

# CO<sub>2</sub> and Greenhouse Gas Emissions

By: [Hannah Ritchie](#), [Pablo Rosado](#), and [Max Roser](#)

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Human emissions of greenhouse gases are the primary driver of [climate change](#) today.<sup>1</sup>

CO<sub>2</sub> and other greenhouse gases like methane and nitrous oxide are emitted when we [burn fossil fuels](#), produce materials such as steel, cement, and plastics, and [grow the food we eat](#). If we want to reduce these emissions, we need to transform our energy systems, industries, and food systems.

[At the same time](#), we need to tackle [energy poverty](#), [low standards of living](#), and [poor nutrition](#), which all remain enormous problems for billions of people.

Technological advances could allow us to do both. The [prices of solar](#), wind, and [batteries](#) have plummeted in recent decades, increasingly undercutting the cost of fossil fuel alternatives. Further progress could allow us to provide cheap, clean energy for everyone. Political change is essential to create a system that supports rapid decarbonization.

Emissions are still rising in many parts of the world. However, several countries have managed to [cut their emissions](#) in recent decades. With affordable low-carbon technologies, other countries can increase their living standards without the high-carbon pathway that rich countries followed in the past.

On this page, you can find our data, visualizations, and writing on CO<sub>2</sub> and other greenhouse gas emissions.

## Key Insights on CO<sub>2</sub> and Greenhouse Gas Emissions

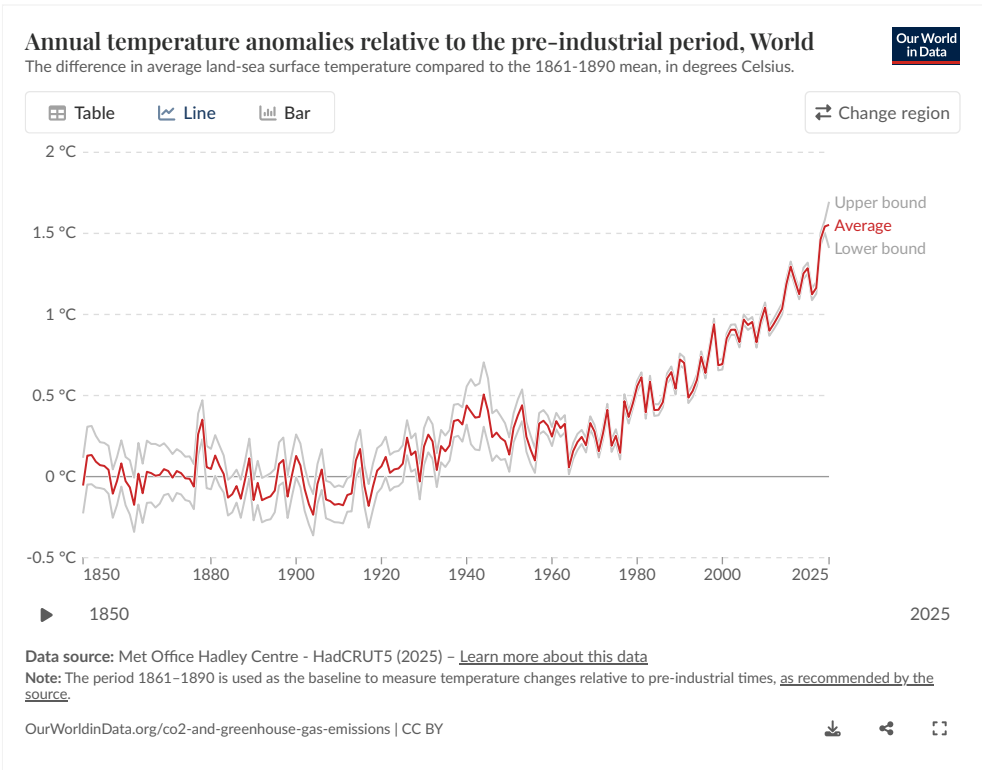
Human greenhouse gas emissions have increased global average temperatures	Global emissions have increased rapidly over the last 50 years and have not yet peaked	Current climate policies will reduce emissions, but not enough to keep temperature rise below 2°C	There are large gaps in emissions across the world
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see this distribution in maps [published by Berkeley Earth](#).

Human emissions have been the main driver of this change. Aerosols have played a slight cooling role in global climate, and natural variability has played a minor role. [This article](#) from Carbon Brief explains this very well, with interactive graphics showing the relative contributions of different factors to the climate.

