



Economics and Sustainable Development

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Confronti 2019

USI Lugano

The world is full of bad news..



We can ..

- Ignore or Deny



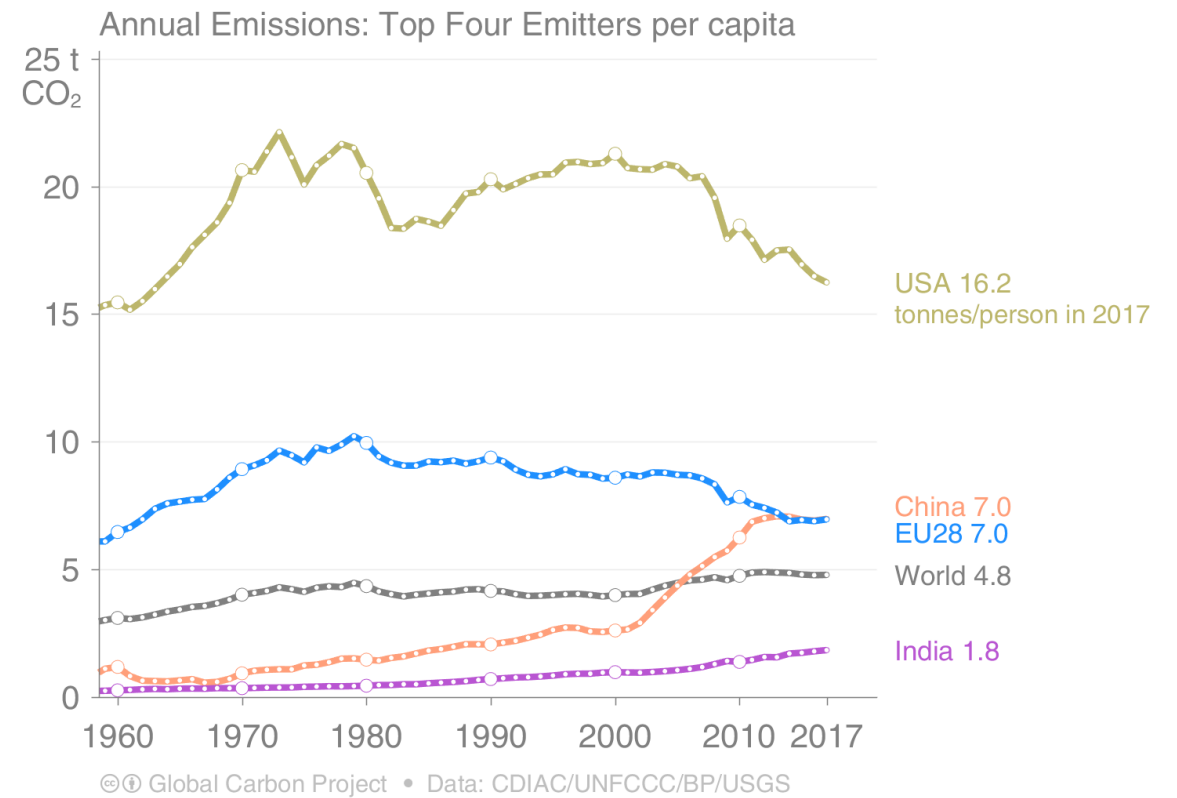
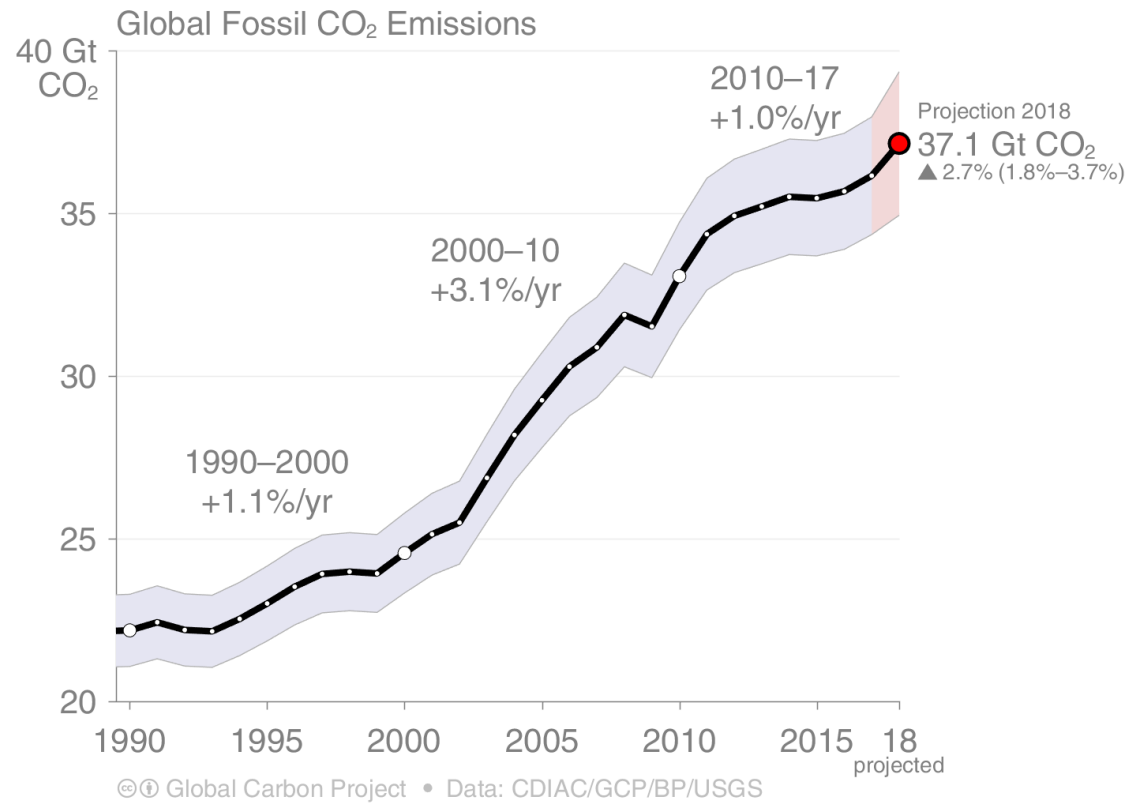
- Be pessimistic



- Be optimistic

- Inquire deeper what should be done to achieve sustainability

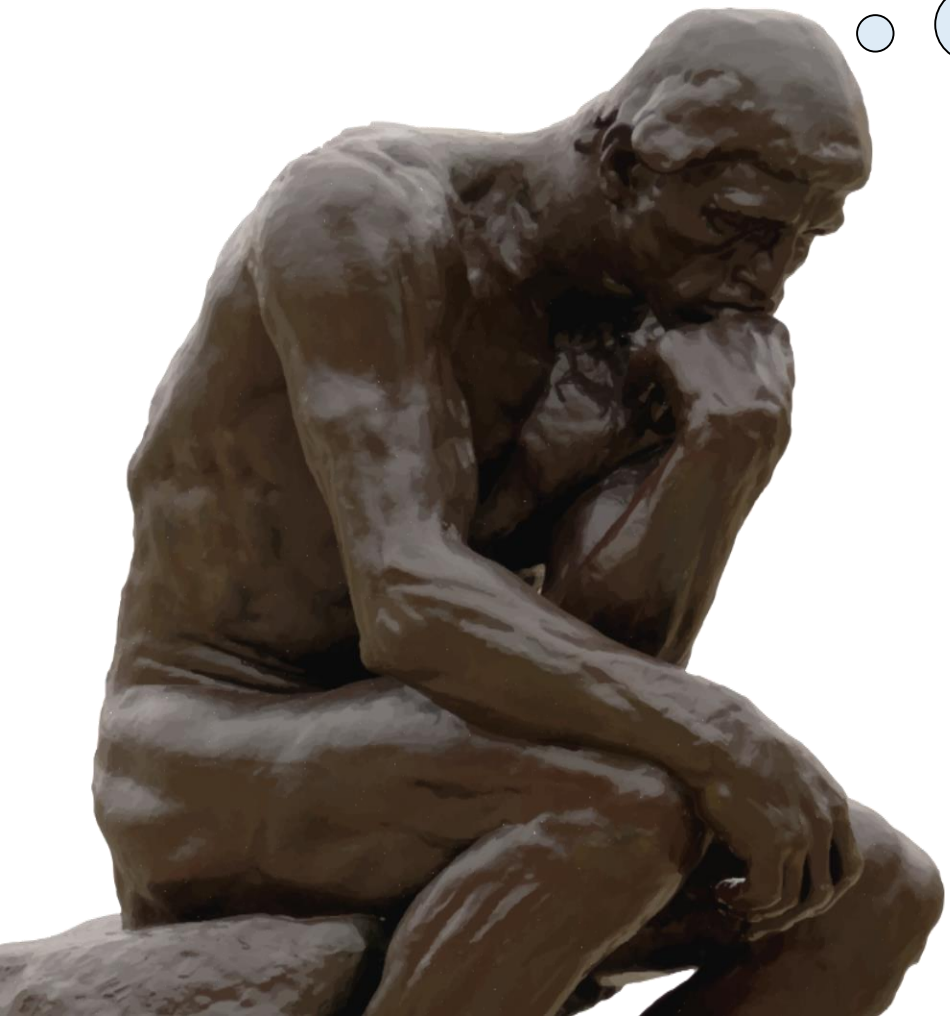
Major problem: CO₂ Emissions



Who is responsible?

