MARTIN-LUTHER-UNIVERSITY
HALLE-WITTENBERG

Faculty of Law and Economic Sciences
Chair of Economic Ethics
Prof. Dr. Ingo Pies

Ethics and Economics of Institutional Governance

Lecture 10
Winter Term 2025/26

Overview

Ethics and Economics of Institutional Governance: 14 Lectures (L)

Introduction (L 1)

1. The Ordonomic Approach (L 2 + 3)
2. The Social Structure of Modern Society (L 4 + 5)
3. The Semantics of Modern Society (L 6)
4. Societal Learning Processes for the Reciprocal Adaptation of Social Structure and Semantics (L 7 + 8 + 9)
5. Case Study on Climate Policy (L 10 + 11)
6. Applications: The Ordonomic Line of Argumentation (L 12 + 13)

Summary and Outlook (L 14)

What have we learned?

The most important lessons of the ninth lecture are:

- Modern society is designed for innovation – and it depends on innovation: its dynamism always creates new problems that can (only) be solved by new knowledge. Paradoxically, standstill would be a step backwards.
- An important source of unproductive tradeoff thinking is the idea that we should try avoiding risks as much as possible. This idea finds a popular expression in different versions of the precautionary principle.
- The strong version of the precautionary principle makes the utopian claim that the non-existence of dangers should be verified.
- The weak version of the precautionary principle must be self-applicable, i.e. it must take into account the fact that risk mitigation measures themselves can be risky. As a result, a comprehensive risk analysis is needed to balance the expected costs and benefits of regulation.
- Knowledge is a public good. That is why there is a tendency towards undersupply: a social dilemma (2-PD). Institutions are important in overcoming the free-rider problem. This is where government organizations and companies can work together productively.
- In the economy – and within companies – the governance problem is to encourage risk-averse actors to engage in innovation that is as risk-neutral as possible.
- This is in the general interest of all citizens, because innovation rents are socially diffused via competition, thus raising general living standards.

Structure of Today‘s Lecture

1. The Open Letter
2. Background information on the climate problem
3. The approach by Nordhaus
4. Further elaboration of the Nordhaus approach

Outline of the Next Lecture

1. Climate alarm? – a provocative perspective
2. The IPCC study of 2018
3. Solar Valley in Saxony-Anhalt
4. Renewable energy versus ETS
5. On the governance structure of global climate policy

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An Open Letter

On 16 July 2020, Luisa Neubauer, Greta Thunberg, Anuna de Wever van der Heyden and Adélaïde Charlier publish an open letter addressed to EU and world leaders, signed by numerous celebrities and academics. Source: https://climateemergencyeu.org/#letter

https://www.zeit.de/2020/19/luisa-neubauer-fridays-for-future-coronakrise

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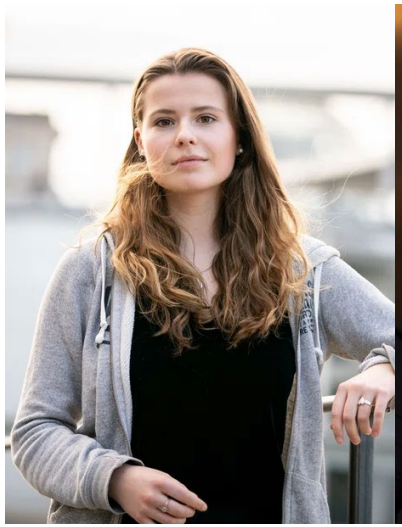
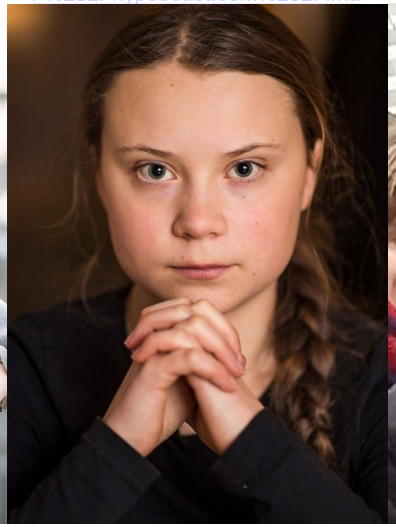

Open Letter: Claims

The Open Letter contains, among other things, the following claims:

- Immediately and completely divest from fossil fuels
- Advocate to make ecocide an international crime at the International Criminal Court
- Safeguard and protect democracy
- Design climate policies that protect workers and the most vulnerable and reduce all forms of inequality: economic, racial and gender
- Treat the climate and ecological emergency like an emergency

Open Letter: Argumentation (I)

The Open Letter contains the following arguments:
(1) The modern world is based on injustices and oppression.

„Climate and environmental justice can not be achieved as long as we continue to ignore and look away from the social and racial injustices and oppression that have laid the foundations of our modern world. The fight for justice and equity is universal. Whether it is the fight for social, racial, climate or environmental justice, gender equality, democracy, human-, indigenous peoples'- LGBTQ- and animal rights, freedom of speech and press, or the fight for a balanced, wellbeing, functioning life supporting system. **If we don't have equality, we have nothing.** We don't have to choose, and divide ourselves over which crisis or issue we should prioritize, because it is all interconnected.“

Open Letter: Argumentation (II)

The Open Letter contains the following arguments:
(2) The EU should lead by example.

„**When you signed the Paris Agreement the EU nations committed to leading the way.** The EU has the economic and political possibility to do so, therefore it is our moral responsibility.
And now you need to actually deliver on your promises.“

Open Letter: Argumentation (III)

The Open Letter contains the following arguments:
(3) The problems cannot be solved within the market economy system – through reform – but only through a radical system change.

„We are facing an existential crisis, and this is a crisis that we can not buy, build, or invest our way out of. **Aiming to 'recover' an economic system that inherently fuels the climate crisis in order to finance climate action is just as absurd as it sounds.** Our current system is not 'broken' – the system is doing exactly what it's supposed and designed to be doing. It can no longer be 'fixed'. We need a new system."

Open Letter: Argumentation (IV)

The Open Letter contains the following arguments:
(4) We must act immediately, even if this is politically, economically and legally not possible within the current system.

„**[E]ven a child can see that the climate and ecological crisis cannot be solved within today's system.** …

[I]f we are to avoid a climate catastrophe we have to make it possible to tear up contracts and abandon existing deals and agreements, on a scale we can't even begin to imagine today. And those types of actions are not politically, economically or legally possible within today's system.

In order to limit global heating to 1,5 degrees, the upcoming months and years are crucial. The clock is ticking. Doing your best is no longer good enough. You must now do the seemingly impossible.“

Open Letter Refers to Science

The Open Letter contains the following statement:

„Science doesn't tell us exactly what to do. But it provides us with information for us to study and evaluate. It's up to us to connect the dots.

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The Open Letter refers to science.

- But how can science comment on this open letter?
- And above all: What exactly is science?

Listen to „the“ Science(s)!

Rational climate policy requires a constructive interplay of natural sciences and social sciences:

Natural Sciences

The natural sciences need to explore how carbon dioxide (CO_2) and other greenhouse gases (GHG) emissions lead to global temperature changes and long-term climate impacts like storms, floods, drought, sea level changes, etc.

Social Sciences

The social sciences need to explore how to create behavioural changes through incentives. And they must compare (expected) costs and benefits in order to reasonably compare relevant policy alternatives.

