Sustainable Development and Low Emissions Economies

Introduction to Sustainable Development and Green Innovation

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May 2025

We can go for a walk where it's quiet and dry
And talk about precious things
Like love and law and poverty, ooh-ooh
(These are the things that kill me)
We can go for a walk where it's quiet and dry
And talk about precious things
But the rain that flattens my hair, ooh
(These are the things that kill me)

The Smiths - The Queen is dead (1986)

Websites-Podcasts I

- Οικονομικός Ταχυδρόμος
- Energy Press
- The Guardian - Environment
- Our World in Data
  Accesible Data and Visualizations
- Bruegel
  Top EU Think Tank
- The Intergovernmental Panel on Climate Change (IPCC)
- European Environmental Agency
- Climate Adapt
  EU Knowledge Repository on Climate Adaptation

Websites-Podcasts II

- UN SDSN
  The United Nations Sustainable Development Solutions Network
- Freakonomics Radio
  Podcast about the hidden side of Economic Thought
- Climate Rising
  Haravard Business School Podcast
- Climate Solutions
  EIB Podcast

Learning Objectives

- **Stocktaking of key Issues in Sustainable Development and Climate Change**

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- **Thinking as Economists!**

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- **Data**
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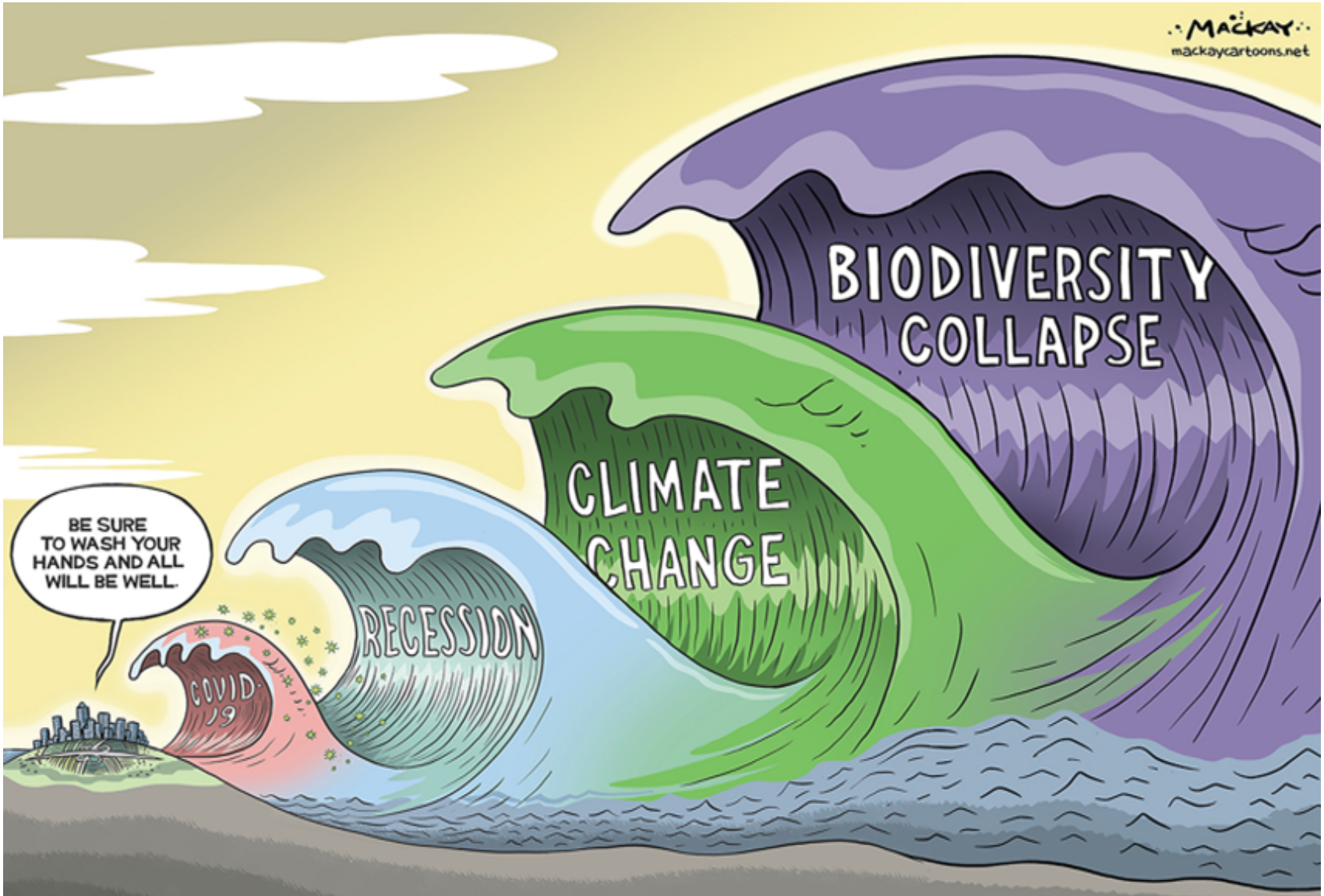
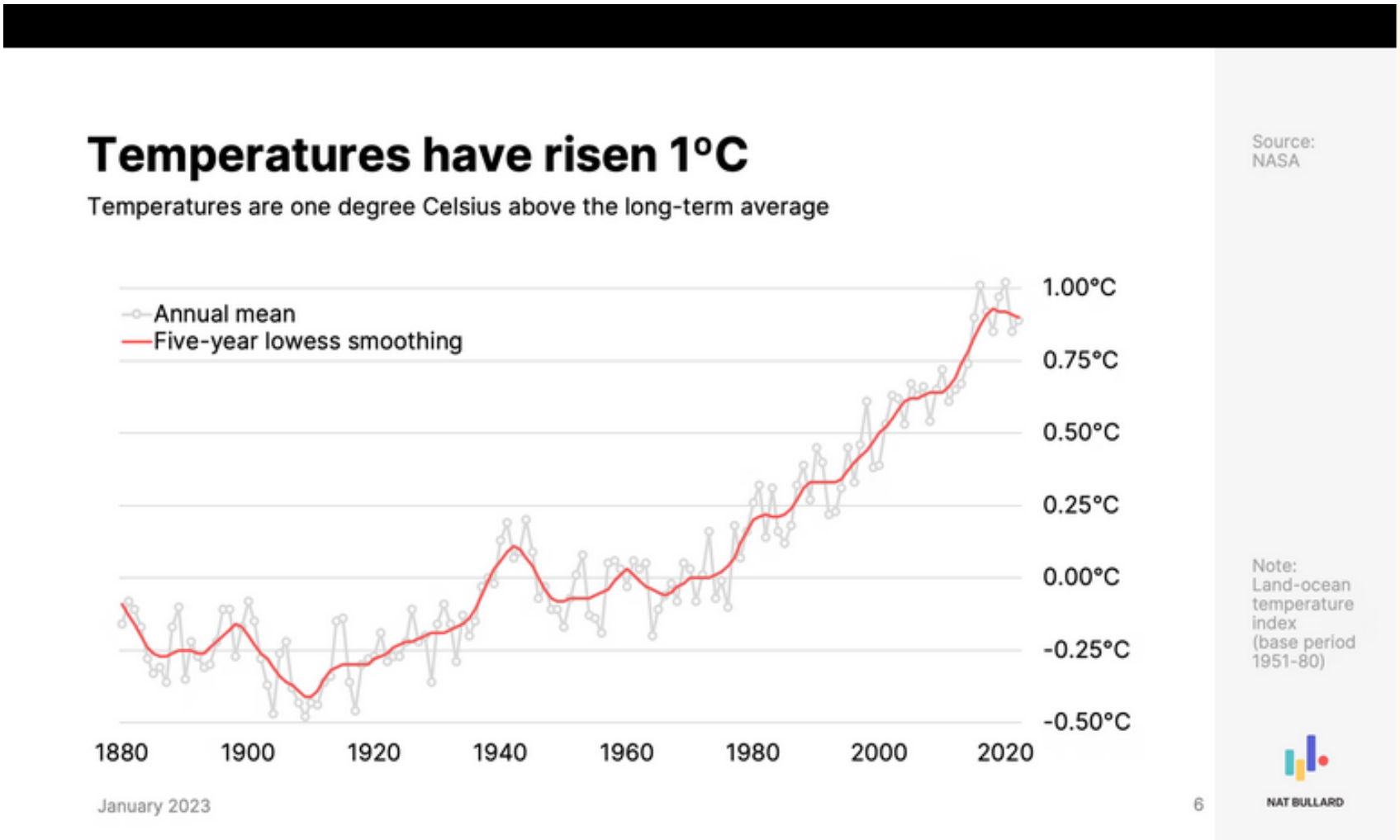
Poly-Crisis


MACKAY
mackaycartoons.net
BIODIVERSITY COLLAPSE
CLIMATE CHANGE
RECESSION
COVID-19
BE SURE TO WASH YOUR HANDS AND ALL WILL BE WELL.

Global Temperature on the Rise

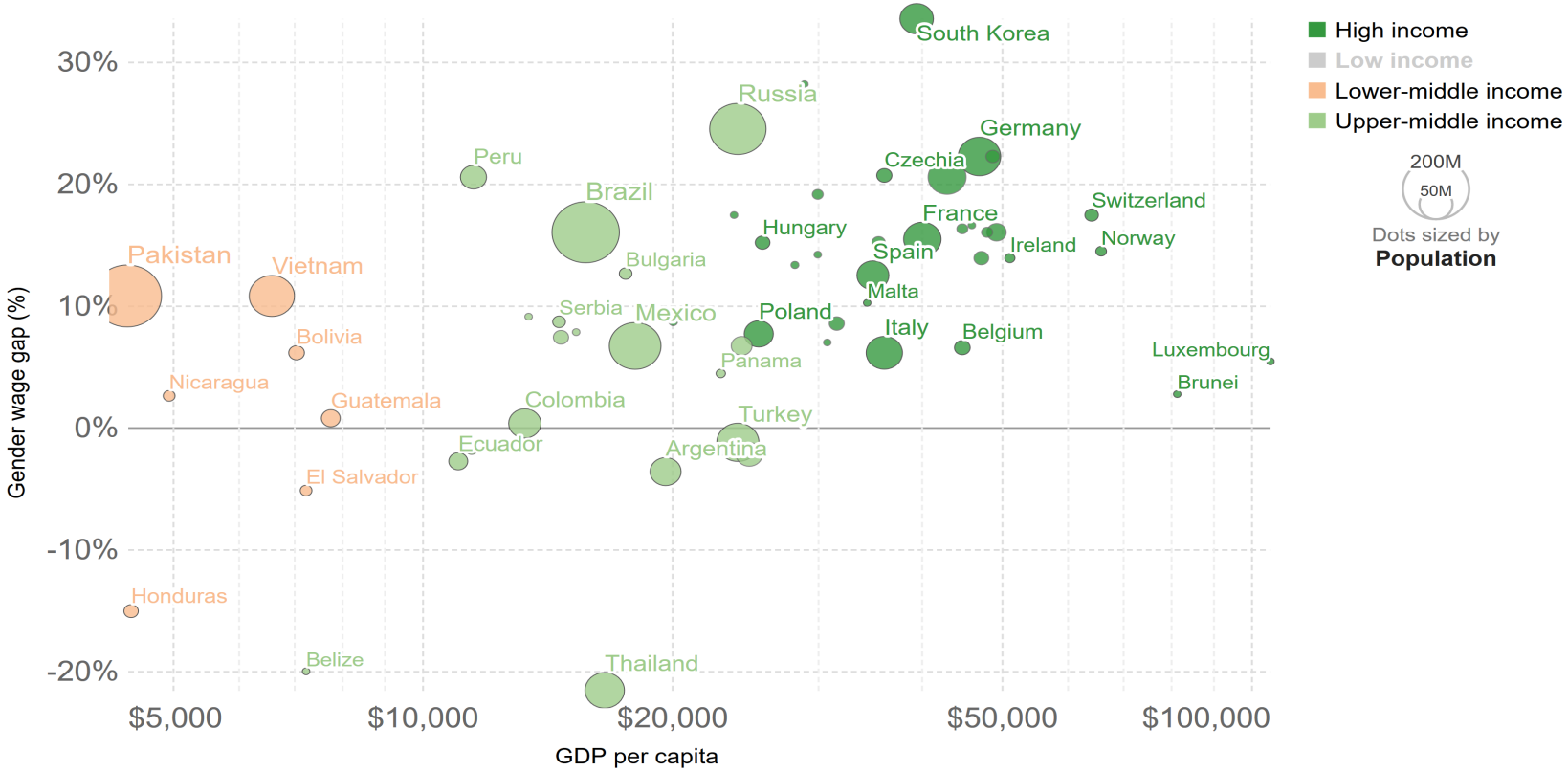


Economic Inequality

Gender Inequality

Gender wage gap vs GDP per capita, 2016

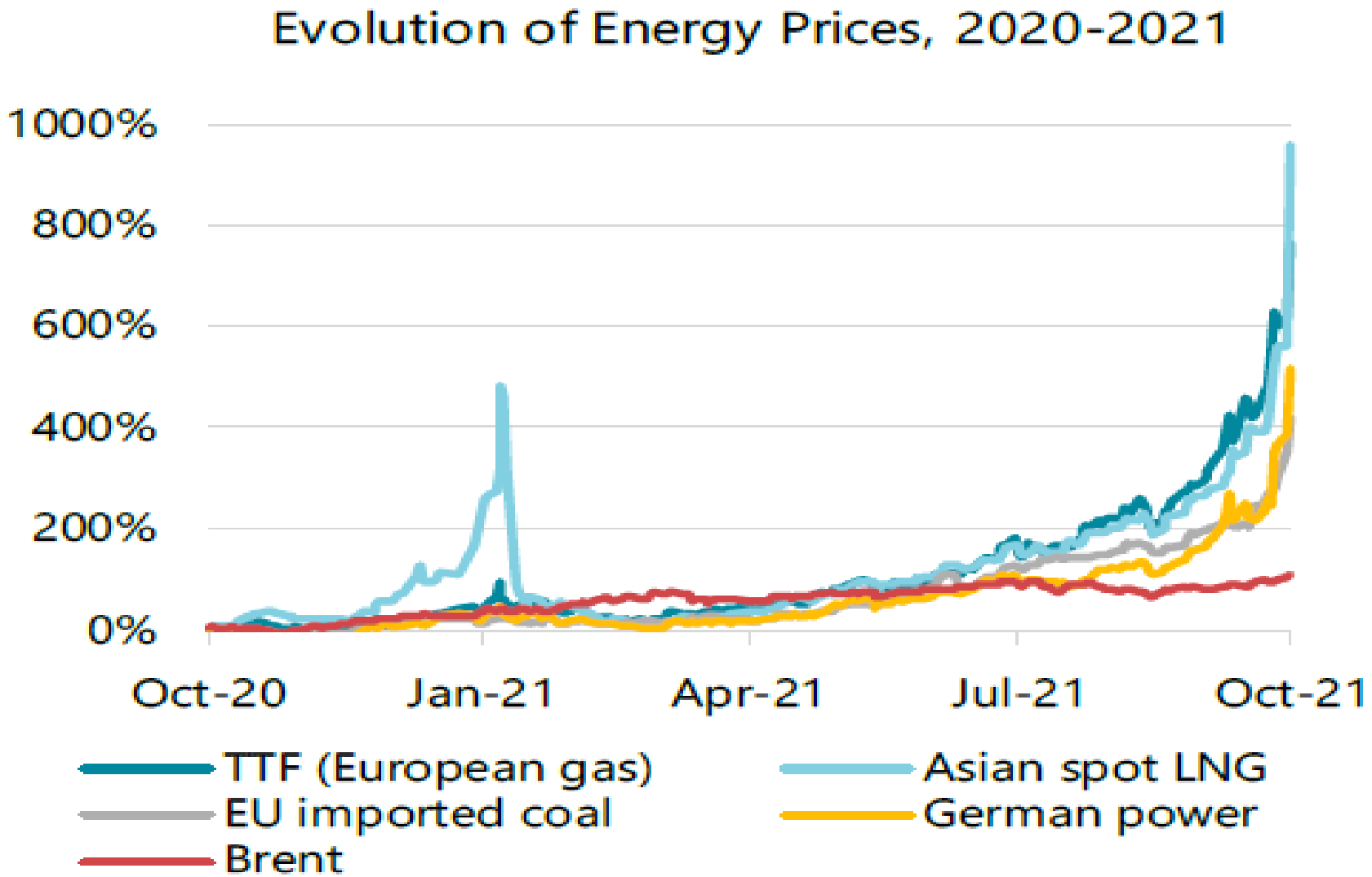
The vertical axis shows the unadjusted gender wage gap calculated as the difference between average earnings of men and average earnings of women expressed as a percentage of average earnings of men. The horizontal axis shows GDP per capita, after adjusting for differences in price levels across countries.



