The electricityMap

Real-time grid mix computation, and GHG accounting implications

A project by the French-Danish startup Tomorrow (tmrow.com)

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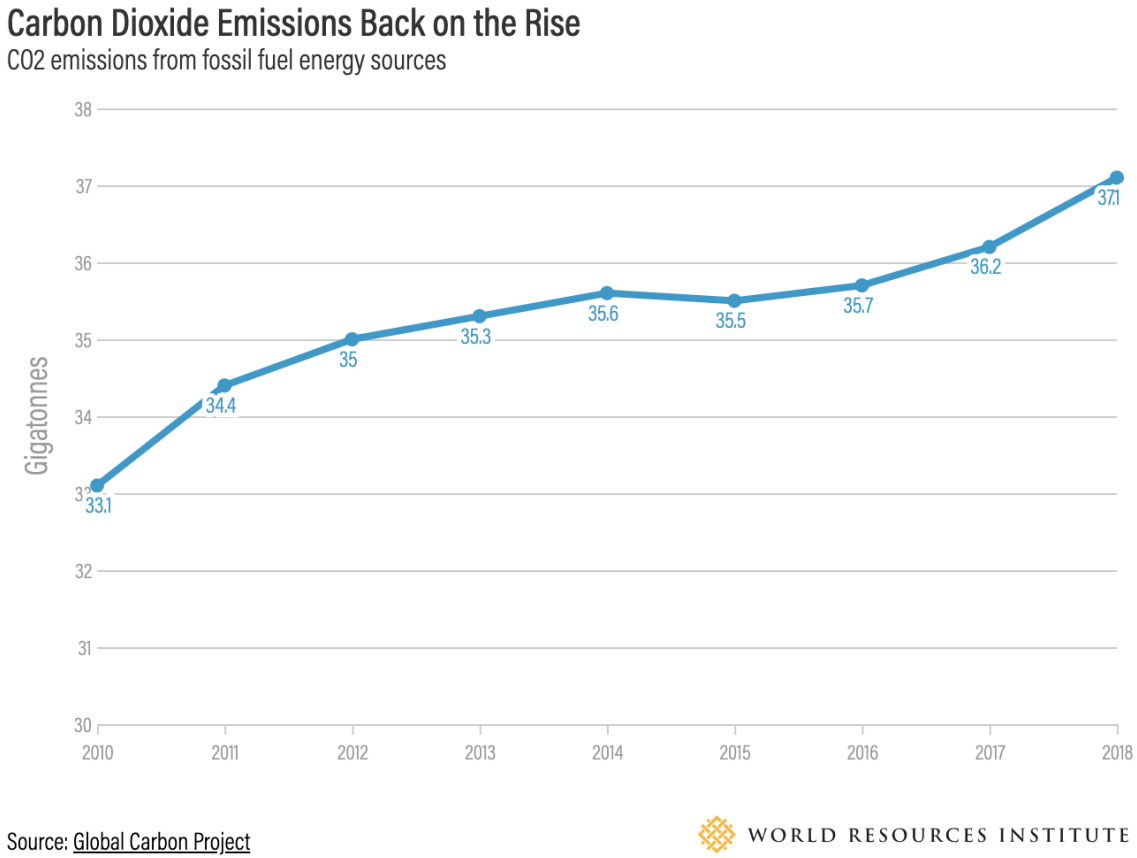
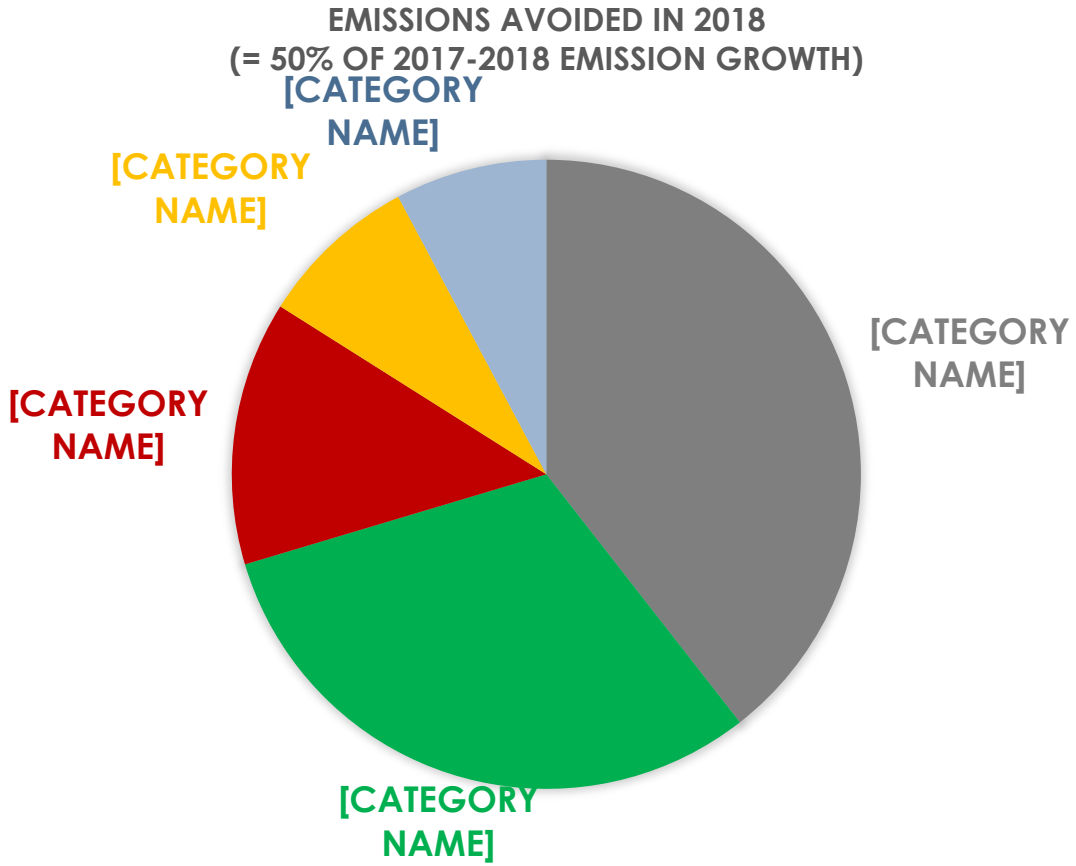
Bruno Lajoie / bruno.lajoie@tmrow.com / +33 6 67 95 10 92

