATER

POWER

KETTLE

TREE PLANTING ORG

CUP

TEA

STAFF

HOT WATER

WATER

POWER

KETTLE
EMISSIONS METRICS BEFORE

- BUSINESS: +16.53
- PUBLIC: +2
- CUP OF TEA: +0.5
- CUP: +5
- TEA: +9.03
- STAFF: +2
- HOT WATER: +1
- WATER: +1
- KETTLE: +8
- POWER: +8.03
- HOT WATER: +9.03

Value Chain

- Genesis
- Custom Built
- Product (+Rental)
- Commodity (+Utility)

Evolution

- Uncharted
- Visible
- Industrialised

CUP OF TEA
EMISSIONS REDUCTION AFTER

Value Chain

Visible

Invisible

Uncharted

Genesis

Custom Built

Product (+Rental)

Commodity (+Utility)

Evolution

PLANET

BUSINESS

PUBLIC

CUP OF TEA

CUP

TEA

STAFF

+4.01

+0.25

+3

+0.5

+0.01

+0.51

-5

-0.25

-3

-0.51

-5

+4.01

+0.01

-0.5

-0.01

+0.01

-0.51

-4.01

-0.01

+0.5

+4.01

+0.01

-0.5

+4.01

+0.01

-0.5
What about the real world?

(It’s not all “cups of tea” is it!)
What about choosing a cloud provider?

(if all compute was equal… which it isn’t in cloud… see “serverless”)
CLOUD CHOICE?

Value Chain

Genesis
Custom Built
Product (+Rental)
Commodity (+Utility)

Evolution

Uncharted

Visible

Invisible

COMPANY

TECH PRODUCTS

POWER

GOOGLE
AWS
AZURE
Maps are useful for identifying and mitigating emissions

Maps are never perfect (enemy of good) but are meant to start conversations
Downside: hard to report on your own and your supply chain emissions (the “Cup of tea” numbers are not real!)

AWS does not give you emissions so you can’t even offset
In 2017, Stripe became a carbon-neutral company

Though Stripe doesn’t make a physical product—our API powers online commerce for millions of businesses around the world—our operations still contribute to global climate change. So, we decided to take action by measuring our greenhouse gas footprint and purchasing enough carbon offsets to reach net-zero emissions.

We began 2017 at an estimated 18,000 metric tonnes of emissions. The GHG Protocol Corporate Standard assesses greenhouse gas emissions on three dimensions. Stripe estimated all three emission scopes, in tonnes of carbon dioxide equivalent (TCO2E), to determine the magnitude of our impact.

Scope 1: Direct GHG

Emissions from sources owned or controlled by Stripe, e.g. natural gas burned to heat our buildings.

320 TCO2E

Scope 2: Indirect GHG

Emissions from purchased energy sources, e.g. the electricity we buy from utility companies.

880 TCO2E

Scope 3: Other Indirect GHG

Emissions from operations that are not directly owned or controlled by Stripe. This includes many sources, but we’ve chosen to focus on servers, employee commuting, and business travel.

16800 TCO2E

Stripe’s climate reporting page, from 2018
But what about my code and systems?
Most climate friendly tech solution? No tech at all

(reduce - reuse - recycle)
Turn off your unused instances and servers

(reduce - reuse - recycle)
Stop building “climate apps” and worrying about “code efficiency” (unless it’s terrible)

(reduce - reuse - recycle)
Code like it’s 1985!

Constraints are not bad

(reduce - reuse - recycle)
Go serverless

(reduce - reuse - recycle)
Sustainability metrics

Do you know how much energy your project will use over its lifecycle?

(reduce - reuse - recycle)
Emissions

Scope 1, 2 and 3

Limited data on emissions

Many sectors still estimating
But what about Business Continuity and Disaster Recovery?
Climate Change is becoming one of the most important risk factors for the C-Level.

But not for Disaster Recovery professionals.
Most Disaster Recovery is about planning for "exceptional" events.

Climate Change is changing "exceptional"
As the O’Reilly scenario shows, it isn’t just about extreme weather

What about impacts on employees and families?
Climate Risks are much more than simply future sea level rise and heating.

How resilient is your organisation?
Wardley Mapping is a really good tool for seeing externalities like Climate Change.
The biggest climate risk is capital risk

See BlackRock
Most sustainability professionals don’t “talk tech”

Go and be their best friend
Ignoring the Climate Crisis isn’t an option...


Firms ignoring climate crisis will go bankrupt, says Mark Carney

Bank of England governor warns of financial collapse linked to climate emergency

- Top asset managers oversee $300bn fossil fuel investments
- Why are asset managers investing in fossil fuel companies?

Mark Carney, the Bank of England governor, has led efforts to address the dangers global heating poses to the financial sector. Photograph: Leon Neal/Getty Images

Companies and industries that are not moving towards zero-carbon...
Climate Change is changing our world:
The new normal
Just because we work in tech doesn’t make us automatically “good”
Get involved

Learn

It’s going to take all of us

https://climateaction.tech/