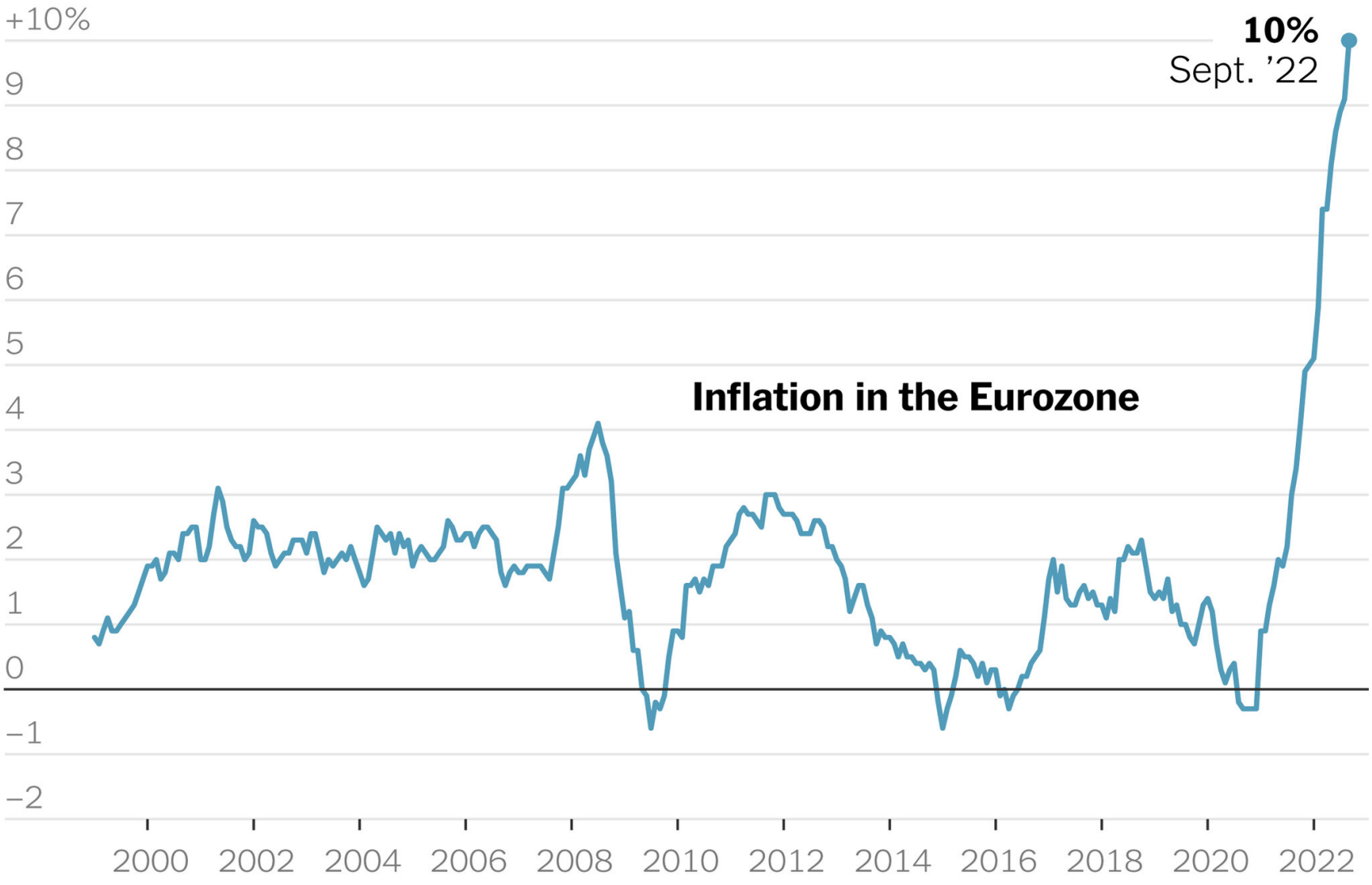
Source: ILOSTAT, Data compiled from multiple sources by World Bank

OurWorldInData.org/income-inequality • CC BY

Energy Crisis



Cost of Living Crisis



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  - **International Cooperation** for the achievement of these Goals

Sustainable Development Goals

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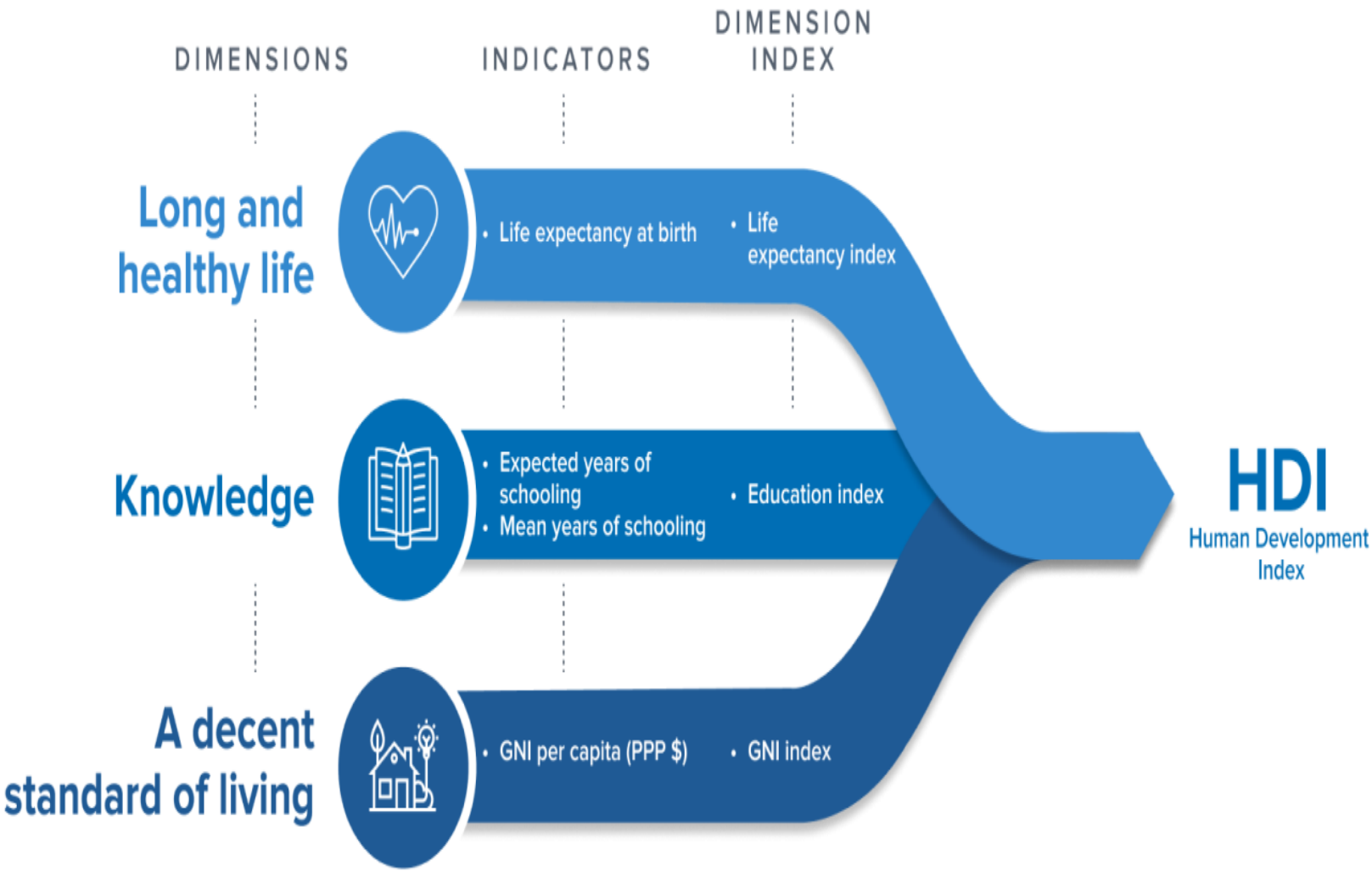
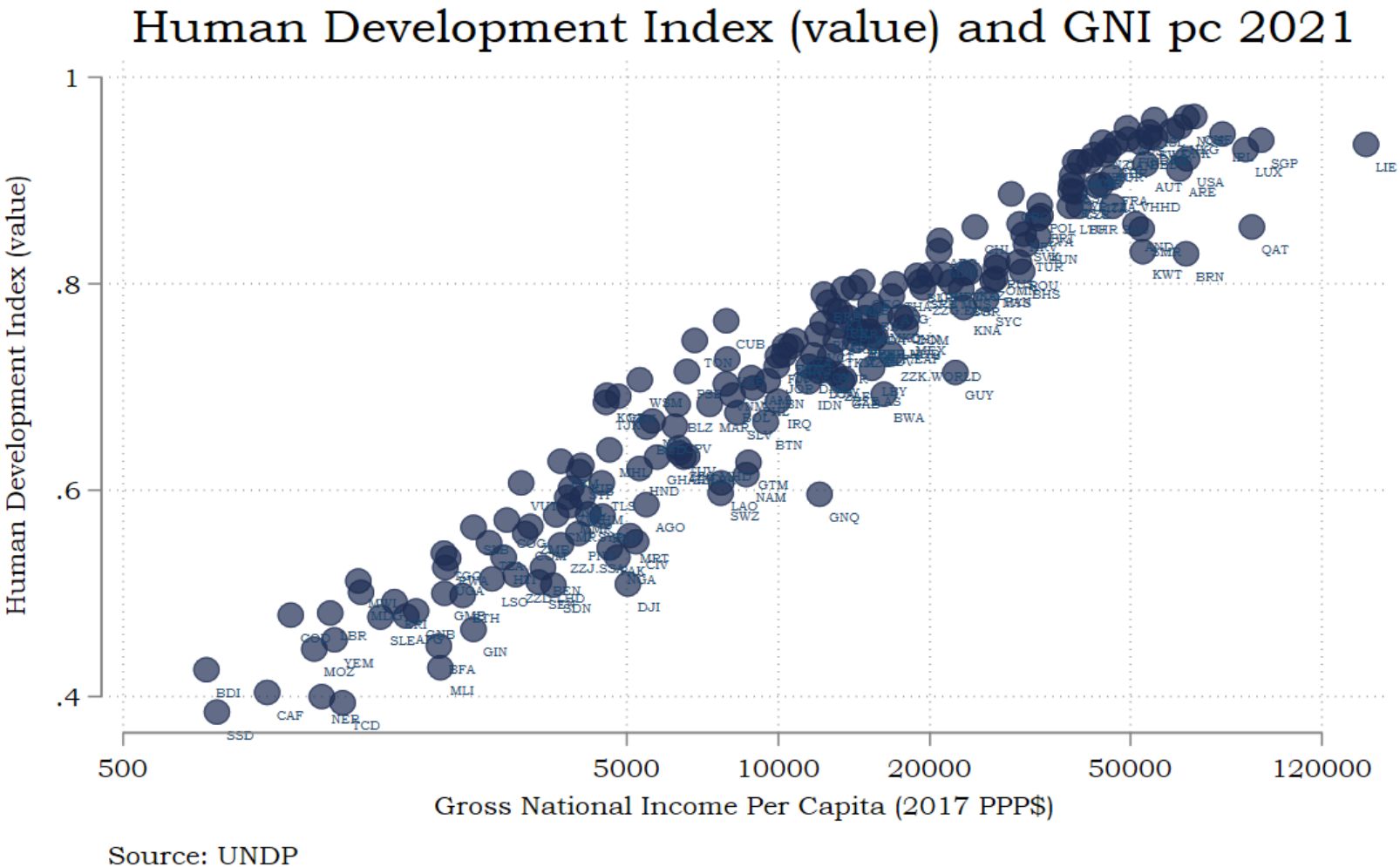
- Associated with but ***not Synonymous to*** **Economic Growth**

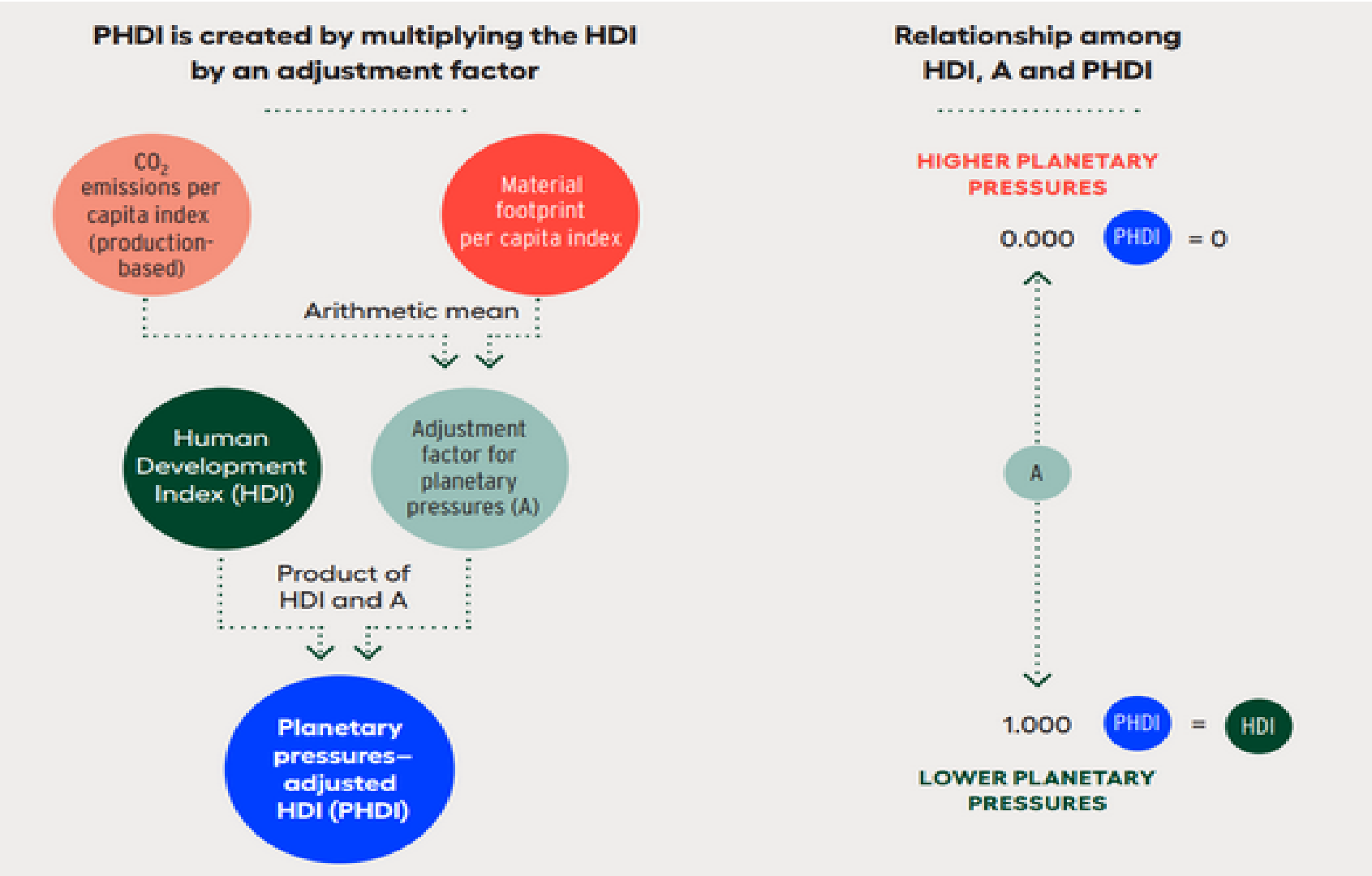
Human Development Index Dimensions



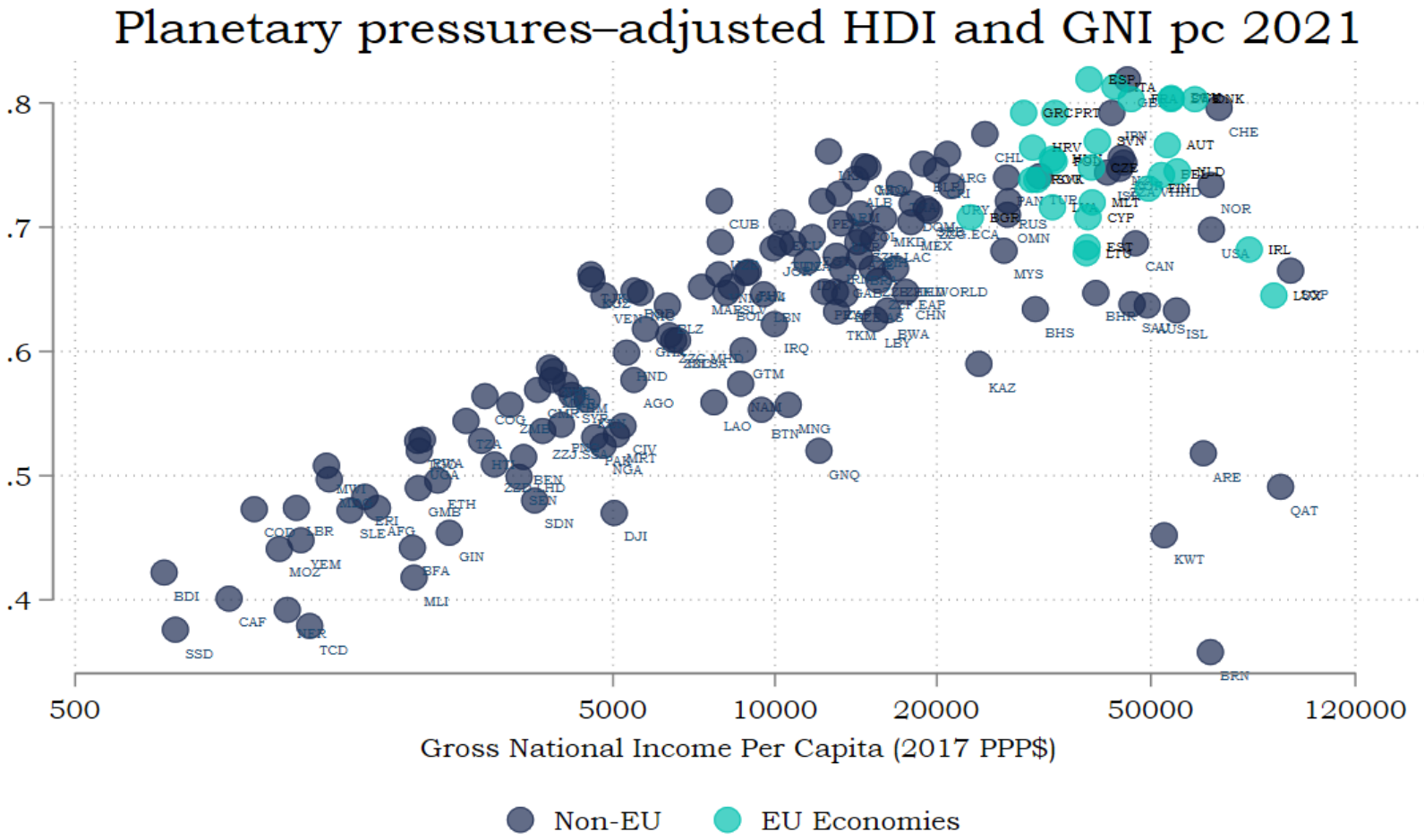
Human vs(?) Economic Development



Planetary Pressures Adjusted HDI



Accounting for Planetary Pressures



Source: UNDP

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- Unprecedented Economic Growth since 1800 commingled with ***Unprecedented Environmental Disruption***

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  - Climate Migration
  - Fiscal Burden

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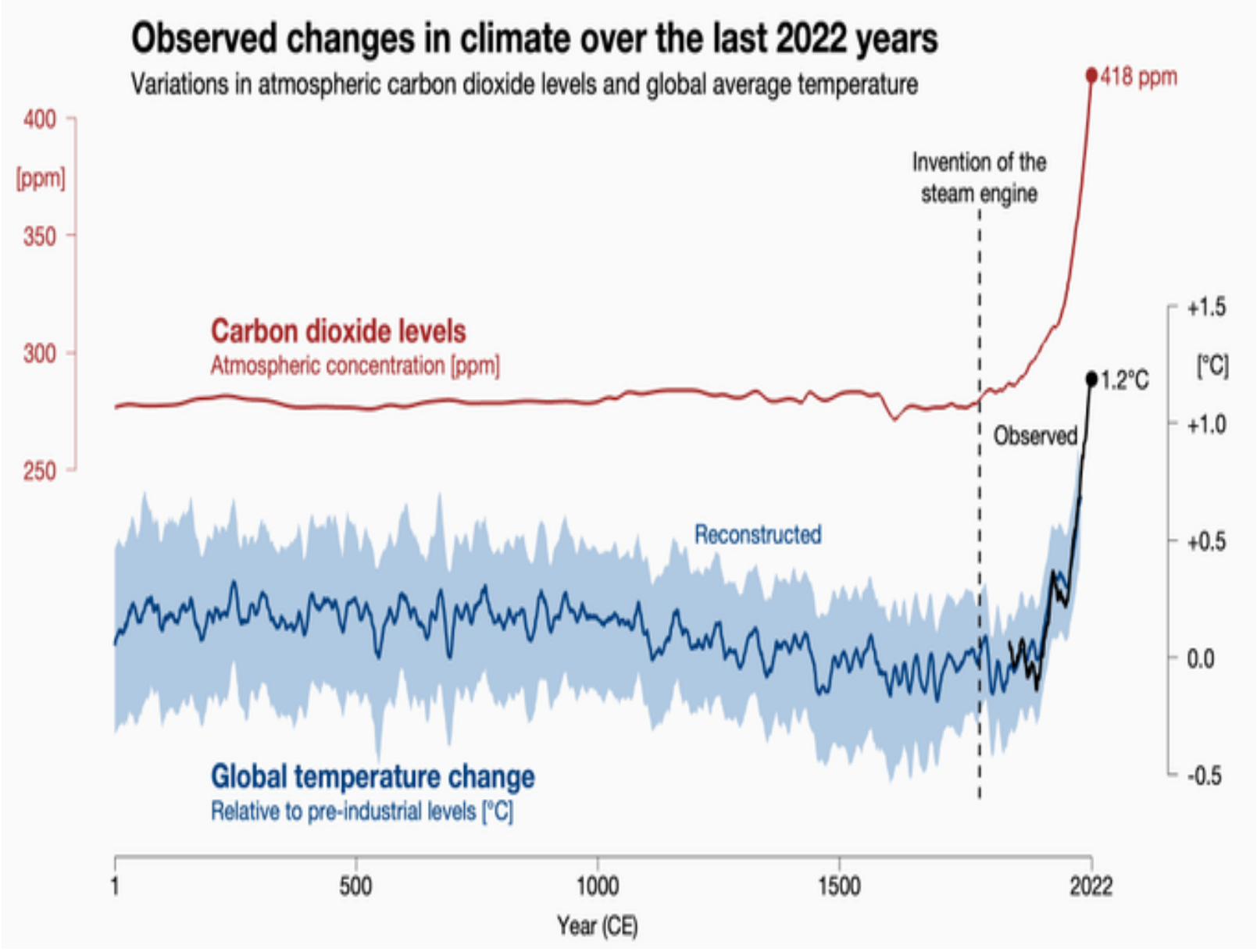
- Global mean sea level increased by 0.2 m between 1901 and 2018.

