# Decoupling (emission from economic growth)

Zero- carbon world + sustainable development and well-being is possible?

Depends on development models in which economic growth is decoupled from greenhouse gas emissions.

Since industrial revolution relied on fossil fuel -> human-made global warming.

Broad environment field: breaking the link economic growth and environmental bad.

OECD: [1933638.pdf (oecd.org)](https://www.oecd.org/env/indicators-modelling-outlooks/1933638.pdf)

European Parliament: [Decoupling economic growth from environmental harm (europa.eu)](https://www.europarl.europa.eu/RegData/etudes/ATAG/2020/651916/EPRS_ATA(2020)651916_EN.pdf)

Many possible environmental pressures can be linked to economic development:

* Exploitation of natural resources
* Loss of biodiversity
* Land use
* …

Considering *Climate change*, what we have to decouple are *greenhouse gas (GHG)*, in particular *emissions of carbon dioxide CO2* which is the main gas responsible for greenhouse effect.

Decoupling definition of *IPCC (Intergovernmental Panel on Climate Change)* as [*economic growth which is no longer strongly associated with the consumption of fossil fuels*](https://www.ipcc.ch/sr15/chapter/glossary/).

[Glossary — Global Warming of 1.5 ºC (ipcc.ch)](https://www.ipcc.ch/sr15/chapter/glossary/)

Relative decoupling: they both keep growing but economic growth faster than fossil fuel consumption.

Absolute: economic growth happens but fossil fuel consumption, and thus emissions, decline.

## The Kaya identity

This equation describes the four drivers of total GHG emission level or growth: *population*, *GDP per capita*, *energy intensity* (energy used per unit of GDP), and *carbon intensity* (emissions per unit of energy consumed).

Immagine che contiene diagramma

Descrizione generata automaticamente

From this equation is evident that what is desirable to reduce are *energy intensity* and *carbon intensity*.

Mitigation policies: key role in energy intensity, increase of energy efficiency production and behavioral changes demand side + changes in carbon intensity, transition from high carbon energy sources to low or no carbon (hydropower, nuclear power, wind power, solar power, biomass).

How Precisely «Kaya Identity» Can Estimate GHG Emissions: [JJEES\_Vol8\_N2\_P91-96.pdf (hu.edu.jo)](http://jjees.hu.edu.jo/files/Vol8N2/JJEES_Vol8_N2_P91-96.pdf)

## Are we decoupling?

[The Great Decoupling (anthropocenemagazine.org)](https://www.anthropocenemagazine.org/Great%20Decoupling/)

There is relative decoupling, controversial whether absolute decoupling can be achieved at global scale.

We saw [absolute decoupling of global CO2 emissions from economic growth happening in 2014-2016](https://www.nature.com/articles/nclimate3202), when emissions stabilised while the global economy continued to grow as a result of improvements in energy efficiency, penetration of renewable energy and reduction of coal use.

However, it was temporary. “Longer data trends would be needed before stable decoupling can be established”. [Chapter 4 — Global Warming of 1.5 ºC (ipcc.ch)](https://www.ipcc.ch/sr15/chapter/chapter-4/)

[Global CO2 emissions rebounded in 2021](https://www.iea.org/news/global-co2-emissions-rebounded-to-their-highest-level-in-history-in-2021) as the global economy relied heavily on coal to power its economic recovery. [Global CO2 emissions rebounded to their highest level in history in 2021 - News - IEA](https://www.iea.org/news/global-co2-emissions-rebounded-to-their-highest-level-in-history-in-2021)

[Change in CO₂ emissions and GDP, World (ourworldindata.org)](https://ourworldindata.org/grapher/co2-emissions-and-gdp?country=~OWID_WRL)

[World Development Indicators | Data Catalog (worldbank.org)](https://datacatalog.worldbank.org/search/dataset/0037712/World-Development-Indicators)

Emission now higher than pre covid, 0.6% higher than 2019, Johannes Emmerling, co-leader of the Low Carbon Pathways unit at the RFF-CMCC – European Institute on Economics and the Environment (EIEE).

Ukraine was -> coal replacing gas in power sector

## Production-based and consumption-based decoupling

Country level: absolute decoupling reached in many countries, by and large relatively wealthy countries, that managed to replace, at least in part, fossil fuels with low-carbon energy.

That situation was a driver of global decoupling of 2014-2016.

[Change in CO₂ emissions and GDP, United Kingdom (ourworldindata.org)](https://ourworldindata.org/grapher/co2-emissions-and-gdp?country=~GBR)

Immagine che contiene grafico

Descrizione generata automaticamente[Change in CO₂ emissions and GDP, India (ourworldindata.org)](https://ourworldindata.org/grapher/co2-emissions-and-gdp?country=~IND)

Not easy to define whether there is decoupling or not, depends on the metric used.