A bit of context (1/2)

- GHG emissions accelerated in 2018
- Coal power is the single largest source of growth



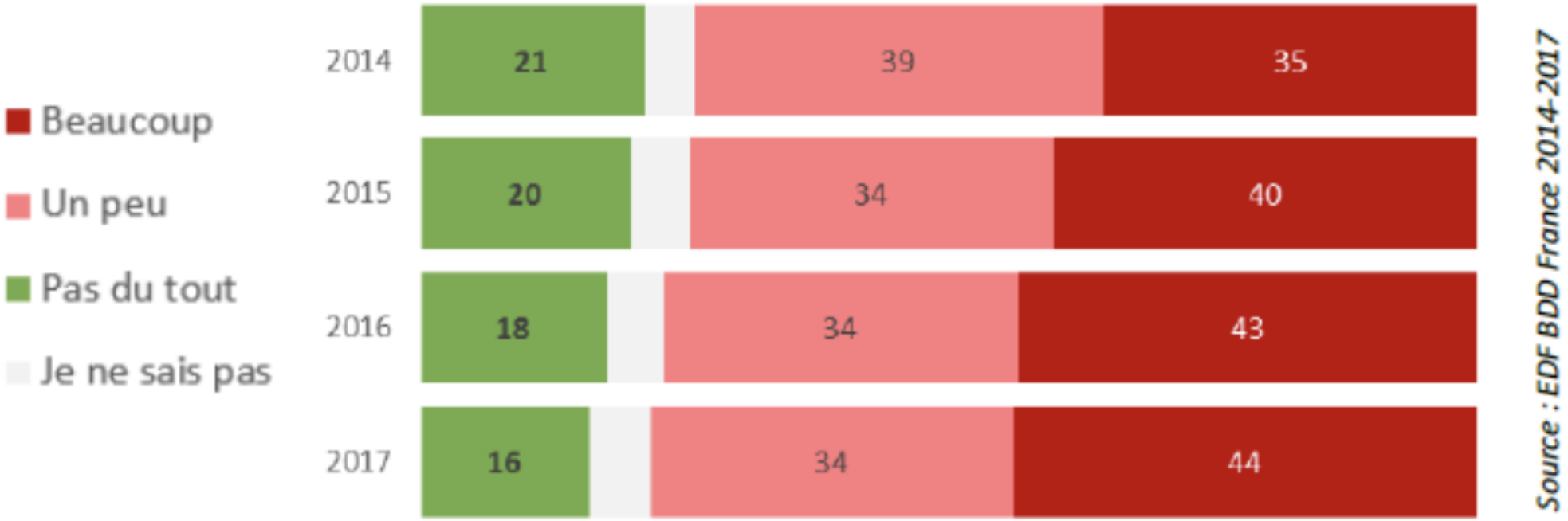
- 2018 growth would have been twice bigger without energy management
- Half of these savings were related to electricity transition



Source: IEA (2019)

A bit of context (2/2)

« Selon vous, le nucléaire contribue t-il à l'effet de serre (au réchauffement de l'atmosphere)? »



We built the **electricityMap** to educate citizens and inform companies about the impact of their electricity consumption

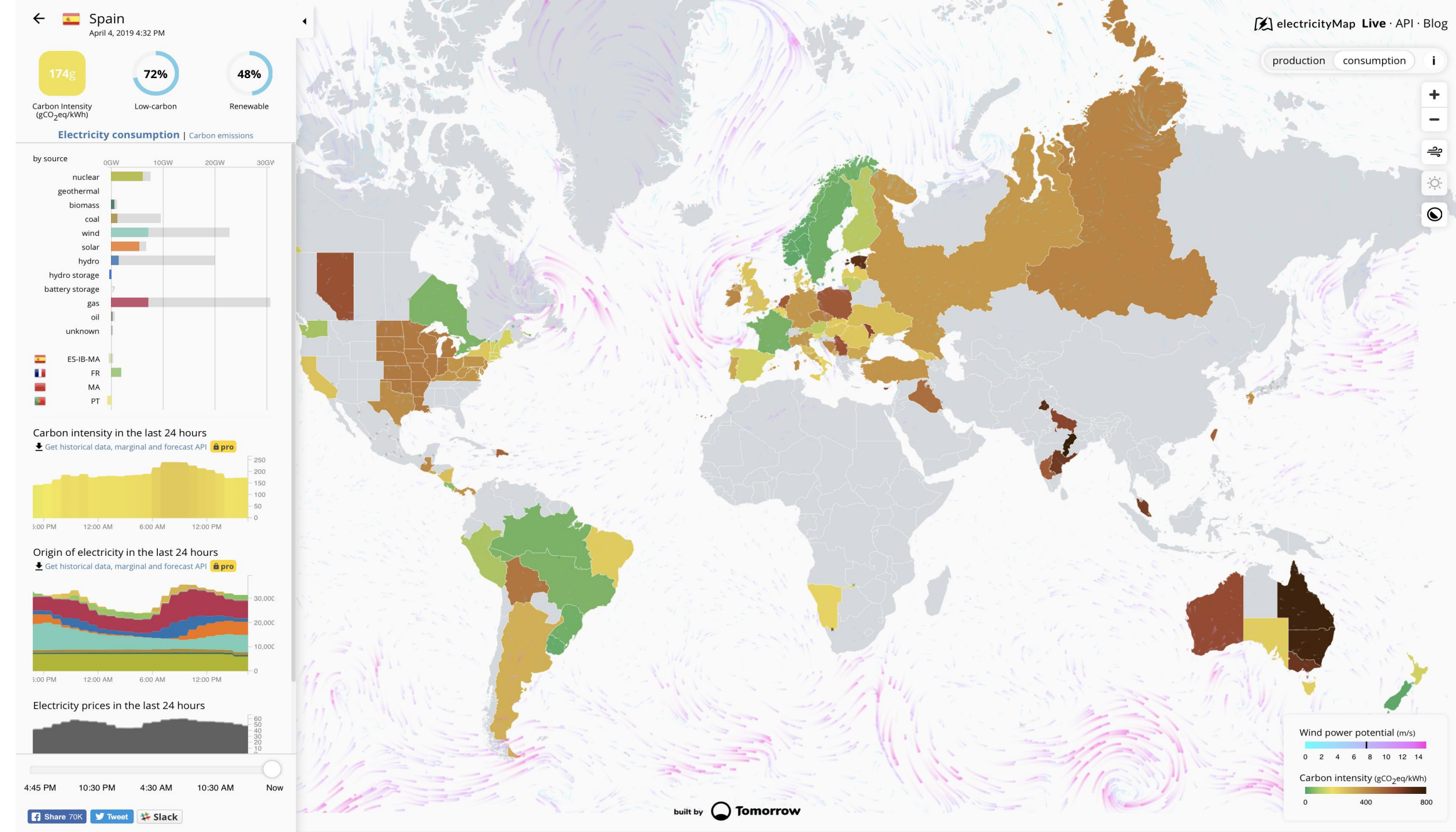
*"How clean your electricity is, **right now**"*

