Bringing the Climate Impact of Electricity Back to Reality

Trevor Hinkle / @trevorhinkle3
trevor.hinkle@tmrow.com

Tomorrow

tmrow.com

Agenda

- Tomorrow / electricityMap and our vision
- How we measure the climate impact of electricity now
- Flaws in this system
- A proposal for a new way of measurement, already being put into action

Who are we?

Olivier Corradi
CEO / Founder

- Built electricitymap.org and made it profitable
- Scaled snips.ai (sold to Sonos) from 1 to 35 employees as VP Eng
- M.Sc. Mathematics from Denmark's Technical University and M.Eng. from Centrale Paris

Trevor Hinkle
Head of electricityMap

- M.Sc. Climate Change at Copenhagen University
- Experience in several growth startups and agencies
- Involved in electricityMap since 2017

Søren Svejstrup
Head of Product

- M.A. Digital Design and Communication from the IT University of Copenhagen

Kenneth Skovhus
Head of Engineering

- M.Sc. Computer Science from Denmark's Technical University

Martin Collignon
COO, Growth

- Fmr. Member of Youth Climate Council at the Danish Ministry of Climate

Google unity IBM lix mobilelife issuu Uber

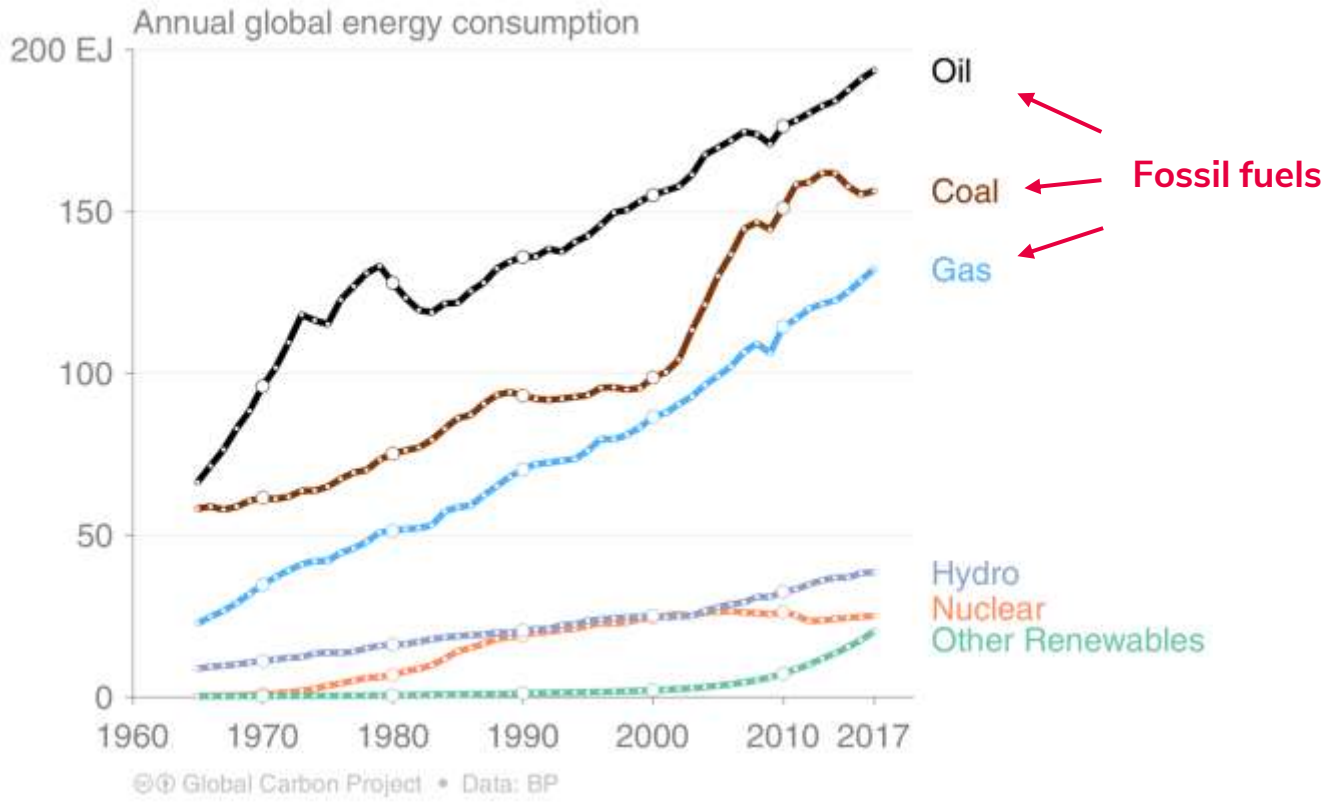
The biggest challenge of our time

Atmospheric CO2 concentration in the last 40 000 years

in ppm (particles per million)

tmrow.com/**climatechange**

We’re addicted to fossil fuels



“ the real danger is when companies and politicians are **making it look like real action is happening, when in fact, almost nothing is being done apart from clever accounting and creative PR** “