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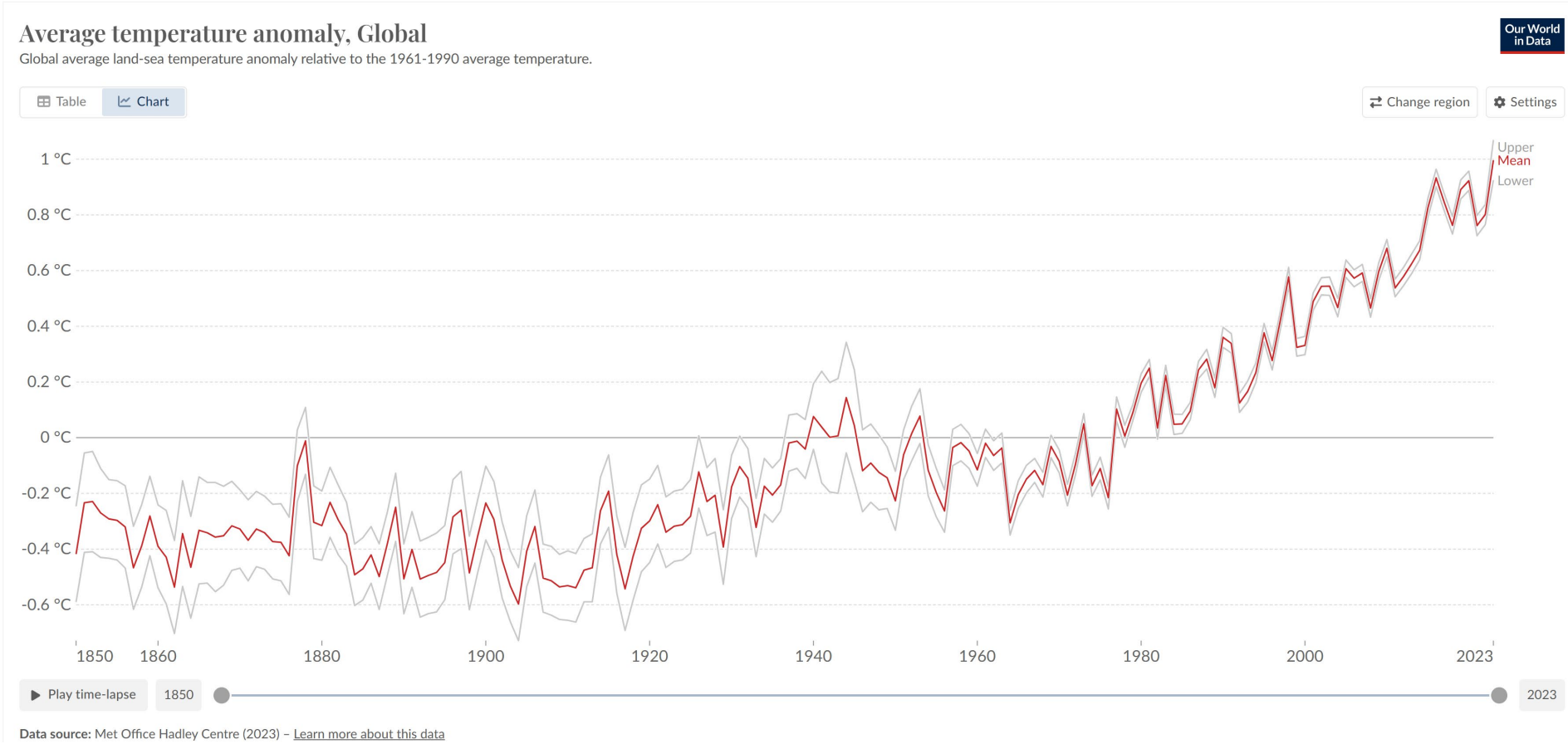
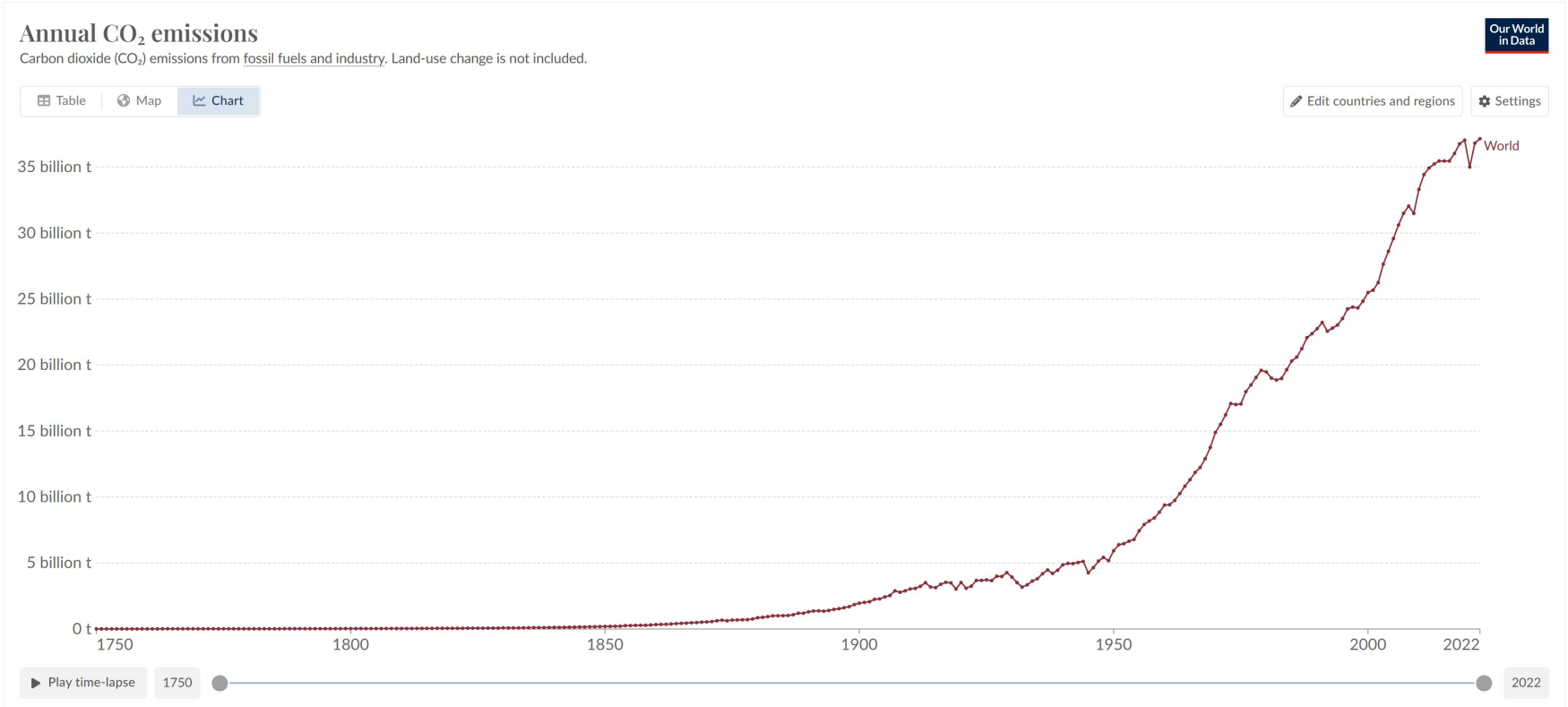
The Global Average Temperature is Rising (Still)

The temperature values are based on measurements and calculations.