IPCC SIXTH ASSESSMENT REPORT (AR6)

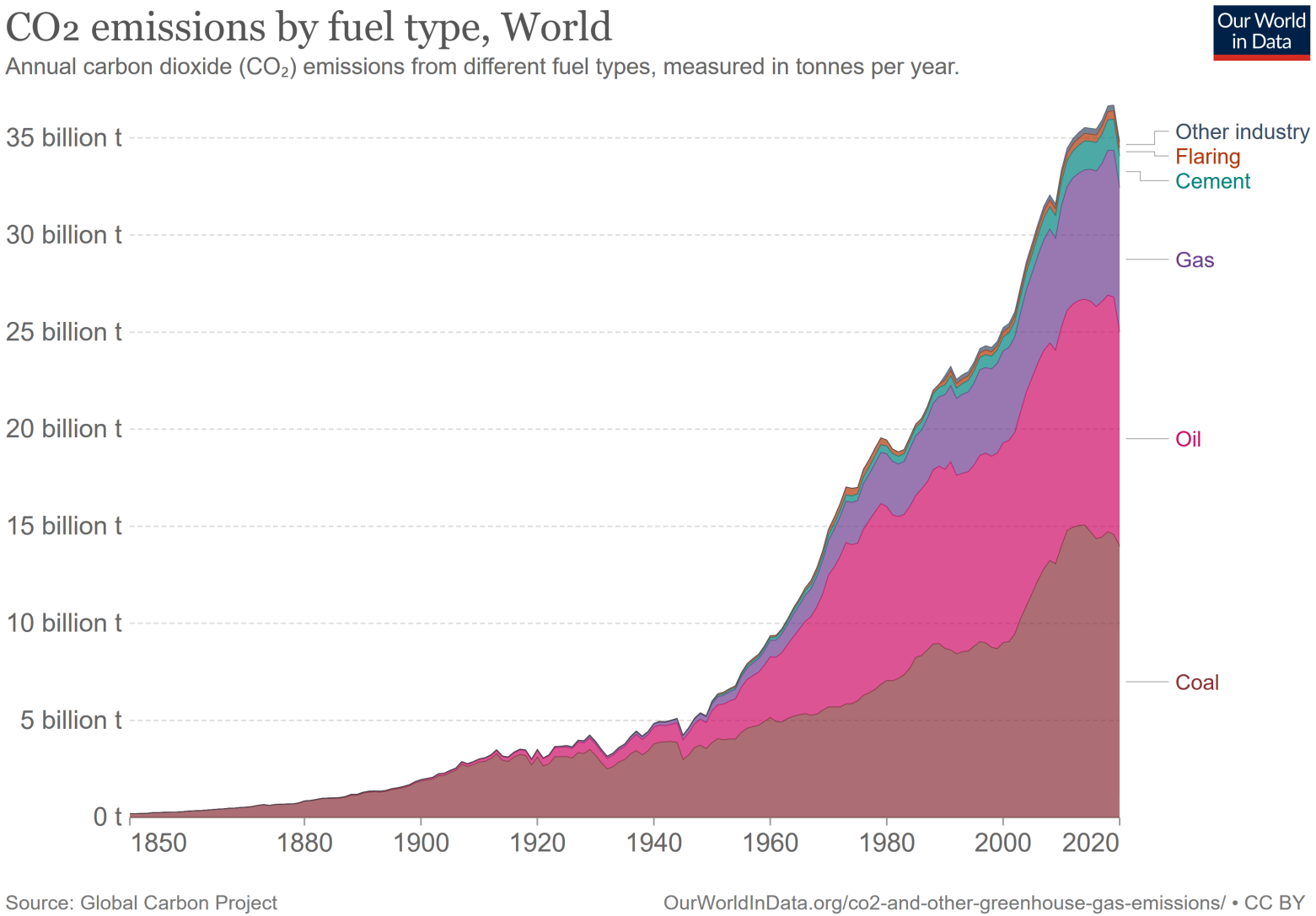
Human activities, principally through emissions of greenhouse gases, have unequivocally caused global warming, with global surface temperature reaching 1.1°C above 1850–1900 in 2011–2020. Global greenhouse gas emissions have continued to increase, with unequal historical and ongoing contributions arising from unsustainable energy use, land use and land-use change, lifestyles and patterns of consumption and production across regions, between and within countries, and among individuals (high confidence)

UN IPCC, March 2023

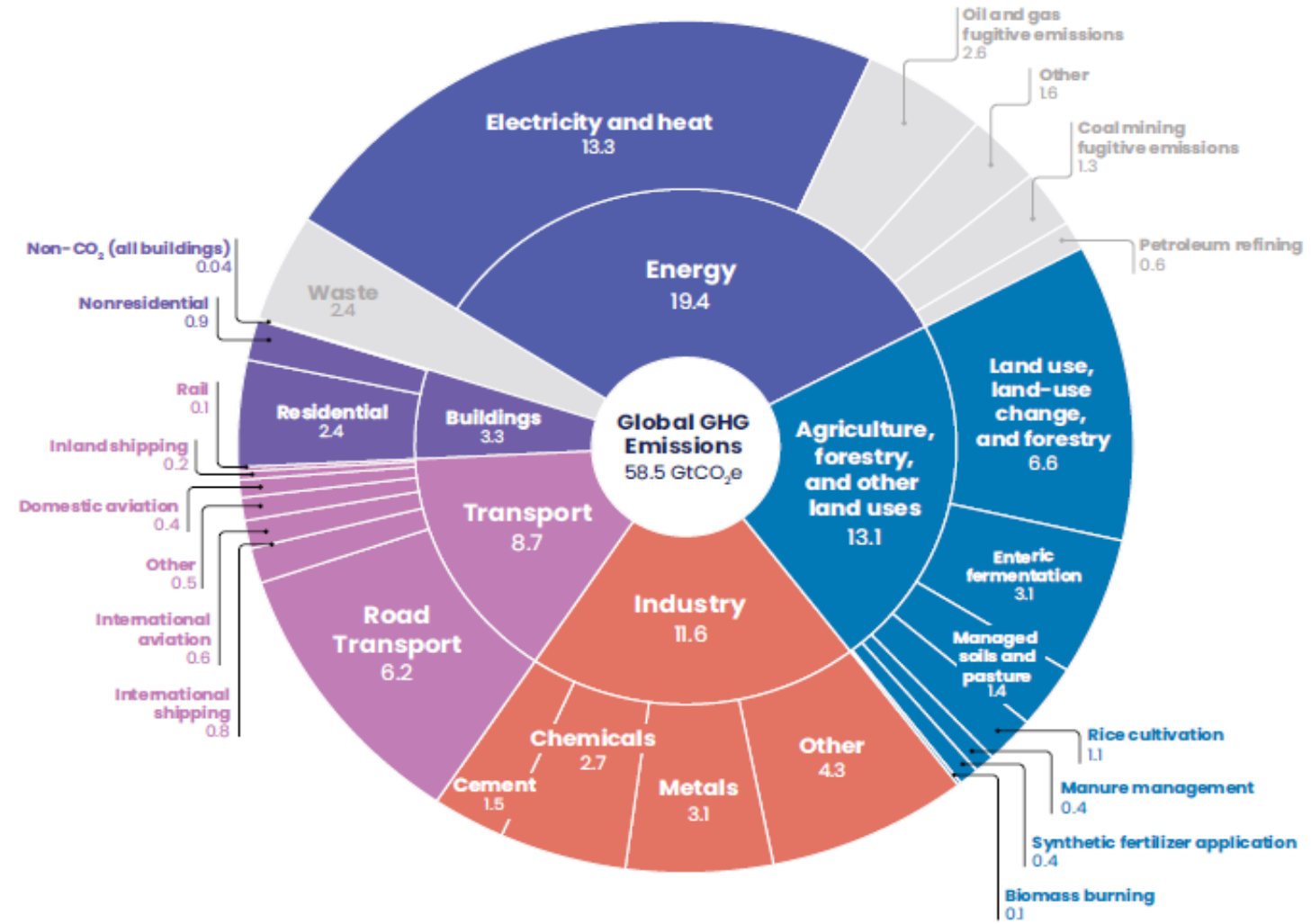
Human-Induced Climate Change



CO2 Emissions by fuel

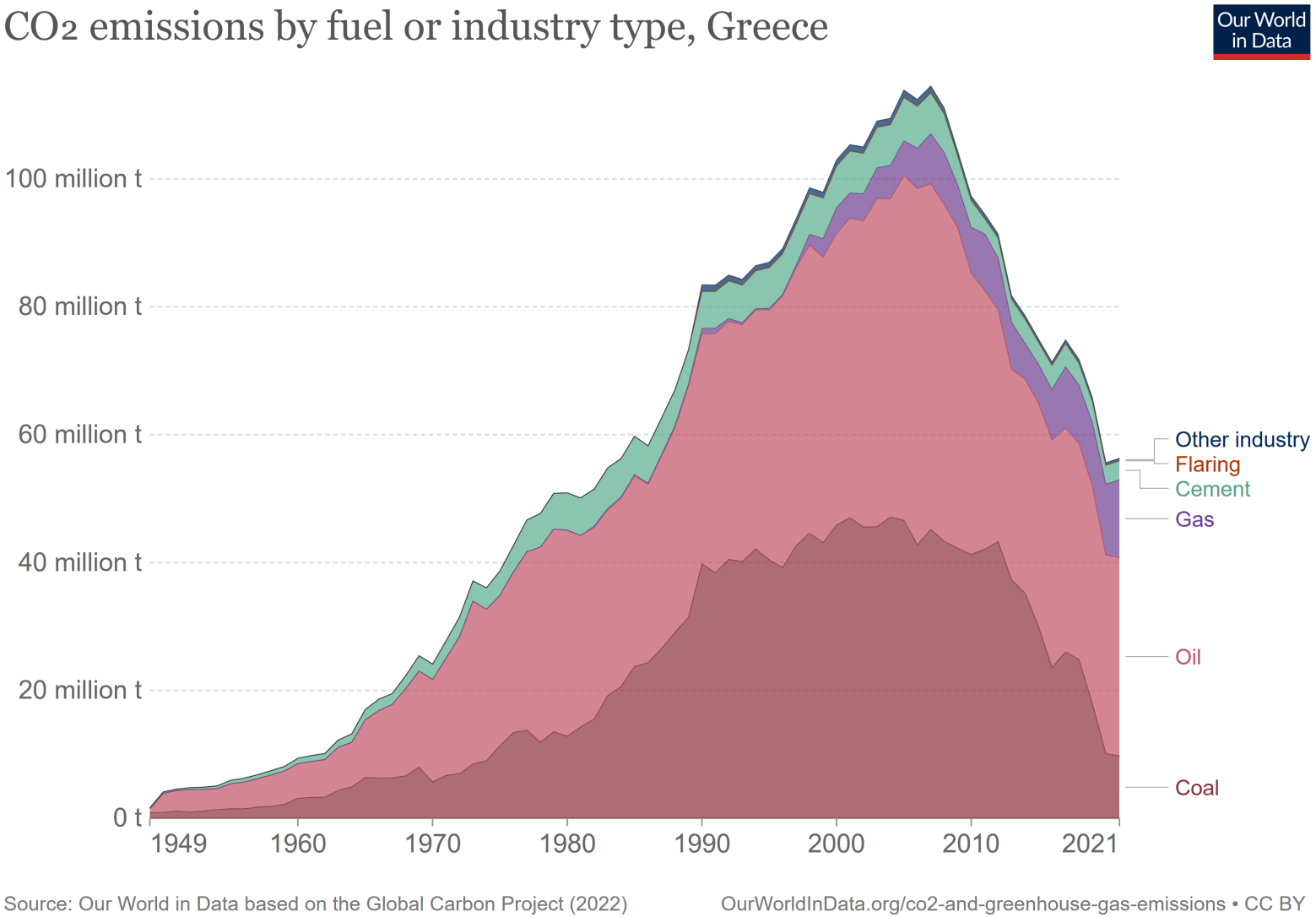


CO2 Emissions by Sector



Notes: CO_2 = carbon dioxide; GHG = greenhouse gas; $GtCO_2e$ = gigatonnes of carbon dioxide equivalent.
Source: Minx et al. (2022), described in Minx et al. (2021) and used in IPCC (2022b).

Greece CO2 Emissions by Source



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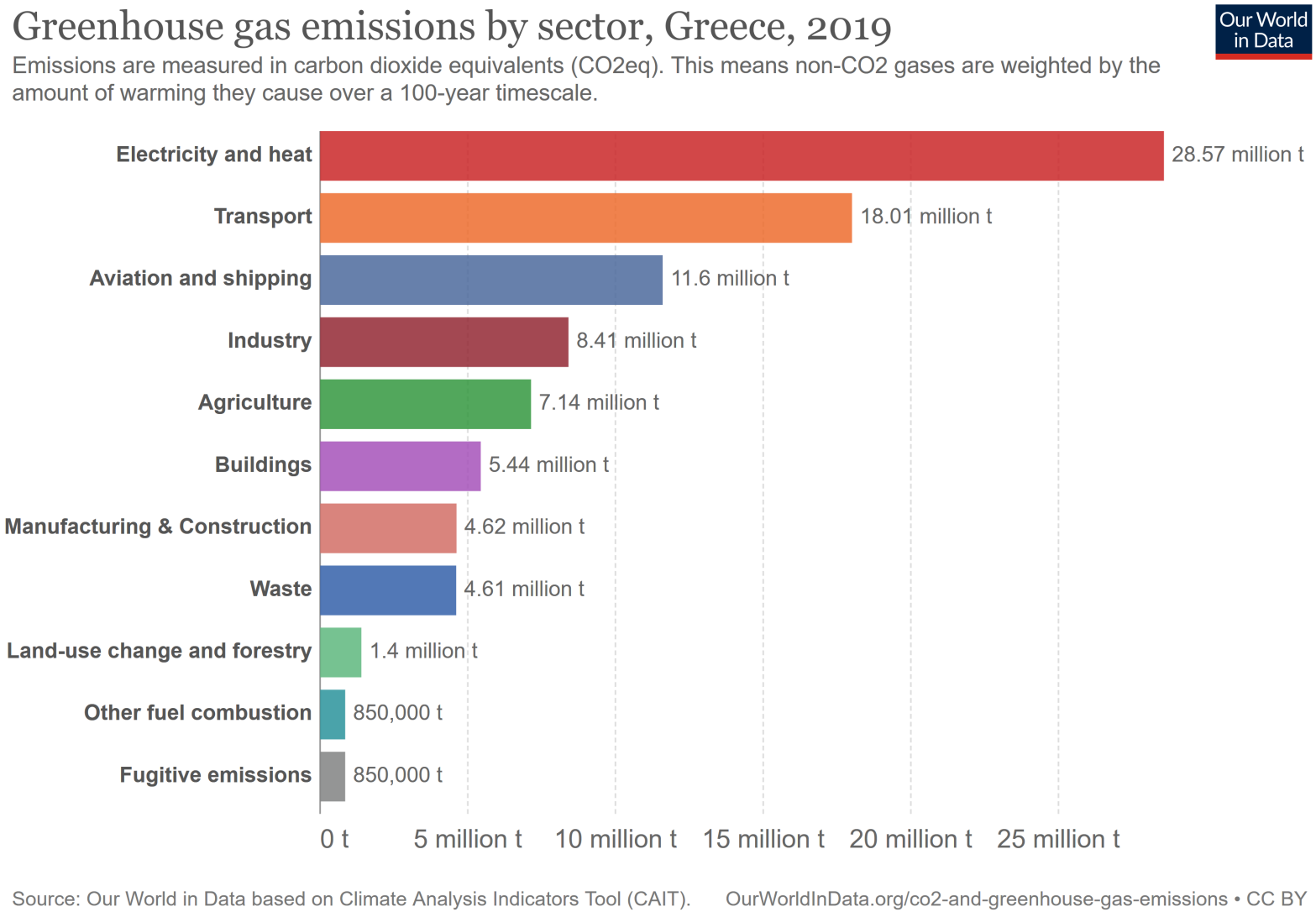
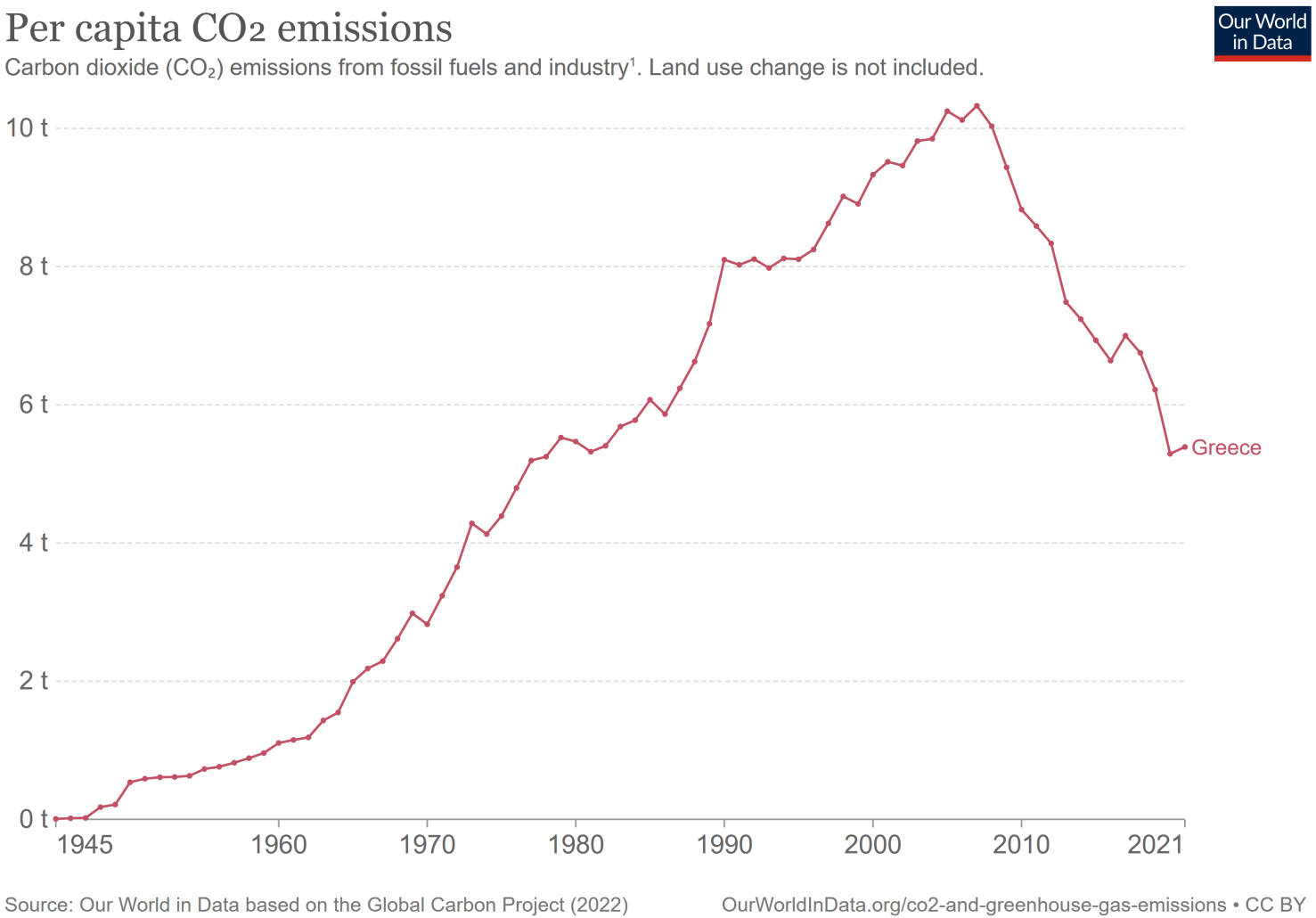