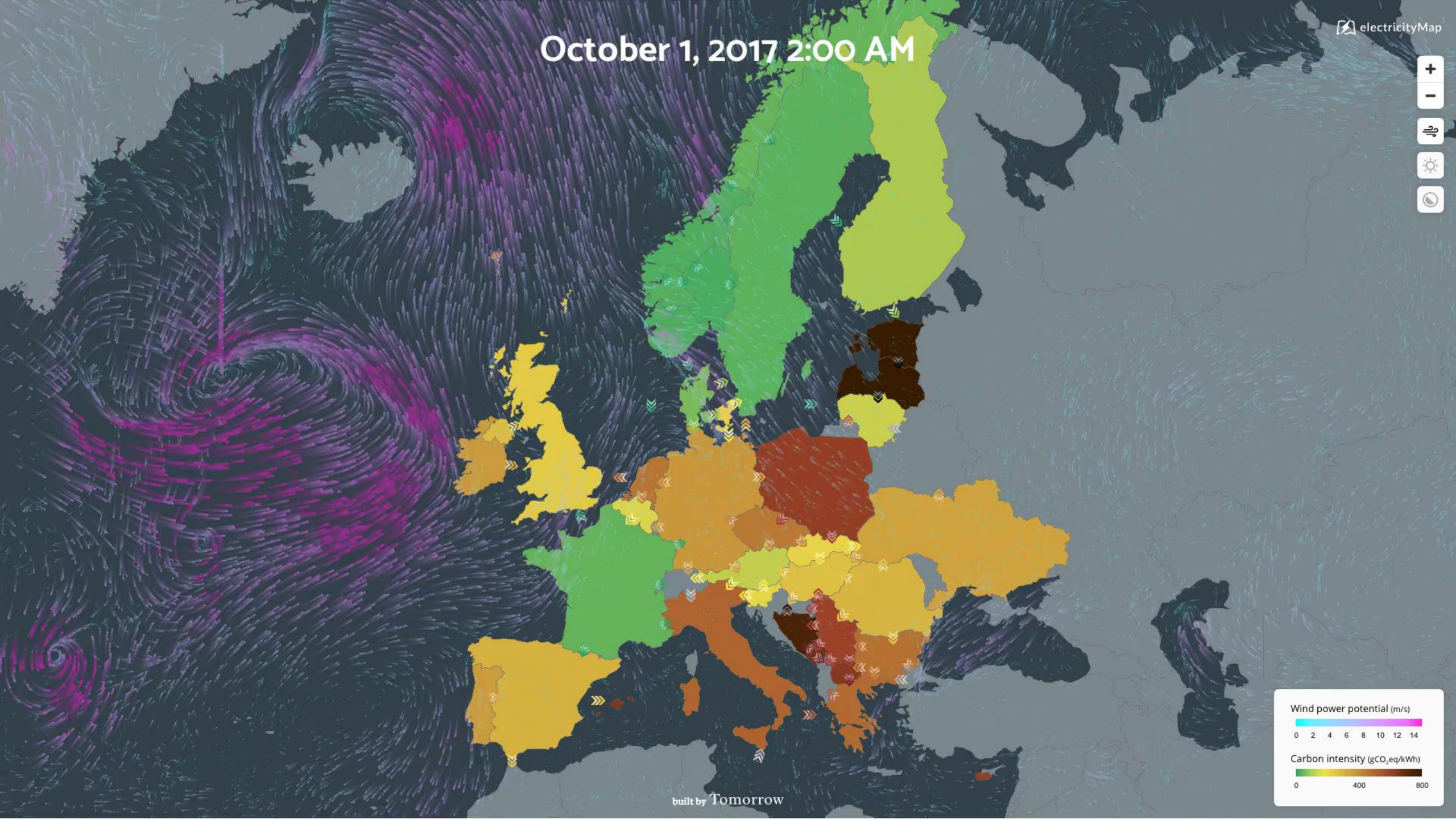
- 3000 daily visitors, >1 million visits in 2018
- >700 open-source
- Used in TV debates, classrooms, universities, by policy makers..

