

Environmentally Sustainable Research in the age of deep decarbonization and Sustainable Development Goals

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AQTIVATE

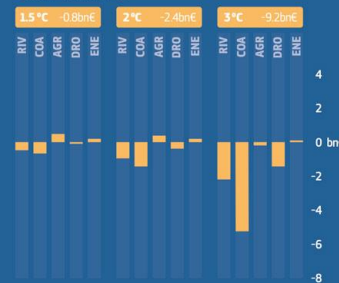
South Europe: A Climate Change Hot-Spot

(European Commission, 2020)

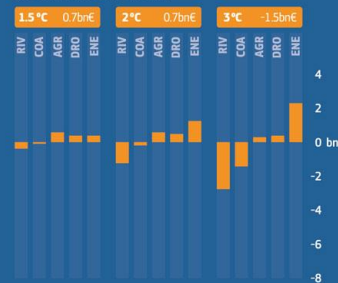
Welfare loss from climate change impacts

JRC PESETA IV conducted an economic analysis of climate change impacts on river and coastal flooding, agriculture, droughts and energy supply. Welfare impacts are estimated as if the future climate affects the economy of nowadays.

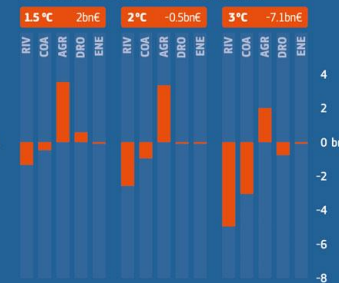
UK & IRELAND



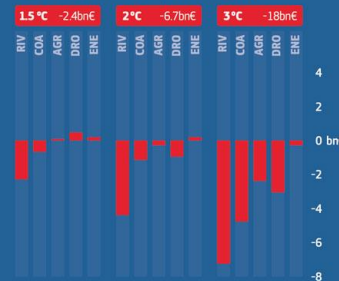
NORTHERN EUROPE



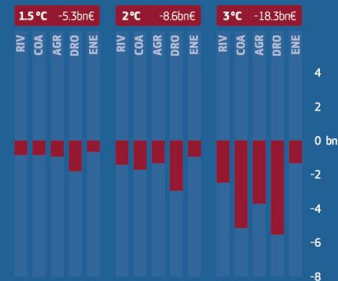
CENTRAL EUROPE (NORTHERN)



CENTRAL EUROPE (SOUTHERN)

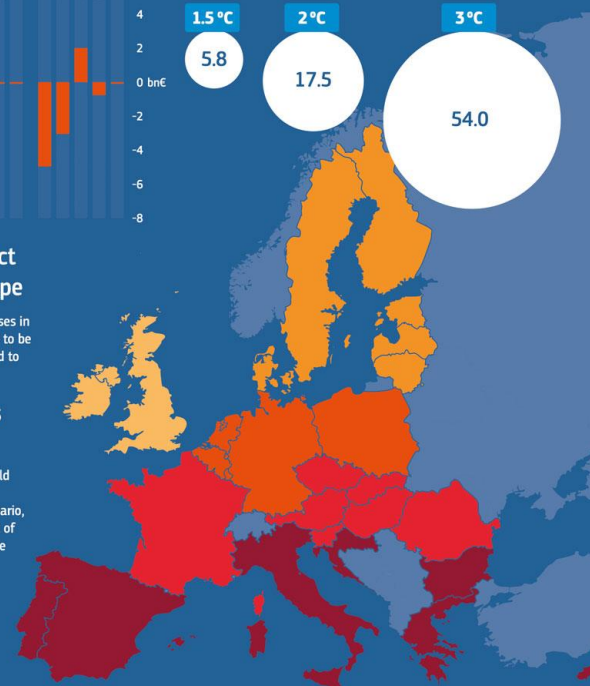


SOUTHERN EUROPE



Welfare losses in EU & UK (bn€)

If human mortality impacts were included, the estimated welfare losses in EU & UK would become much larger for all scenarios (an increase to 41.9€bn at 1.5 °C, 82.6€bn at 2 °C and 175.9€bn at 3 °C)



Far greater impact on southern Europe

The magnitude of welfare losses in southern regions is estimated to be several times larger compared to northern regions.

Mitigation makes a difference

Limiting warming to 2 °C would reduce the welfare losses by 70% compared to a 3 °C scenario, while achieving the Paris goal of 1.5 °C would lower the welfare losses by 90%



The assessment does not evaluate the full economic impacts of climate change in Europe as not all possible climate impacts were analysed.

For more information, including assumptions of the modelling framework used, see: JRC PESETA IV project <https://ec.europa.eu/jrc/en/peseta-iv>



Results from Climate Models of the Cyprus Institute & the Max Planck Institute for Chemistry in Germany

- Since 1980, East Mediterranean and Middle East is warming faster than the global average
- Climate projections show higher temperature increases in summer, with unprecedented heat waves
- Reduced rainfall and sea level rise of 0.5 – 1 metre are projected for the end of 21st century
- Every economic sector and every aspect of human life will be adversely affected (water scarcity, agriculture, nature, energy, public health, infrastructures)

“We are a Small Country, We should not Bear the Burden of Climate Change Actions”

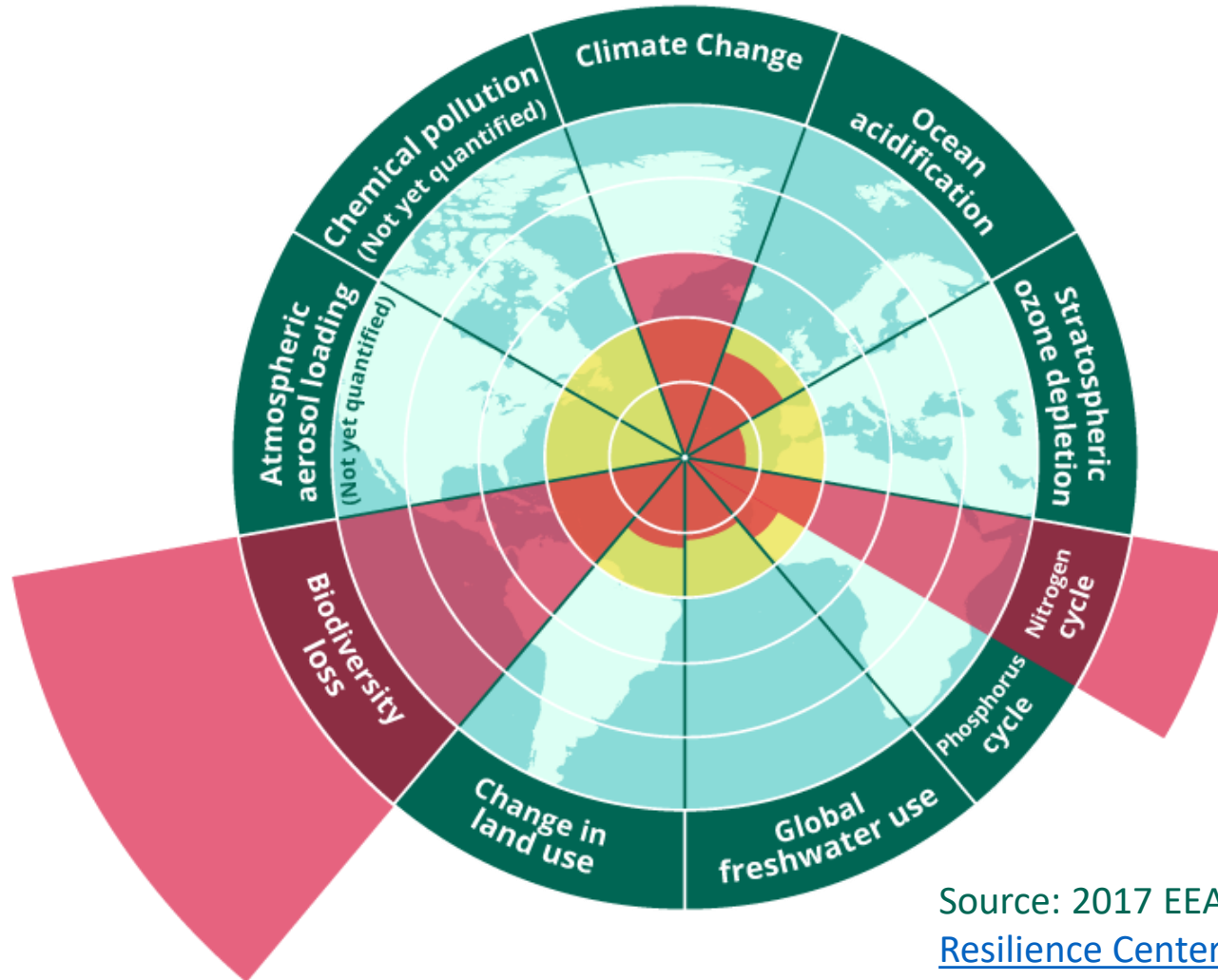
- Today, over 70 countries (90% of global GDP) have made pledges to reach net zero carbon emissions some time between 2050 and 2070
- All countries / world regions have reasons to claim that they are not to blame for climate change and delay their action
- “Tragedy of the Commons”
- We are all responsible, and we will all suffer if we don't act swiftly and at unprecedented scale