- Greta Thunberg, July 23rd 2019, Paris

In 2016, we built electricitymap.org

to map the world's electricity emissions, **in real-time**

- 3000 daily active users, >1 million visits in 2018, 100% organic
- >700 github contributions with >90 country integrations
- Used in TV debates, classrooms, universities, by policy makers..

GET IT ON Google Play

Download on the App Store

Our peer-reviewed methodology aggregates hundreds of datasets to account for imports/exports of electricity, going beyond public data

Our published research on this topic can be found here: Tranberg et al. (2018) "Real-Time Carbon Accounting Method for the European Electricity Markets" https://arxiv.org/abs/1812.06679

Case Study 1: Microsoft/Vattenfall Wind Farm in NL

- MS buys entire production of Vattenfall wind farm in NL to supply their data center
- Local citizens upset that green electricity appears to be mostly going to data center when it could power 370k households
- ***How did this really affect the grid? How we do measure the additionality of this action? Who is really getting the benefit here?***

Sources: https://nos.nl/artikel/2350450-opening-grootste-windpark-van-nederland-meeste-stroom-naar-datacenter-microsoft.html
https://www.techzine.nl/nieuws/cloud/116037/microsoft-zal-nederlandse-datacenter-volledig-groene-stroom-voorzien/

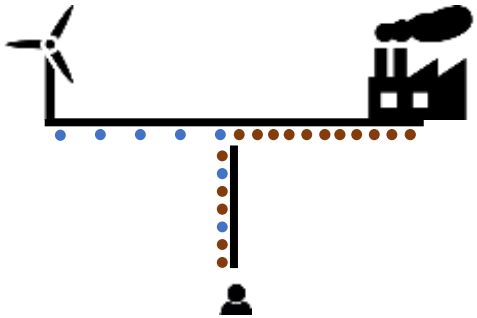
How does the world measure the climate impact of electricity use?

Attributional accounting

How much CO2 have I emitted as a result of my electricity consumption in a given period ?

Relevant for electricity consumers

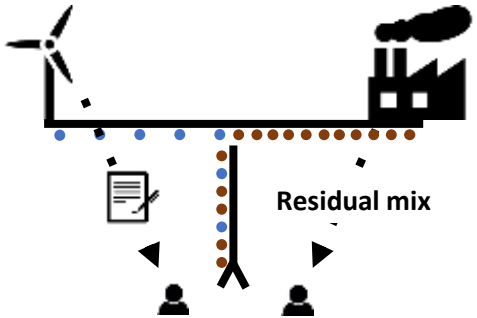
Location-based approach



33%
wind
67% coal

Using average carbon intensity

Market-based approach



100% **wind** 0% coal

0% wind **100%** **coal**

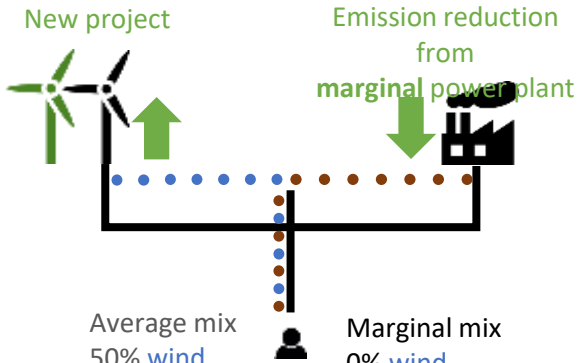
Using "Guarantees of Origin" or RECs

Consequential accounting

*How much CO2 is my project or my action **avoiding** ?*

Relevant for project-owners

Marginal approach



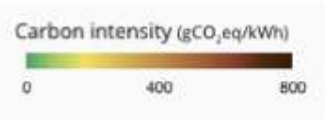
Average mix
50% wind
50% coal

Marginal mix
0% wind
100% coal

Using marginal carbon intensity

The two rules are fundamentally different!