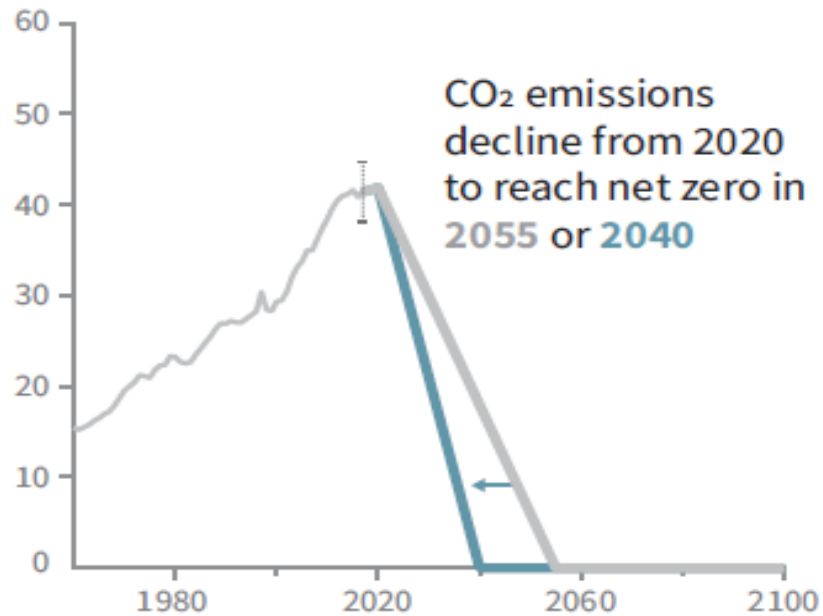
- The others...
- It is the economy, stupid!
- It is politics, stupid!

- It is us...

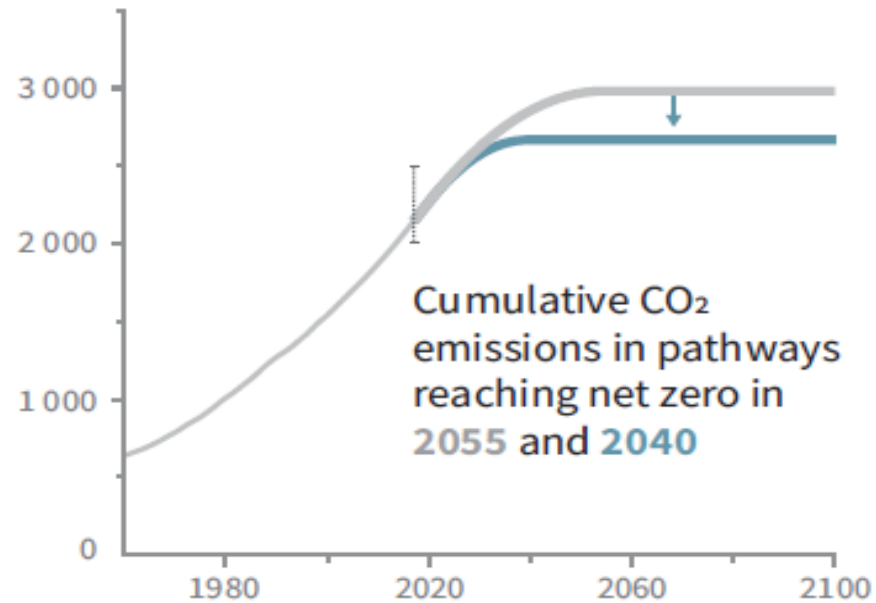


Sustainability requires to get something done

b) Stylized net global CO₂ emission pathways
Billion tonnes CO₂ per year (GtCO₂/yr)

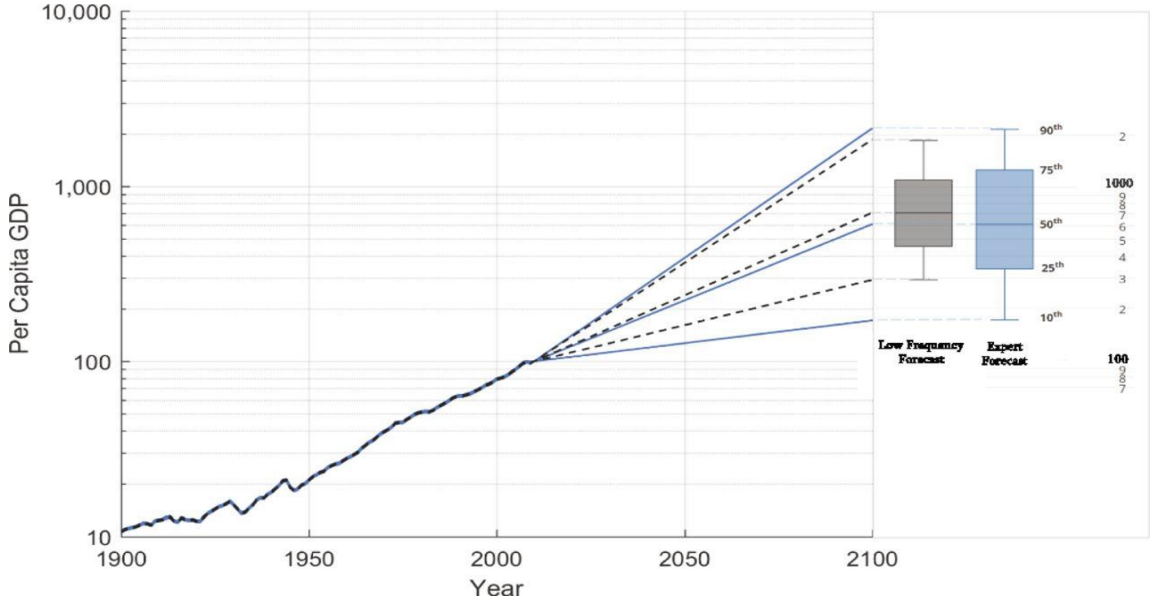


c) Cumulative net CO₂ emissions
Billion tonnes CO₂ (GtCO₂)

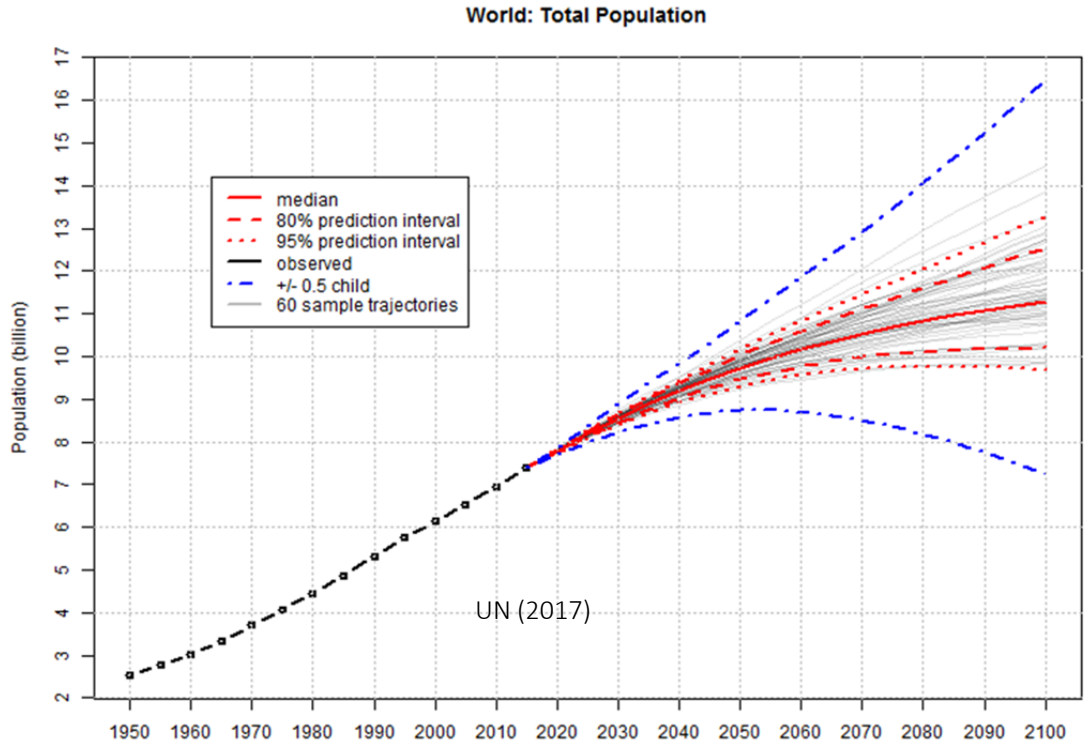


IPCC (2018)