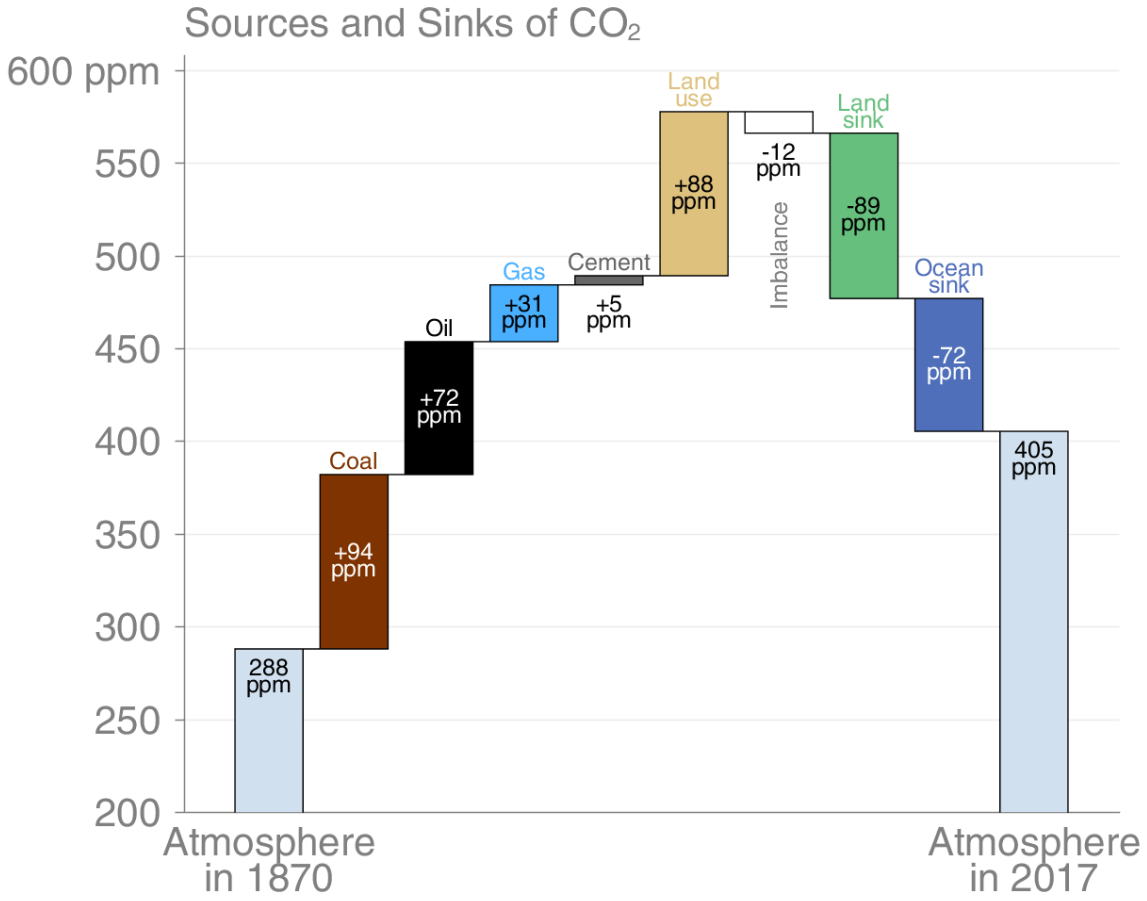
Global CO_2 emissions are rising (still)

Carbon dioxide (CO_2) is the most important greenhouse gas.



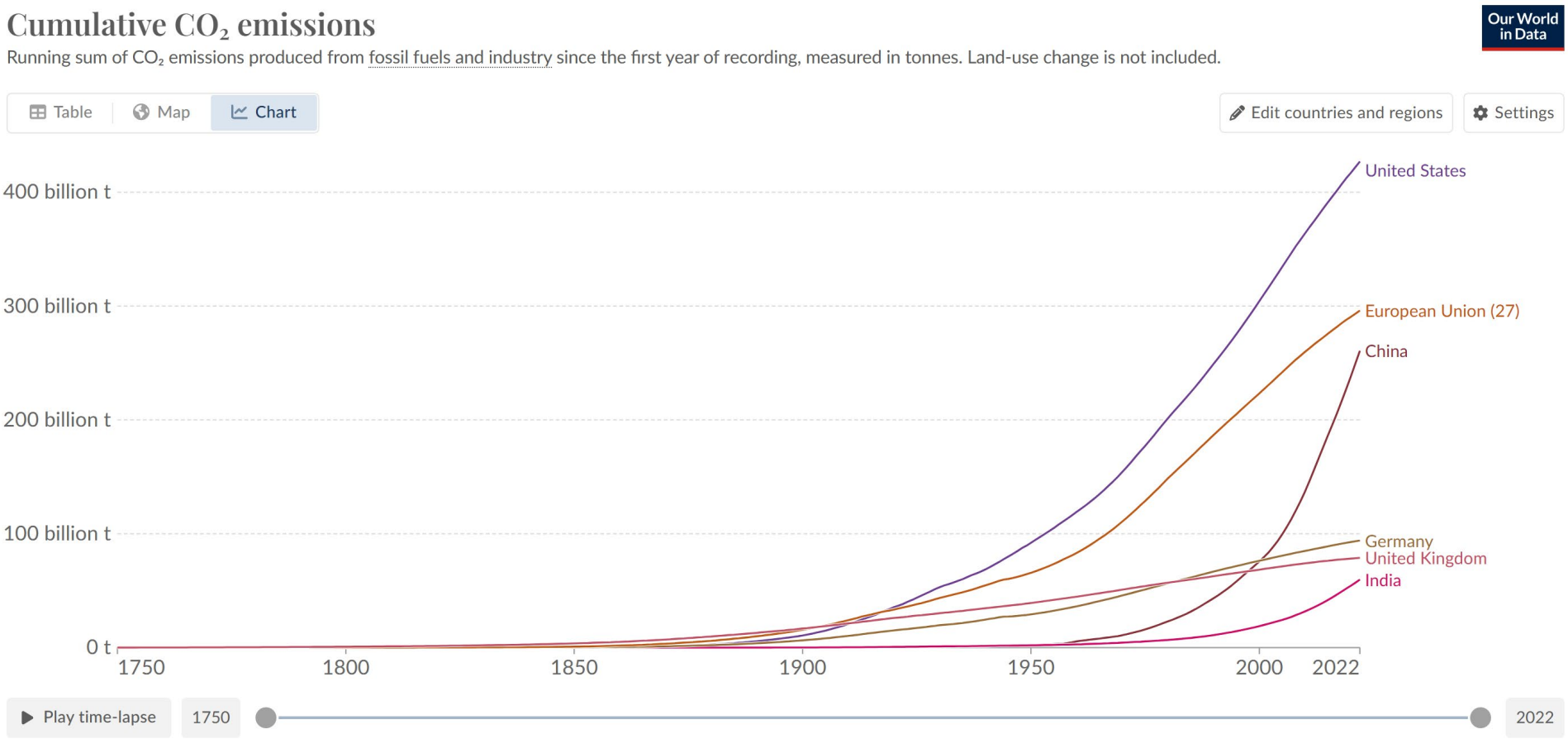
Global CO_2 Concentration: Sources and Sinks

The cumulative contributions to the global carbon budget from 1870
The carbon imbalance represents the gap in our current understanding of sources & sinks