Countries with net zero emission pledges

(<https://zerotracker.net/>)

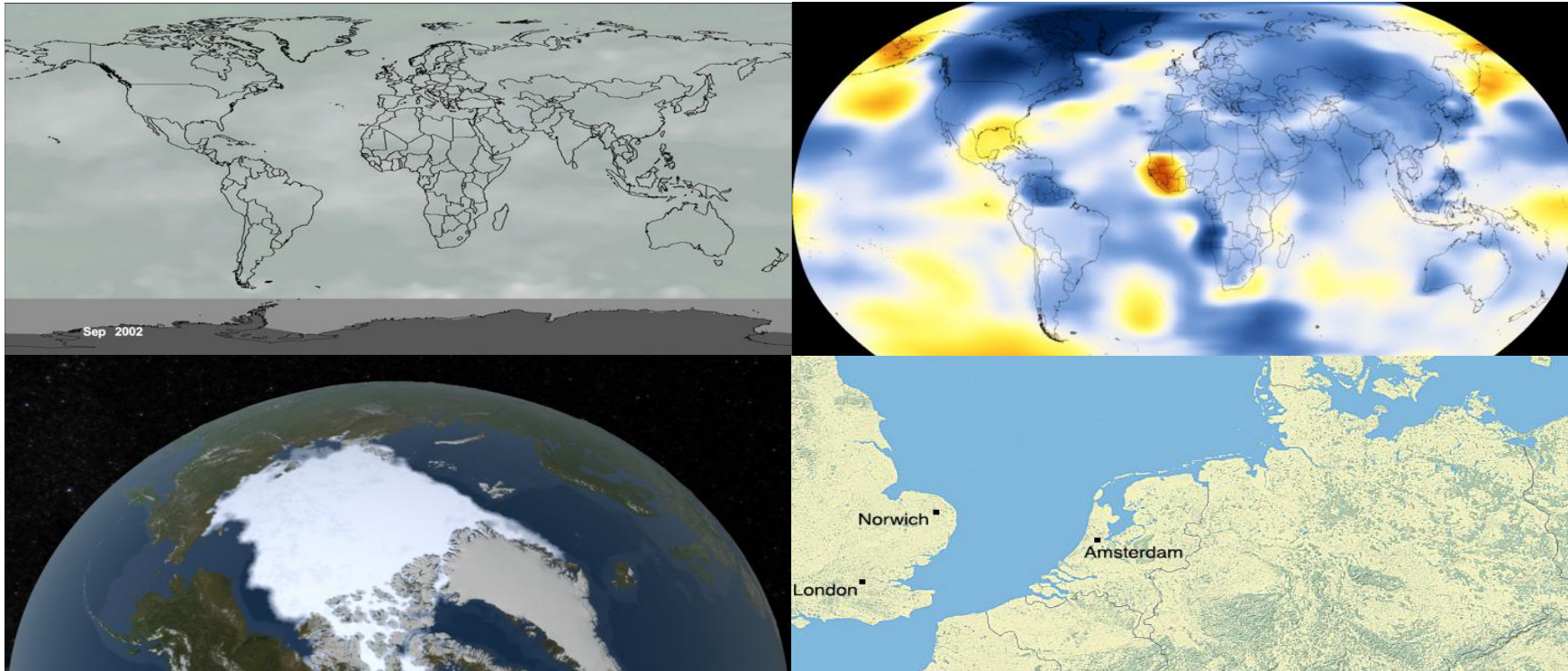


Human Activities Exceed Planetary Boundaries



Source: 2017 EEA elaboration on [Stockholm Resilience Center's](#) original image

<https://climate.nasa.gov/interactives/climate-time-machine>



NASA Global Climate Change Vital Signs of the Planet (n.d.): LINK to Climate Time Machine.