GET IT ON Google Play

Download on the App Store

www.electricitymap.org

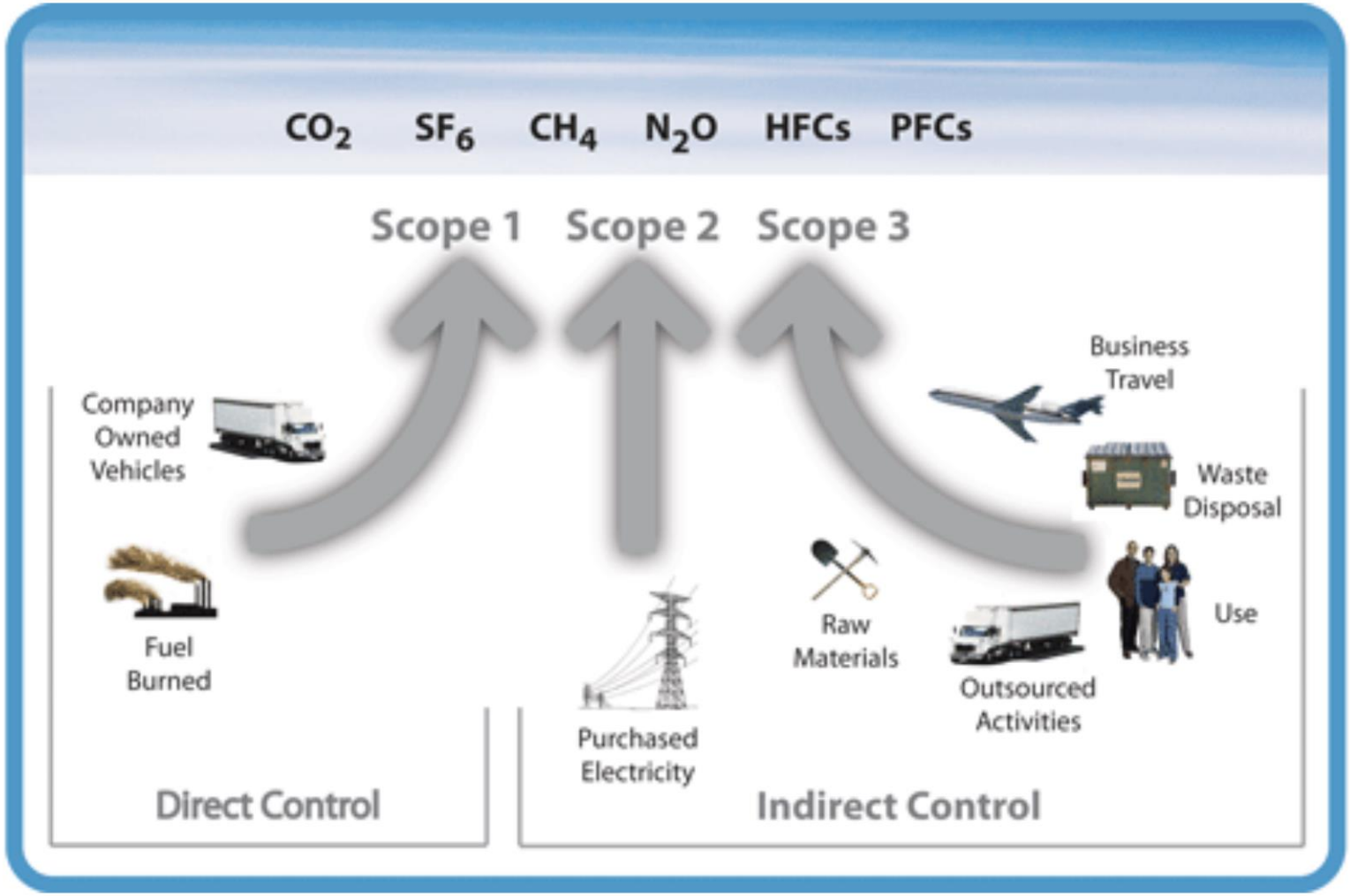

Spain
April 4, 2019 4:32 PM
174g
Carbon Intensity (gCO2eq/kWh)
72%
Low-carbon
48%
Renewable
Electricity consumption | Carbon emissions
by source
0GW
10GW
20GW
30GW
nuclear
geothermal
biomass
coal
wind
solar
hydro
hydro storage
battery storage
gas
oil
unknown
ES-IB-MA
FR
MA
PT
Carbon intensity in the last 24 hours
Get historical data, marginal and forecast API
pro
250
200
150
100
50
0
12:00 AM
6:00 AM
12:00 PM
Origin of electricity in the last 24 hours
Get historical data, marginal and forecast API
pro
30,000
20,000
10,000
0
12:00 AM
6:00 AM
12:00 PM
Electricity prices in the last 24 hours
60
50
40
30
20
10
4:45 PM
10:30 PM
4:30 AM
10:30 AM
Now
Share 70K
Tweet
Slack
electricityMap Live · API · Blog
production
consumption
i
Wind power potential (m/s)
0 2 4 6 8 10 12 14
Carbon intensity (gCO2eq/kWh)
0
400
800
built by Tomorrow


October 1, 2017 2:00 AM
electricityMap
Wind power potential (m/s)
0 2 4 6 8 10 12 14
Carbon intensity (gCO2eq/kWh)
0 400 800
built by Tomorrow

Greenhouse Gas Accounting (1/2)

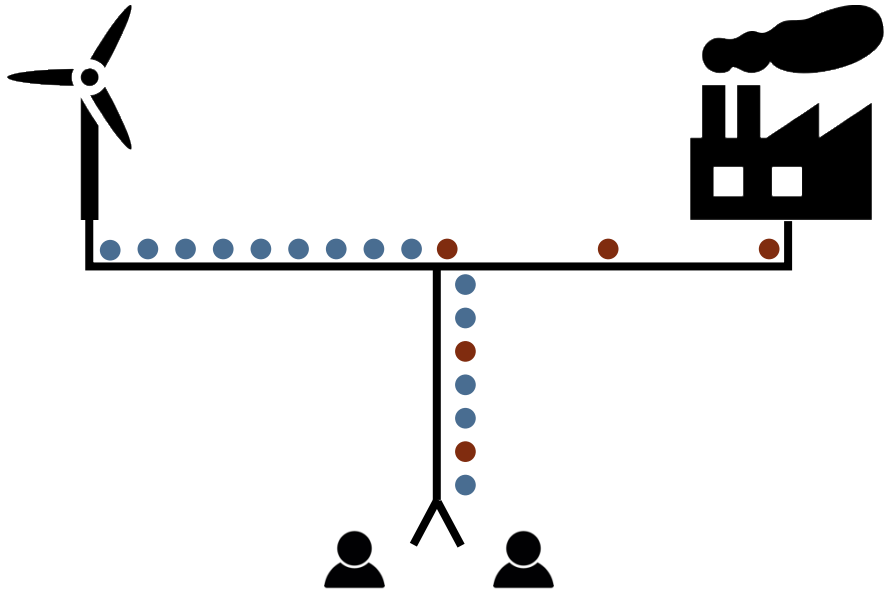
How to claim the origin of electricity consumed, and its carbon footprint ?
(attributional accounting)

Emissions related to your electricity consumption are part of the
Scope 2 of your GHG accounting



Two accounting methodology co-exist and are allowed (!!)