And this with global growth

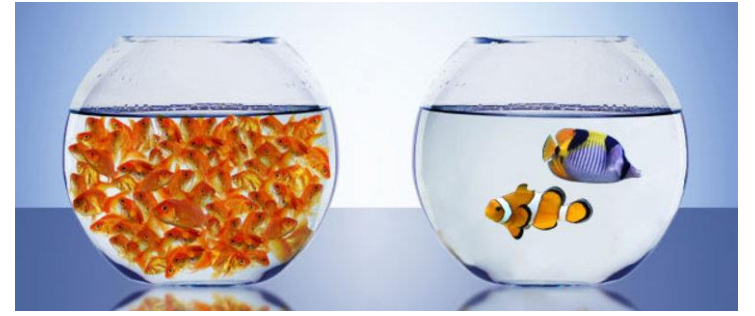


Christensen, Gillingham, Nordhaus (2018)



Source: United Nations, Department of Economic and Social Affairs, Population Division (2017).
World Population Prospects: The 2017 Revision. <http://esa.un.org/unpd/wpp/>

What is often believed



*«Over time, long run **growth** in living standards is strongly associated with **rising energy use**, especially in developing countries» (Becker, Murphy, Topel 2011)*

*«The Earth can support only a limited number of people in a sustainable manner .. Humanity has a **clear choice**: between more people with poorer lifestyles and fewer people with a better quality of life» (Population Matters 2019)*

*« Nuclear power makes a significant contribution to reducing greenhouse gas emissions worldwide while fulfilling at the same time the **increasing energy demands** of a growing world population and supporting global sustainable development » (IAEA 2018)*

Really?

What about:

- New Technologies
- Renewable Energies
- Prices and Substitution
- Policies
- Demographic transition
- Behavioral changes
- Knowledge diffusion
- ..?

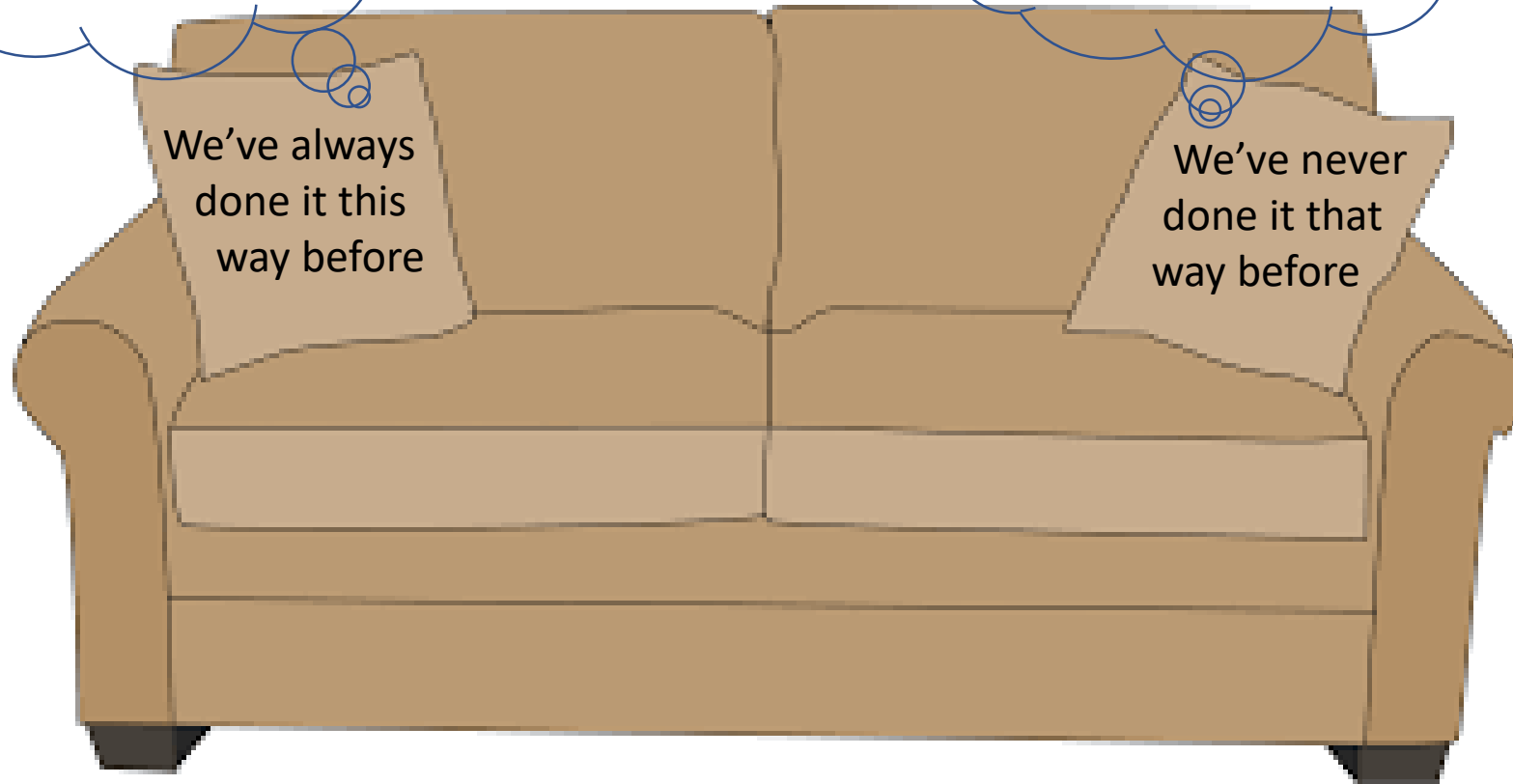


Fossil fuels

We've always
done it this
way before

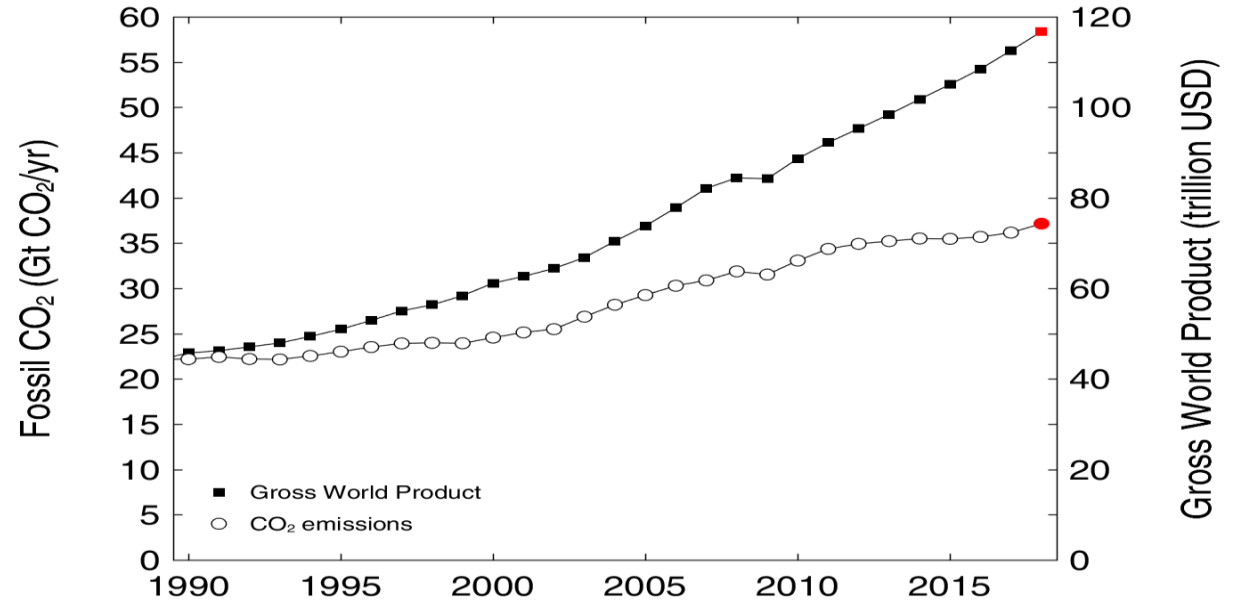
Green energies

We've never
done it that
way before



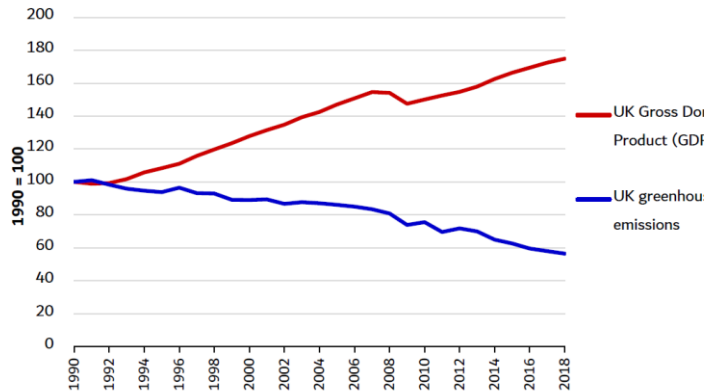
CO₂ and GDP

- World
- UK
- Sweden
- British Columbia



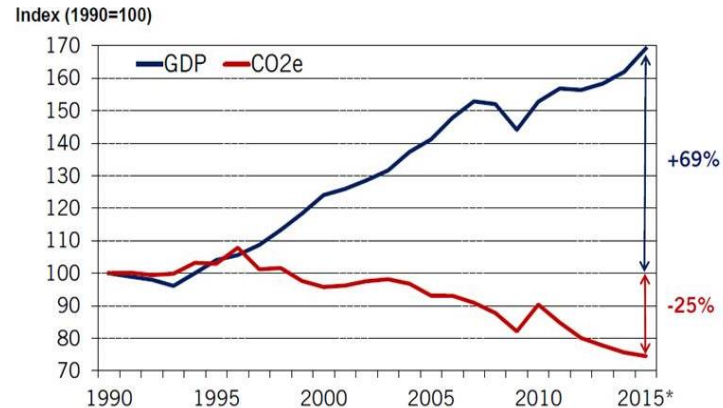
Source: [Jackson et al 2018](#); [Global Carbon Budget 2018](#)