Greece CO2 per capita



1. Fossil emissions: Fossil emissions measure the quantity of carbon dioxide (CO_2) emitted from the burning of fossil fuels, and directly from industrial processes such as cement and steel production. Fossil CO_2 includes emissions from coal, oil, gas, flaring, cement, steel, and other industrial processes. Fossil emissions do not include land use change, deforestation, soils, or vegetation.

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  - Prevent & Adapt to ***Extreme Events*** (floods, droughts, wildfires)
  - ***Compensate*** populations severely affected by CC

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- **Behavioral Change**

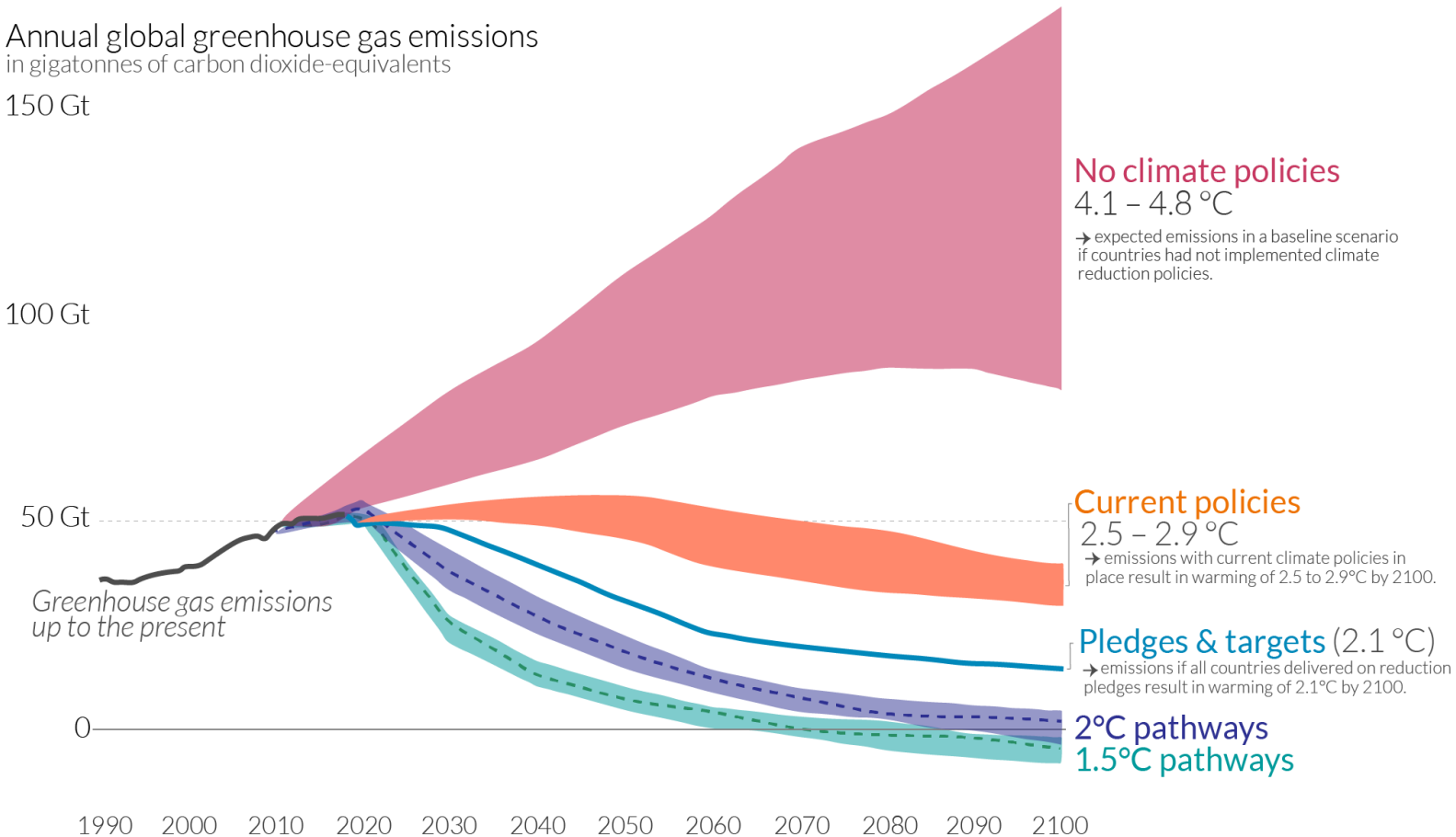
  Societal Shift towards Sustainable Practices

Climate Policies and Temperature

Global greenhouse gas emissions and warming scenarios

– Each pathway comes with uncertainty, marked by the shading from low to high emissions under each scenario.
– Warming refers to the expected global temperature rise by 2100, relative to pre-industrial temperatures.

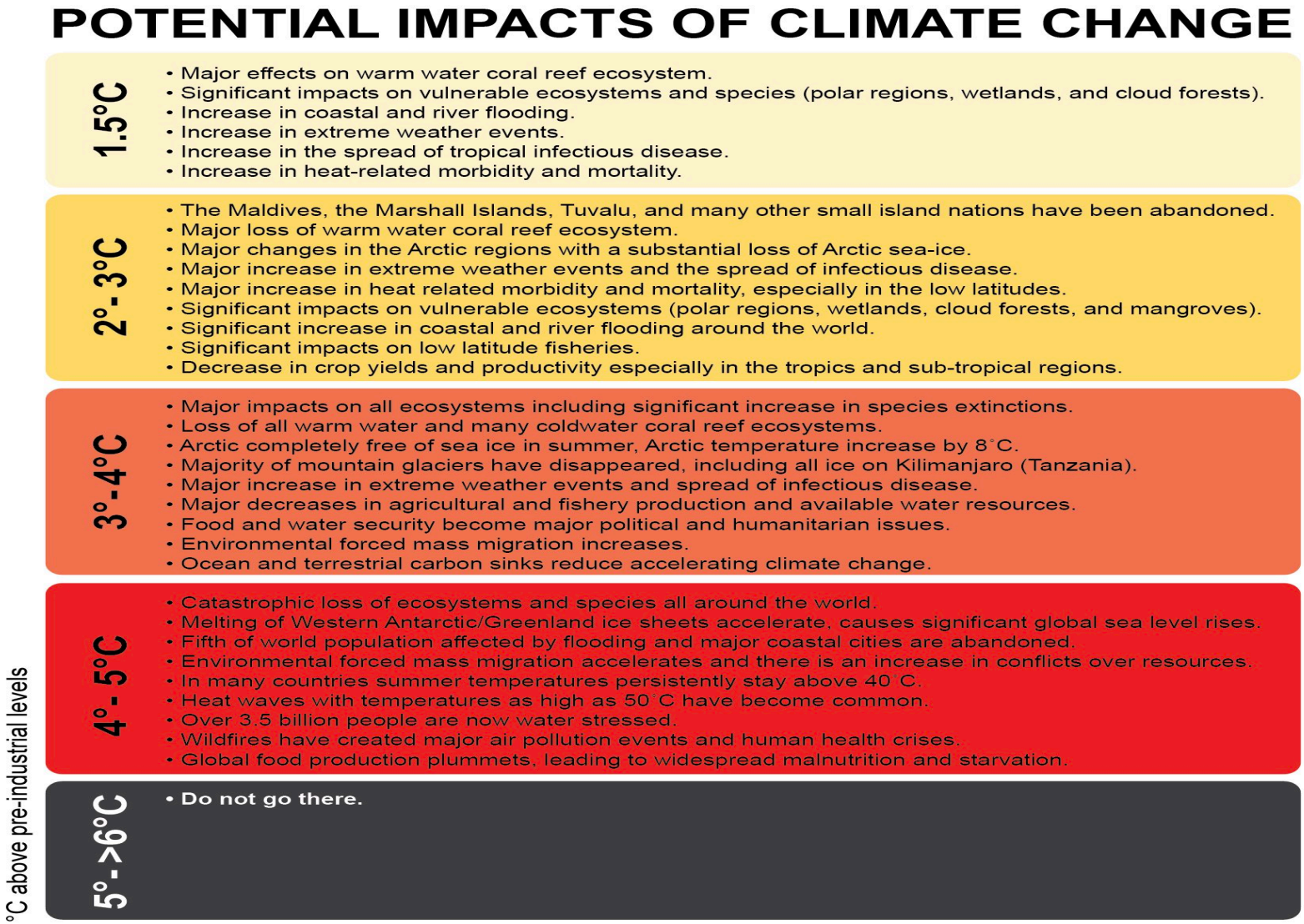
Our World in Data



Data source: Climate Action Tracker (based on national policies and pledges as of November 2021).
OurWorldinData.org – Research and data to make progress against the world's largest problems.

Last updated: April 2022.

Global Temperature Impacts



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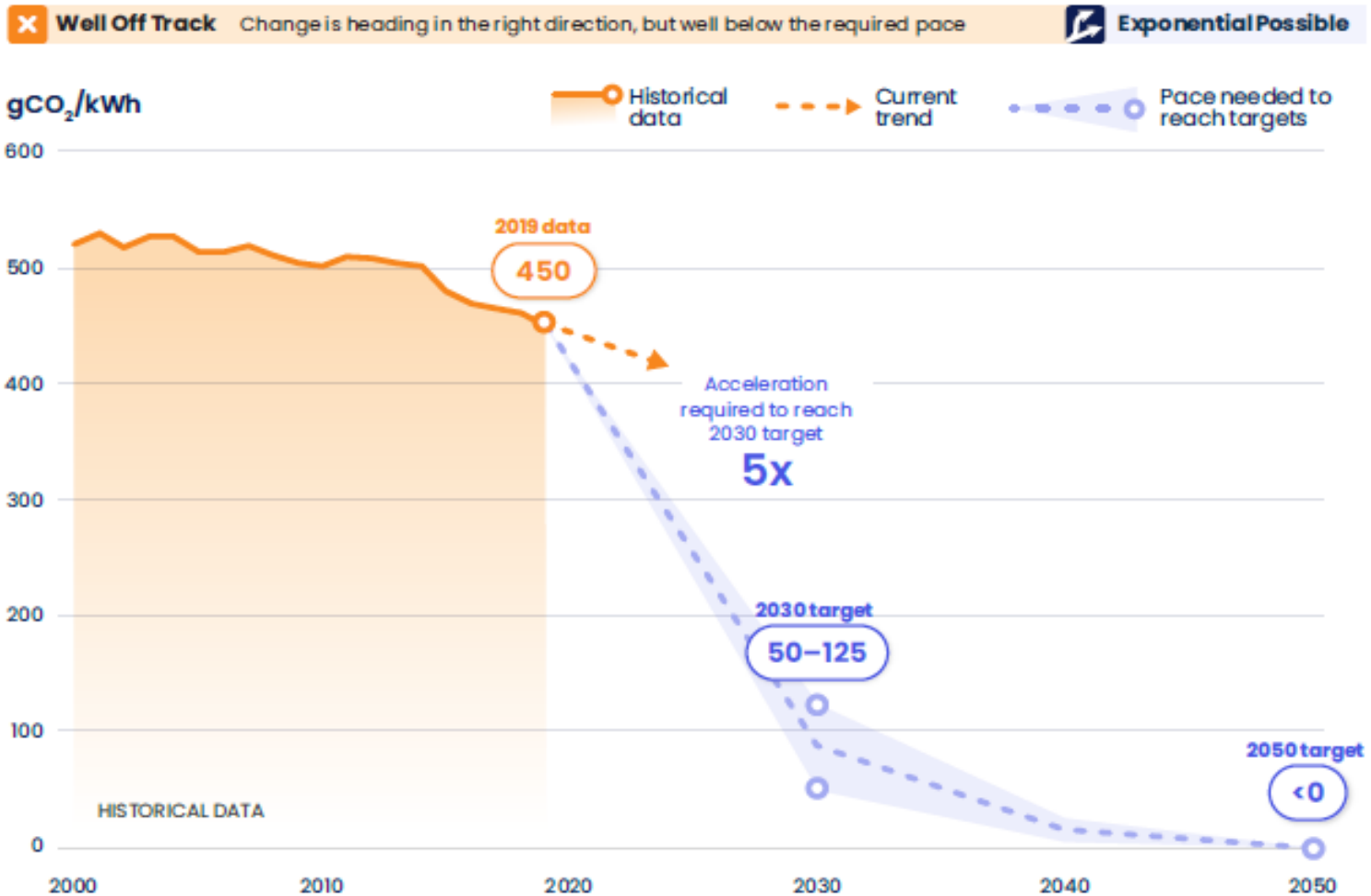
  $\rightarrow$ **CRD** possible when this interdependence is leveraged
- **Example**: Clean energy generation + healthy diets from sustainable food systems,+ universal health coverage and social protection
  = Substantial **health and well-being co-benefits**

Energy Efficiency Trends and Needs



Notes: gCO_2/kWh = grams of carbon dioxide per kilowatt-hour. Data for 2021 are an estimate for now; 2020 data will be added when available.

Sources: Historical data from IEA (2021f), computed using the "GHG emissions from fuel combustion" data product in accordance with the associated IEA license agreement; targets from Climate Action Tracker (2020b).