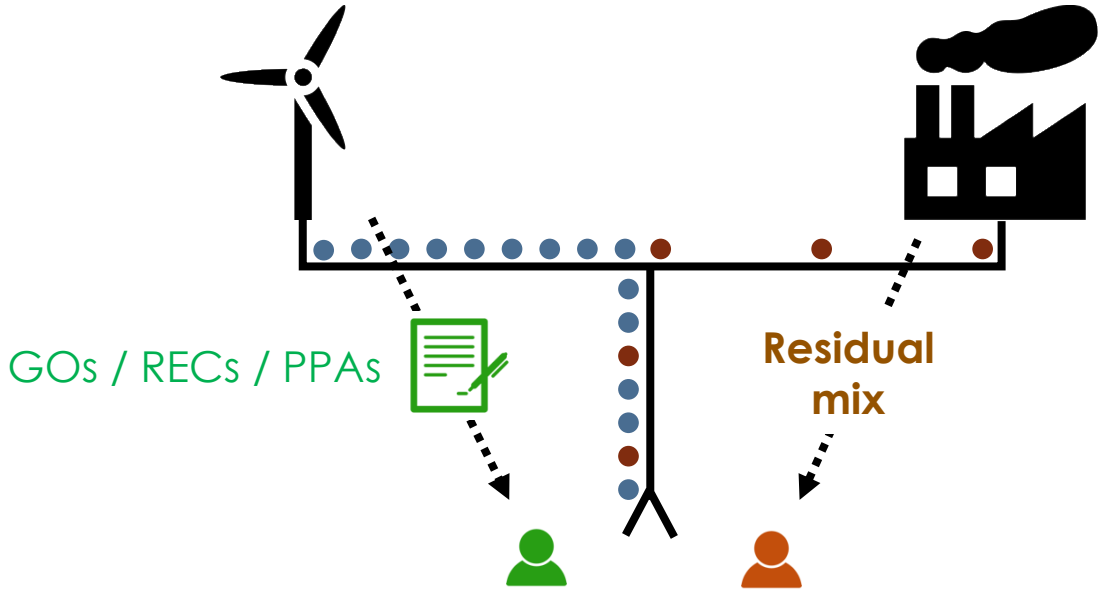
Physical point-of-view
("location-based" accounting)



67% wind
33% coal

electricityMap approach

Contractual point-of-view
("market-based" accounting)