UK



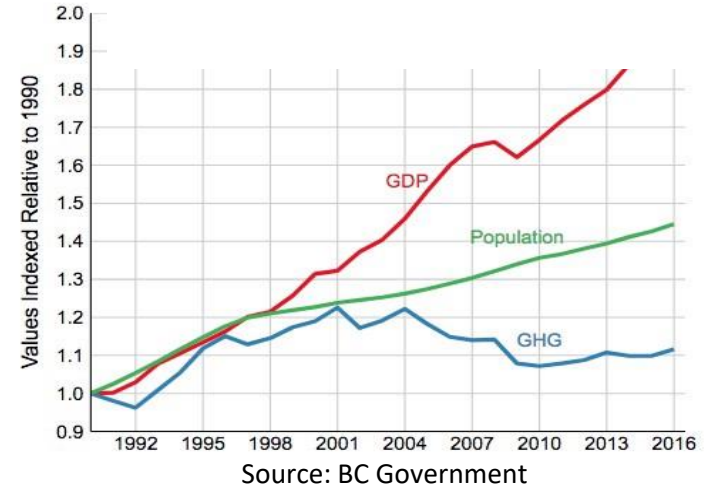
Source: CCC analysis 2019

Sweden



¹ In accordance with Sweden's National Inventory Report, submitted under the UNFCCC and the Kyoto Protocol. CO₂ = approx. 80% of total CO₂e emissions. Preliminary data for 2015.
Sources: Swedish Environmental Protection Agency, Statistics Sweden

British Columbia

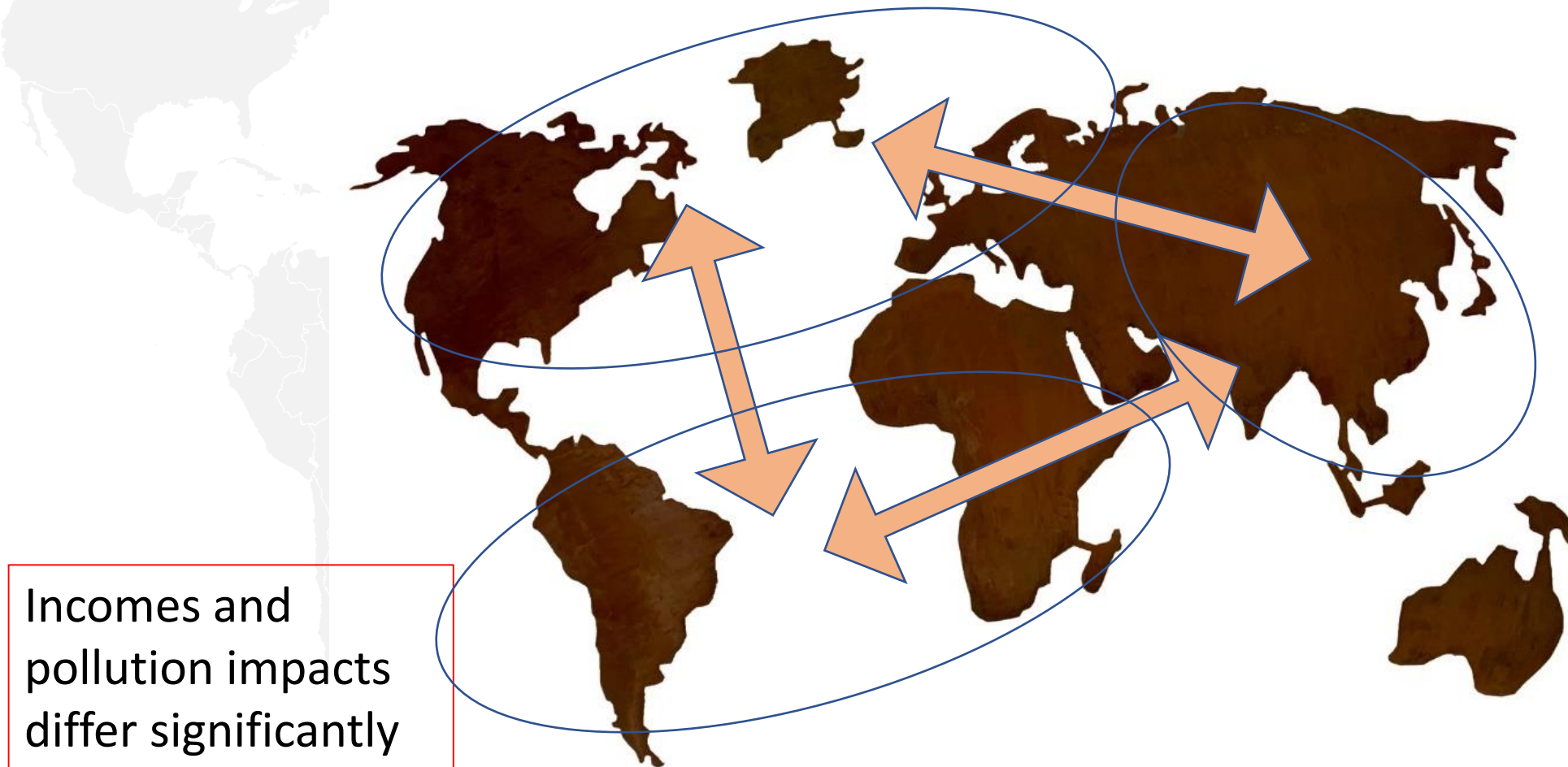


Source: BC Government

Climate Economics

- Per capita **consumption growth rate** may become somewhat lower with **stringent climate policy**
- Policy effects have to be **compared** to development **without** a policy
- **Countries** are very **different**