Innovation Essentials

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`OECD Oslo Manual 2018`

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- ***Under capitalism, innovative activity-which in other types of economy is fortuitous and optional-becomes mandatory, a life and death matter for the firm***
  W. Baumol 2002

Innovation: The X Factor

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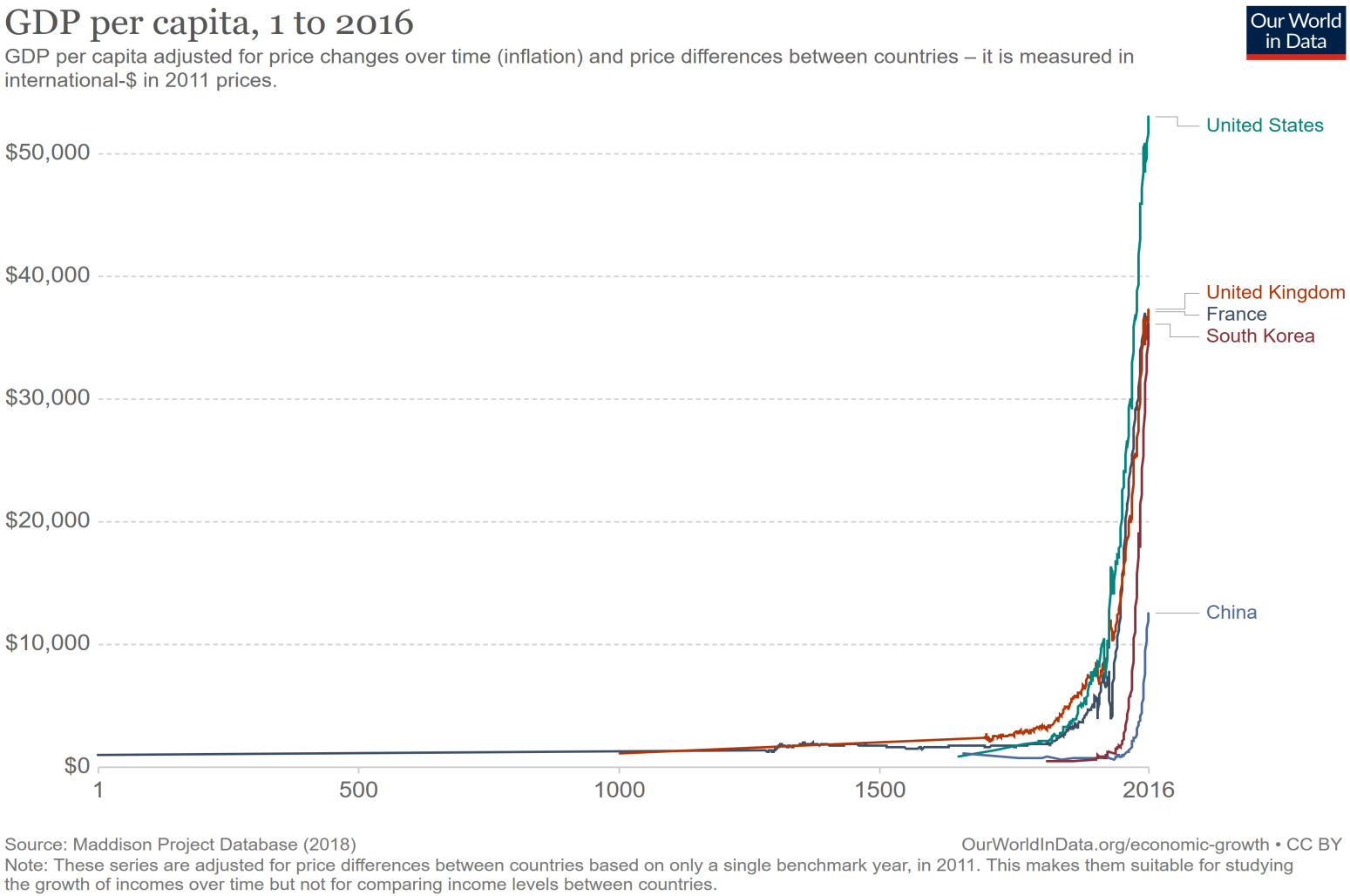
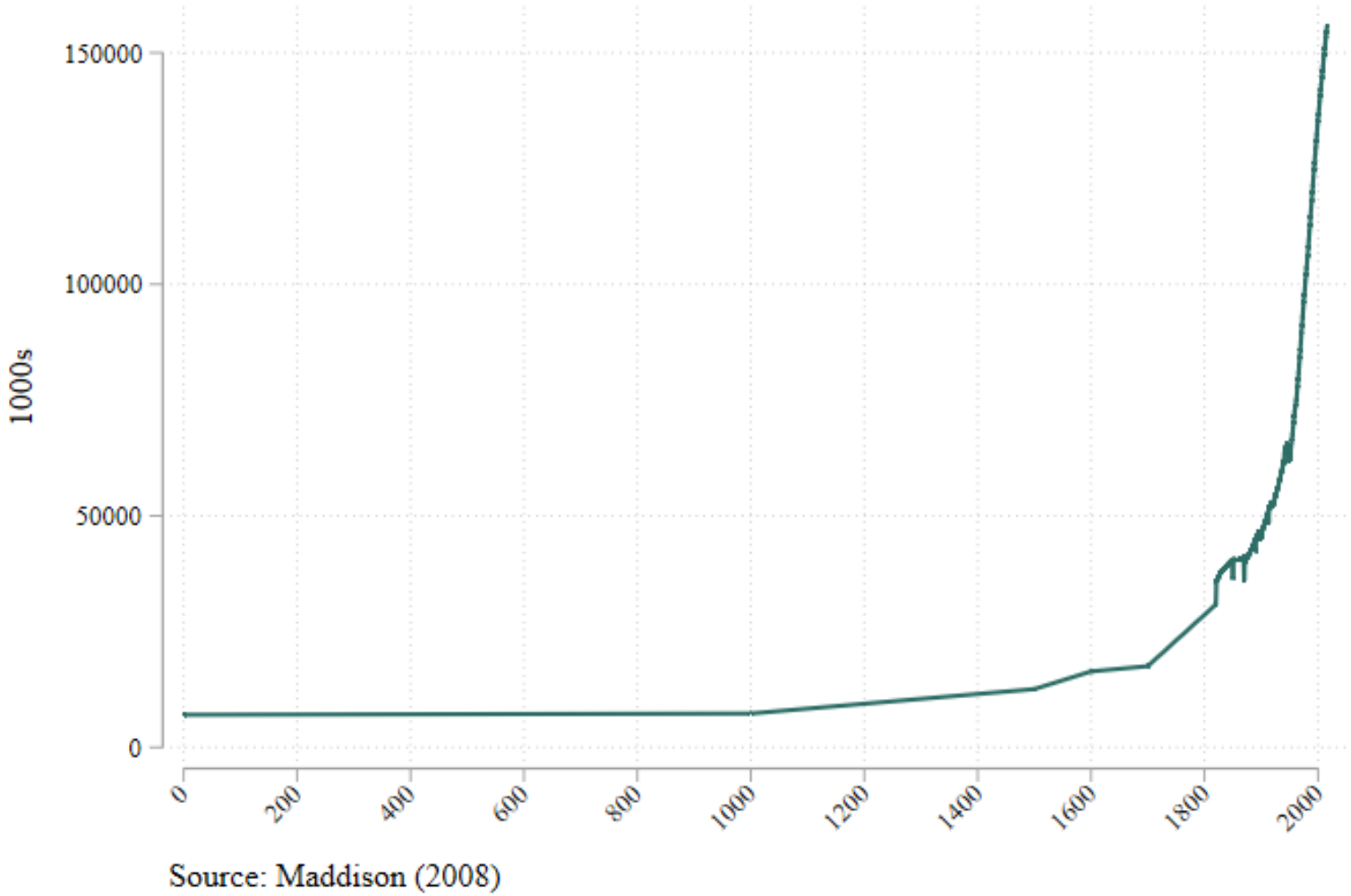
- Matt Ridley: ***Innovation is the child of freedom and the parent of prosperity. It is on balance a very good thing. We abandon it at our peril***

Industrial Revolution and GDP per capita



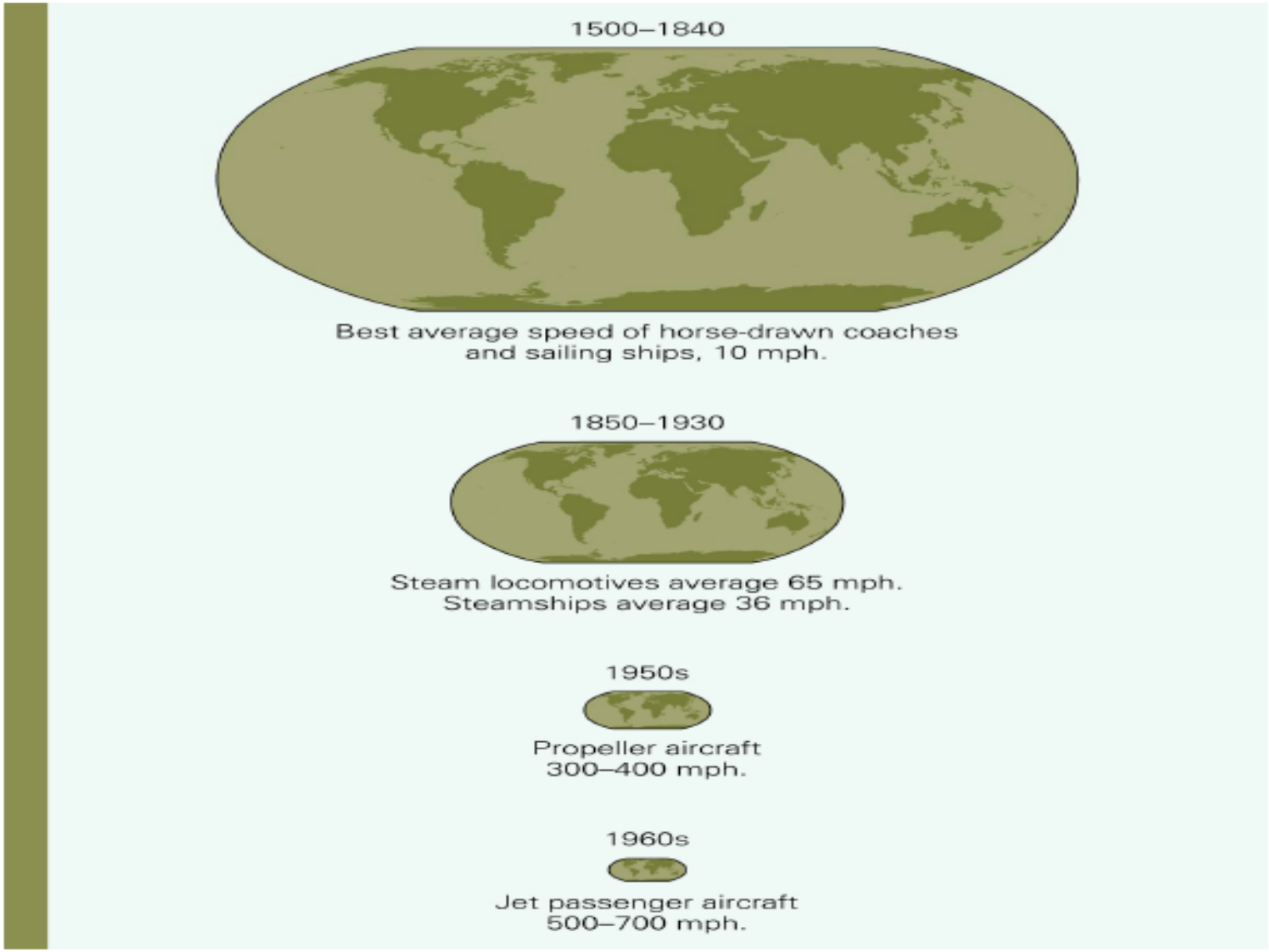
World Population



Source: Maddison (2008)

Embedded Human Knowledge

The Death of Distance



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- ***There is no day when you can say: computers did not exist the day before and did the day after, any more than you could say that one ape-person was an ape, and her daughter was a person***
  (Matt Ridley)

Unpredictable Indeed

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- ***There's no chance the iPhone is going to get significant market share. No chance.***

  Steve Ballmer, chief executive of Microsoft 2007

Innovation and Institutions

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  - Social Attitudes that promote **Systemic Change** and are open to new Ideas

Chinese vs Columbus Flagship

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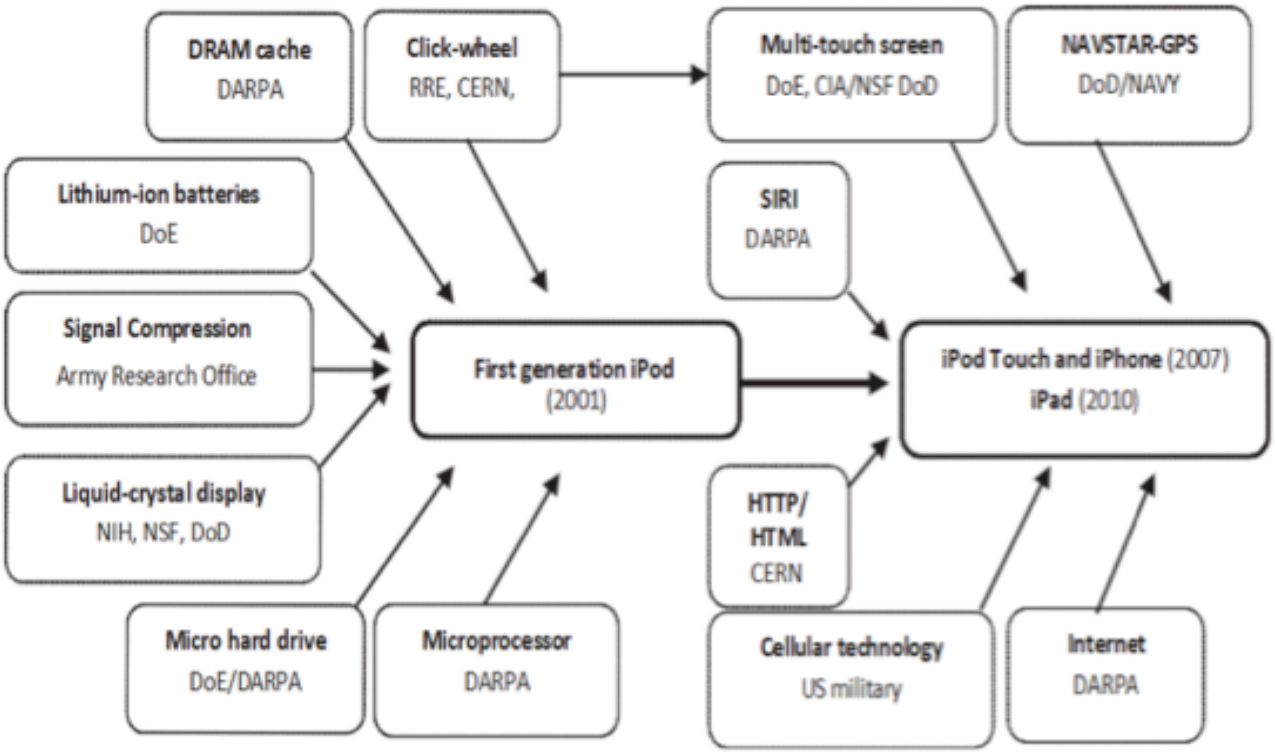
- Strong Role of Government in US Innovation dominance (DARPA, Bell Labs) and Japanese & Korean tech boom after 1950

Public Sector and Smart Innovation

What makes the iPhone so 'smart'?



©MarianaMazzucato The Entrepreneurial State: debunking private vs. public sector myths, p. 109, Fig. 13

Innovation Promotion Toolbox

Innovation Policy Toolkit

Policy	*Quality of evidence (1)*	*Conclusiveness of evidence (2)*	*Net benefit (3)*	*Time frame (4)*	*Effect on inequality (5)*
Direct R&D grants	Medium	Medium	💡💡	Medium run	↑
R&D tax credits	High	High	💡💡💡	Short run	↑
Patent box	Medium	Medium	Negative	NA	↑
Skilled immigration	High	High	💡💡💡	Short to medium run	↓
Universities: incentives	Medium	Low	💡	Medium run	↑
Universities: STEM supply	Medium	Medium	💡💡	Long run	↓
Trade and competition	High	Medium	💡💡💡	Medium run	↑
Intellectual property reform	Medium	Low	Unknown	Medium run	Unknown
Mission-oriented policies	Low	Low	💡	Medium run	Unknown

Source: Bloom, van Reenen and Williams (2019)

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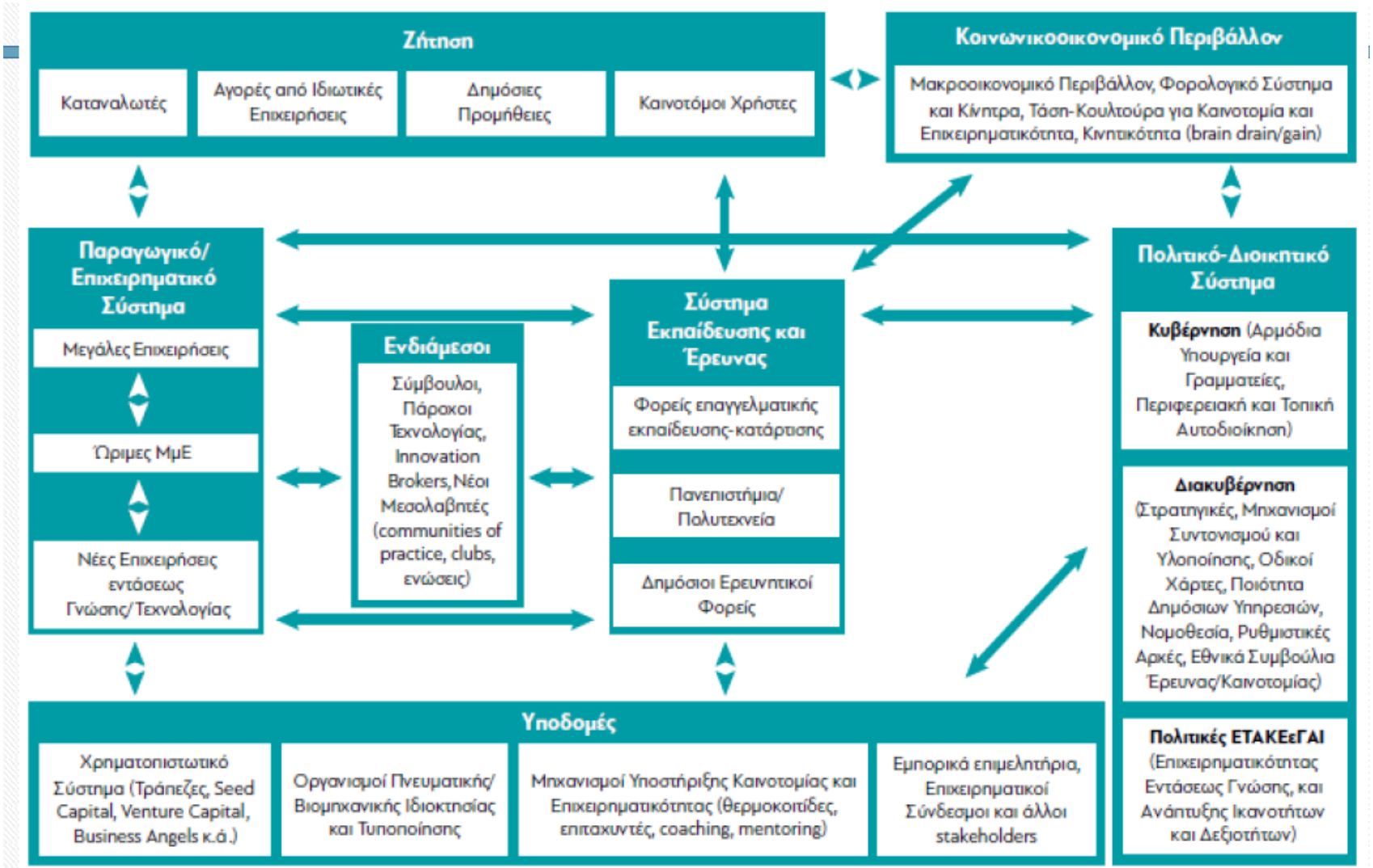
- National and Regional Innovation Systems foster ***Creation and Dissemination*** of Innovation

National Innovation System (DIANEOSIS)



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- **Tolerance**
  - Embrace ***Different People and New Ideas***
  - Directly connected with the other 2 T's!