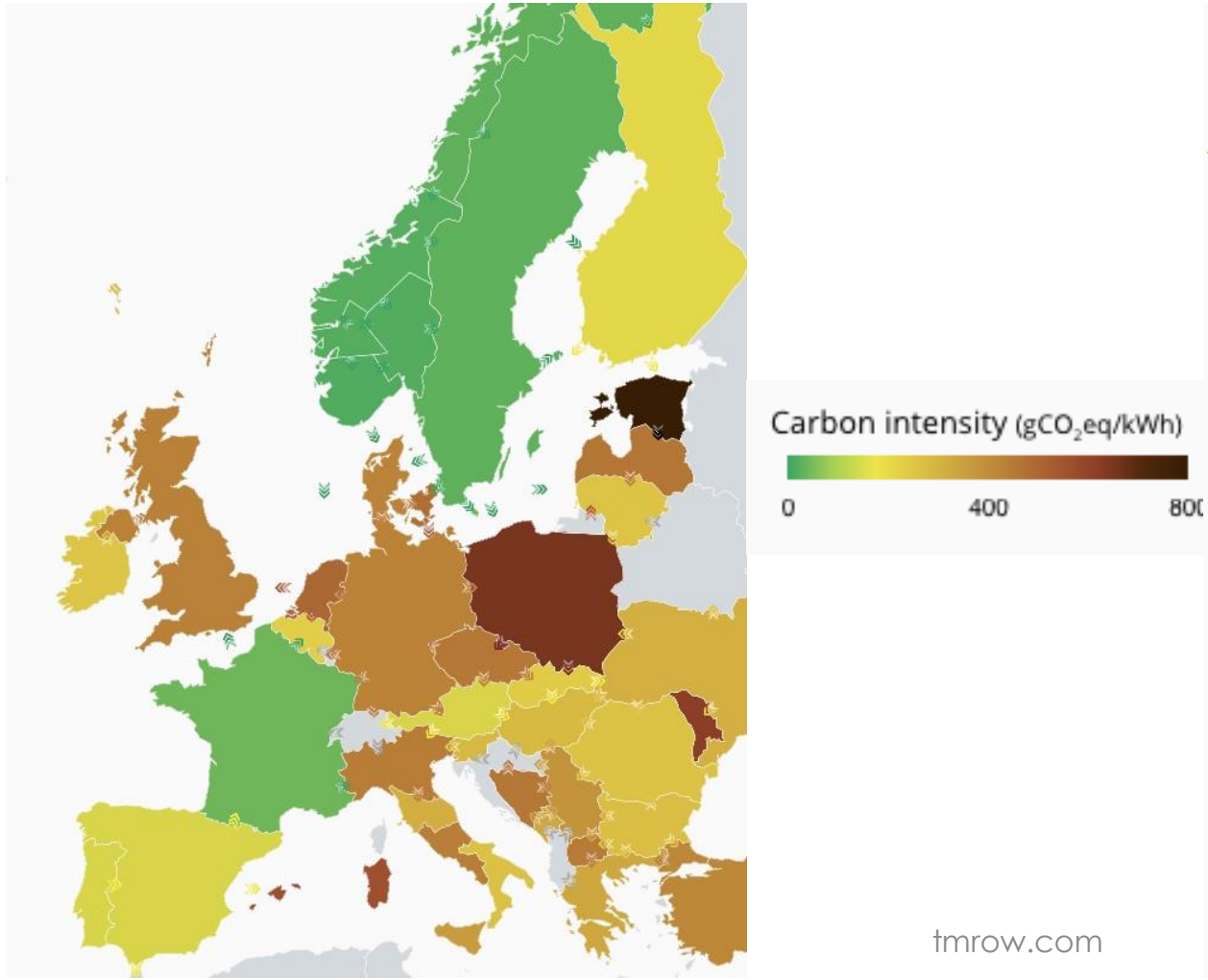


100% wind
0% coal

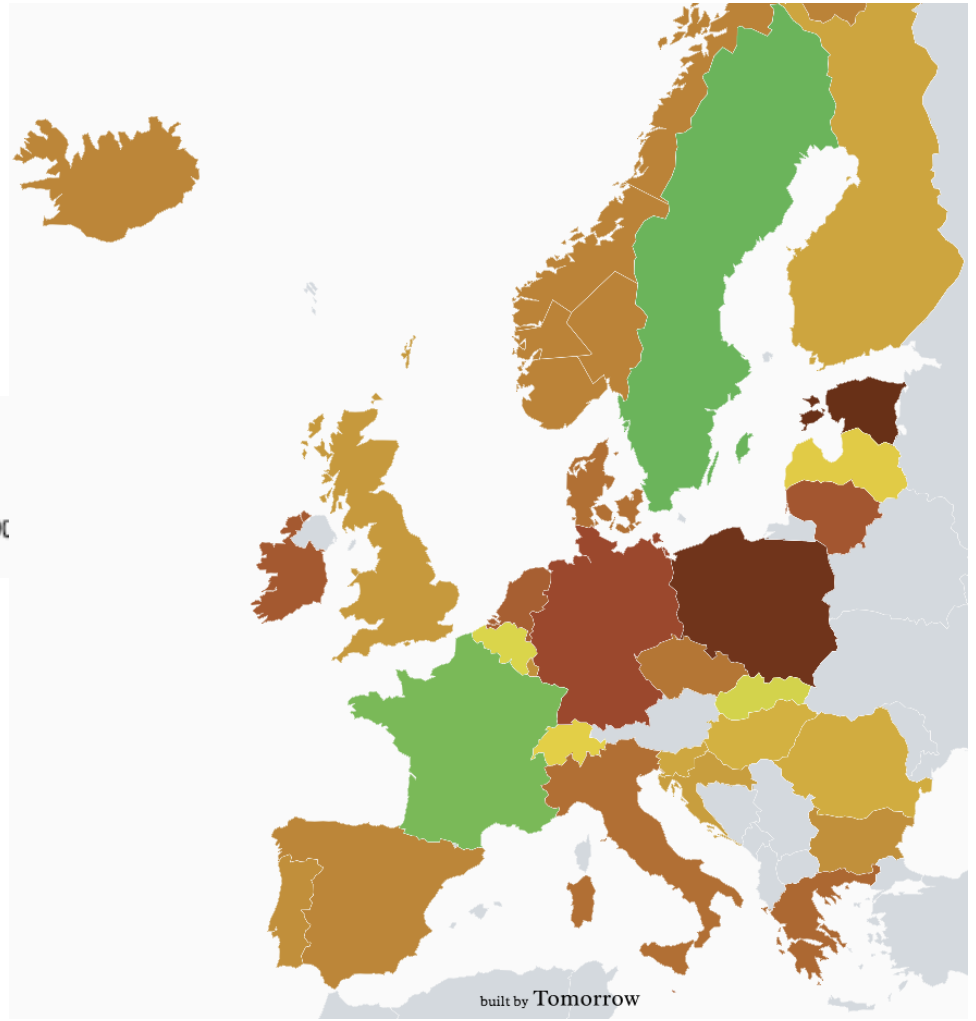
0% wind
100% coal

The two approaches gives totally different results (!)

Location-based point of view, 2017 average
(only depends on place & time of consumption)



Contractual point of view, 2017 average
(for those who did not buy green certificates)



Everyone is green (double claims !)

example: Norwegian citizen vs. European data center

- As 97% of Norwegian citizens, I don't have a "green electricity contract". I believe electricity is clean in Norway, because hydro plants makes up nearly all power plant around me.
- However, the Norwegian residual mix is actually very dirty (made up of ⅓ coal, ⅓ gas, ⅓ nuclear in 2017), because Norwegian hydro plants sold almost all their certificate throughout Europe.
- I will claim that if I buy an electric vehicle, I will be green because I will run on hydro.
- The European company that had bought the Norwegian green certificate will also claim to be 100% renewable powered.
- Listening to the market-based proponent, I should keep my gasoline car until I have switched to a green electricity contract, because running on the residual mix is dirtier.

Let's be coherent

- The location-based is the only reasonable approach to say anything about the origin of your electricity, and quantify it's GHG impact, because it preserves causality
- The market-based instead measures **the origin of the power plant to which you are giving a financial subsidy**
- Yes, market-based may in some case have accelerated renewable installation by incentivizing companies to enter new PPAs
- But it has happens in place of real efficiency measures, and created vast greenwashing that slowed down consumer awareness & responsibilities:
  - Exaggerated marketing claims such as "green electricity contract" or "powered 100% by renewable" happens when using market-based
  - Companies should not be able to report 0 scope 2 emissions using their green certificate purchase, mis-funelling green finance
  - Certificates should be constrained in space and time to follow physical constraints of the grid, thereby making it much more expensive to become "100% renewable", increasing subsidy to renewable sector

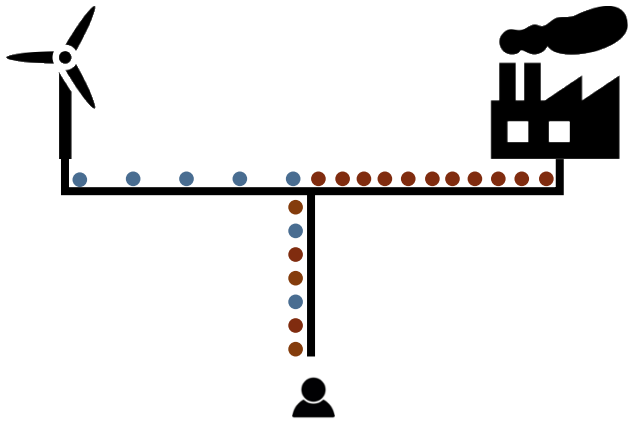
- → Market-based is a incomplete measure of financial subsidy you given to renewable sectors (price paid for certificates is not tracked!)
- → How to properly measure the impact of a specific action/project/investment on the power grid?
- → Use the marginal signal (consequential accounting)

Greenhouse Gas Accounting (2/2)

How to claim the benefits of a grid-related project ?
(consequential accounting)

The **marginal** origin of electricity consumed is used to quantify the consequence of an action on the grid

Average mix

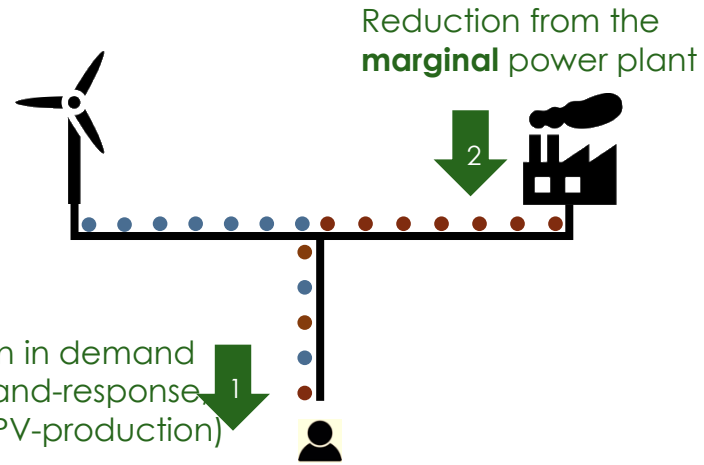


average grid mix: 33% wind, **67% coal**

average grid carbon intensity: 670 gCO_2/kWh

The **average** carbon intensity allows quantifying how much CO_2 an electricity consumer **emits** over a given period