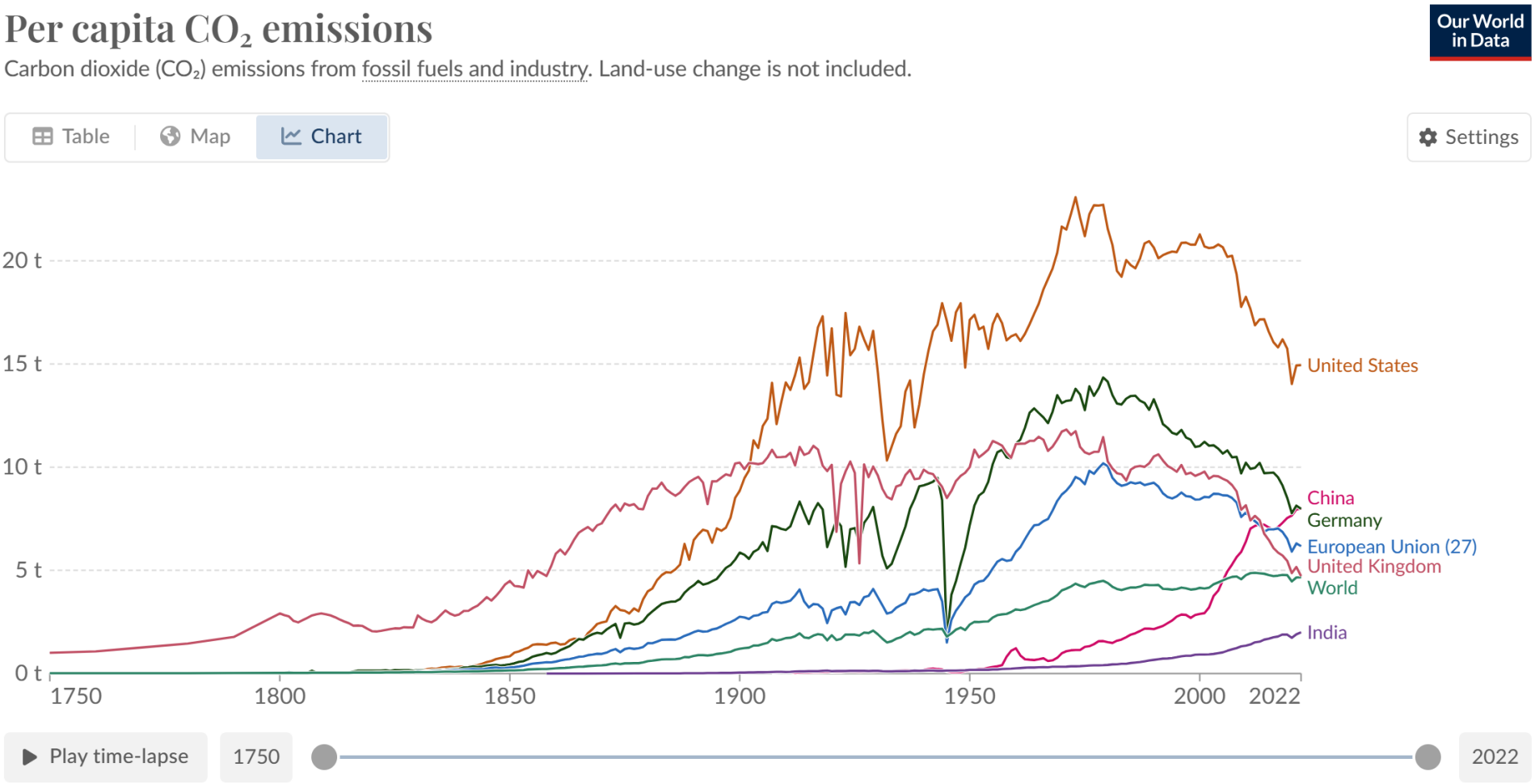


Quelle: GCP (2018)