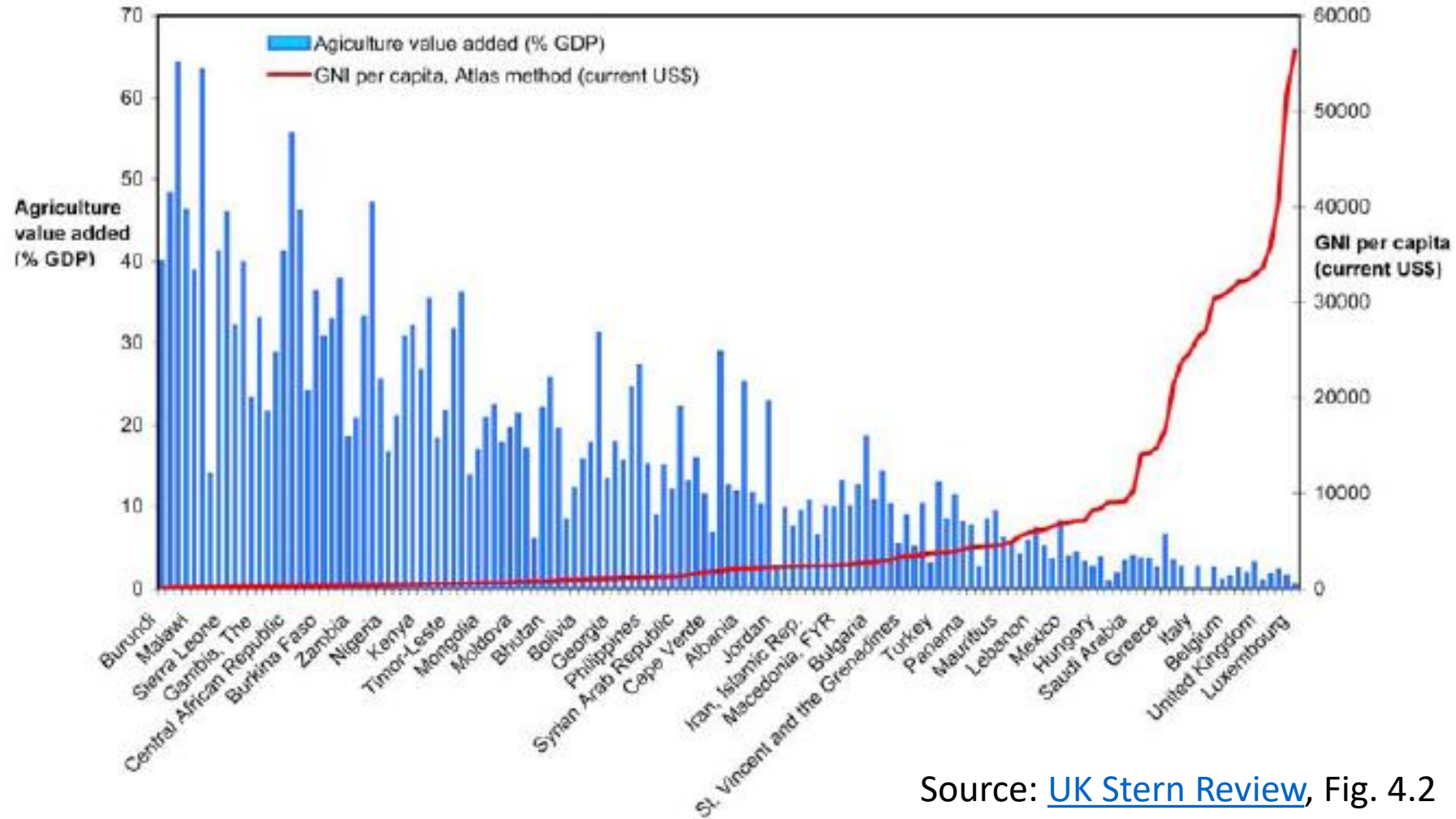


Click on images to watch the impacts

Climate Change Undermines Social Justice

- Climate change mitigation may be costly for vulnerable households (e.g. higher energy prices) – Policymakers must pay attention
- BUT: Uncontrolled climate change creates greater inequalities:
 - Between rich & poor countries in the planet
 - Between rich & poor citizens within a country
 - Between our generation and future generations

Poorest Nations Very Dependent on Agriculture, which is Very Vulnerable to Climate Change!



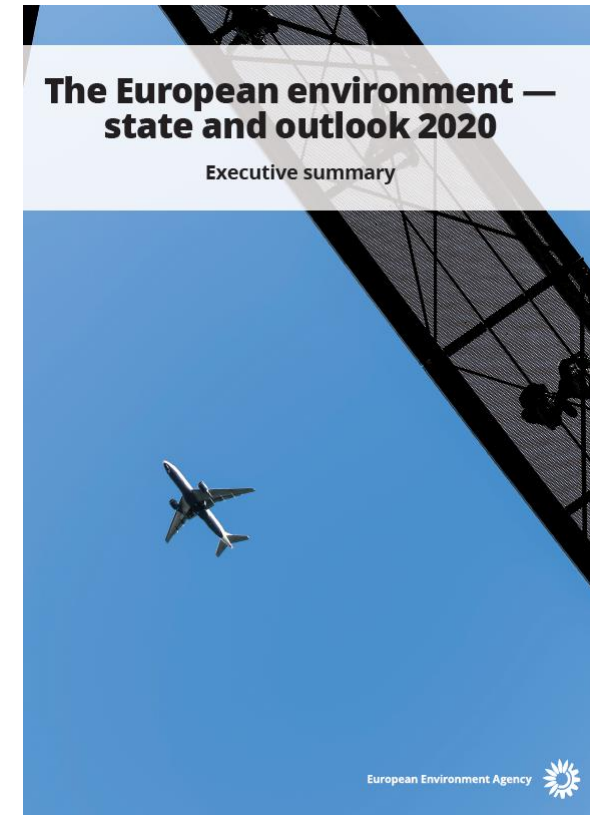
Source: [UK Stern Review](#), Fig. 4.2

Benefits of Low-Carbon Economies Outweigh the Costs of Climate Change Mitigation

- UN Intergovernmental Panel on Climate Change: “global cost of limiting warming to 2°C over the 21st century is lower than the economic benefits of reducing warming”
- European Central Bank: Climate risk for businesses is higher than the cost of their green transition
- Private companies broadly agree (e.g. McKinsey: “the required economic transformation will not only create immediate economic opportunities but also open up the prospect of a fundamentally transformed global economy with lower energy costs, and numerous other benefits”)
- BUT: Attention to the cost of the zero-carbon transition!

Beyond the climate emergency, our way of life exceeds the boundaries of the planet

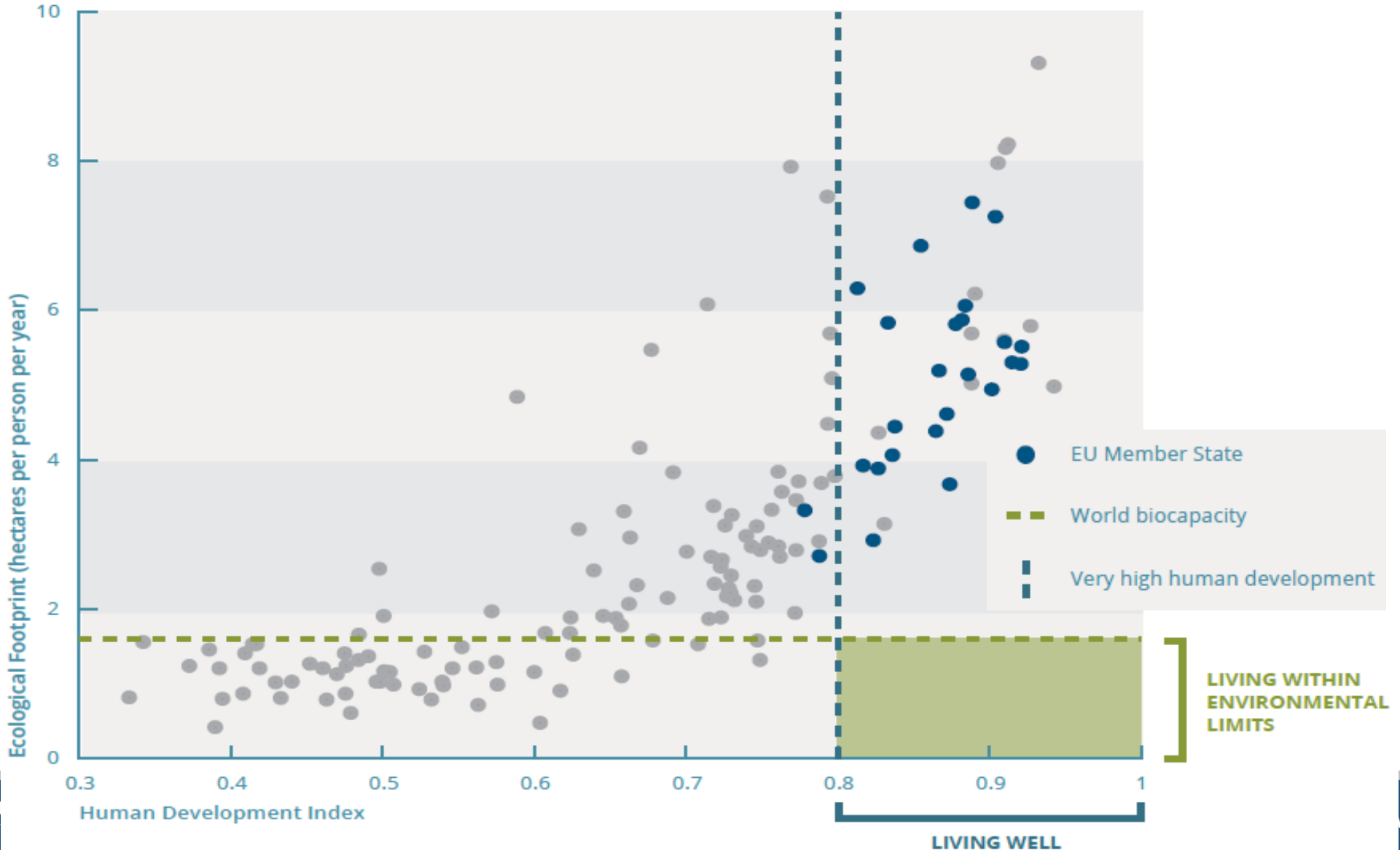
- Europe consumes much more resources than the capacity of its ecosystems and of the whole planet
- We need systemic solutions to protect nature and achieve a circular economy, which also yield economic benefits.
- **How?** By aligning public and private investments with the 17 UN Sustainable Development Goals