Marginal mix

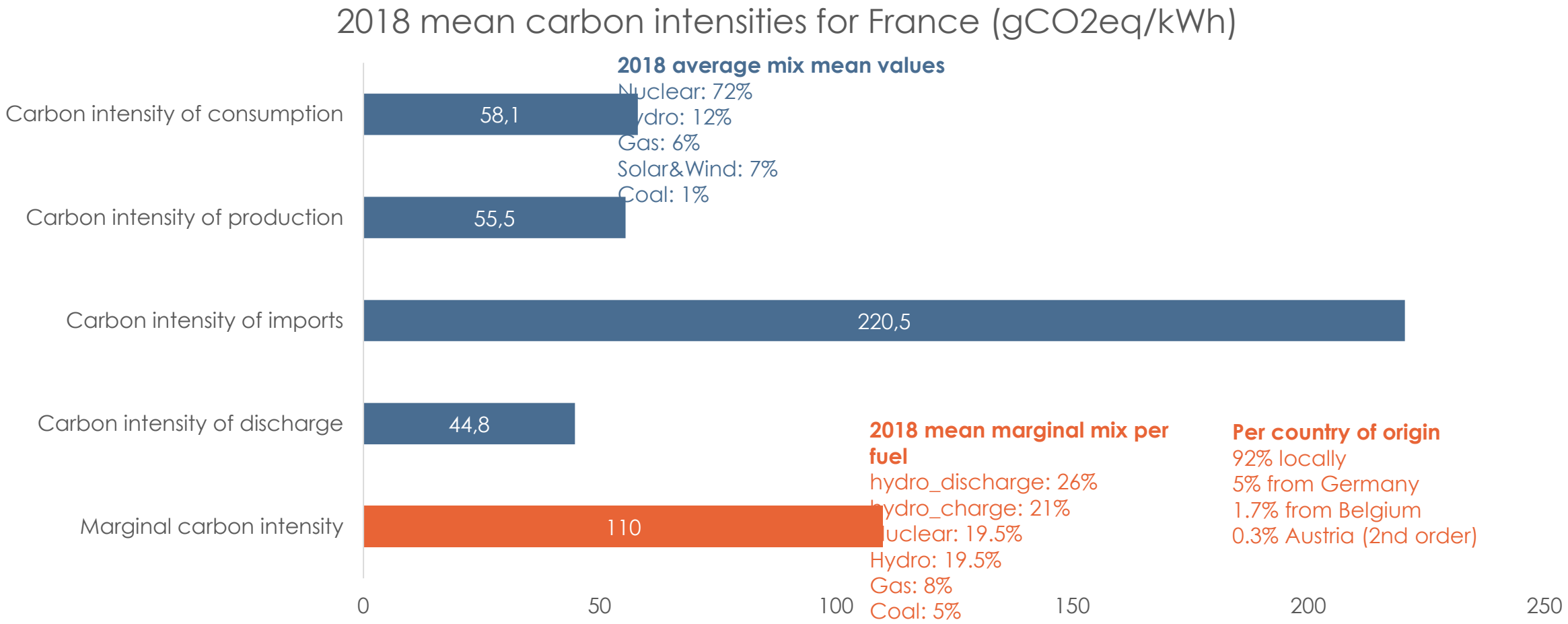


marginal grid mix: 0% wind, **100% coal**

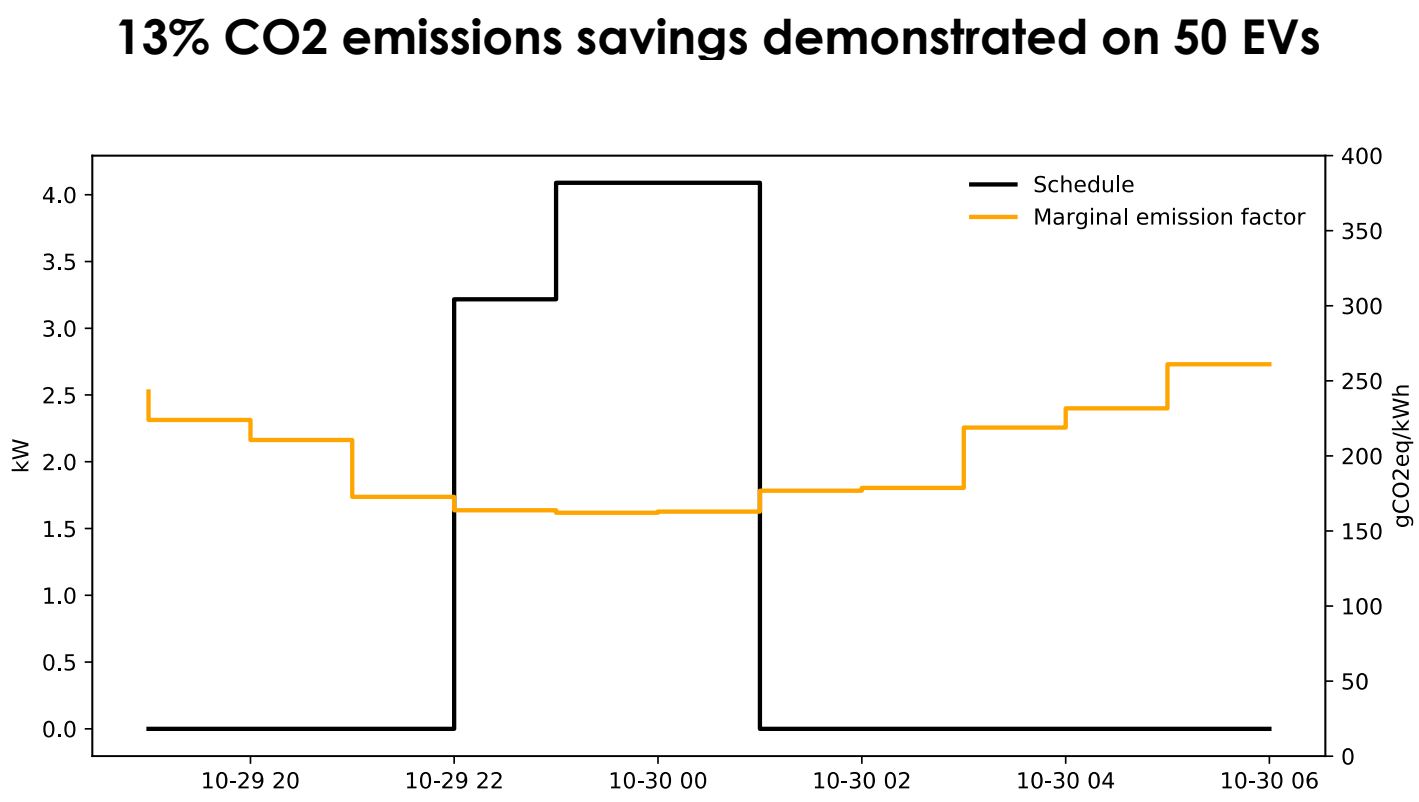
marginal grid carbon intensity: 1000 gCO_2/kWh