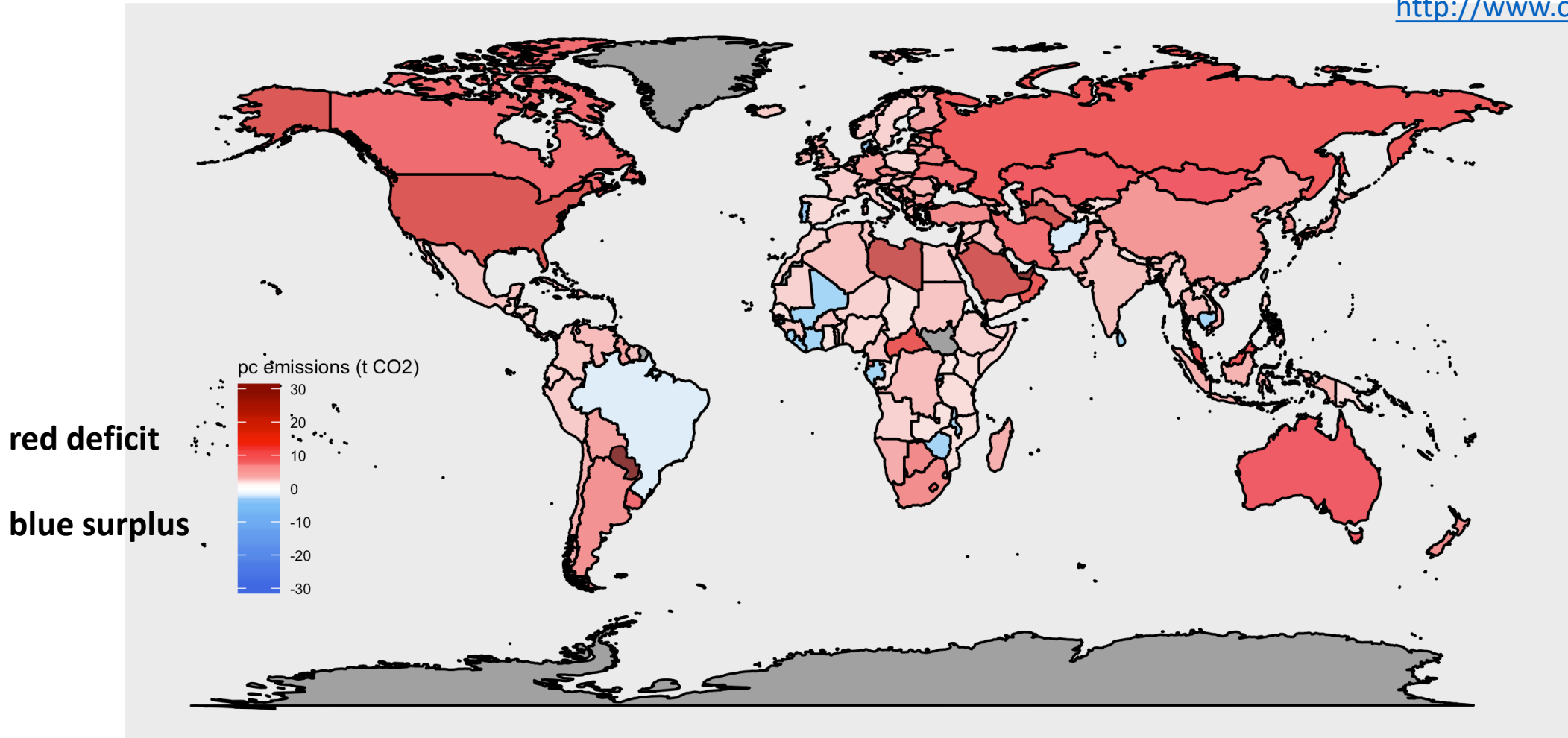
Different World Regions



Incomes and
pollution impacts
differ significantly

Equitable Carbon Budgets and NDCs in 2030

<http://www.ccalc.ethz.ch/>



Comparison of equitable carbon budgets with NDC targets

Assumptions: 1000 Gt available for 2000-50, emissions 1990-2014 50% weight, calculation of equitable emissions between 2014 and 2050 (average per capita per country per annum), comparison of equitable emissions with NDC in 2030

Free Riding?

- Constitution, legal obligations, international treaties

- **Domestic Abatement**

Health, domestic production and employment, induced innovation, first mover advantages, lower transition risks

- **Abatement Abroad**

Global markets for an identical good (like CO₂) have a global price, even when abatement costs differ between countries



Exposure to polluted air..
.. is like smoking a pack a day*

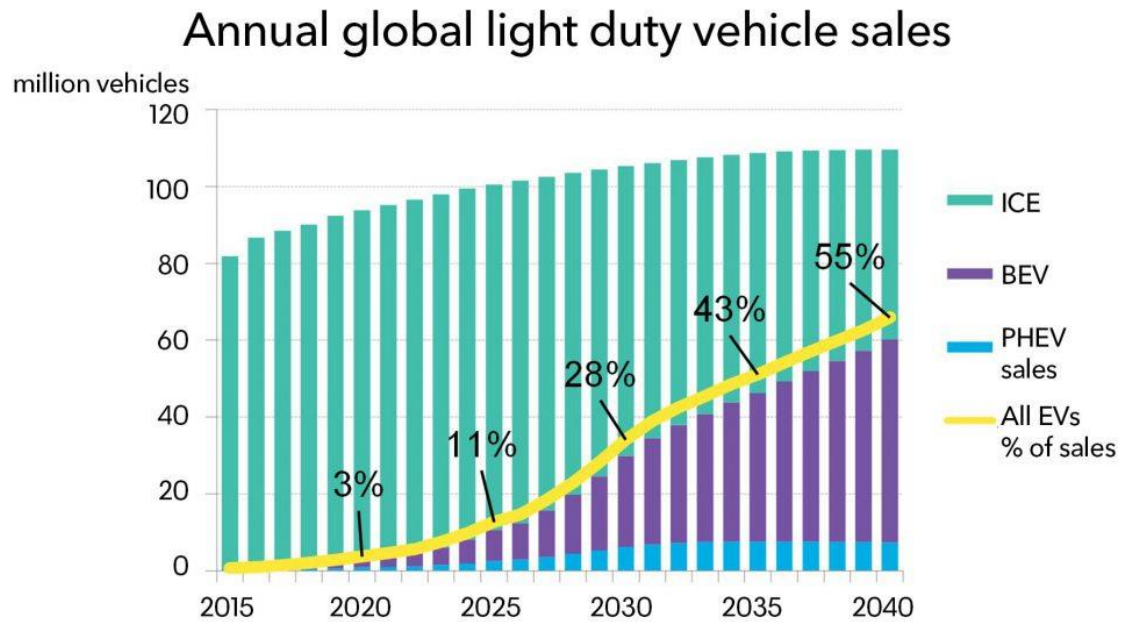


- Exposure to air pollution specifically to ground-level ozone, fine particulate matter, nitrogen oxide and black carbon
- The increase in emphysema (lung disease) is similar to the lung damage caused by 29 pack-years of smoking and 3 years of aging (One pack-year means smoking a pack of cigarettes a day for a year)

*The study, published 2019 in the medical journal JAMA, is the largest of its kind. It included more than 7,000 adults ages 45 to 84 for over a decade in six US metropolitan areas

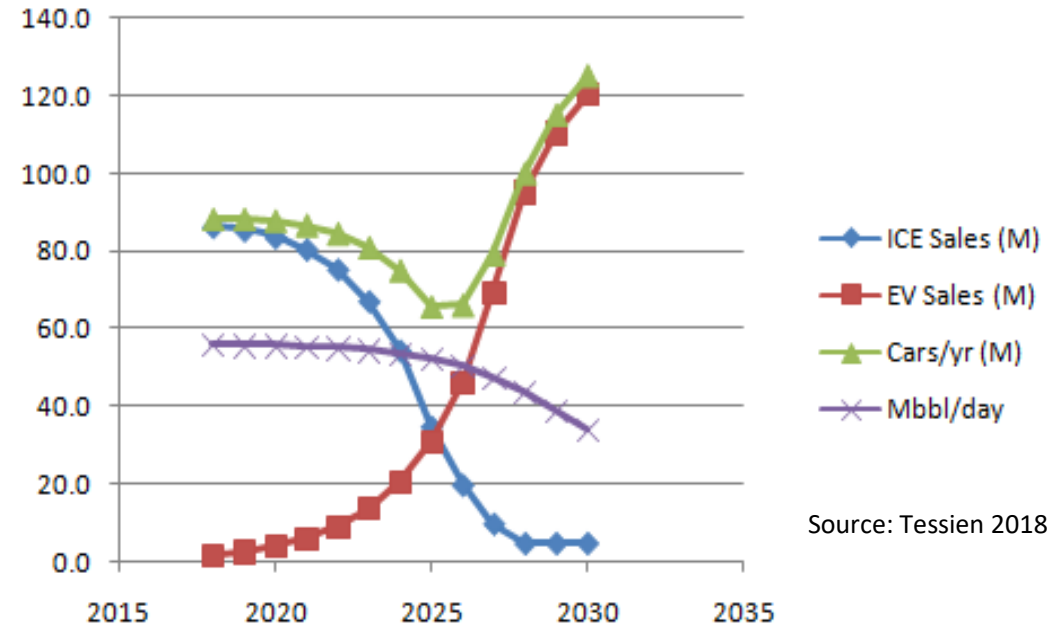
Road transport

What many expect..



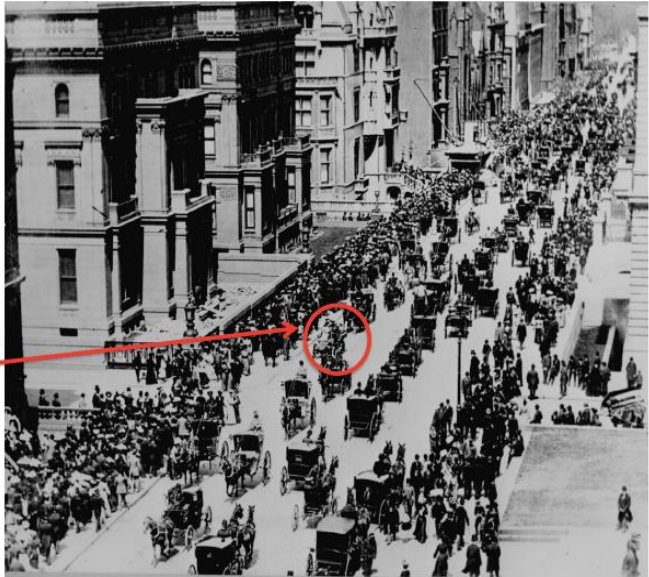

Source: Bloomberg New Energy Finance

What is more likely..