The Historical Dimension: Cumulative CO_2 Emissions

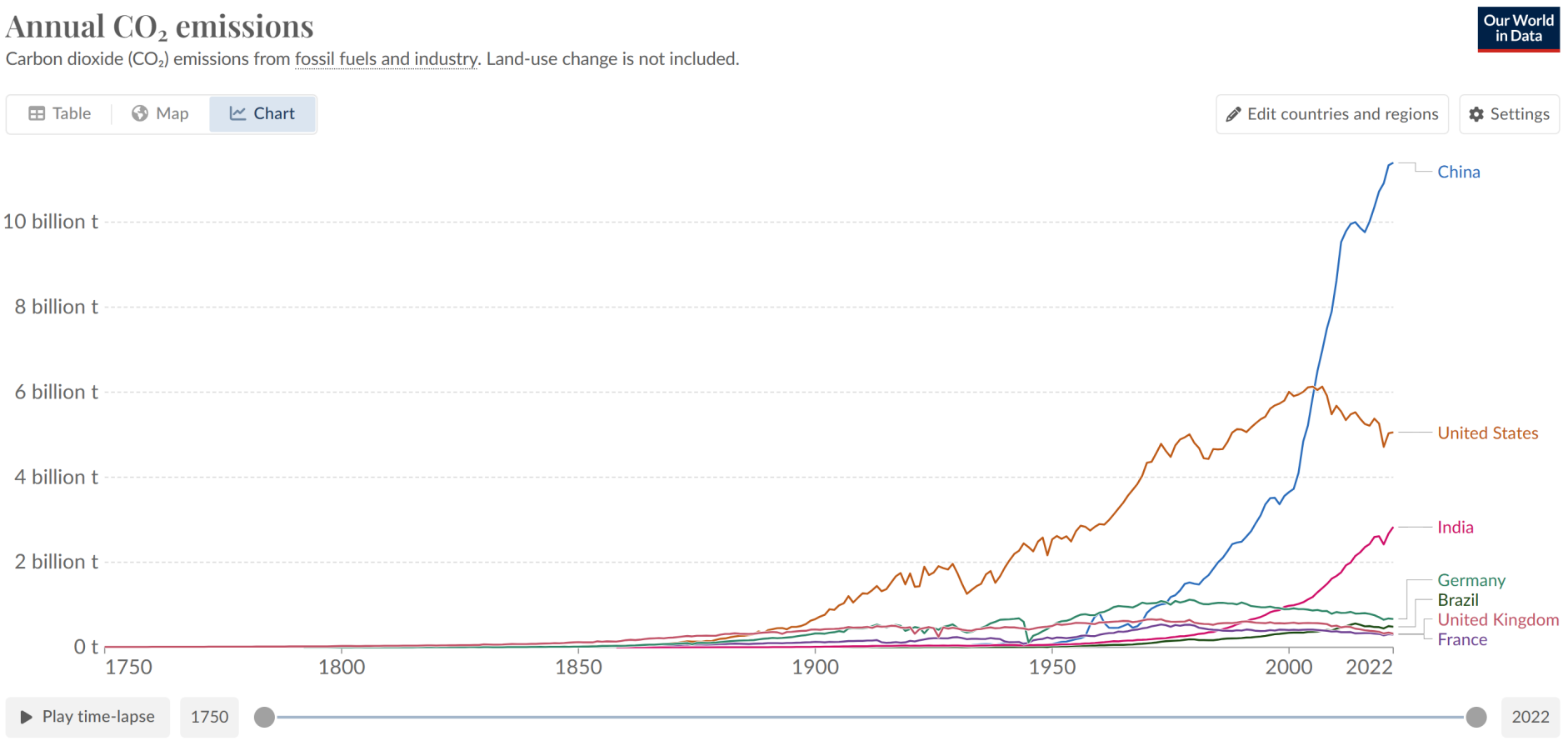


The Individual Dimension: CO_2 Emissions per Capita

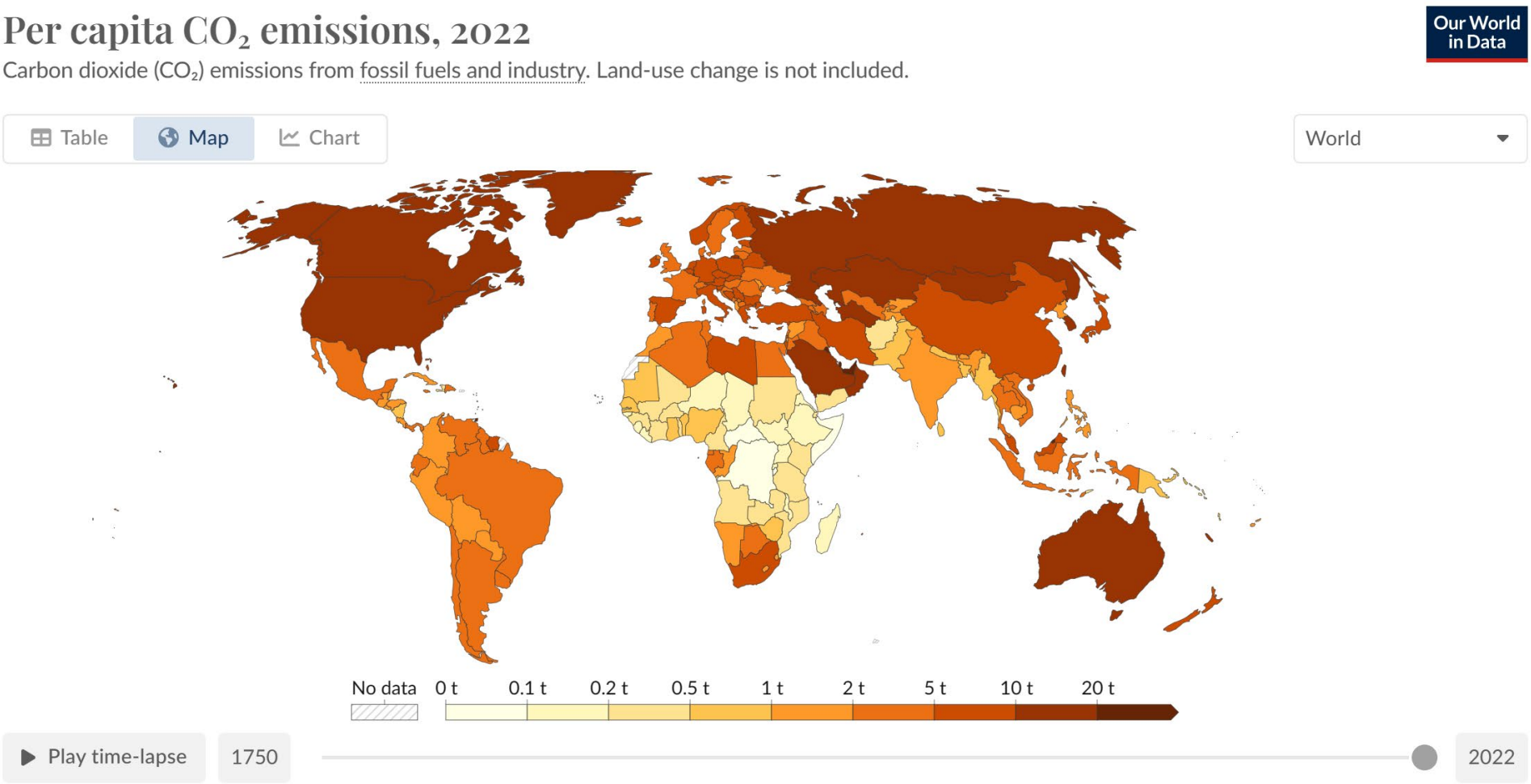


Annual CO_2 Emissions by Selected Countries

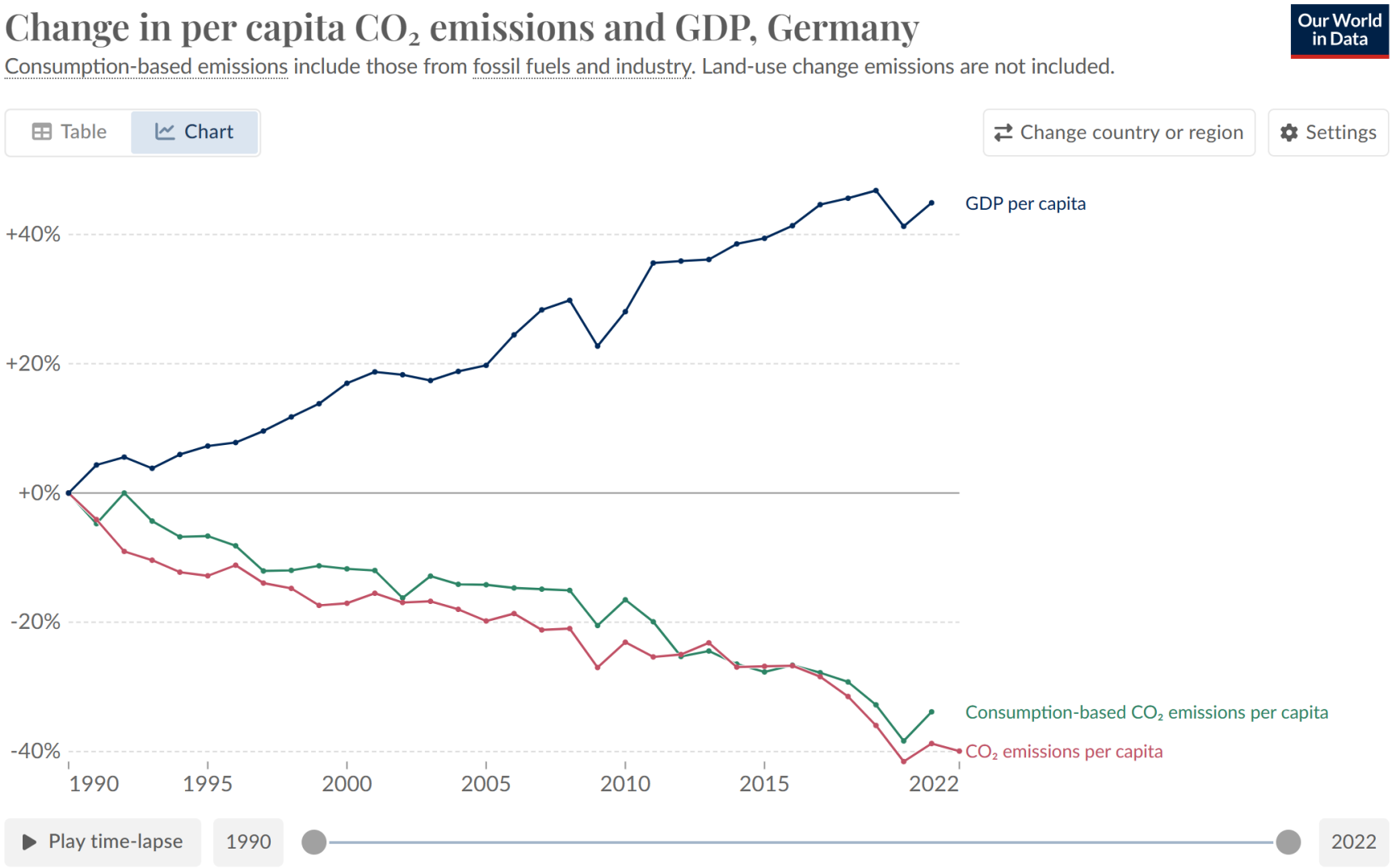
Conversion: (a) English Billions = German Milliarden, (b) 1 Giga ton = 1 Mrd. Tonnen = 1 billion tons