WHAT YOU SHOULD KNOW ABOUT THIS DATA

- This data comes from the United Kingdom’s [Met Office](#) and combines air and sea surface temperatures in the Northern and Southern Hemispheres. It is called the “HadCRUT” (Hadley Centre/Climatic Research Unit Temperature) dataset.<sup>3</sup>
- It measures temperature anomalies across the world at high resolutions.
- There is [very strong agreement](#) in temperature trends across the large global datasets measured and produced by other leading institutions.



Explore Data on CO<sub>2</sub> and Greenhouse Gas Emissions

CO<sub>2</sub> and Greenhouse Gas Emissions Data Explorer

Explore data on greenhouse gas emissions.

Download this dataset

GAS OR WARMING

CO<sub>2</sub>

ACCOUNTING

Territorial

Consumption-based

FUEL OR LAND USE CHANGE

All fossil em...

COUNT

Per capita

☐ Relative to world total

Q Ty

CO<sub>2</sub> emissions per capita

Carbon dioxide (CO<sub>2</sub>) emissions from burning fossil fuels and industrial processes. This includes emissions from transport, electricity generation, and heating, but not land-use change.

Table

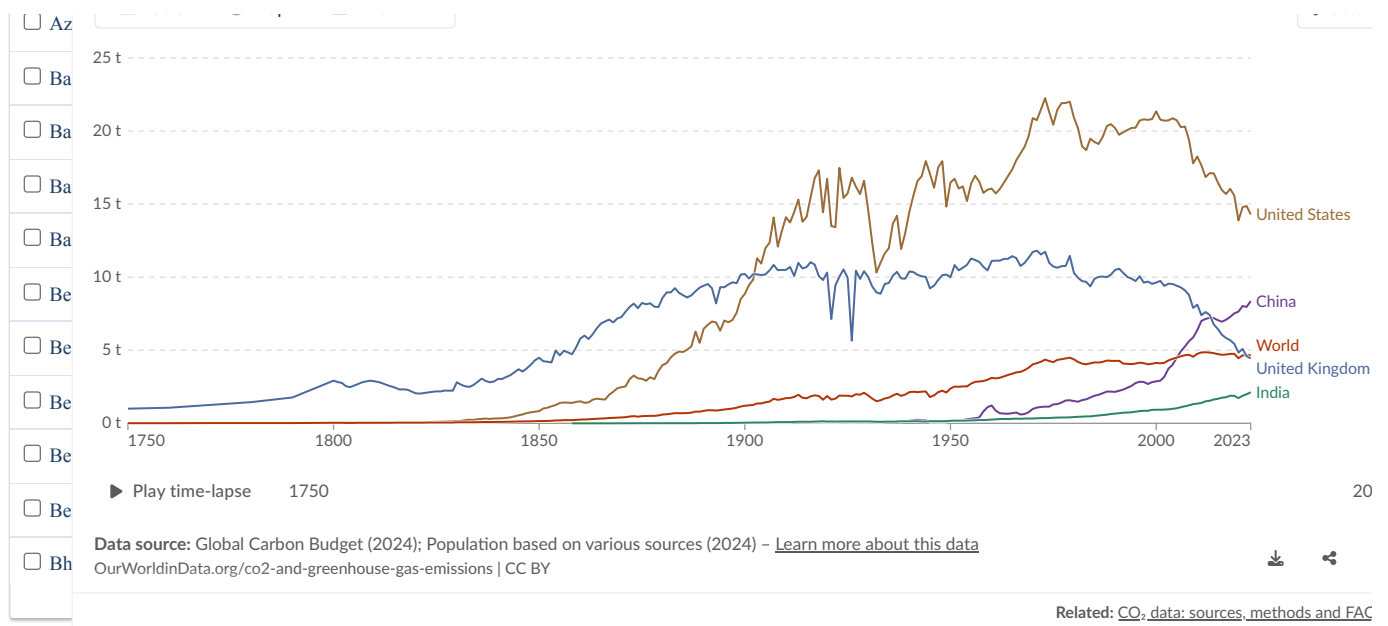
Map

Line

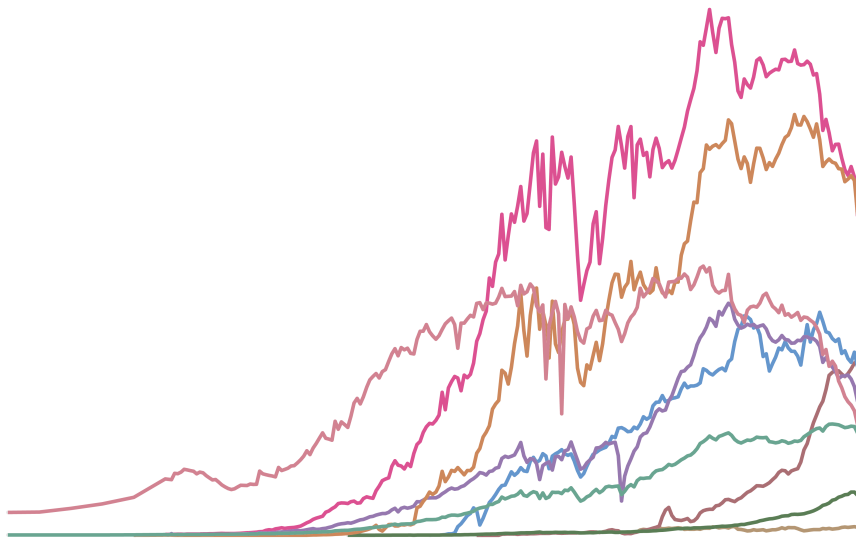
+2

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## Research & Writing



September 27, 2023

### Per capita, national, historical: how do countries compare on CO<sub>2</sub> metrics?

There are many ways to measure countries' contributions to climate change. What do they tell us?