Source: Tessien 2018

Disruptive Development

<p>5th Ave New York City, April 15, 1900</p> <p><u>1900:</u> Where is <u>THE</u> <u>CAR?</u></p>  <p>Photo: Fifth Ave NYC on Easter Morning 1900 Source: US National Archives from (Wikipedia)</p> <p><small>Leading Market Disruption- Copyright © 2001-2014 by Tony Seba</small></p>	<p>5th Ave New York City, March 23, 1913</p> <p><u>1913:</u> Where is <u>THE</u> <u>HORSE?</u></p>  <p>Photo: Easter 1913, New York. Fifth Avenue looking north. George Grantham Bain Collection Source: shorpy.com</p> <p><small>Leading Market Disruption- Copyright © 2001-2014 by Tony Seba</small></p>
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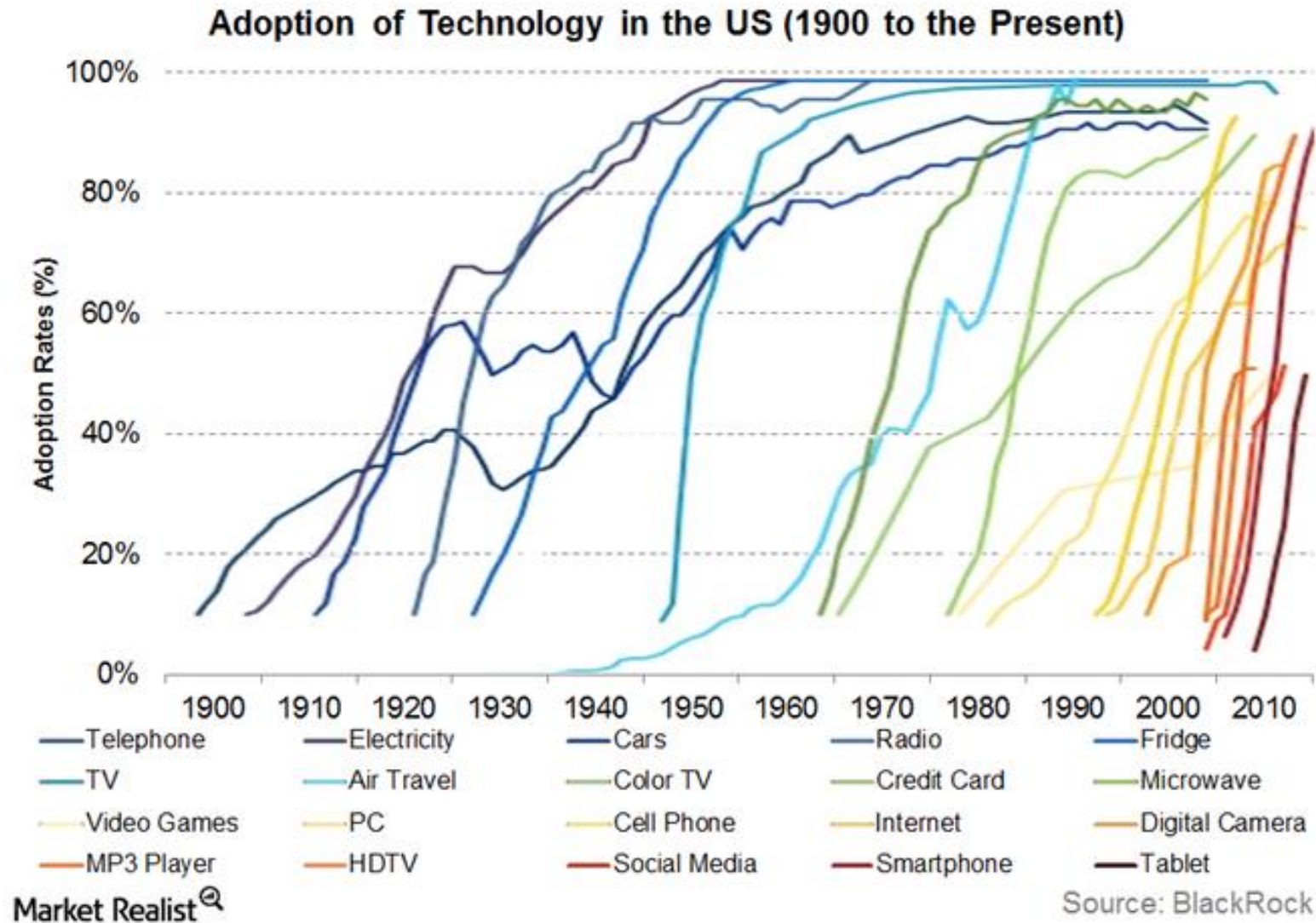


2018

Electric cars

The death of the internal combustion engine

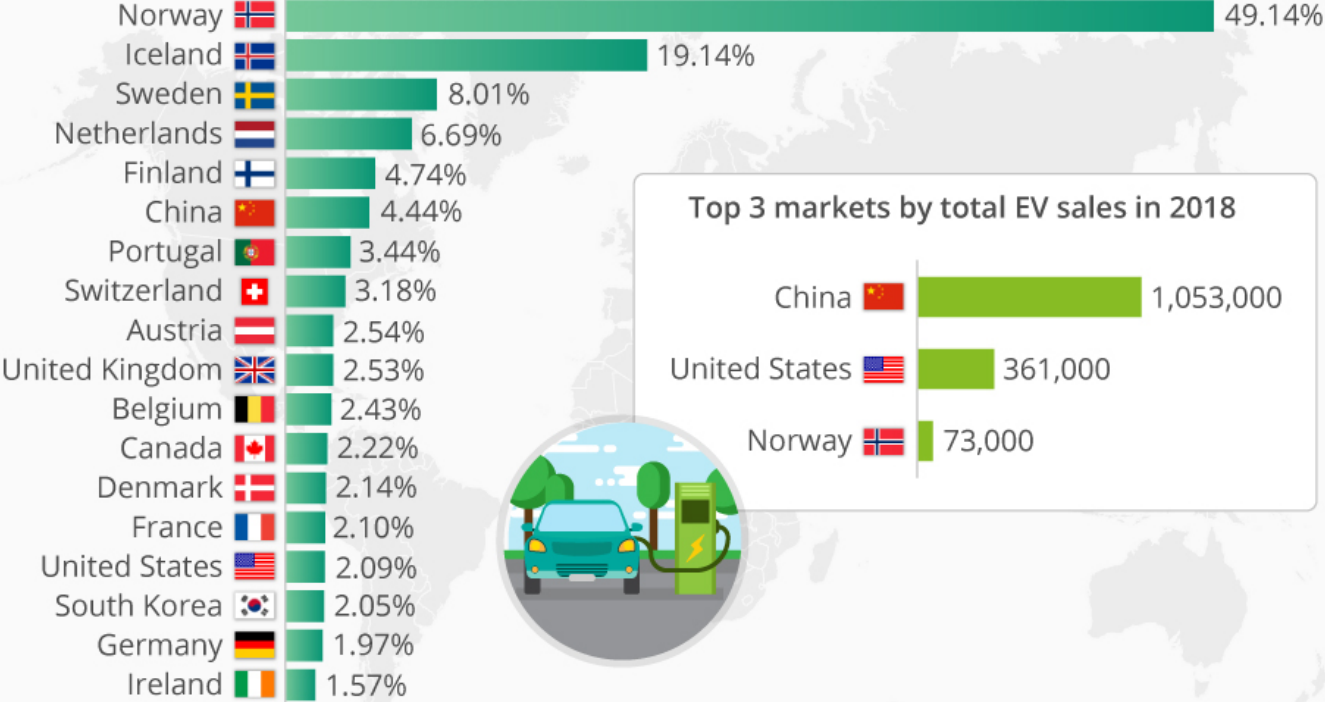
Technology Adoption



Transportation

Electric Mobility: Norway Races Ahead

Countries with the highest share of plug-in electric vehicles in new passenger car sales in 2018*



* including plug-in hybrids and light vehicles, excluding commercial vehicles
Sources: ACEA, CAAM, InsideEVs, KAIDA

Bans of ICE cars

Country	Ban announced	Ban commences
China	2017	no date set
Costa Rica	2018	2021
Denmark	2019	2030
France	2017	2040
Iceland	2018	2030
India	2017	2030
Ireland	2018	2030
Israel	2018	2030
Netherlands	2017	2030
Norway	2017	2025
United Kingdom	2017	2040 – England, Wales, Northern Ireland 2032 – Scotland
Sri Lanka	2017	2040
Sweden	2018	2030

+ many cities..