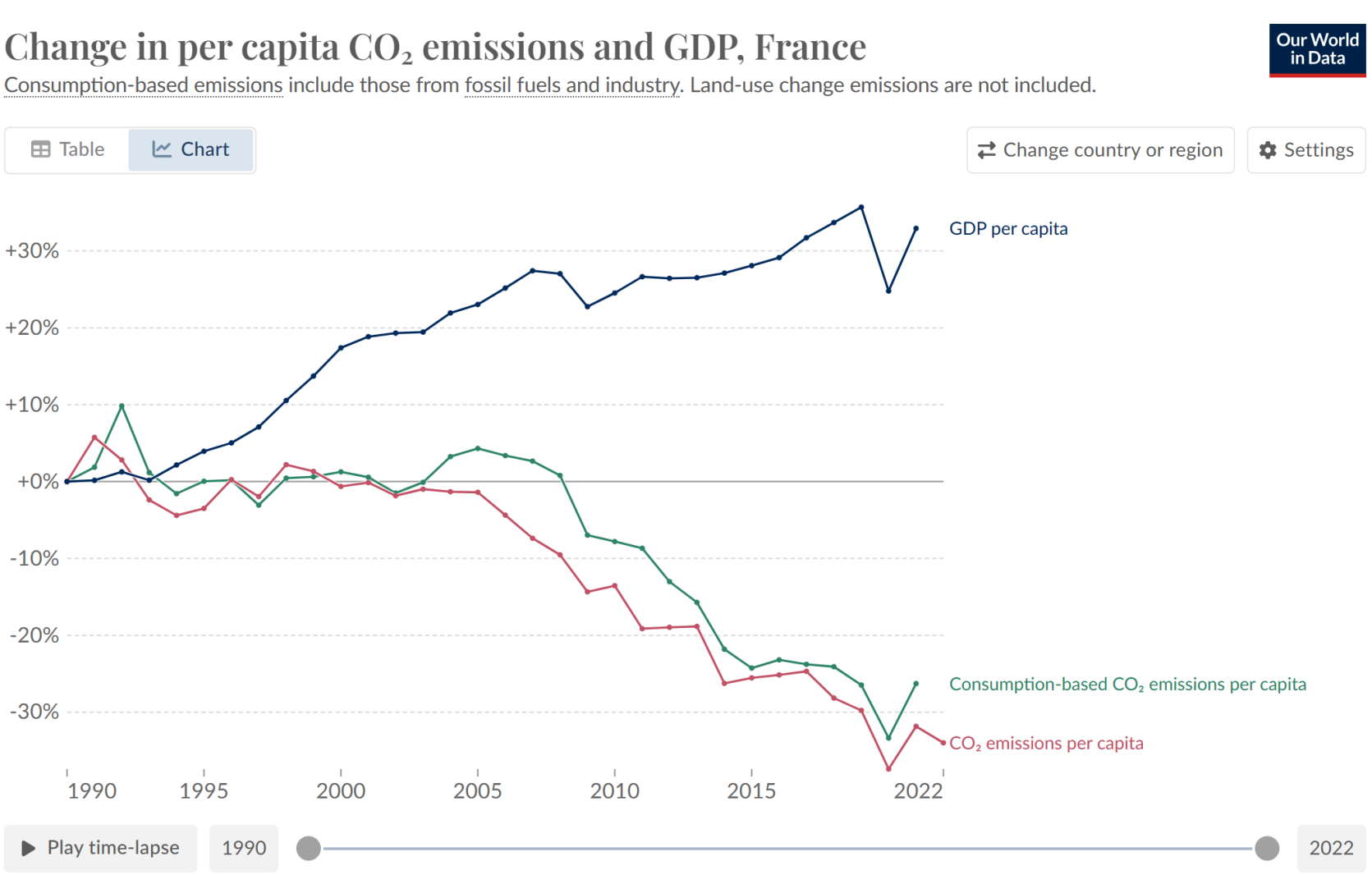
CO_2 Emissions per Capita in Global Comparison, 2017



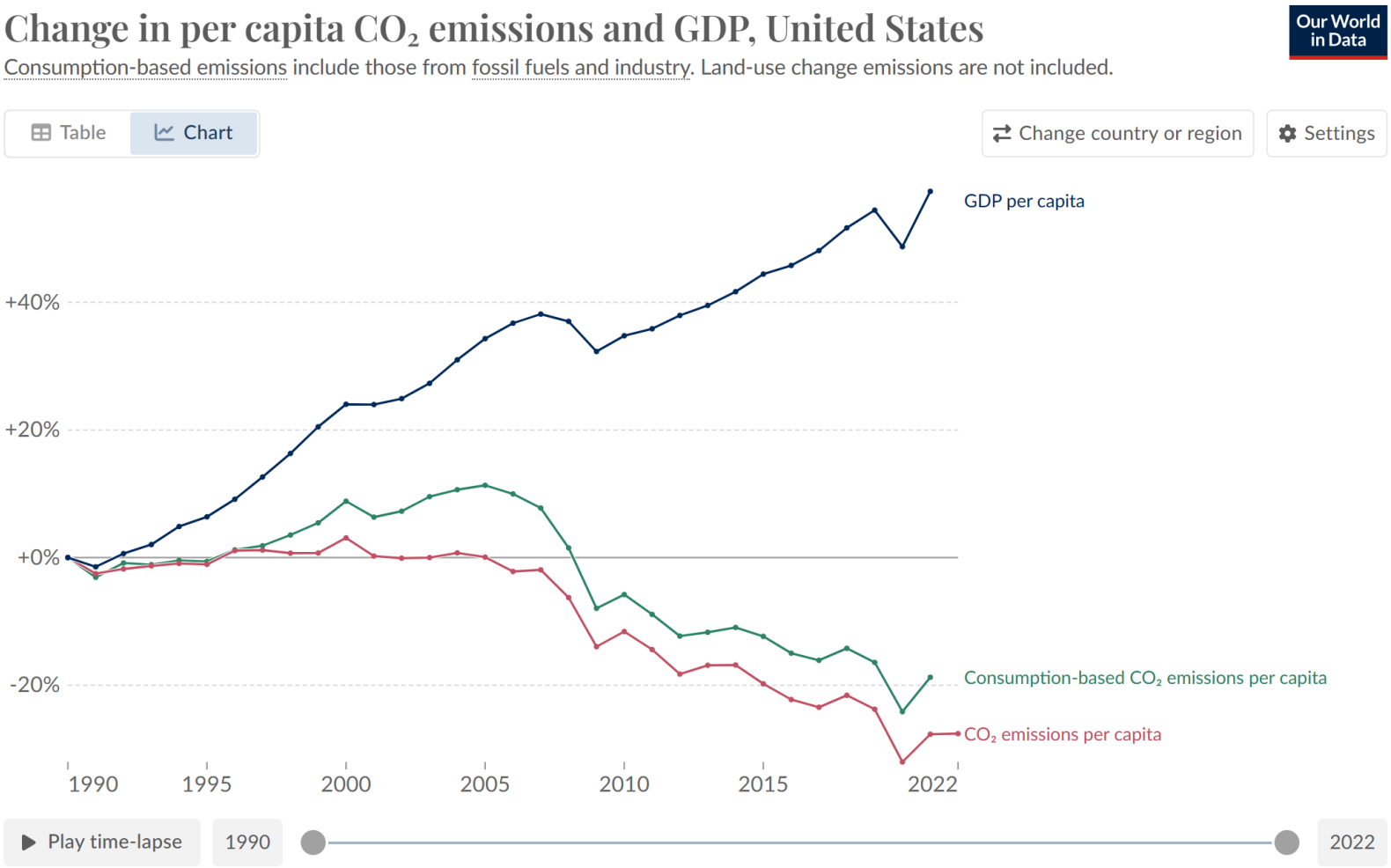
For Germany, imports and exports show similar amounts of CO_2