There is a difference between consumption and production-based emissions accounting.

Production-based: emissions counted for the country that produces them. If I import lot of goods from high emitters and I reduce my emissions seems I am not emitting.

Consumption-based: consider what I import and consume.

To confirm the difference between the two counting systems,[a recent study](https://www.sciencedirect.com/science/article/pii/S2666792421000664) shows that, out of 116 countries considered, 32 (mainly developed countries) achieved absolute decoupling in the period 2015-2018 from a production-based perspective. However, the number changes to 23 using a consumption-based perspective.

[Evidence of decoupling consumption-based CO2 emissions from economic growth - ScienceDirect](https://www.sciencedirect.com/science/article/pii/S2666792421000664) [Absolute Decoupling of Economic Growth… | The Breakthrough Institute](https://thebreakthrough.org/issues/energy/absolute-decoupling-of-economic-growth-and-emissions-in-32-countries)

“Countries with absolute decoupling of consumption based emissions tend to achieve decoupling at relatively high levels of economic development and high per capita emissions,” [reads the latest IPCC report](https://report.ipcc.ch/ar6wg3/pdf/IPCC_AR6_WGIII_FinalDraft_FullReport.pdf) in chapter 2.3.3. “Most countries of the EU and North America are in this group. Decoupling was not only achieved by outsourcing carbon intensive production, but also improvements in production efficiency and energy mix, leading to a decline of emissions.”

## Decoupling and alternative scenarios

Assuming population and economic growth will continue in the coming decades, absolute decoupling is essential to achieve carbon neutral world.

But, not sufficient to avoid consuming the remaining *CO2 emission budget*, under the global warming limit of 1.5°C or 2°C.

Moreover, the starting assumption might change. If the objective is not to maximise GDP but to [maximise individual **wellbeing**](https://link.springer.com/article/10.1007/s11205-021-02670-2)**–** which does not rely only on economic factors but also on social, institutional and environmental ones – one should ask whether we are going to be happier as GDP keeps increasing, and what would happen in the long run.

“As a response to these questions, and looking for the best way to achieve a sustainable future, [**degrowth scenarios**, which describe a future in which economic output declines](https://www.nature.com/articles/s41467-021-22884-9), are being explored by a niche of researchers,” says Emmerling. “In a way, this point of view is optimistic in terms of climate change mitigation: assuming – or hoping – that economic growth will decrease, or even turn negative in the long run, we can rely on less emissions reductions. Indeed, with a strong economy, we need to do much more to reduce emissions intensity to zero or even become negative.”

For the first time,[the IPCC talked about degrowth](https://timotheeparrique.com/degrowth-in-the-ipcc-ar6-wgii/) in its report of the second working group “[Impacts, Adaptation and Vulnerability](https://www.climateforesight.eu/future-earth/what-the-world-has-to-say-about-the-latest-ipcc-report/)” issued in February 2022, referring to it as a school of thought that is sceptical of decoupling, an alternative perspective on development and a strategy for achieving sustainability.

[Degrowth in the IPCC AR6 WGII – Timothée Parrique (timotheeparrique.com)](https://timotheeparrique.com/degrowth-in-the-ipcc-ar6-wgii/)

[1.5 °C degrowth scenarios suggest the need for new mitigation pathways | Nature Communications](https://www.nature.com/articles/s41467-021-22884-9)

## Kaya identity tentative multivariate

[Energies | Free Full-Text | Evaluating the Causal Relations between the Kaya Identity Index and ODIAC-Based Fossil Fuel CO2 Flux (mdpi.com)](https://www.mdpi.com/1996-1073/13/22/6009)

[(4) (PDF) Evaluating the Mutual Relationship between IPAT/Kaya Identity Index and ODIAC-Based GOSAT Fossil-Fuel CO2 Flux: Potential and Constraints in Utilizing Decomposed Variables (researchgate.net)](https://www.researchgate.net/publication/343715127_Evaluating_the_Mutual_Relationship_between_IPATKaya_Identity_Index_and_ODIAC-Based_GOSAT_Fossil-Fuel_CO2_Flux_Potential_and_Constraints_in_Utilizing_Decomposed_Variables)

[Kaya identity: drivers of CO₂ emissions, World (ourworldindata.org)](https://ourworldindata.org/grapher/kaya-identity-co2)

[CRAN - Package kayadata (r-project.org)](https://cran.r-project.org/web/packages/kayadata/index.html)

[Decarb My State](https://decarbmystate.com/) , [chihacknight/decarbonize-my-state: What does it take to decarbonize your state? (github.com)](https://github.com/chihacknight/decarbonize-my-state)