Stranded Assets

- Assets become "stranded" when suffering from unanticipated or premature **write-offs, downward revaluations, or conversions to liabilities**
- **Fossil fuel industry:** With the agreed temperature targets
 - a third of **oil** reserves,
 - half of **gas** reserves and
 - more than 80% of known **coal** reserves should remain unused
- Also affected are
 - **Fossil-based technologies** such as ICE cars
 - **Financial investments** (climate finance)

The Fall of General Electric (GE)

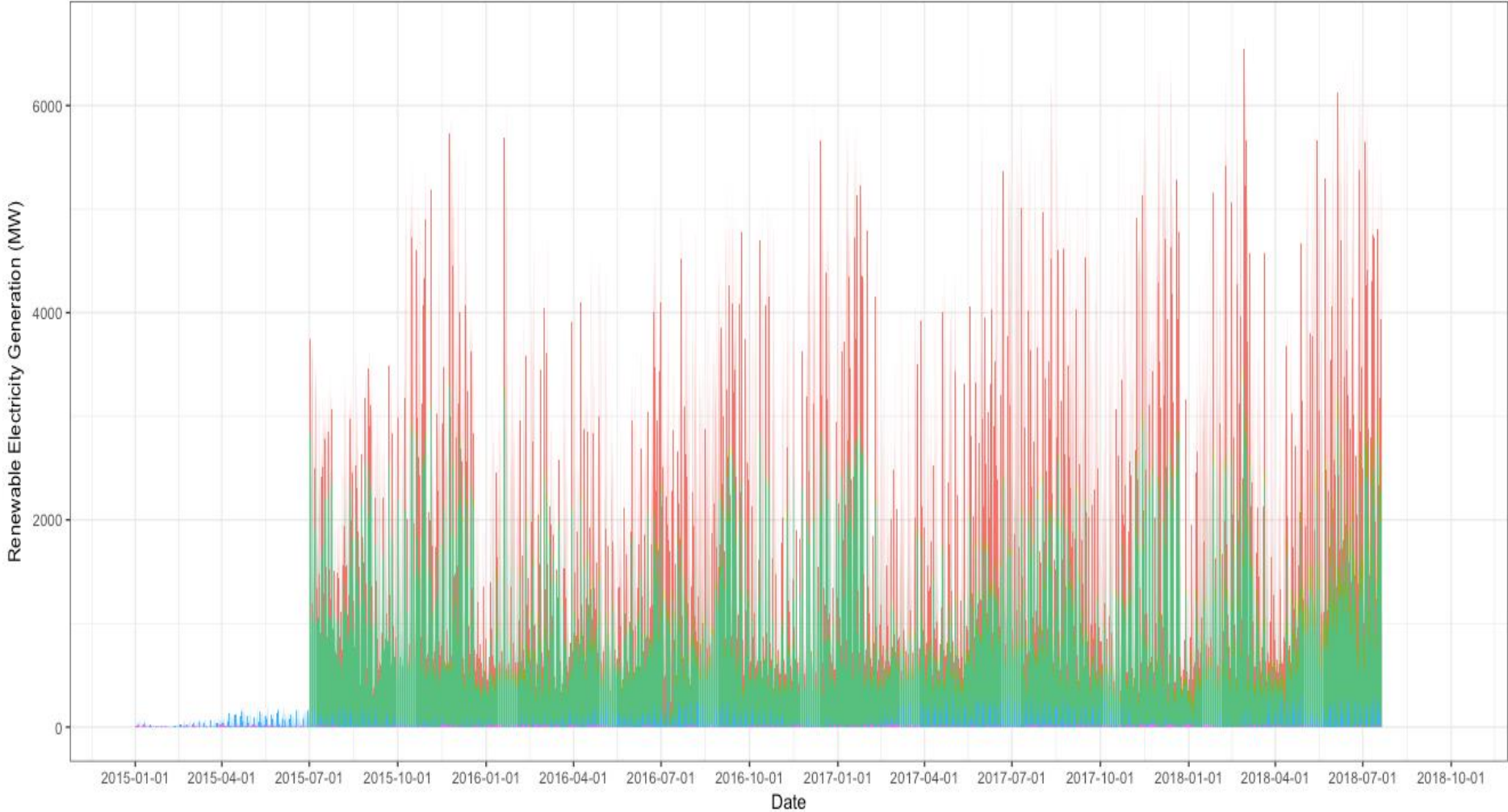


- GE was born 1892 and quickly became a household name.
- For many it was the most important US company.
- 2018, GE's more than 100-year run on the Dow Jones Industrial Average came to an end.

- 2019 GE will demolish a California natural gas-fired plant with 20 years remaining in its technical life.
- The plant will become a **battery storage site**
- GE lost nearly \$200 billion within a few years by betting on fossil fuels.

Renewable Power 2015 – 2018

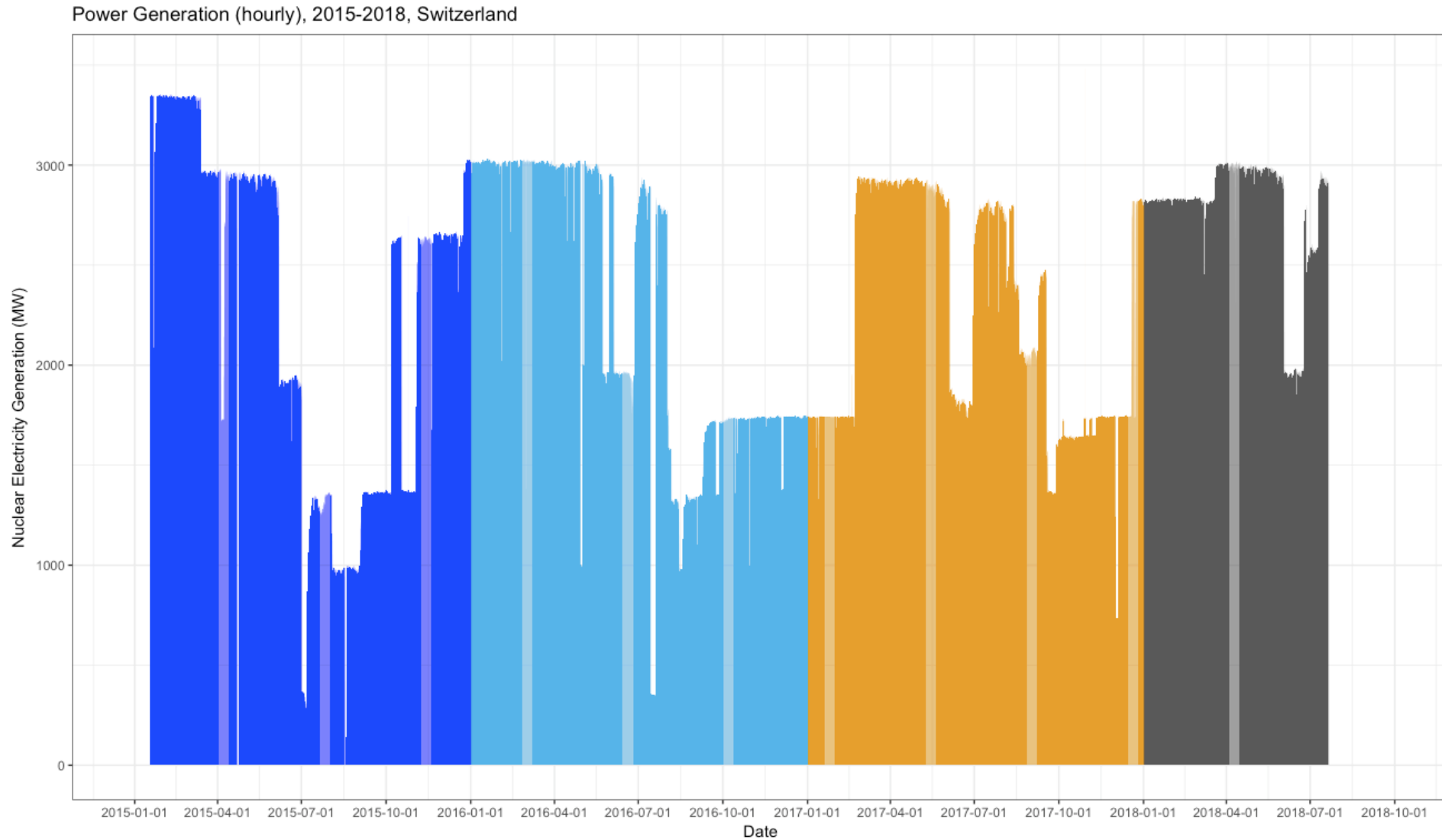
Renewables Power Generation (hourly), 2015-2018, Switzerland



Renewable Power Source ■ Hydro pumped storage ■ Hydro run-of-river and poundage ■ Hydro water reservoir ■ Solar ■ Wind