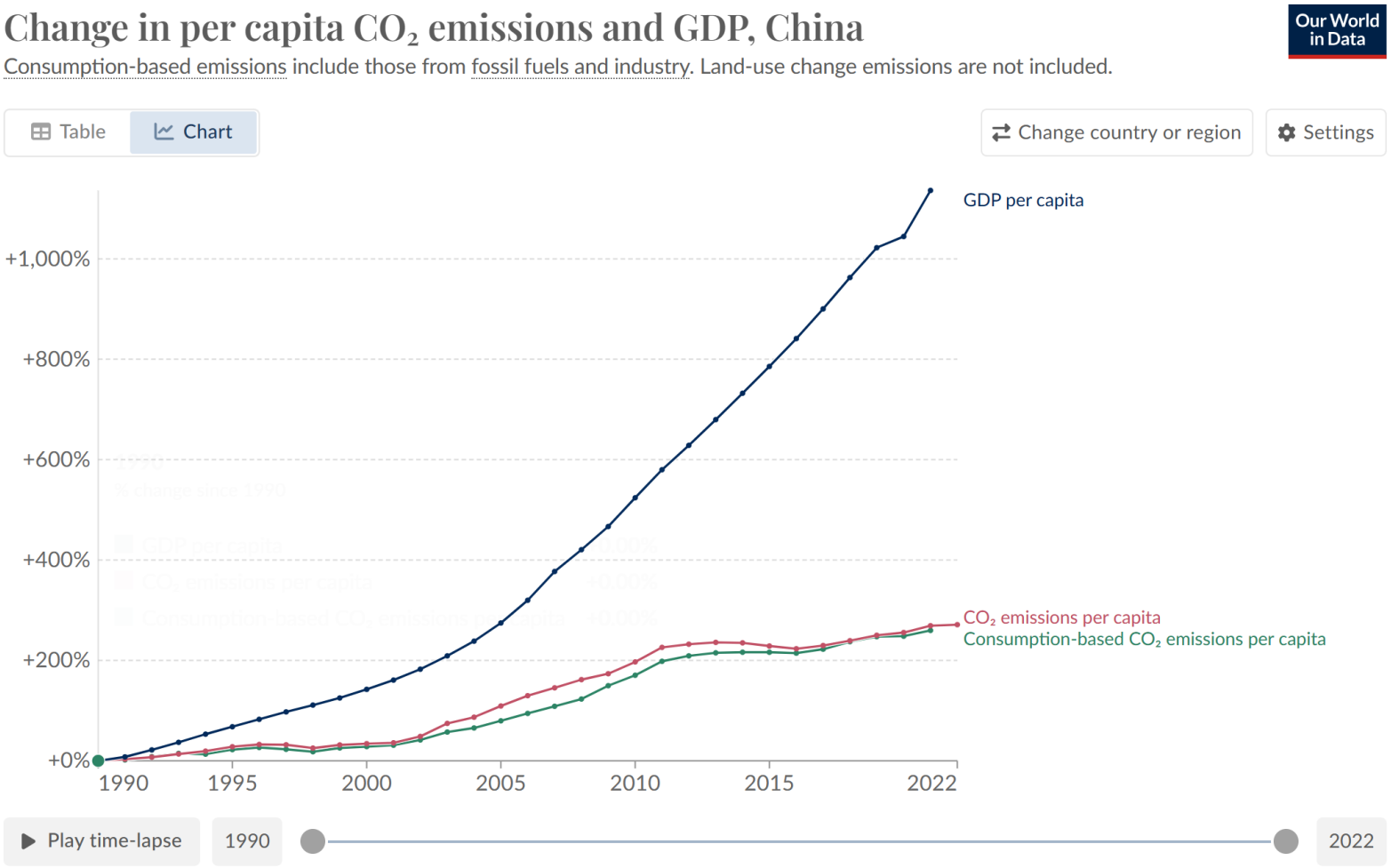
For France, imports of CO_2 are slightly higher than CO_2 exports



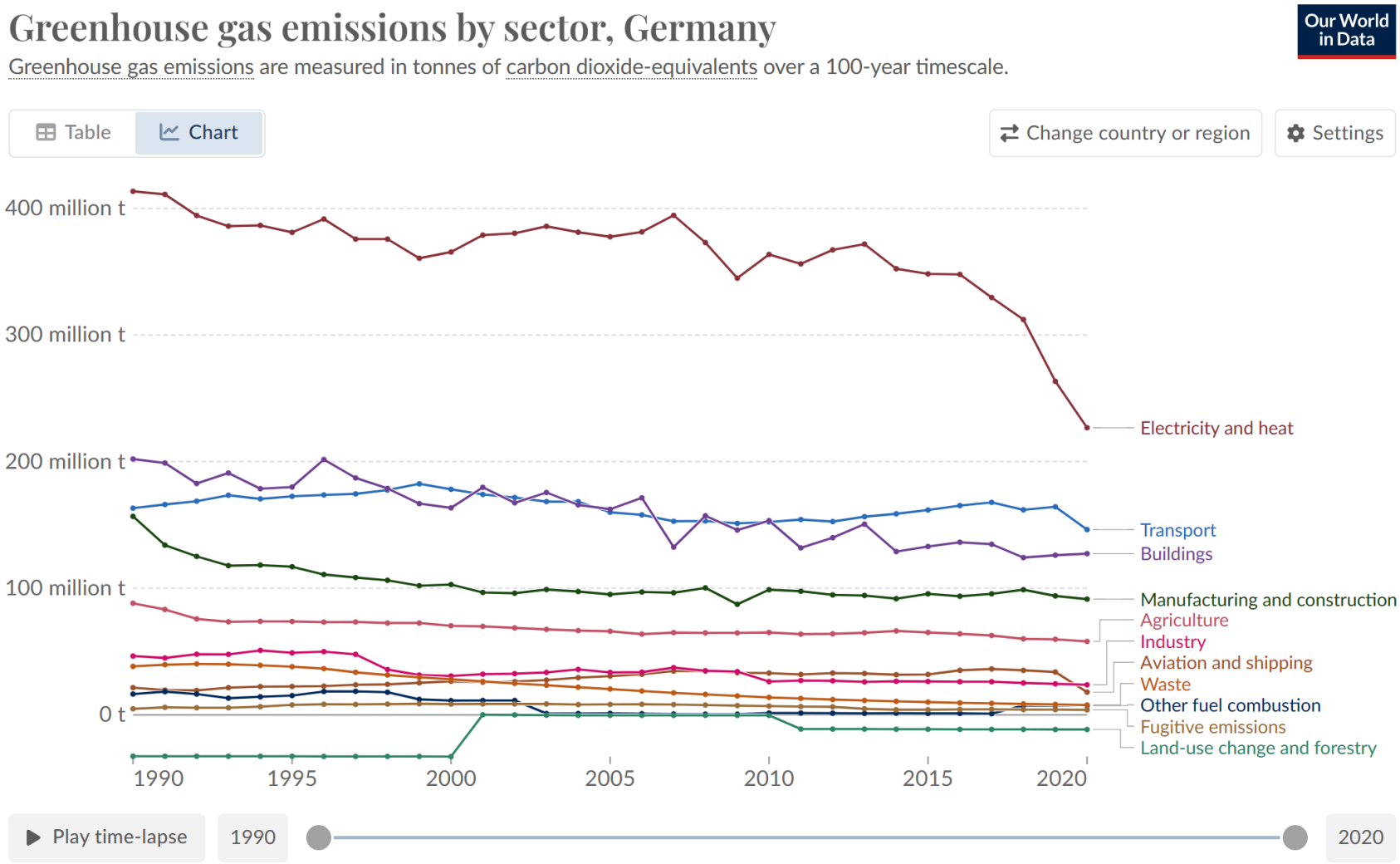
For the US, imports of CO_2 are higher than CO_2 exports