Hannah Ritchie, Pablo Rosado, and Max Roser

December 01, 2021

### Many countries have offshored production

It is possible to reduce emissions

Hannah Ritchie

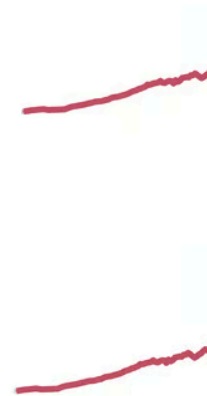
## Overview Articles



June 23, 2020

## CO<sub>2</sub> emissions by fuel

Hannah Ritchie, Pablo Rosado, and Max Roser

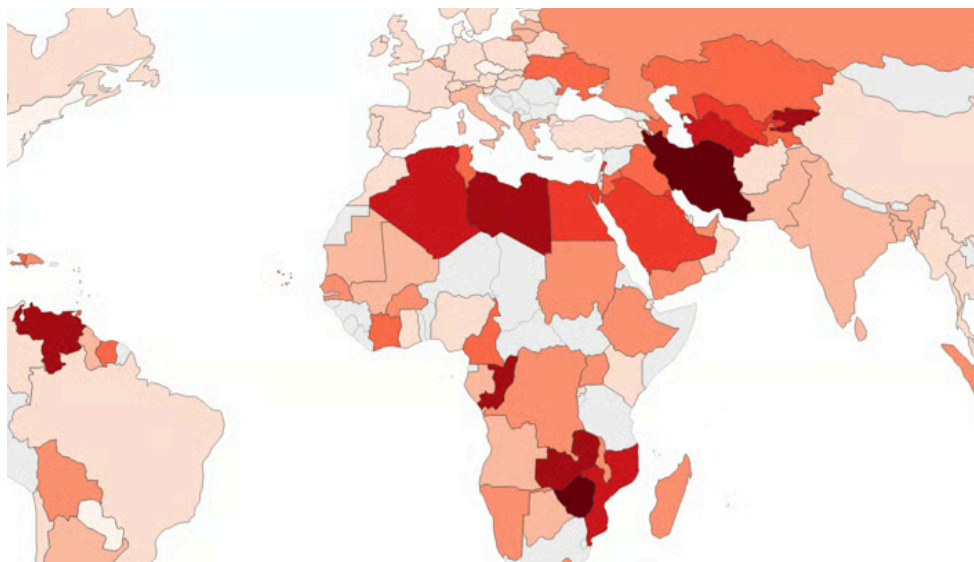


June 10, 2020

## Greenhouse gas emissions

Hannah Ritchie, Pablo Rosado

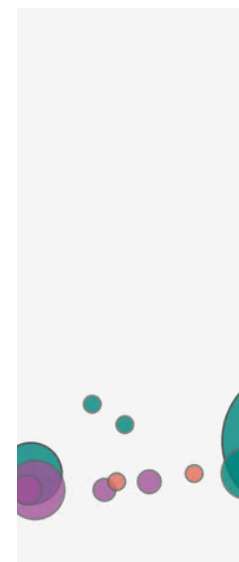