<https://www.eea.europa.eu/soer/publications/soer-2020>

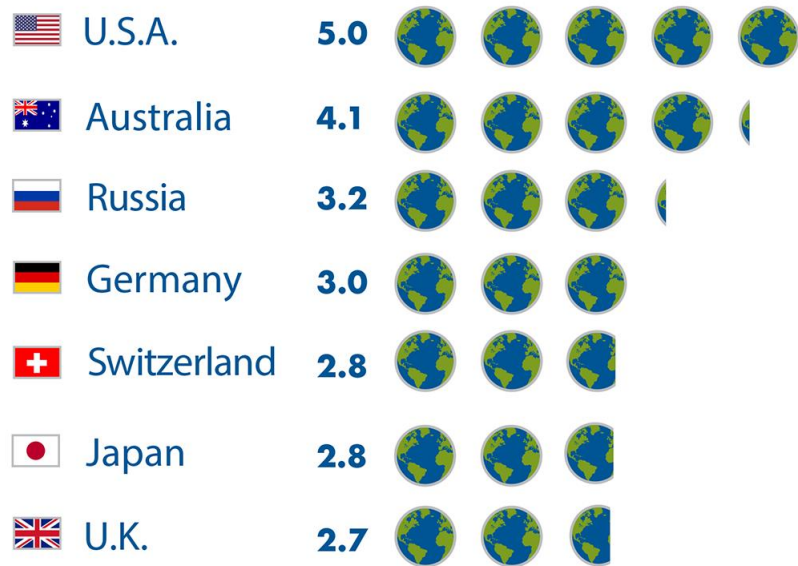
Economic Development *and* Sustainability?

([European Environment Agency, 2016](#))



We are Living Beyond the Planet's Capacity

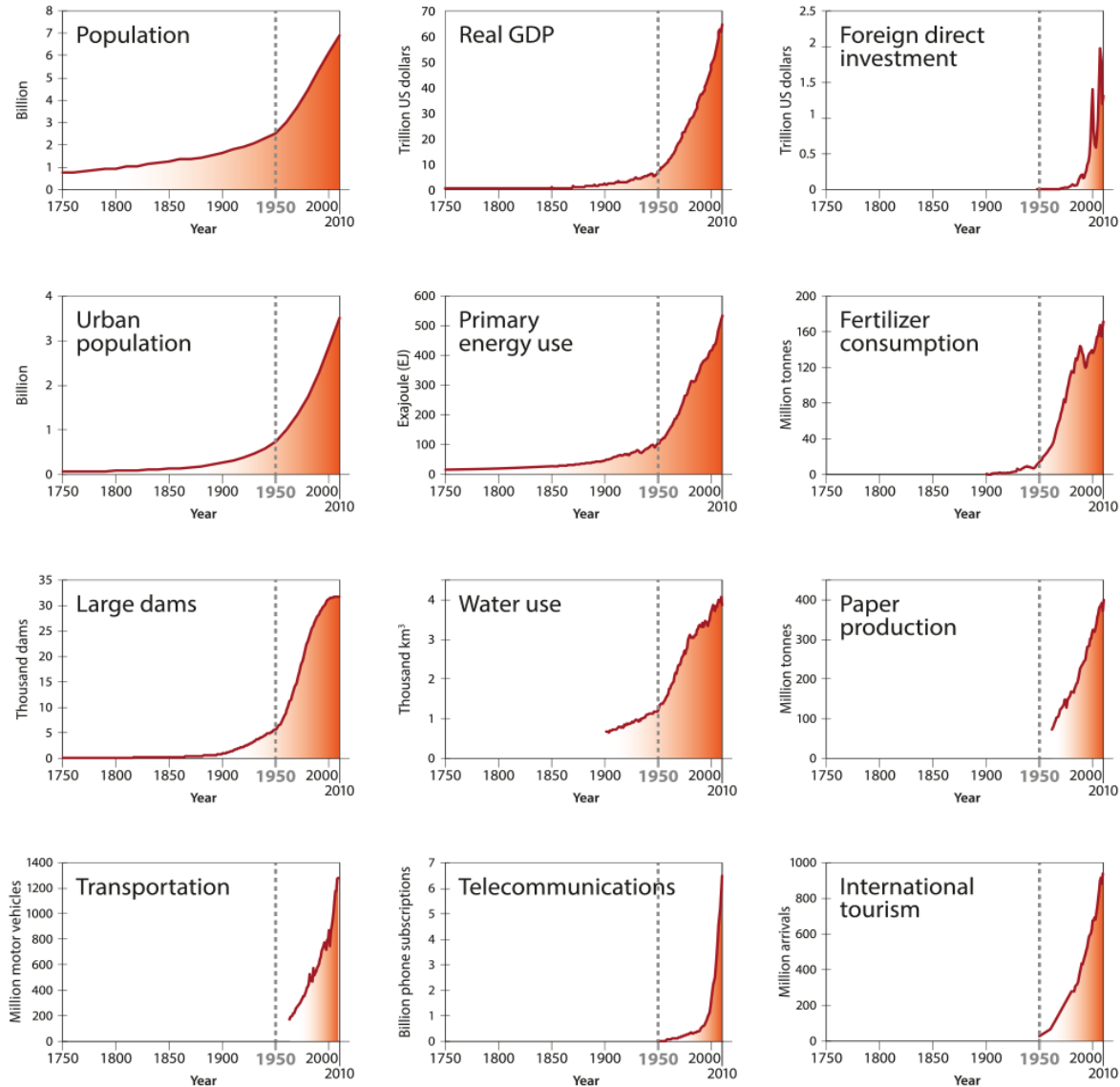
How many Earths do we need if the world's population lived like...