The **marginal** carbon intensity allows quantifying how much CO_2 a project or an action **avoids** on the electricity grid

In France, the marginal carbon intensity is on average two times higher due to higher reliance on pumped hydro storage, gas and coal plants



We've demonstrated CO2 emissions reductions in EV smart charging using marginal carbon intensity forecasts



The climate impact of every choice you make.

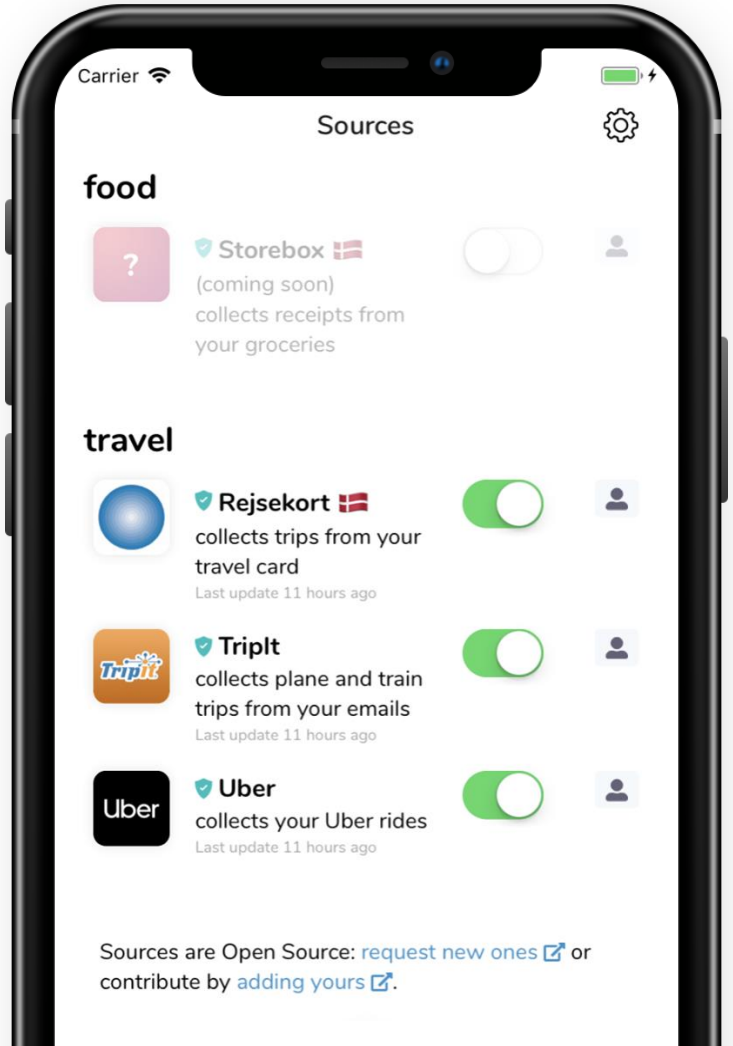
Tomorrow automatically calculates the climate impact of your daily choices by connecting to apps and services you already use.

beta release: summer 2019

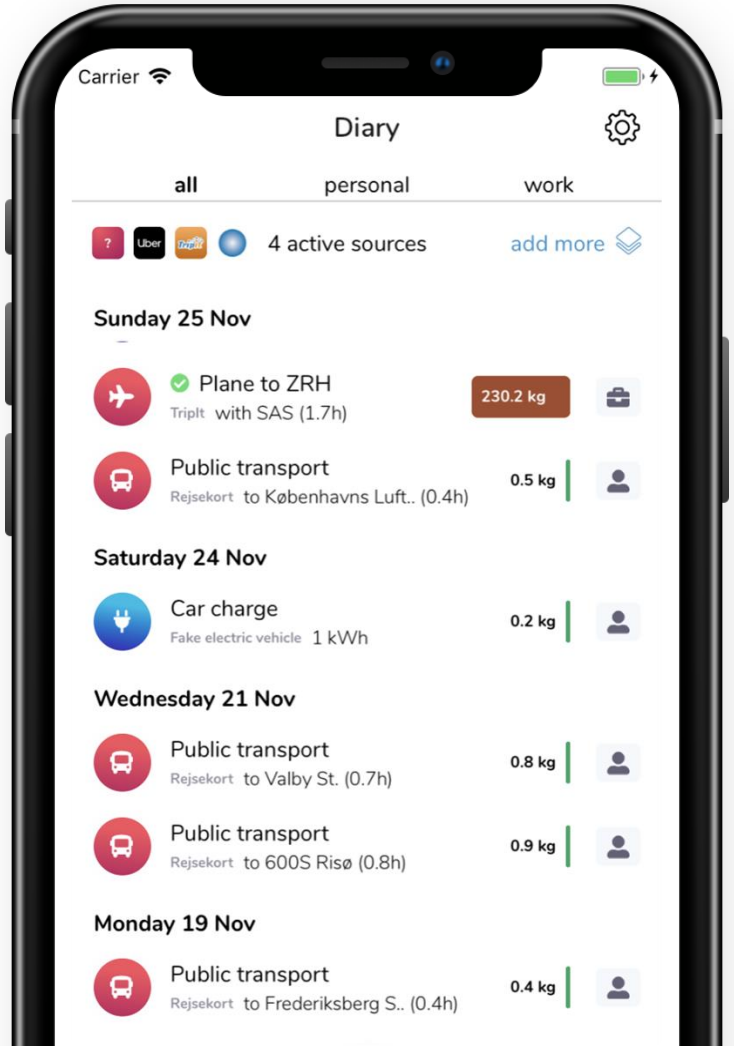
Join the waitlist (email) >

Tomorrow - my carbon life is an app that automatically computes the carbon footprint of your daily activities

Connect



Discover



Act