## Emissions from Energy



November 03, 2021

## Fossil fuel subsidies: If we want to reduce greenhouse gas emissions we should not pay people to burn fossil fuels

Max Roser

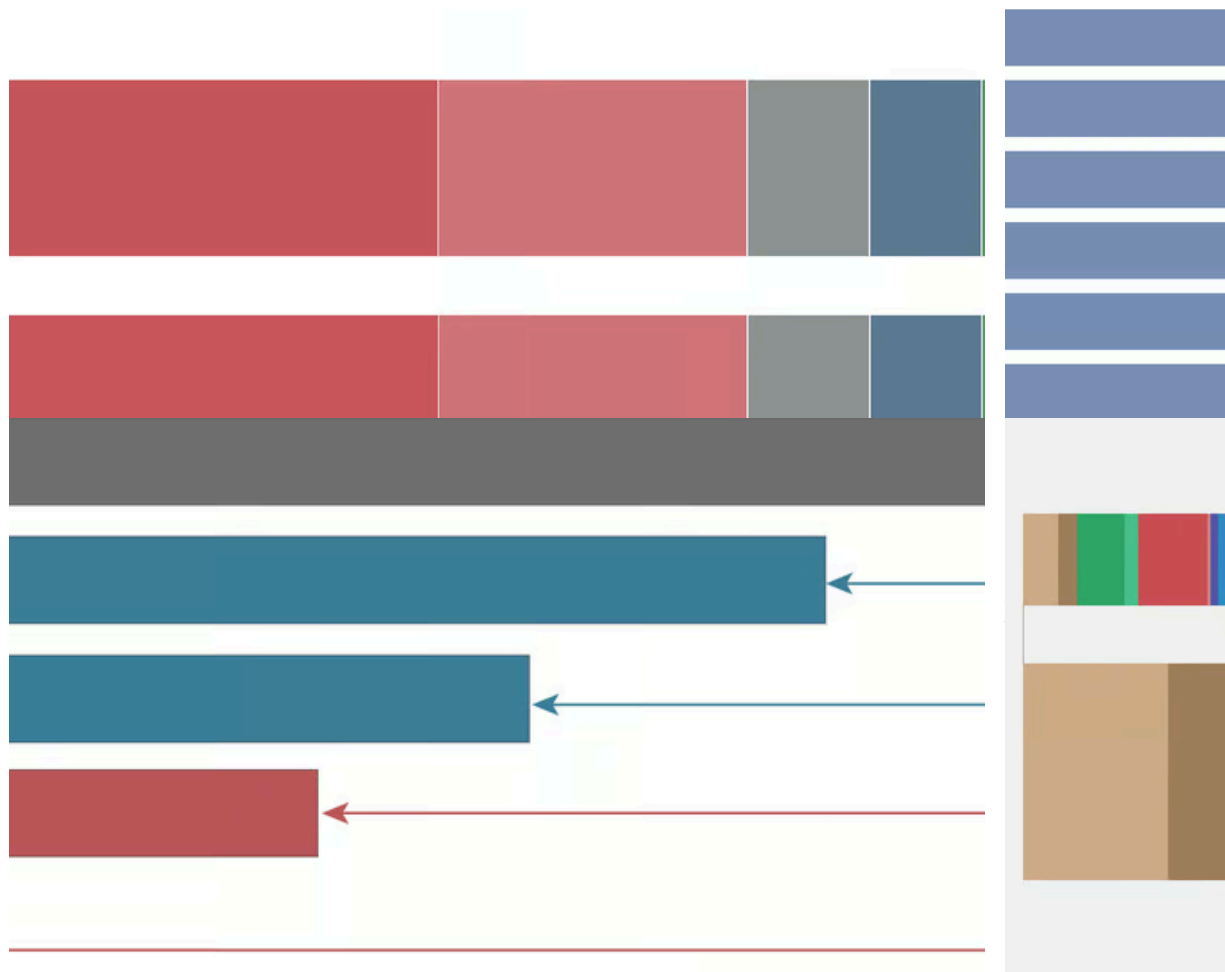


December 10, 2020

## The world's energy sources

Max Roser

## Emissions from Transport



June 10, 2021

**Emissions from food alone could use up all of our budget for 1.5°C or 2°C – but we have a range of opportunities to avoid this**