Source: Global Footprint Network National Footprint and Biocapacity Accounts 2019
data.footprintnetwork.org

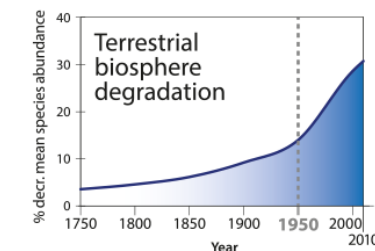
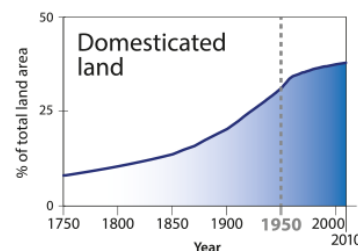
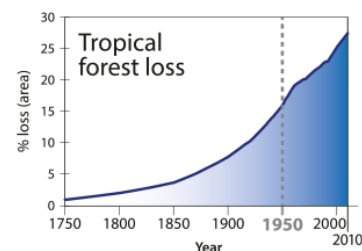
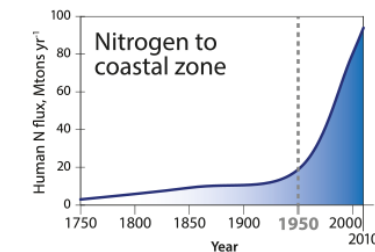
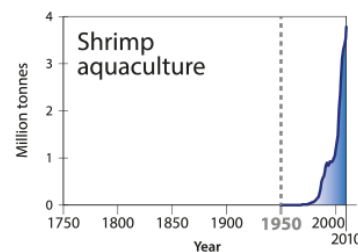
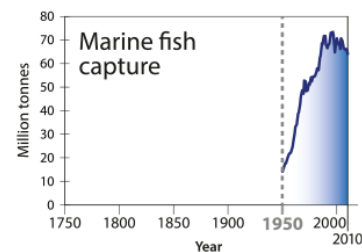
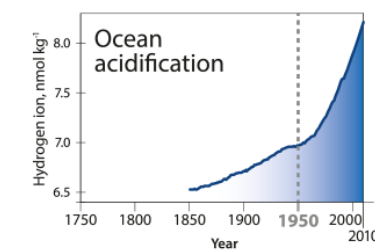
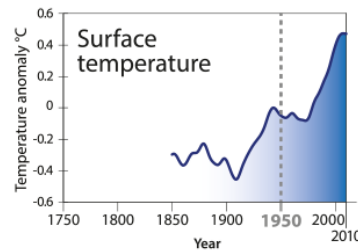
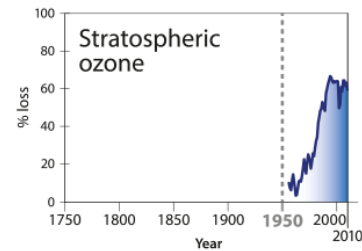
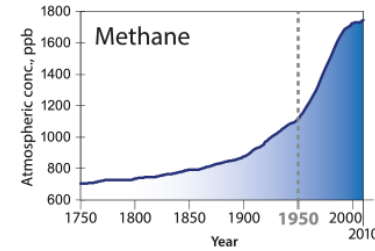
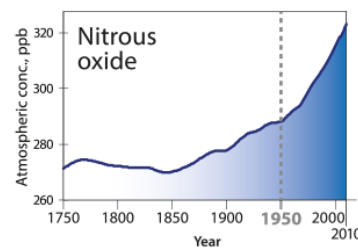
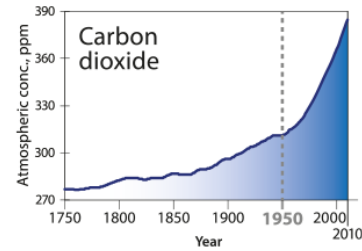
The Great Acceleration – 1 (www.igbp.net)

Socio-economic trends



The Great Acceleration – 2 (www.igbp.net)

Earth system trends



Is “Green Growth” Possible?

- Green Growth: Improving living standards for all + ensuring environmental protection
- *Is Green Growth Possible?* There have been several responses, ranging from very negative ([Limits to Growth](#)) to very optimistic ([Porter Hypothesis](#))
- High-income countries & households consume more resources, but can also afford to improve resource productivity with technology & regulatory measures
- ➔ Decoupling between GDP and consumption of energy, natural resources, pollutant emissions:
Already happening, but is it enough?

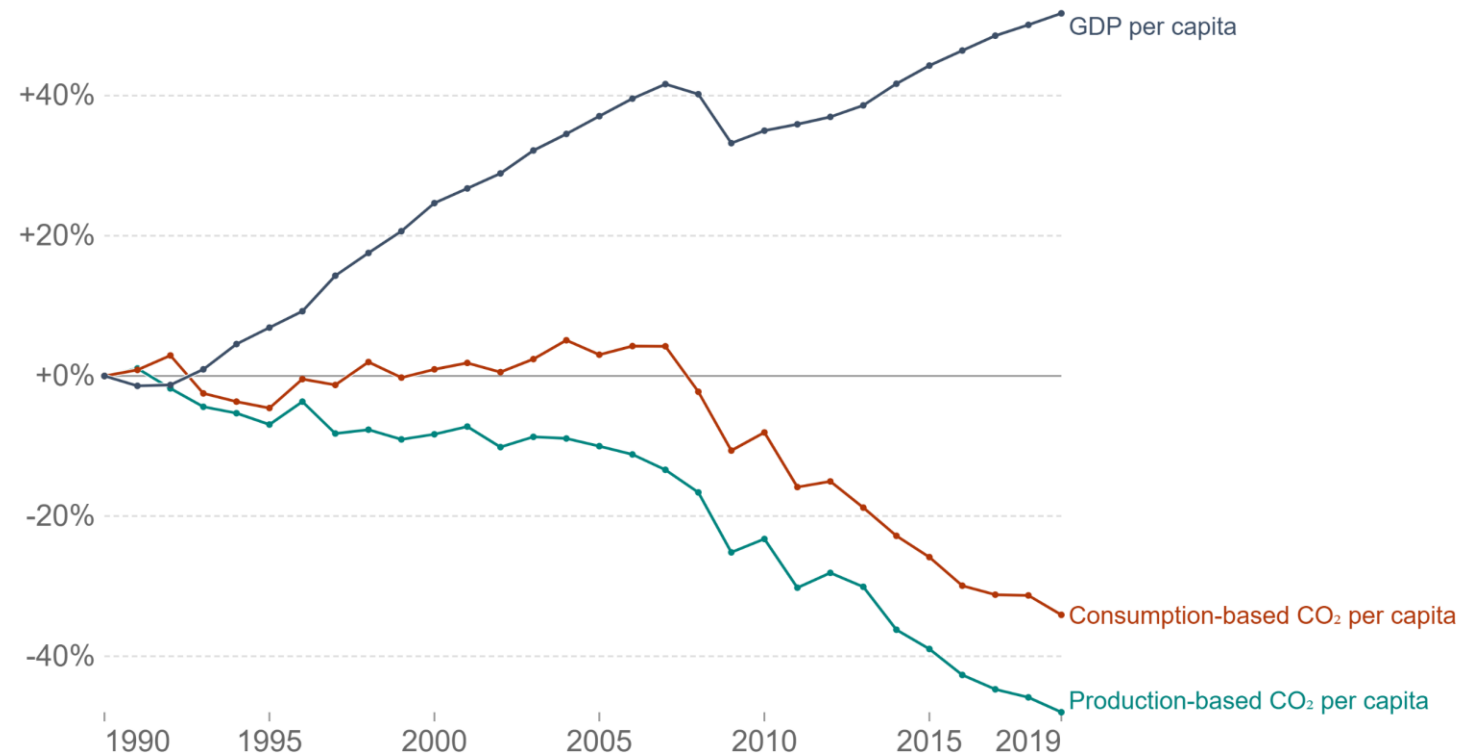
GDP and Greenhouse Gas Emissions, UK

(<https://ourworldindata.org/co2-gdp-decoupling>)

Change in per capita CO₂ emissions and GDP, United Kingdom

Our World
in Data

Annual consumption-based emissions are domestic emissions adjusted for trade. If a country imports goods the CO₂ emissions caused in the production of those goods are added to its domestic emissions; if it exports goods then this is subtracted.



Source: Data compiled from multiple sources by World Bank, Our World in Data based on the Global Carbon Project

Note: GDP figures are adjusted for inflation over time.