European Innovation Scoreboard

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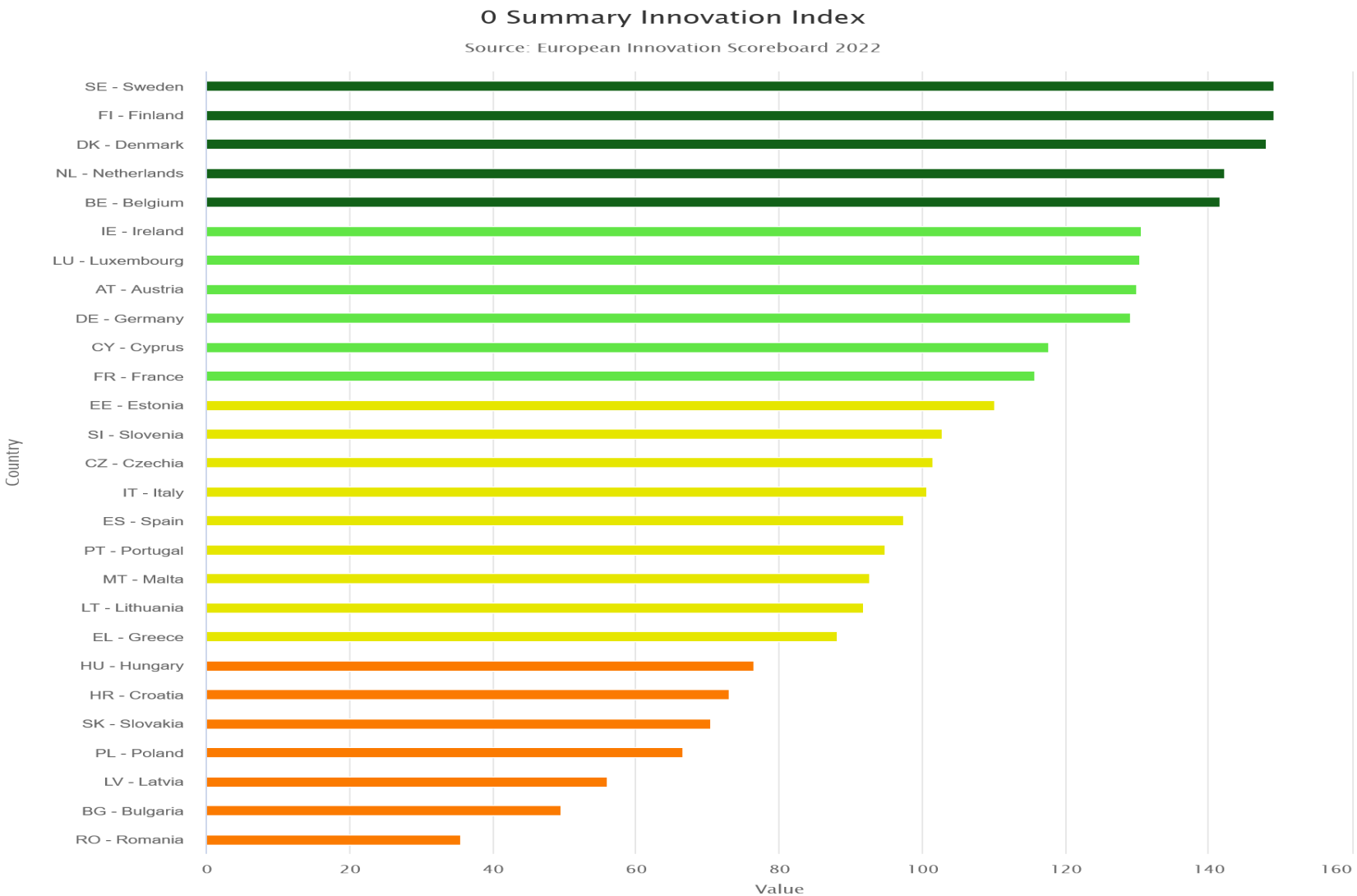
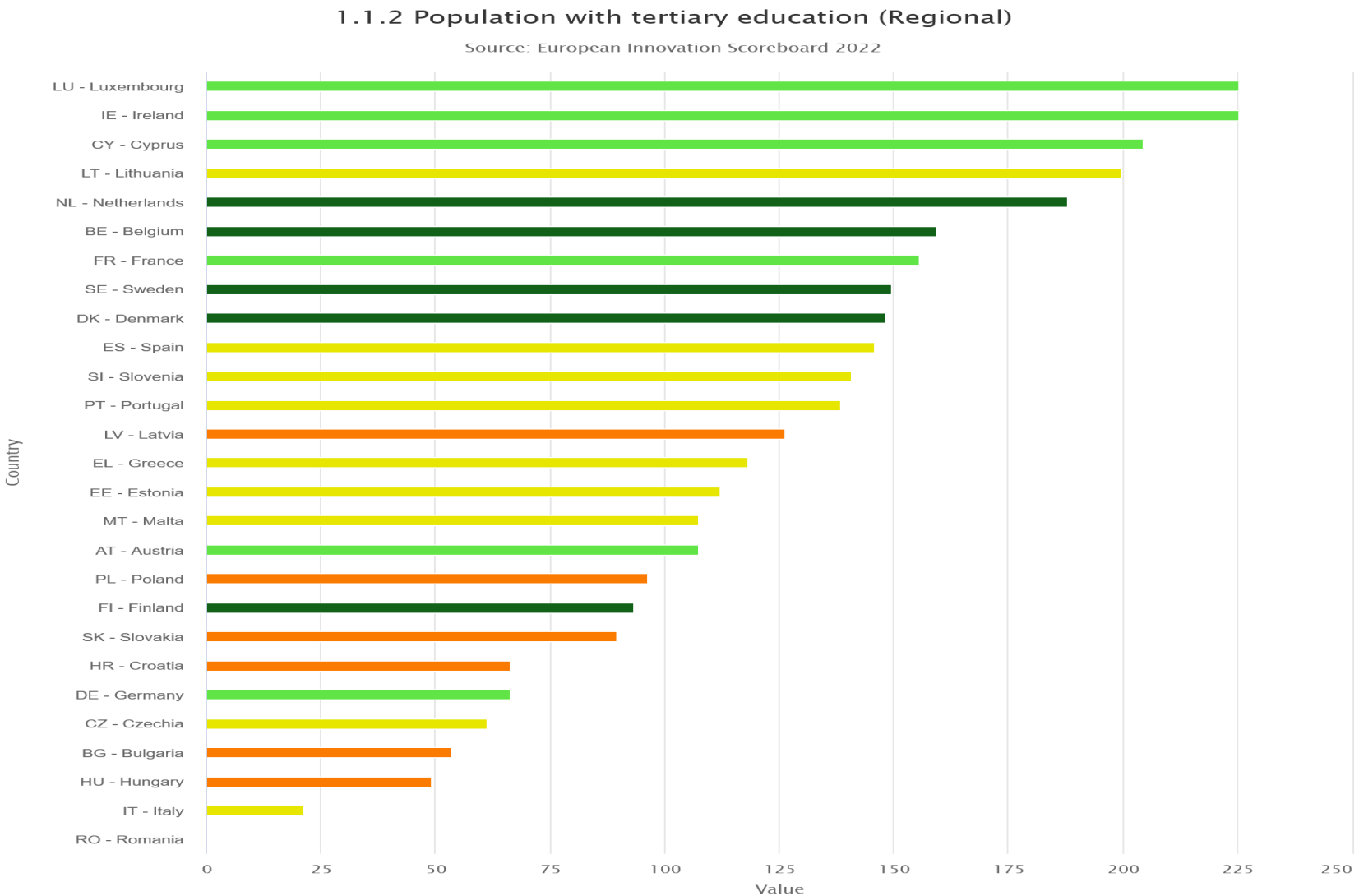
- Greece among the **Moderate Innovators** gradually (***but slowly)*** closing the gap with EU best practices
- Strong in Human Capital and Innovators, lacking in Commercialization, attracting and retaining Talent & Government Support