Source: ENTSO-E, Transparency Platform

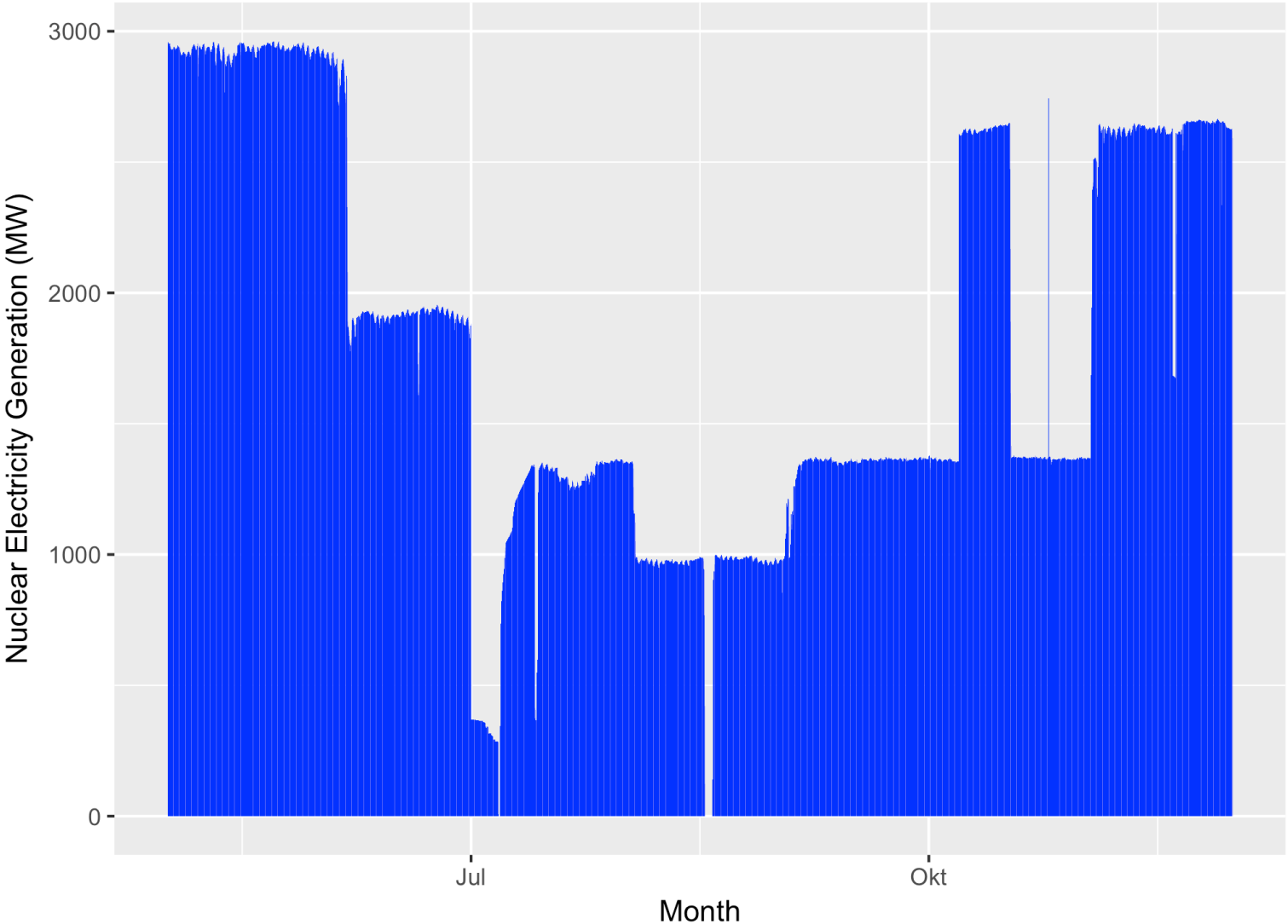
Nuclear power generation 2015 – 2018



Source: ENTSO-E, Transparency Platform

Summer 2015

Power Generation (hourly), Mai - Oct 2015, Switzerland

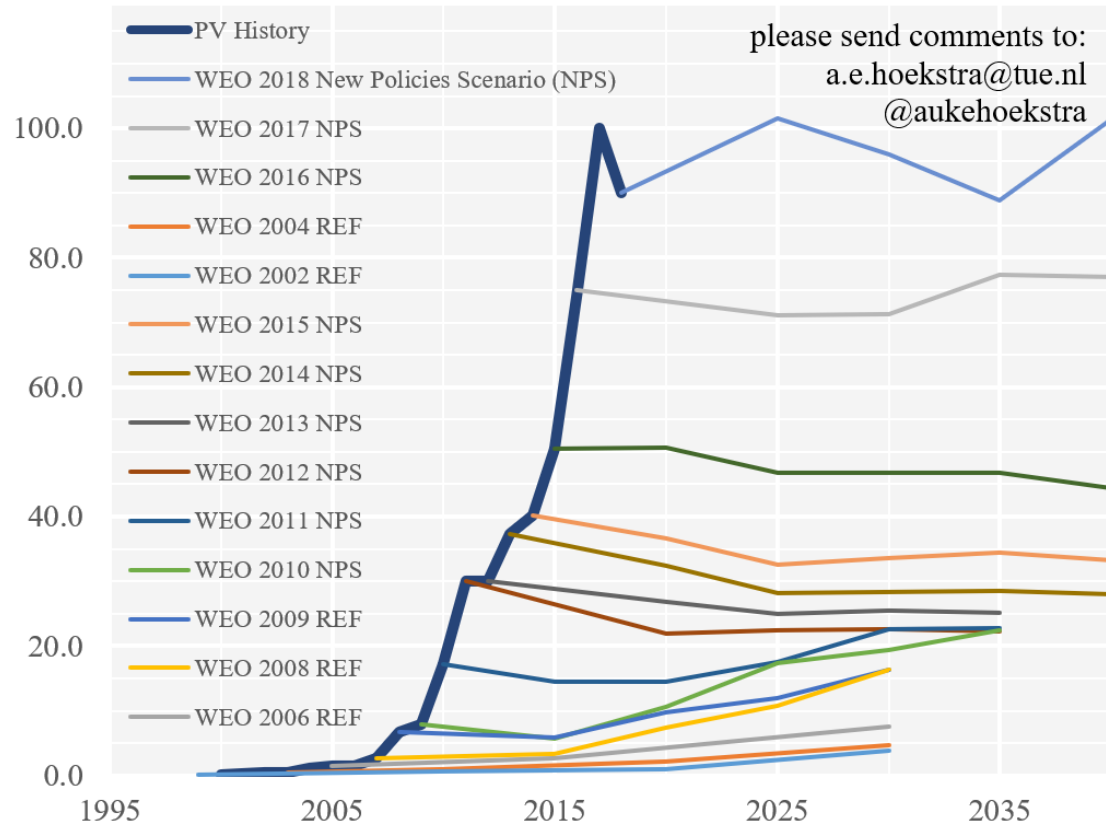


Datenquelle: ENTSO-E, Transparency Platform

PV and batteries

Annual PV additions: historic data vs IEA WEO predictions

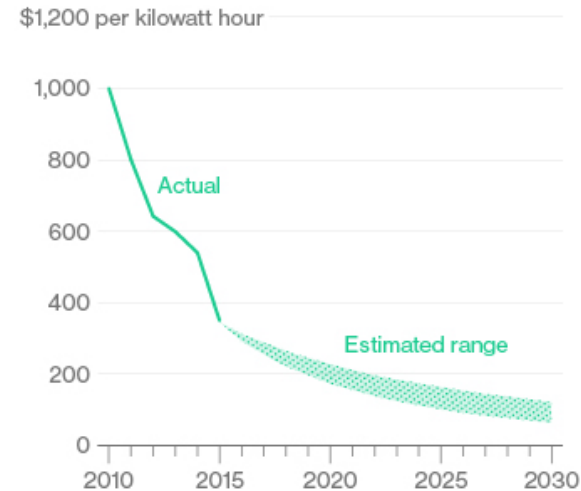
In GW of added capacity per year - source International Energy Agency - World Energy Outlook



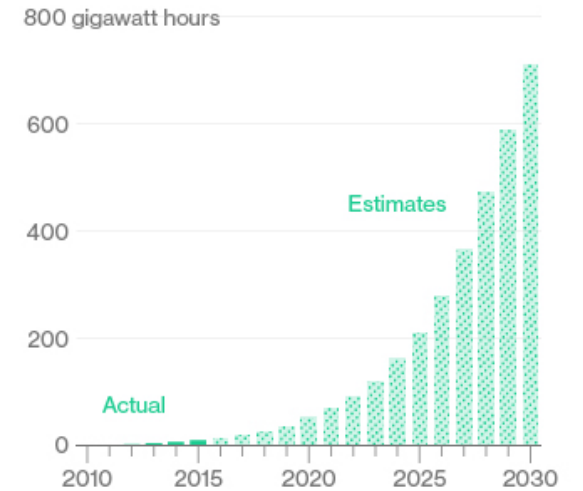
It's All About the Batteries

Batteries make up a third of the cost of an electric vehicle. As battery costs continue to fall, demand for EVs will rise.

Cost for lithium-ion battery packs



Yearly demand for EV battery power



Source: Data compiled by Bloomberg New Energy Finance



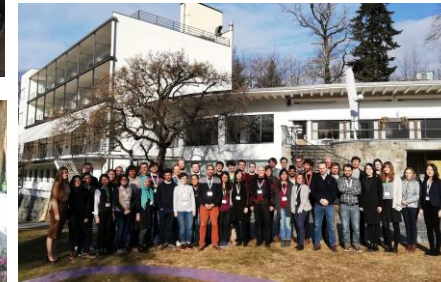
Conclusions

- Stringent climate policies support **new technologies**
- Policy may use **different instruments**
- Policies can be designed in an **efficient yet equitable** way
- **Policies** need to be **workable**



Thank you

for your attention!



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