OurWorldInData.org/co2-and-other-greenhouse-gas-emissions • CC BY

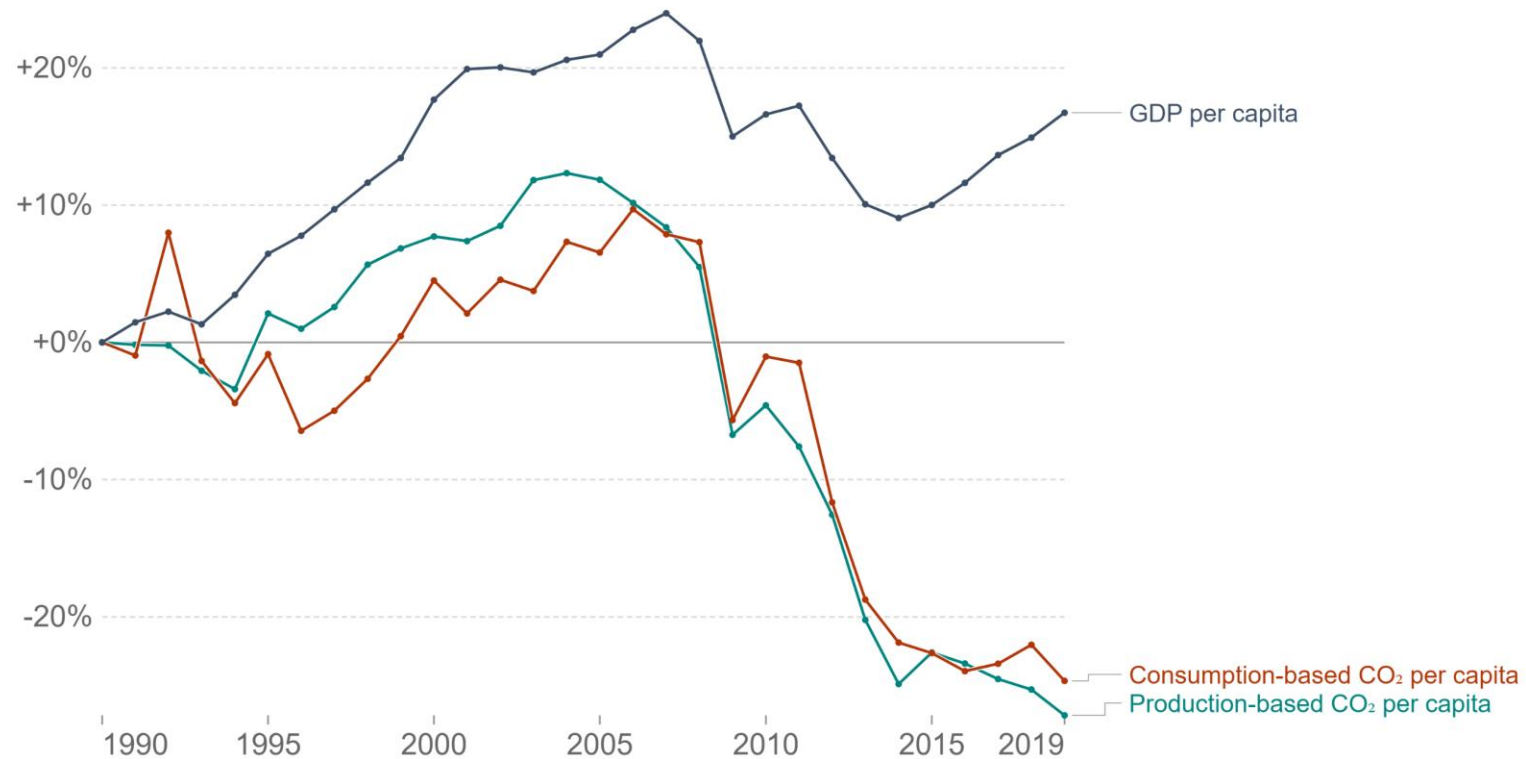
GDP and Greenhouse Gas Emissions, Italy

(<https://ourworldindata.org/co2-gdp-decoupling>)

Change in per capita CO₂ emissions and GDP, Italy



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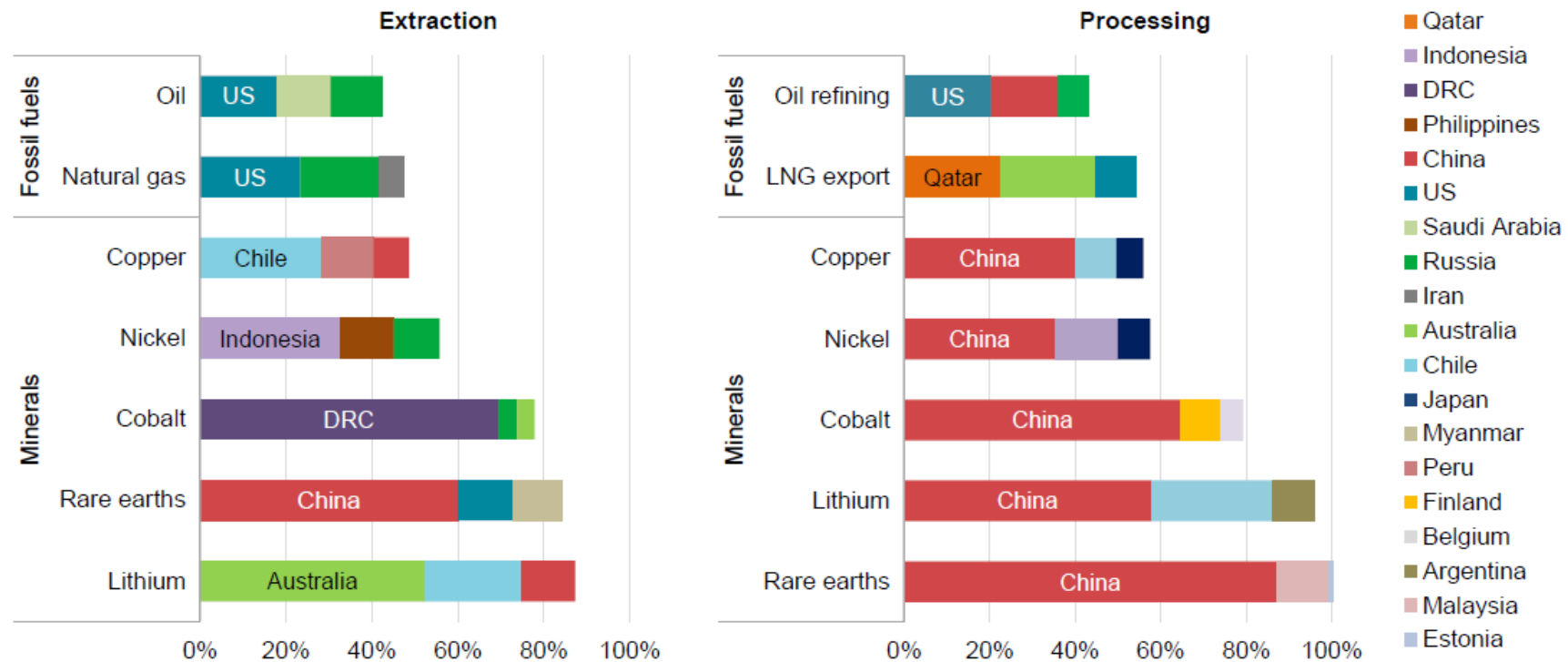
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OurWorldInData.org/co2-and-other-greenhouse-gas-emissions • CC BY