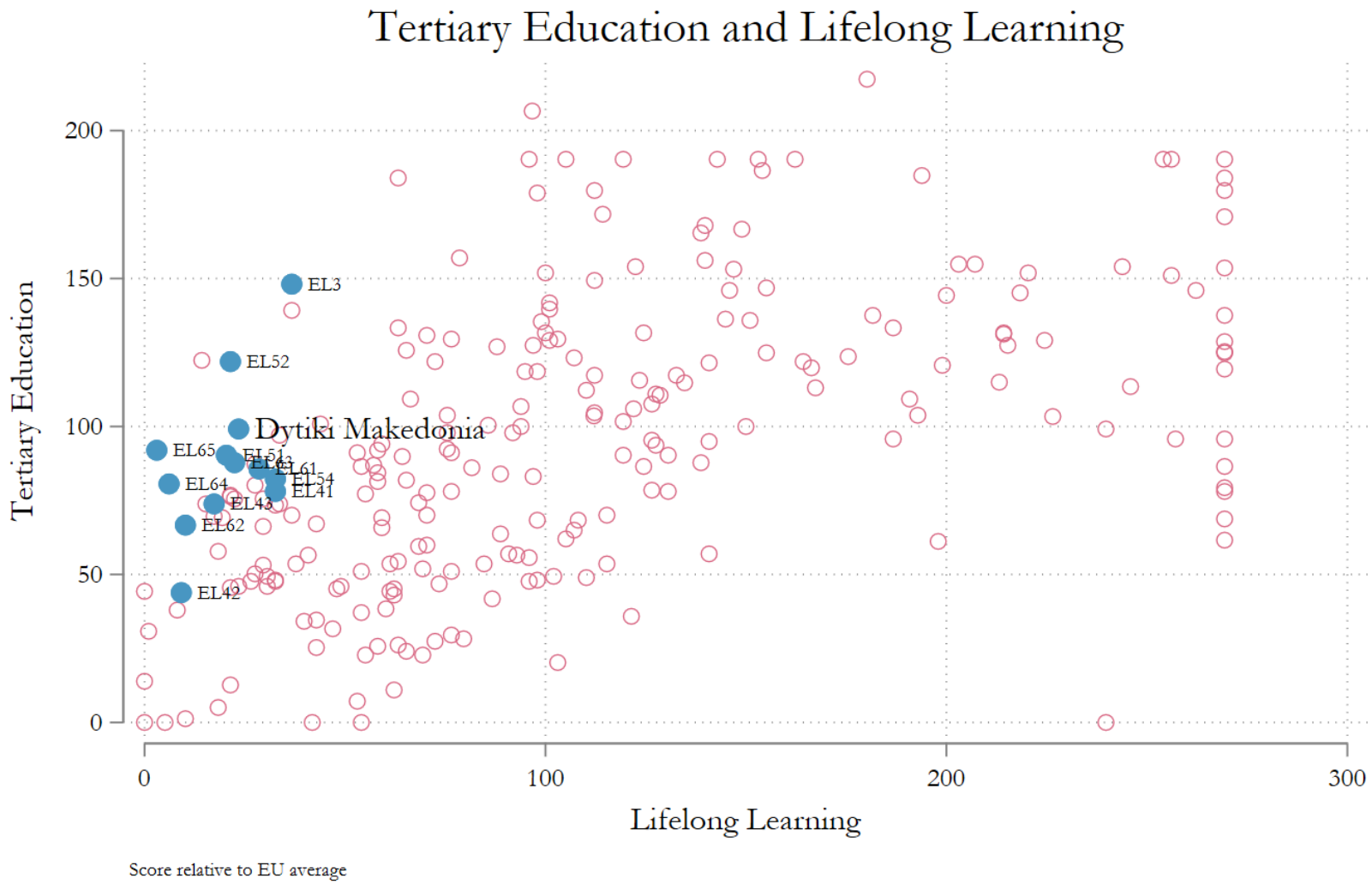
EIS - Summary Innovation Index



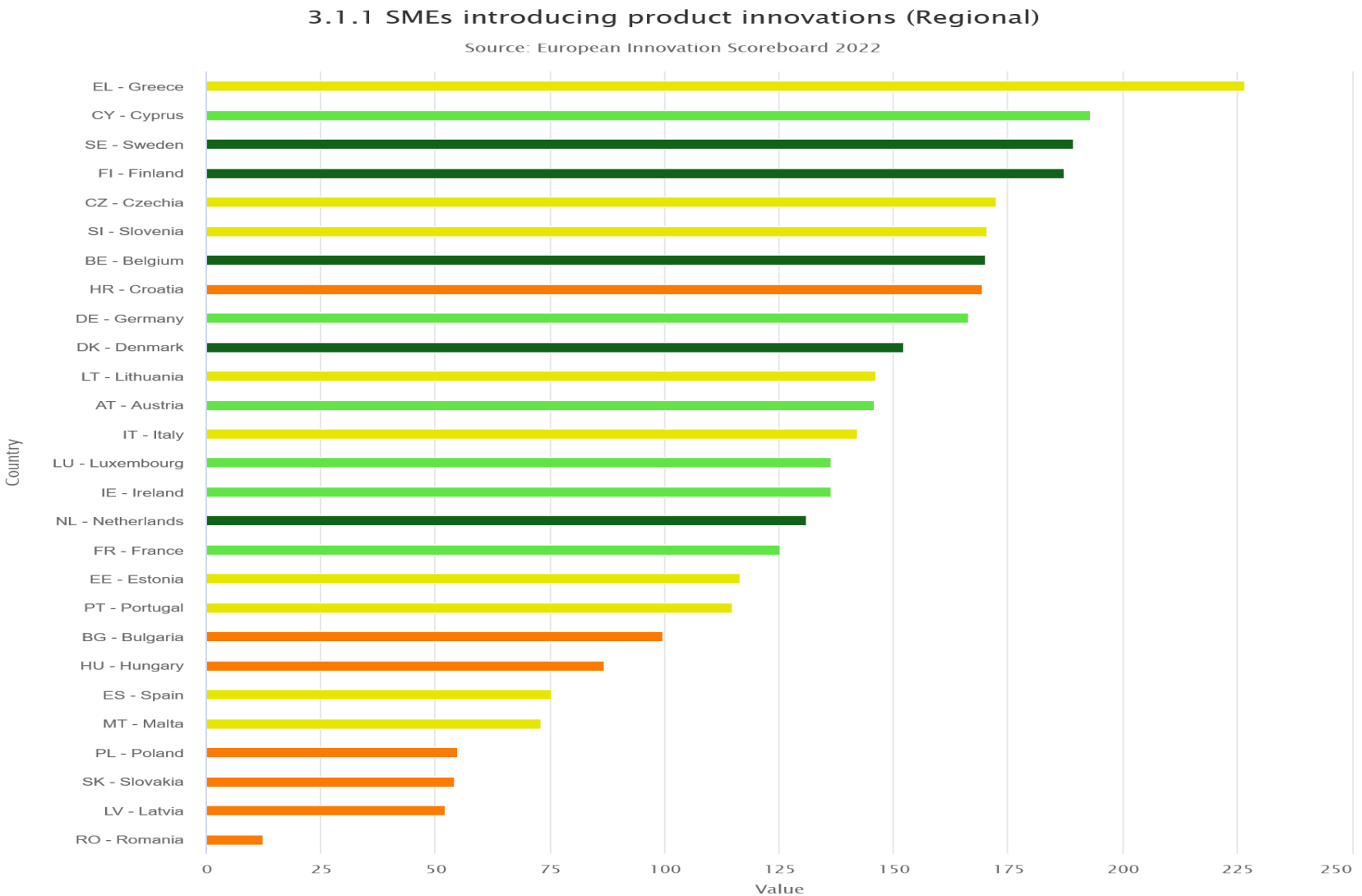
EIS - Tertiary Education



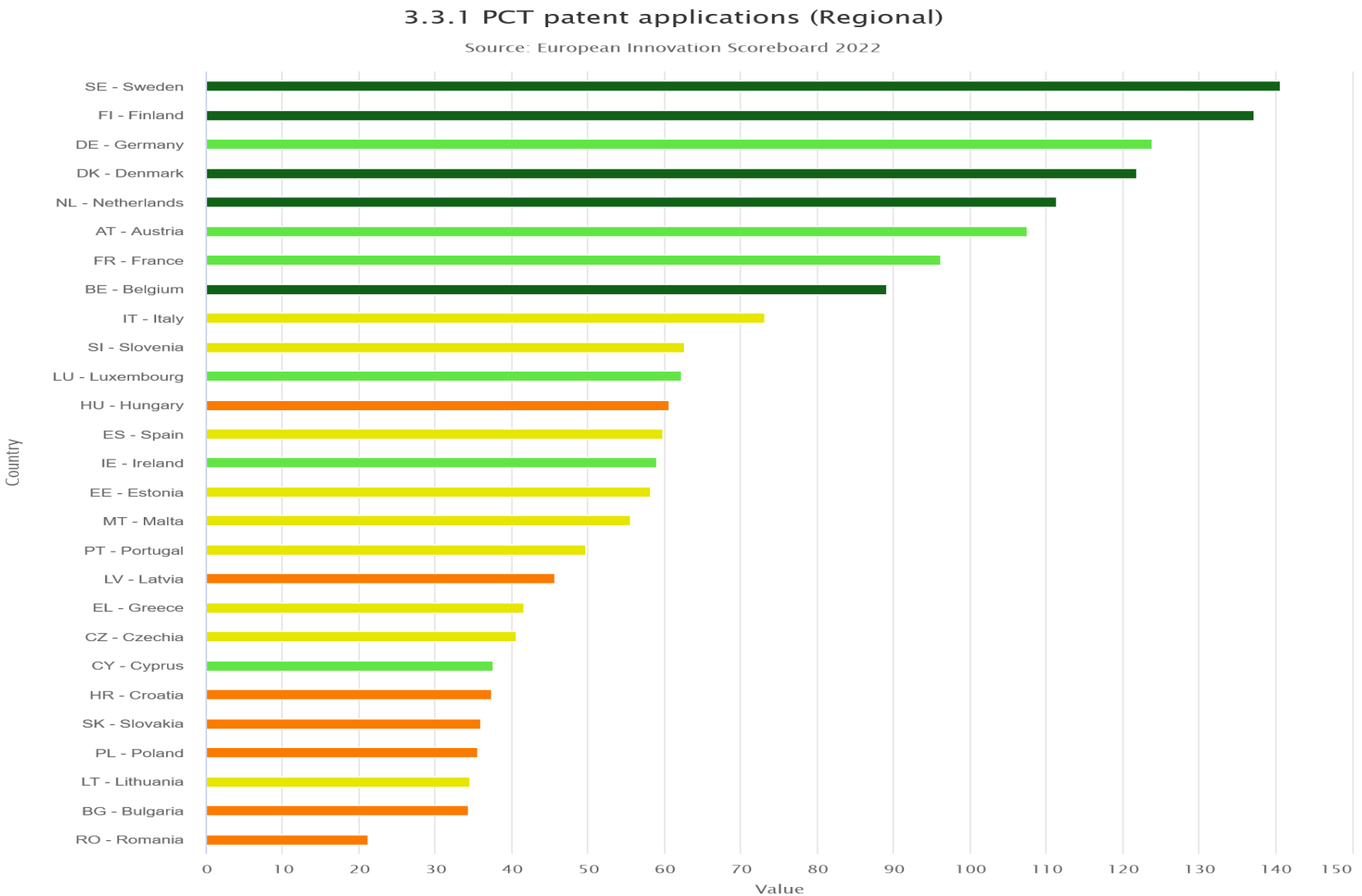
Regional Innovation Scoreboard



EIS - Innovative SMEs



EIS - Patent Applications



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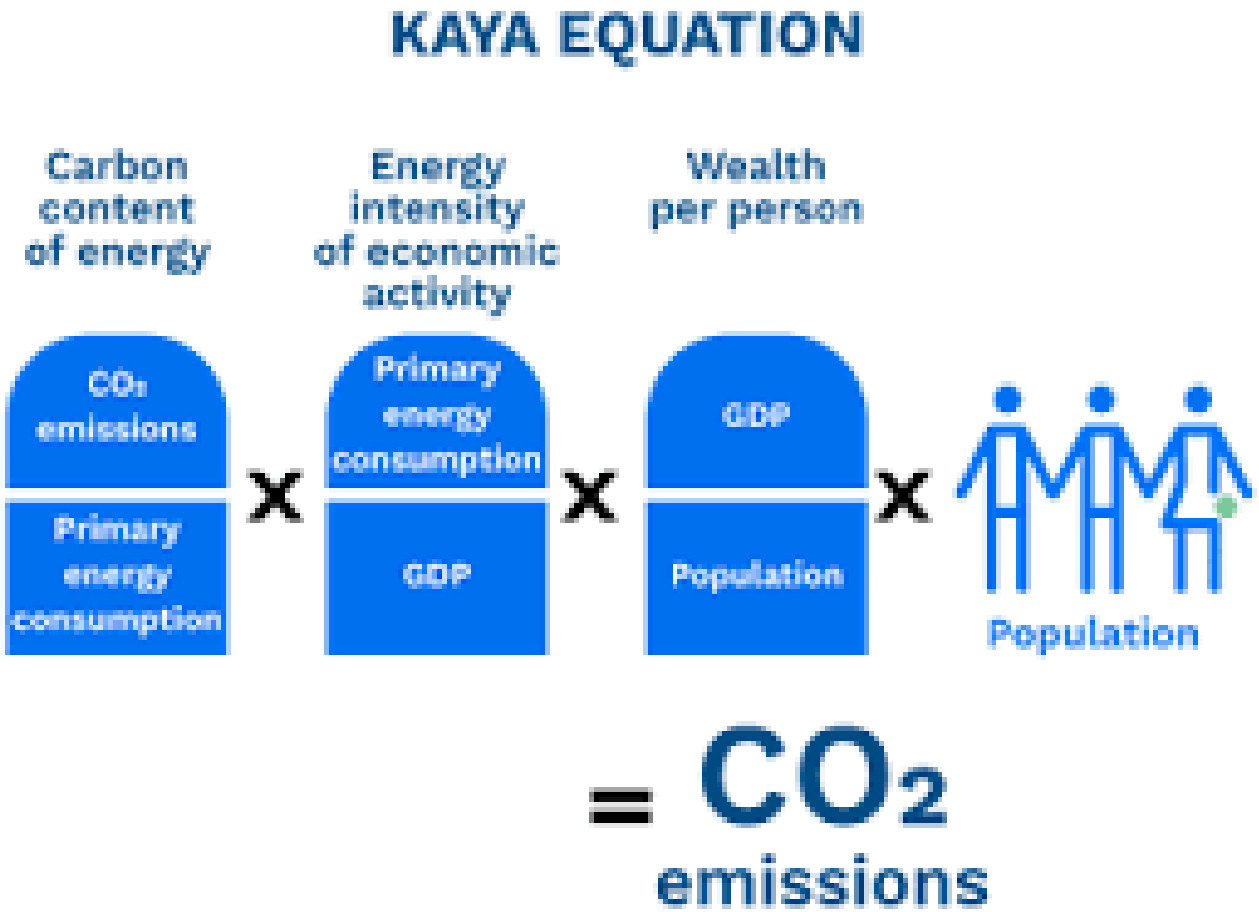
- Fundamental to $\downarrow$ the costs of clean technologies below those of environment-harming technologies

Kaya Identity



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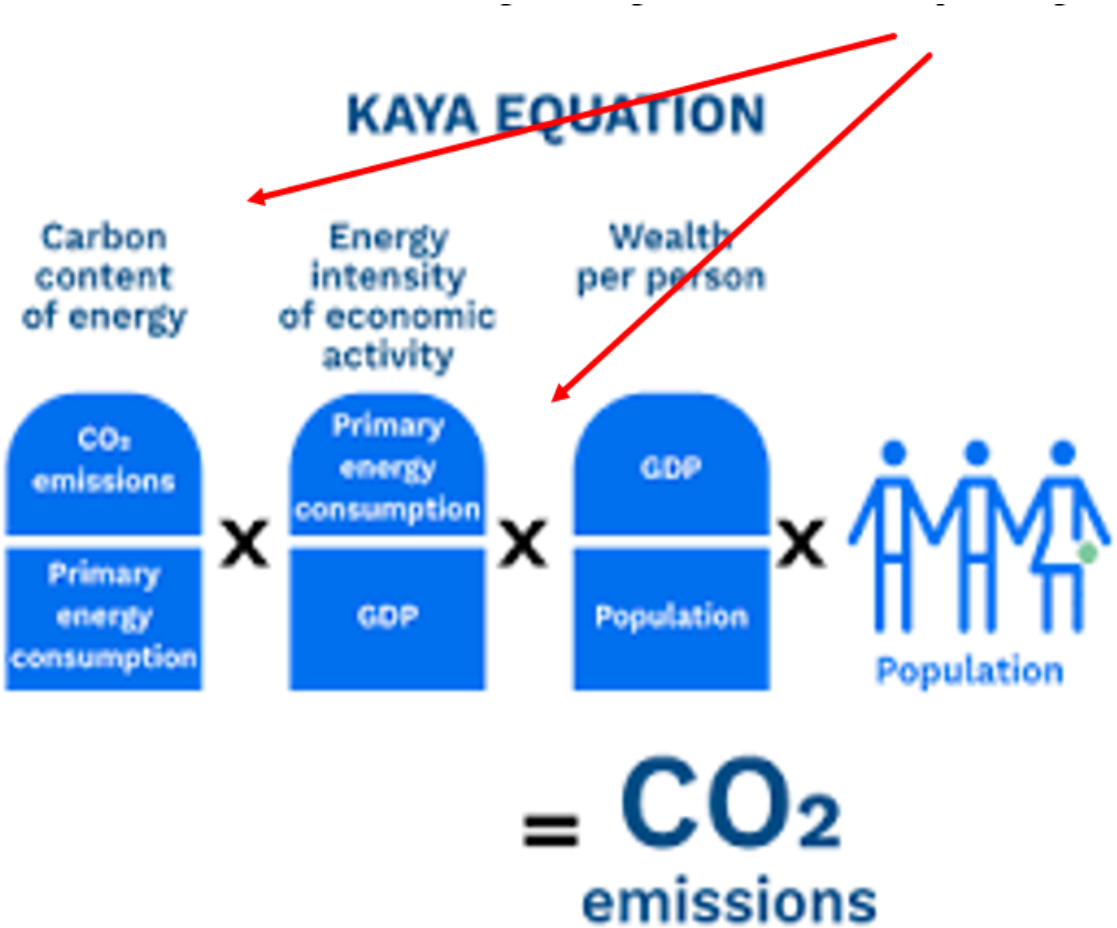

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- ***Innovation Systems*** needed in place to foster New Technologies for CC Mitigation and Adaptation

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- Reshaping **Production**, **Financial System and Individual Behaviors** in the process

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- **IEA Net-zero Roadmap 2023**: technologies not yet available on the market $\rightarrow$ 35% of Emissions reductions needed for net zero compared to 50% in 2021

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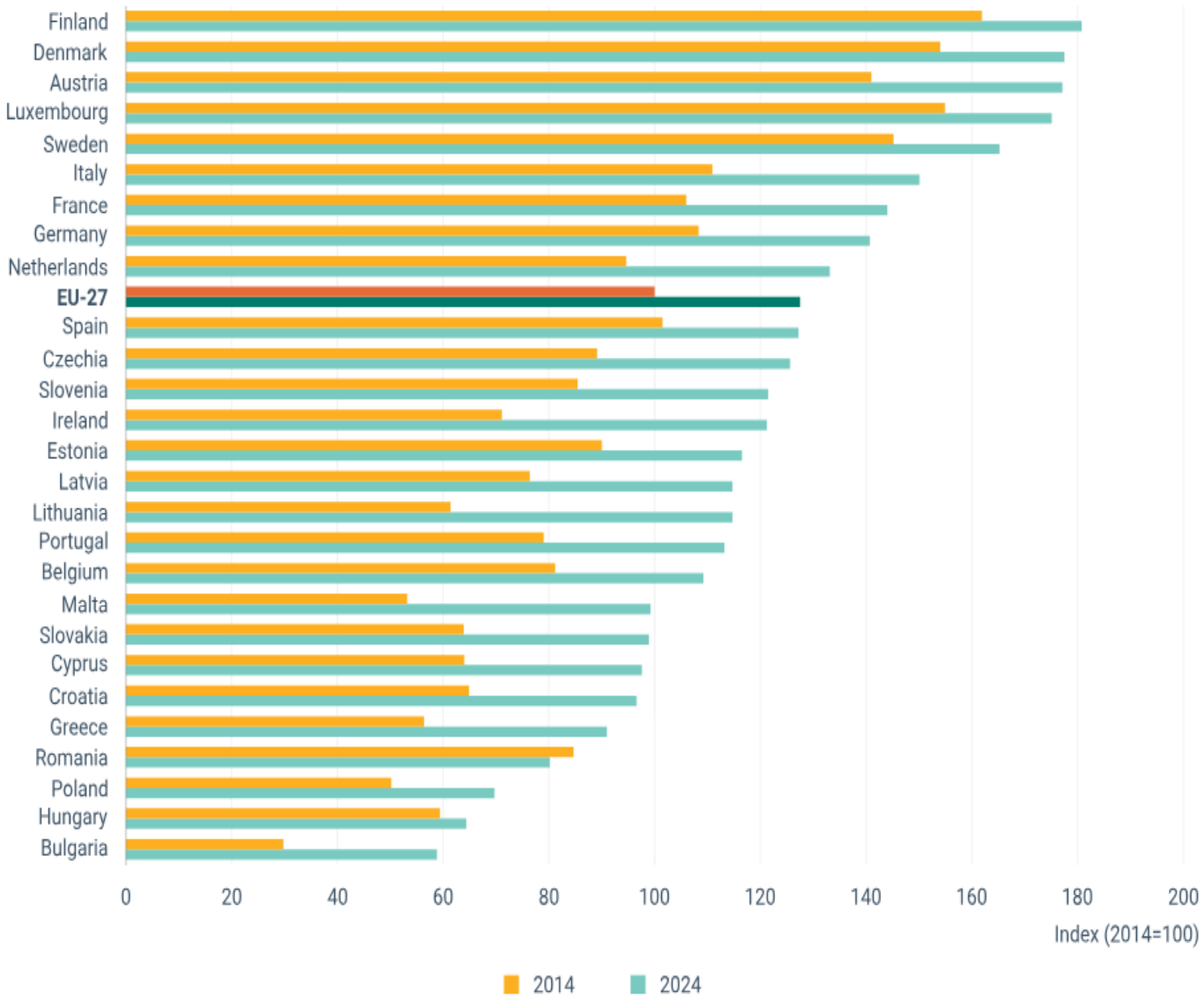
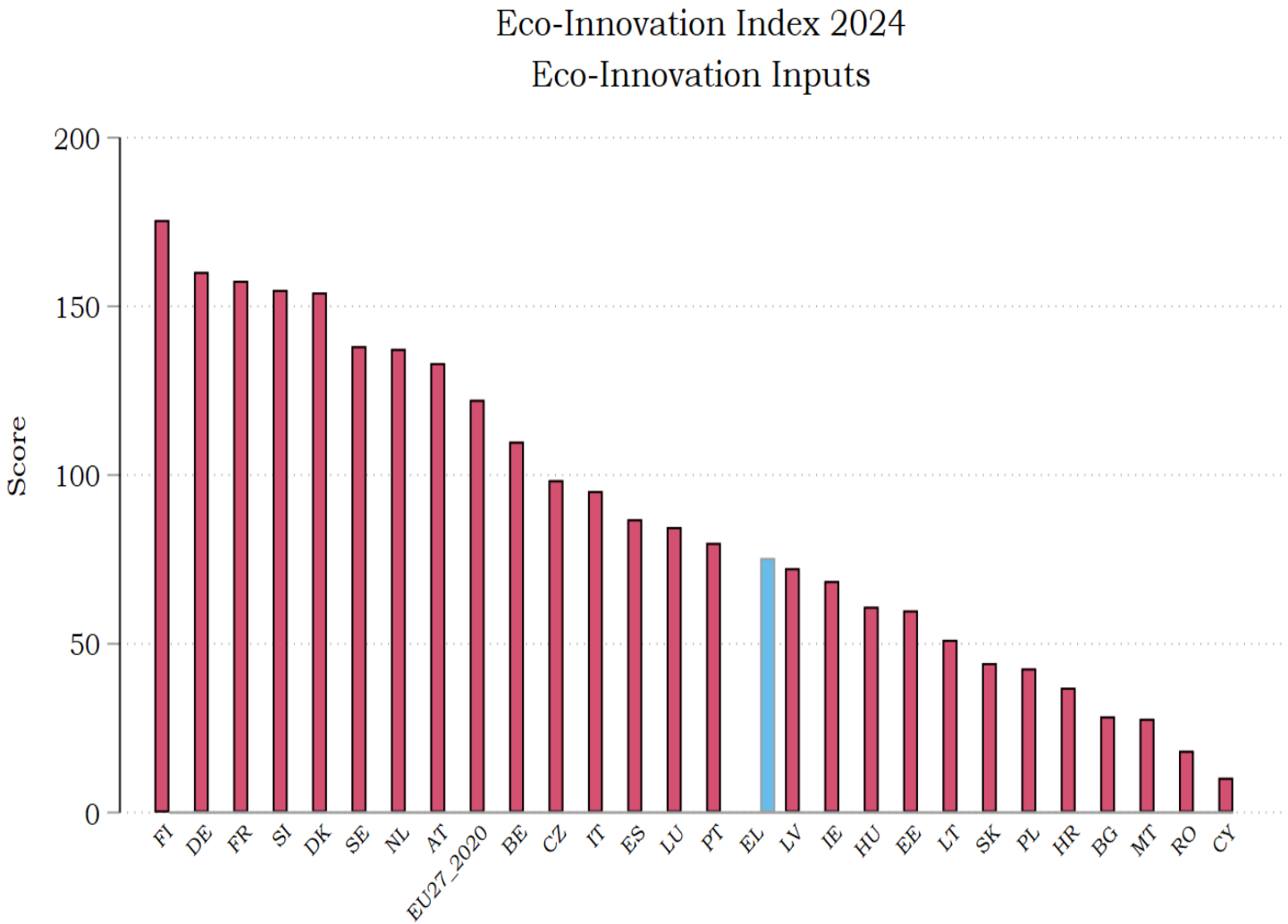
- ***Marked progress*** across EU (2014-24) but still a gap between leaders and laggards