*Hannah Ritchie*

November 06, 2019

**Food production is r**

*Hannah Ritchie*

## More Key Articles on Greenhouse Gas Emissions

June 01, 2021

**The argument for a carbon price**

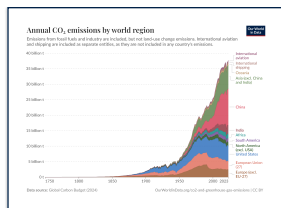
*Max Roser*

October 14, 2022

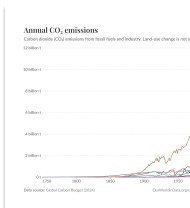
**Which countries hav**

*Hannah Ritchie and Pablo Ri*

## Key Charts on CO<sub>2</sub> & Greenhouse Gas Emissions



Annual CO<sub>2</sub> emissions by world region

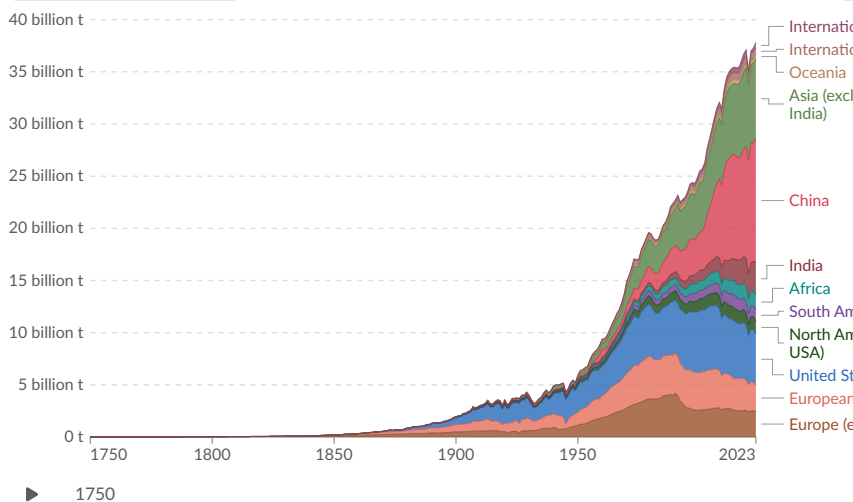


Annual CO<sub>2</sub> emissions

## Annual CO<sub>2</sub> emissions by world region

Emissions from fossil fuels and industry are included, but not land-use change emissions. International aviation and shipping are included as separate entities, as they are not included in any country's emissions.

Table Chart



Data source: Global Carbon Budget (2024) – [Learn more about this data](#)  
 OurWorldinData.org/co2-and-greenhouse-gas-emissions | CC BY

Related: [CO<sub>2</sub>](#), [data](#), [sources](#), [methods](#)



Chart 1 of 158



See all charts on this topic

## ENDNOTES

- IPCC, 2021: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, In press, doi:10.1017/9781009157896.
- Lacis, A. A., Schmidt, G. A., Rind, D., & Ruedy, R. A. (2010). Atmospheric CO<sub>2</sub>: Principal control knob governing Earth's temperature. *Science*, 330(6002), 356-359.
- Morice, C.P., J.J. Kennedy, N.A. Rayner, J.P. Winn, E. Hogan, R.E. Killick, R.J.H. Dunn, T.J. Osborn, P.D. Jones and I.R. Simpson (in press) An updated assessment of near-surface temperature change from 1850: the HadCRUT5 dataset. *Journal of Geophysical Research (Atmospheres)* doi:10.1029/2019JD032361 (supporting information).
- The underlying data for this chart is sourced from the Climate Action Tracker – based on policies and pledges as of April 2022.

## Cite this work

Our articles and data visualizations rely on work from many different people and organizations. When citing this topic page, please also cite the underlying data sources. This topic page can be cited as:

Hannah Ritchie, Pablo Rosado, and Max Roser (2023) – “CO<sub>2</sub> and Greenhouse Gas Emissions” Published online at OurWorldinData.org.  
Retrieved from: 'https://ourworldindata.org/co2-and-greenhouse-gas-emissions' [Online Resource]



#### BibTeX citation

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  title = {CO2 and Greenhouse Gas Emissions},  
  journal = {Our World in Data},  
  year = {2023},  
  note = {https://ourworldindata.org/co2-and-greenhouse-gas-emissions}  
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