Our Energy Dependence is Changing (Source: [IEA](#))

Production of many energy transition minerals today is more geographically concentrated than that of oil or natural gas

Share of top three producing countries in production of selected minerals and fossil fuels, 2019



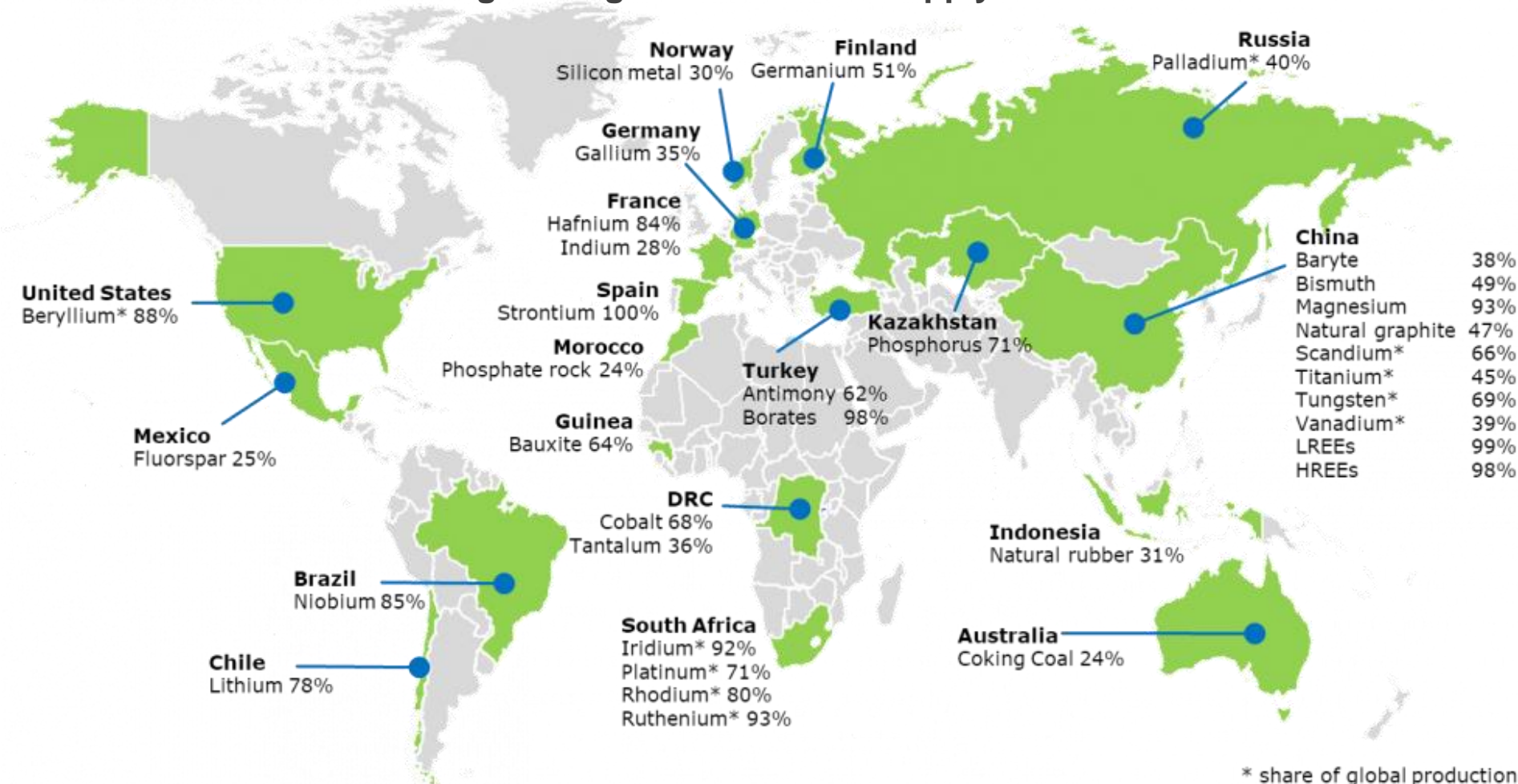
IEA. All rights reserved.

Notes: LNG = liquefied natural gas; US = United States. The values for copper processing are for refining operations.
Sources: IEA (2020a); USGS (2021), World Bureau of Metal Statistics (2020); Adamas Intelligence (2020).

Europe is Highly Dependent on Imported Raw Materials

(Source: [European Commission](#))

Countries accounting for largest share of EU supply of Critical Raw Materials



What are defined as the main environmental problems

T.M. 1, Part 1, p. 24 of 25

Two are the most important problems concerning the interaction between economic activity and the natural environment:

- Use of resources
- Climate change
- **Climate change** and (**excessive**) **resource use** are closely linked: **62% of global greenhouse gas emissions** - excluding emissions from land use and forestry - **are released during the extraction, processing and manufacture of goods.**
- These **two problems** create enormous pressure to transform economic activity and, consequently, **business behaviour**. Fundamental changes are already taking place and will continue both at the level of products and processes.



62%

The limits of linear consumption

- In modern production processes, there are still opportunities to increase efficiency, but the gains are not sufficient to create real competitive advantage or differentiation.
- There is a great acceleration in energy use and resource depletion has a negative impact when improvements in energy efficiency and resource efficiency are negligible.
- Agricultural productivity is increasing more slowly than ever, soil fertility is declining and even the nutritional value of food is decreasing.
- The supply security associated with large, complexly optimised global supply chains appears to be at risk. Many production sites with excessive demands for virgin resources.



The European Green Deal

- **A very ambitious plan** of the EU to address all environmental challenges of the planet.
 - “New Growth Strategy for Europe”:
 - Climate change mitigation and adaptation
 - Clean, affordable and secure energy
 - Industrial strategy for **circular economy**
 - Energy efficient buildings
 - Sustainable and smart mobility
 - “From Farm to Fork”: fair, healthy and environmentally friendly food system
 - Protection & restoration of ecosystems & biodiversity
 - Zero pollution without toxic substances
 - Just green transition (“leaving no-one behind”)

The July 2021 “Fit-for-55” energy and climate package to deliver the European Green Deal

13 changes in Regulations & Directives with the objectives to:

- Reduce greenhouse gas emissions faster
- Accelerate penetration of renewable energy
- Increase economy-wide energy efficiency improvements
- Reduce emissions and deploy clean fuels in road transport
- Strengthen the environmental requirements from aviation & shipping sectors
- Promote investments in infrastructure for alternative fuels & electromobility
- Develop a Forest Strategy
- Change energy taxation levels to account for the carbon content of fuels