Location-based view
(average grid carbon intensity)



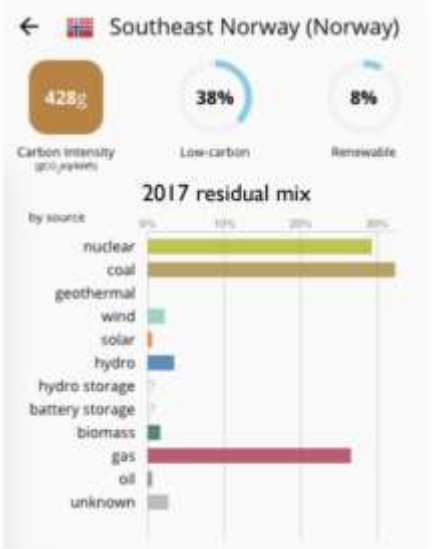
Market-based view
2017 residual mix (i.e. consumers without a 'green contract')

Case Study 2: Norwegian EVs and European Data Centers

- As a Norwegian citizen, I buy an EV because I think Norwegian electricity is mostly hydro and therefore clean, hence I'm reducing my impact

- But Norway has sold most of their green electricity certificates throughout Europe (a market-based approach)

- Both me an a Norwegian citizen and a European data center company who bought these certificates will claim responsibility - double-counting!



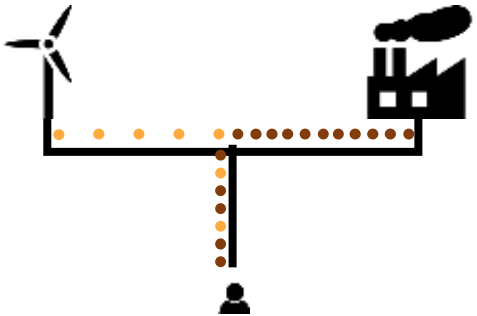
Challenges with the market-based system

- **Double-counting** and cross-sector integration challenges
- Conflating **responsibility** and **impact** measurements
- Difficulty in measuring **additionality** of market-based schemes - similar to offsets
- A system that ignores the **physical realities** of the grid

How can we bring the climate impact of electricity back to reality?

Step 1: **Responsibility**
"Clean up your own house"

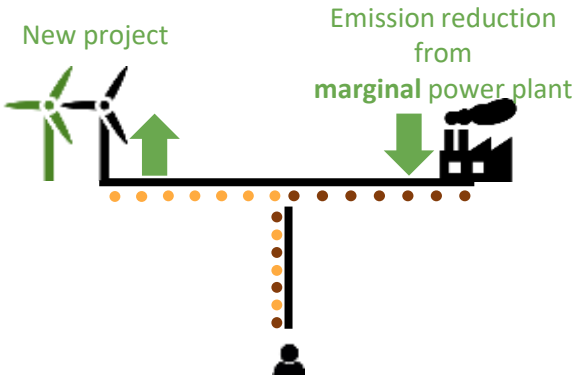
Location-based carbon accounting approach



Using **average** carbon intensity

Step 2: **Impact**
"What is the best way to lower the world's CO2 emissions from electricity?"

Marginal approach



Using **marginal** carbon intensity

Examples of Impact activities through this framework

- Time-based or geographic-based **load-shifting/optimization** of consumption based on the carbon intensity of the grid

- **PPAs and GOs/RECs** optimized based on marginal impact, and taking into account:
  - Geographic and physical constraints such as cross-border flows
  - Time constraints? Account for hourly variations?

- Others?

This framework in action (1/2): Google’s 24/7 carbon-free goal

This framework in action (2/2): Optimizing time-of-use of electricity

Google The Keyword Latest stories Product updates Company news

DATA CENTERS AND INFRASTRUCTURE

Our data centers now work harder when the sun shines and wind blows

Ana Radovanovic
Technical Lead for Carbon-Intelligent

Addressing the challenge of climate change demands a transformation in how the world produces and uses energy. Google has been carbon neutral

Summary

- The way we often account for the climate impact of electricity has inherent flaws, presenting **major climate and PR risks**
- We can avoid these risks by disaggregating **responsibility** and **impact** measurements, and...
- We can use marginal carbon intensity models to better measure the **additionality** of impact activities

democratising climate action

Trevor Hinkle / @trevorhinkle3
trevor.hinkle@tmrow.com

tmrow.com