EU Eco-Innovation Index 2014-24



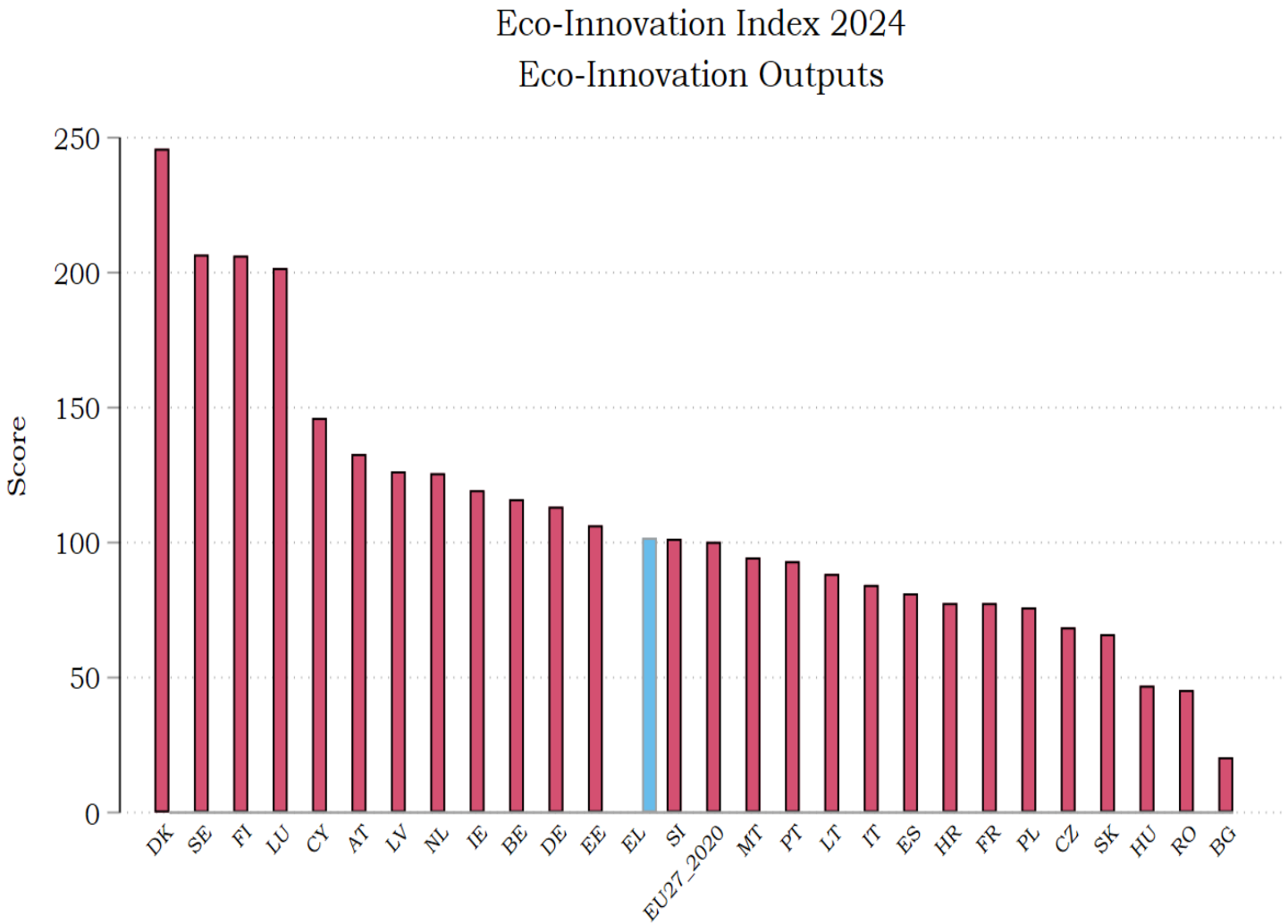
Eco-Innovation Outputs 24



Source: EU Eco-Innovation Scoreboard

EU-27 2024=100

Eco-Innovation Outputs 2024



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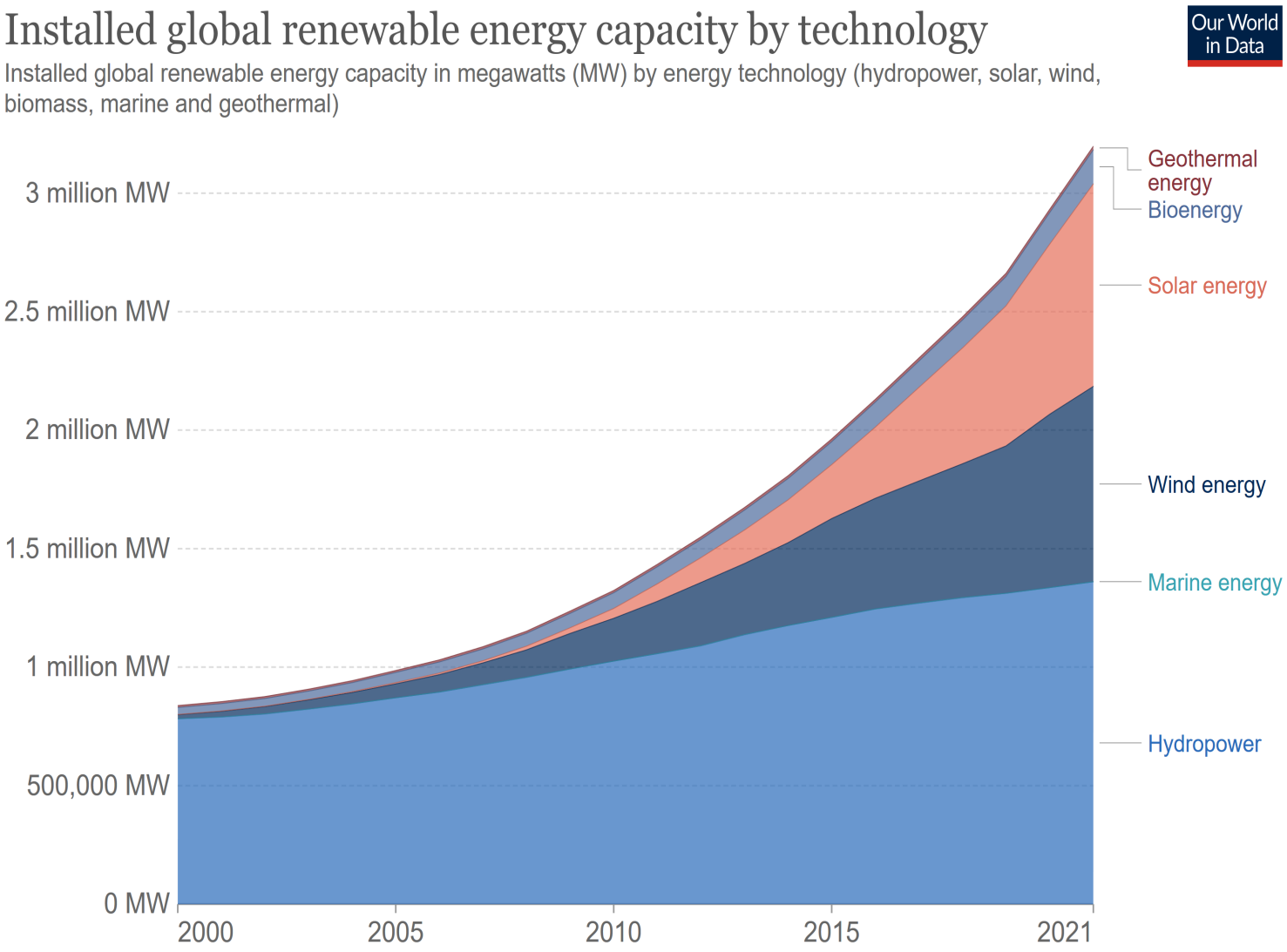
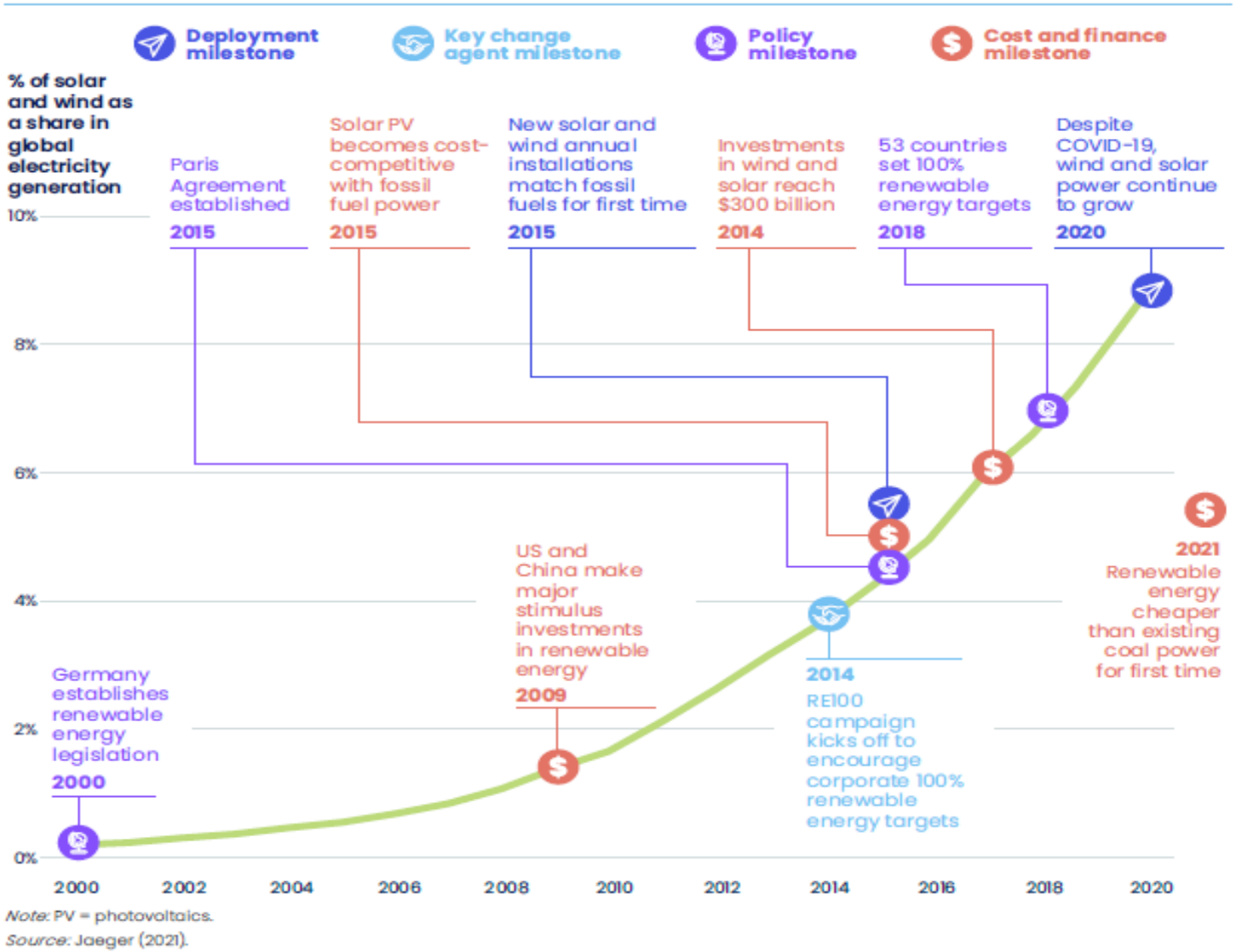
- **Climate Change Adaptation**
  - **Green Rooftops & Green Facades**
  - **Early Warning Systems** to warn communities about extreme weather events
  - **Flexible Green Walls** (***Concertainer***)

Renewable Energy on the Rise

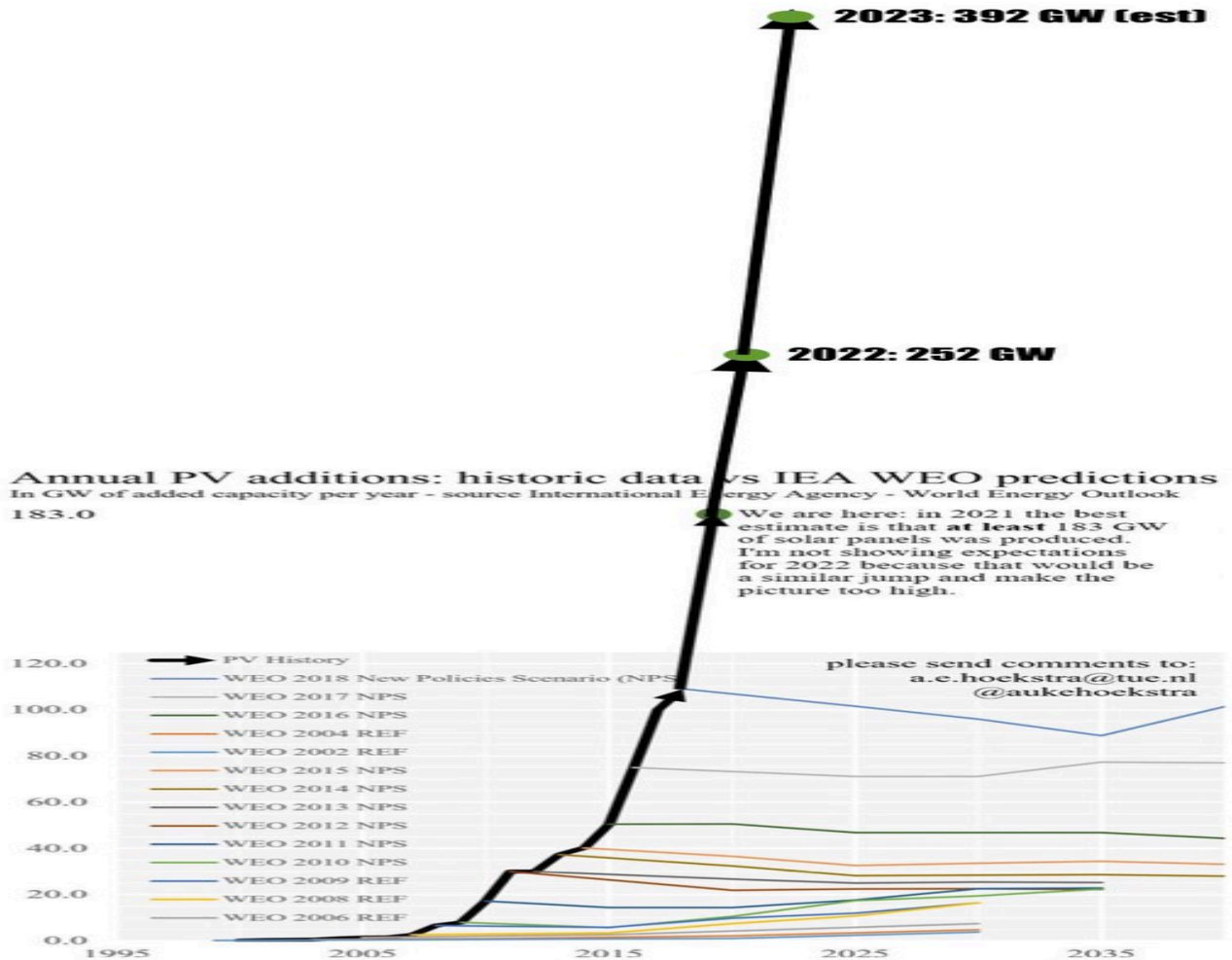


Solar & Wind % in Total Energy

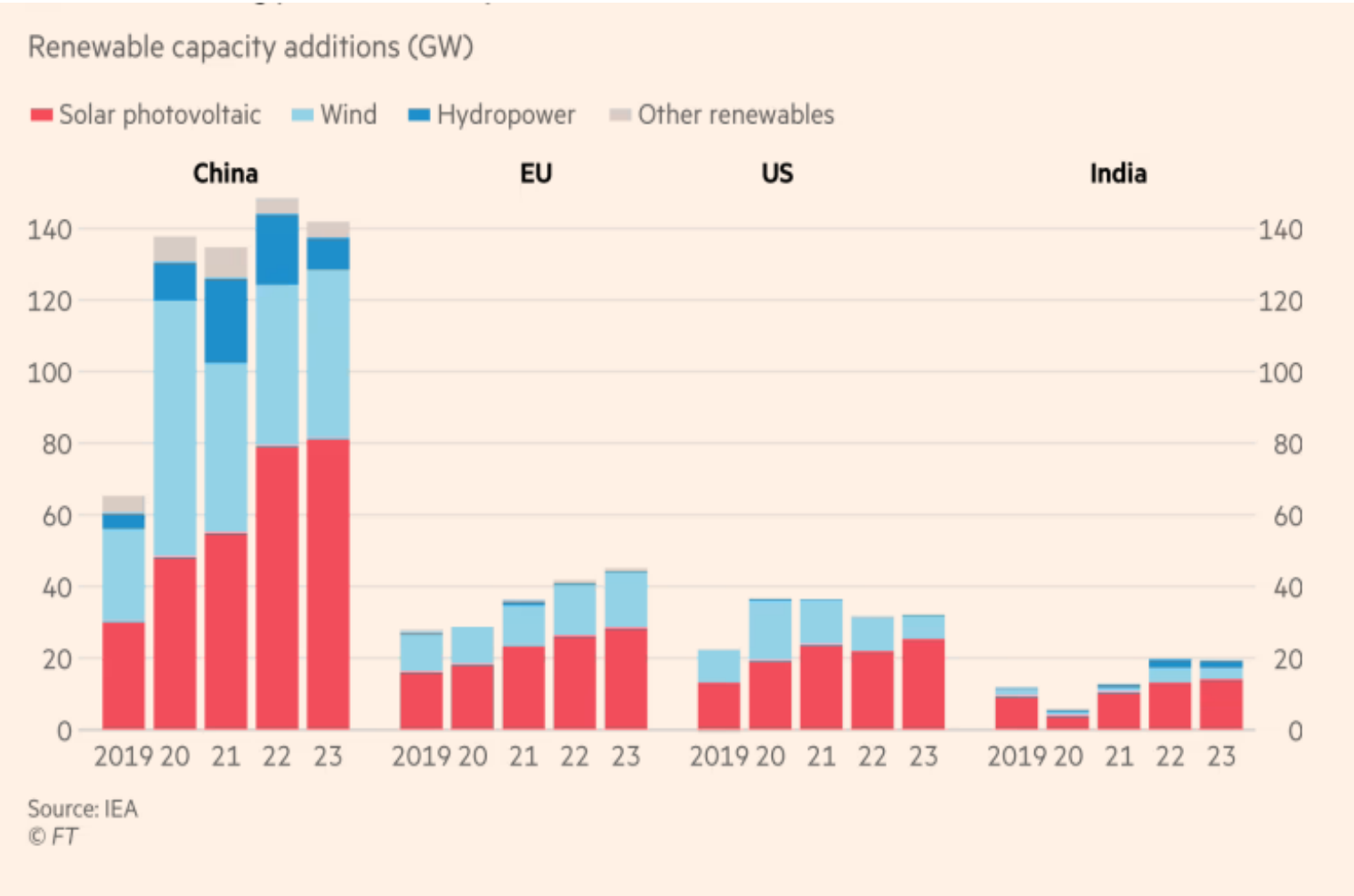


Note: PV = photovoltaics.
Source: Jaeger (2021).

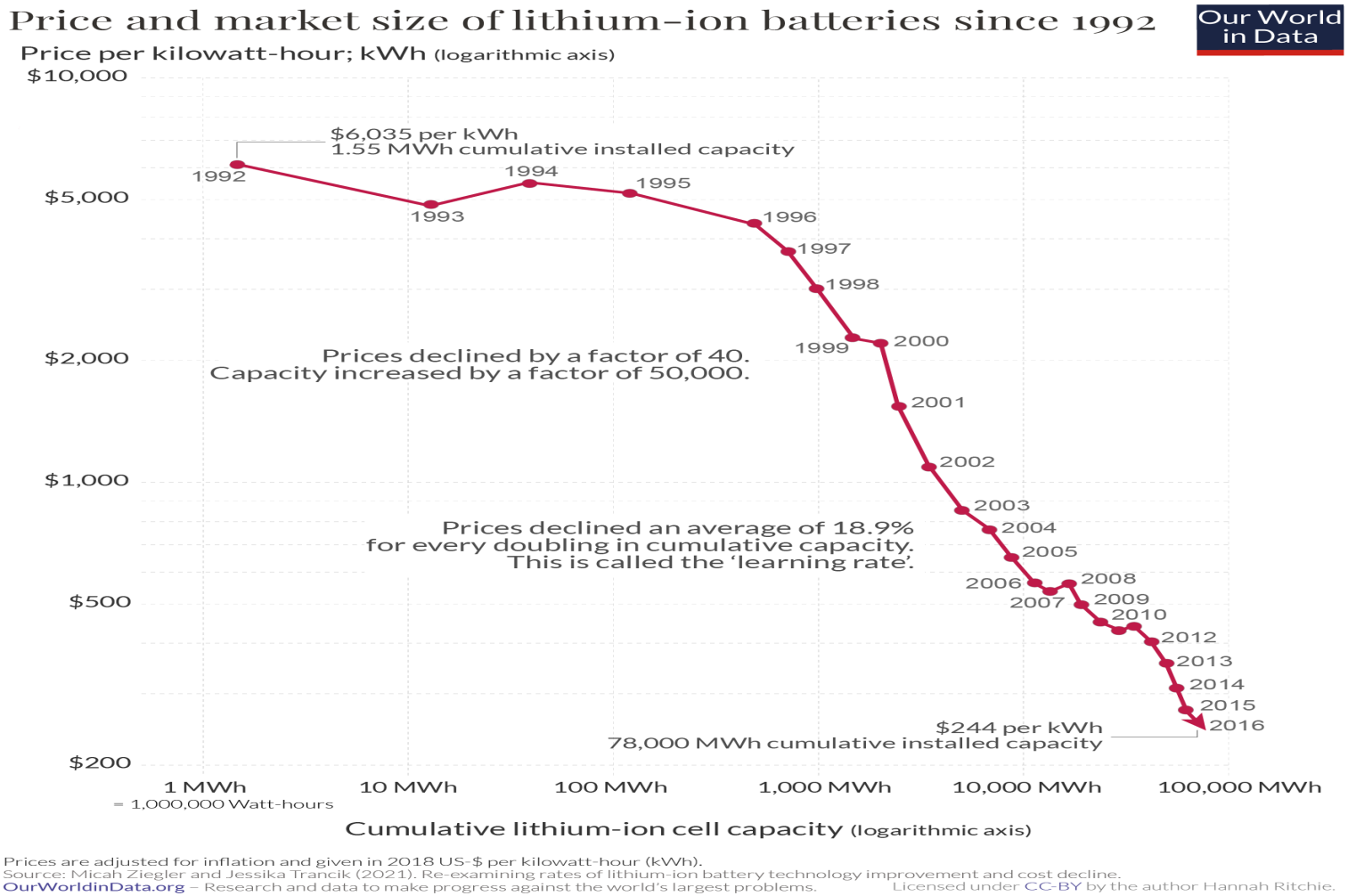
Solar PV Evolution



Solar Capacity Key Player(s)



Lithium Battery Costs



Renewables Cost Efficiency