Sustainability

- **What is sustainability?**

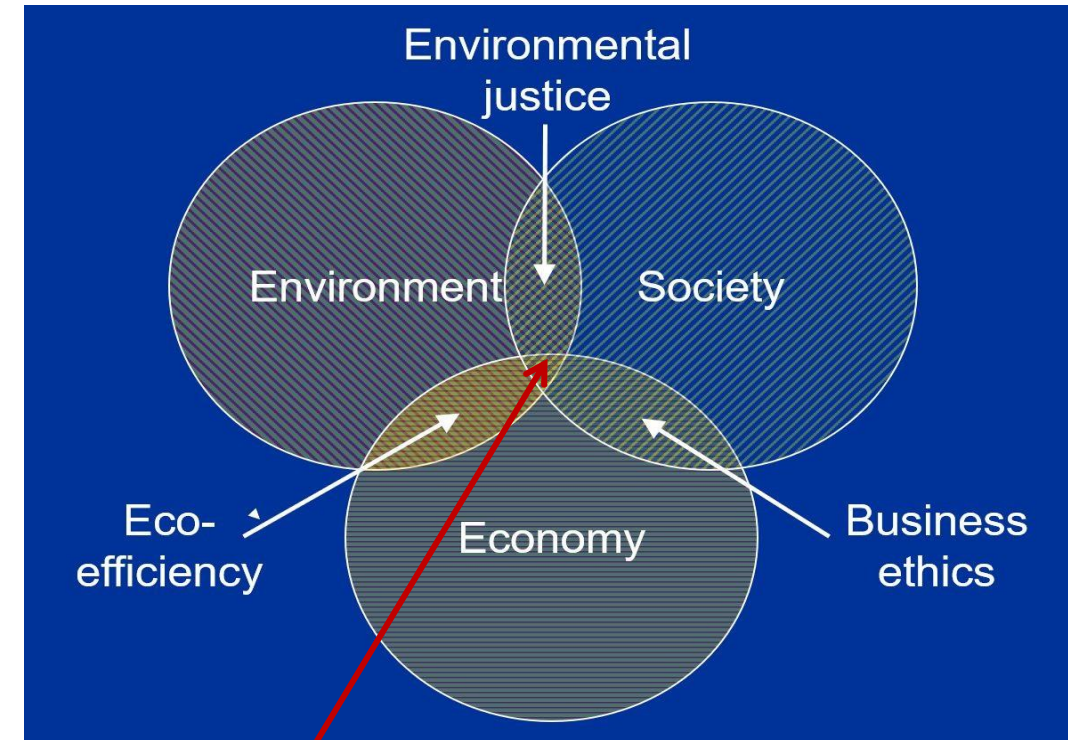
The ability to be maintained at a certain rate or level.

- **It's applied to our economic system:**

Avoiding depletion of natural resources to maintain ecological balance.

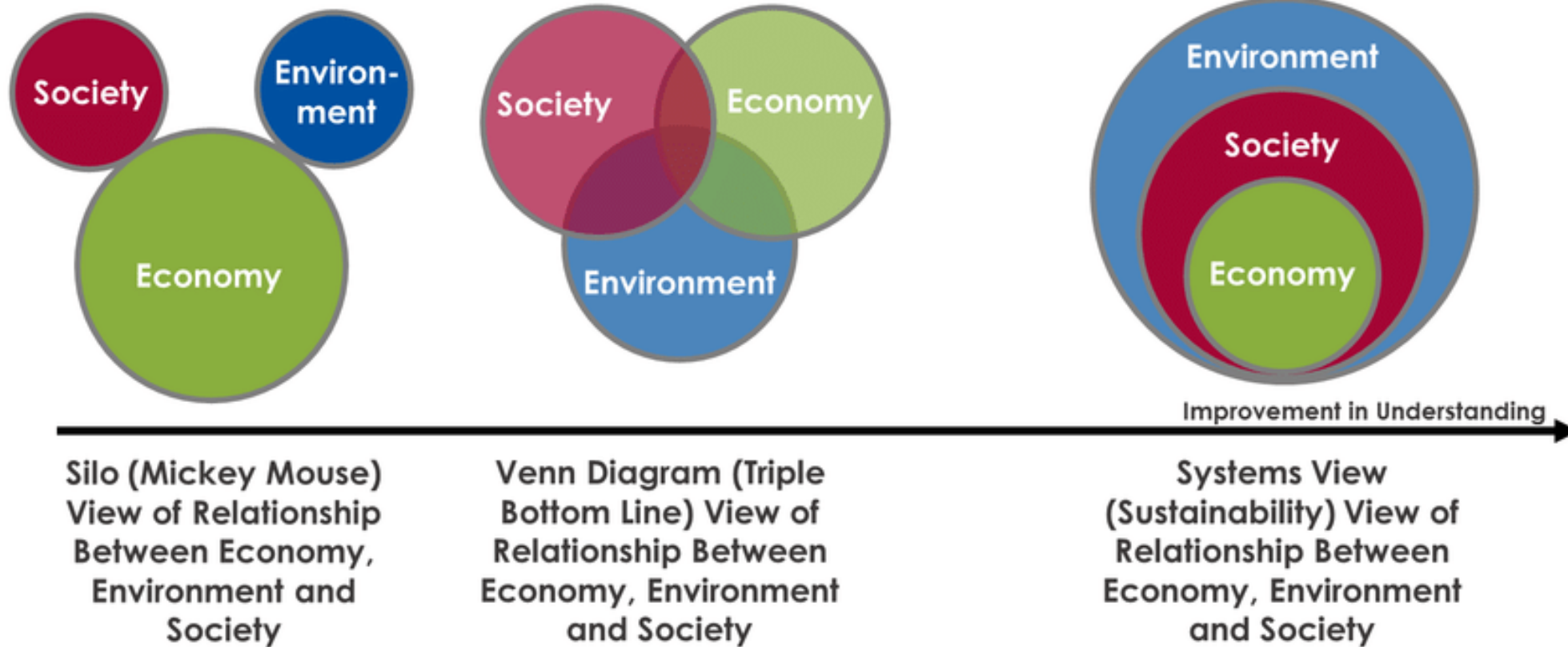
- **Definition by the Brundtland commission (1983, the United Nations):**

Development that "meets the needs of the present without compromising the ability of future generations to meet their own needs".



Sustainability

Our View of Sustainability is Evolving



SUSTAINABLE DEVELOPMENT GOALS

- In 2015, the United Nations General Assembly made a decision that could be described as a **historic agreement** that will affect the lives of millions of people, maybe even yours.
- It is the **adoption of 17 Goals, known as "Sustainable Development Goals"**, which express today's global challenges, in an effort for all countries to respond effectively to global problems.
- More than **150 country leaders pledged to transform our world into a world without poverty, hunger and inequality. A world with decent work and good education, a world at peace without the threat of climate change, a world that, through the principles of sustainable development, takes care of the needs not only of the present generation but also of future generations - your world.**

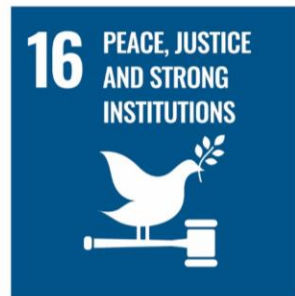
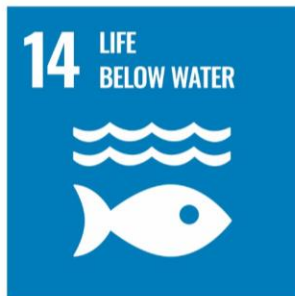
<https://www.un.org/sustainabledevelopment/>

Sustainability Indicators for Data Centres

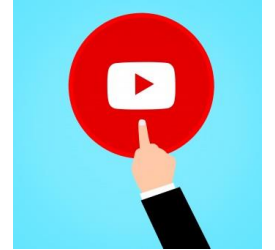
(based on recently adopted Energy Efficiency Directive (EU) 2023/1791)

- Data centres accounted for 2,7% of electricity demand in 2018 in the EU and may reach 3,2% by 2030.
- Big data centres (>500 kW) must collect data from 15/5/2024 and report on:
“... at least some basic dimensions of a sustainable data centre, namely how efficiently it uses energy, how much of that energy comes from renewable energy sources, the reuse of any waste heat that it produces, the effectiveness of cooling, the effectiveness of carbon usage and the usage of freshwater.”

SUSTAINABLE DEVELOPMENT GOALS



How would YOU understand environmentally sustainable research?



<https://www.youtube.com/watch?v=qfOgdj4Okdw>

Thank you

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