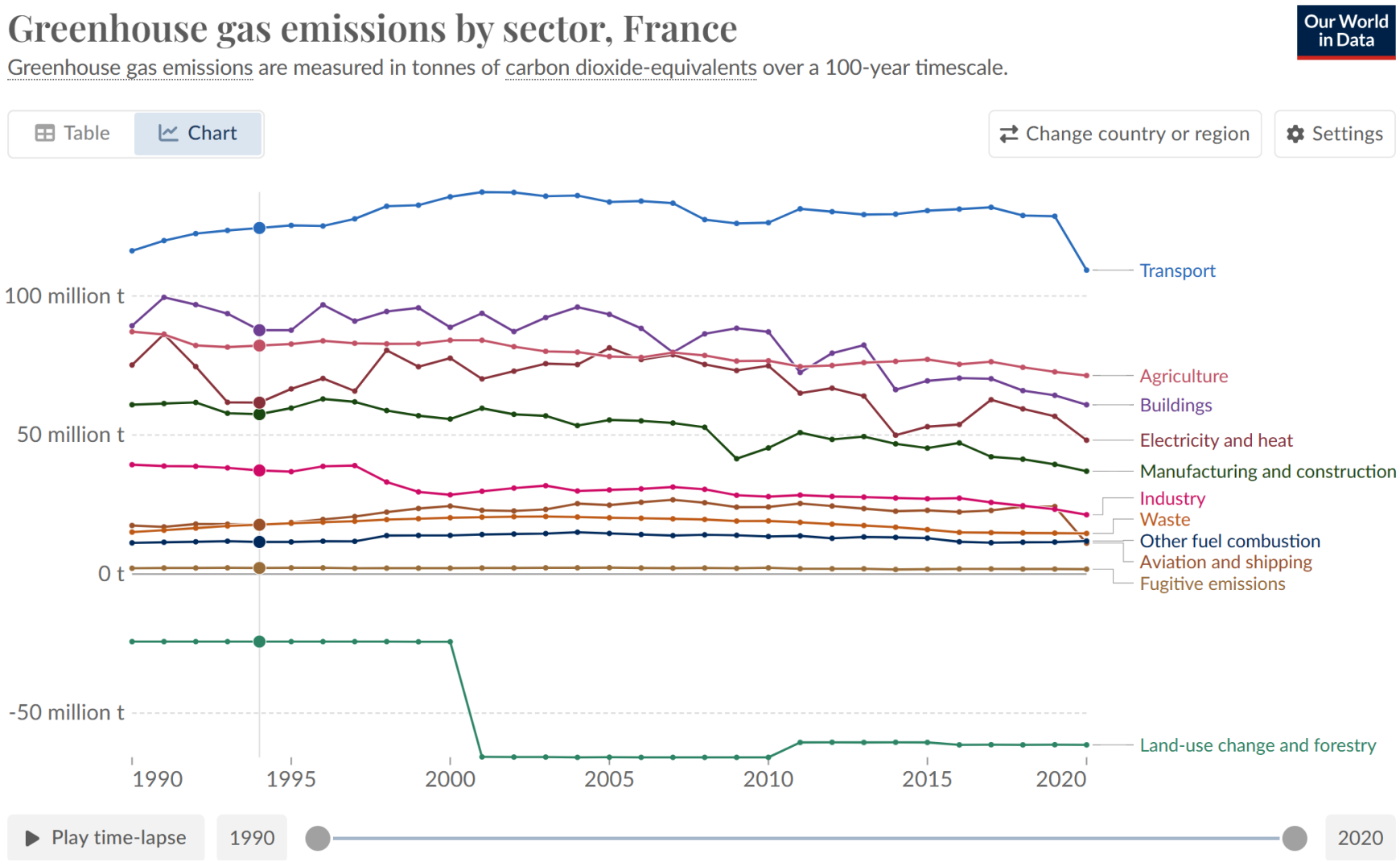
For China, exports of CO_2 are slightly higher than CO_2 imports



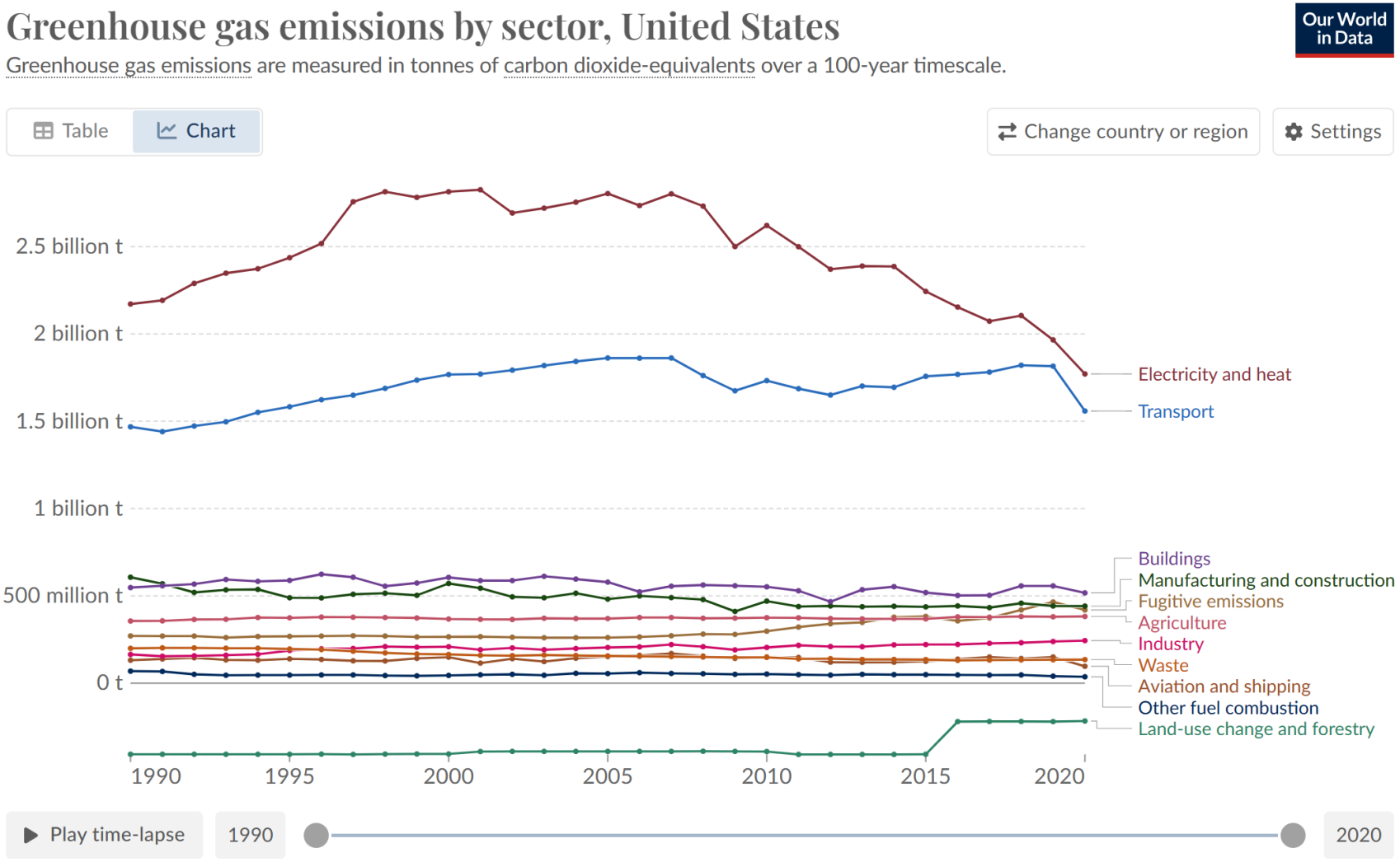
Sectoral Greenhouse Gas Emissions in Germany, 1990-2020



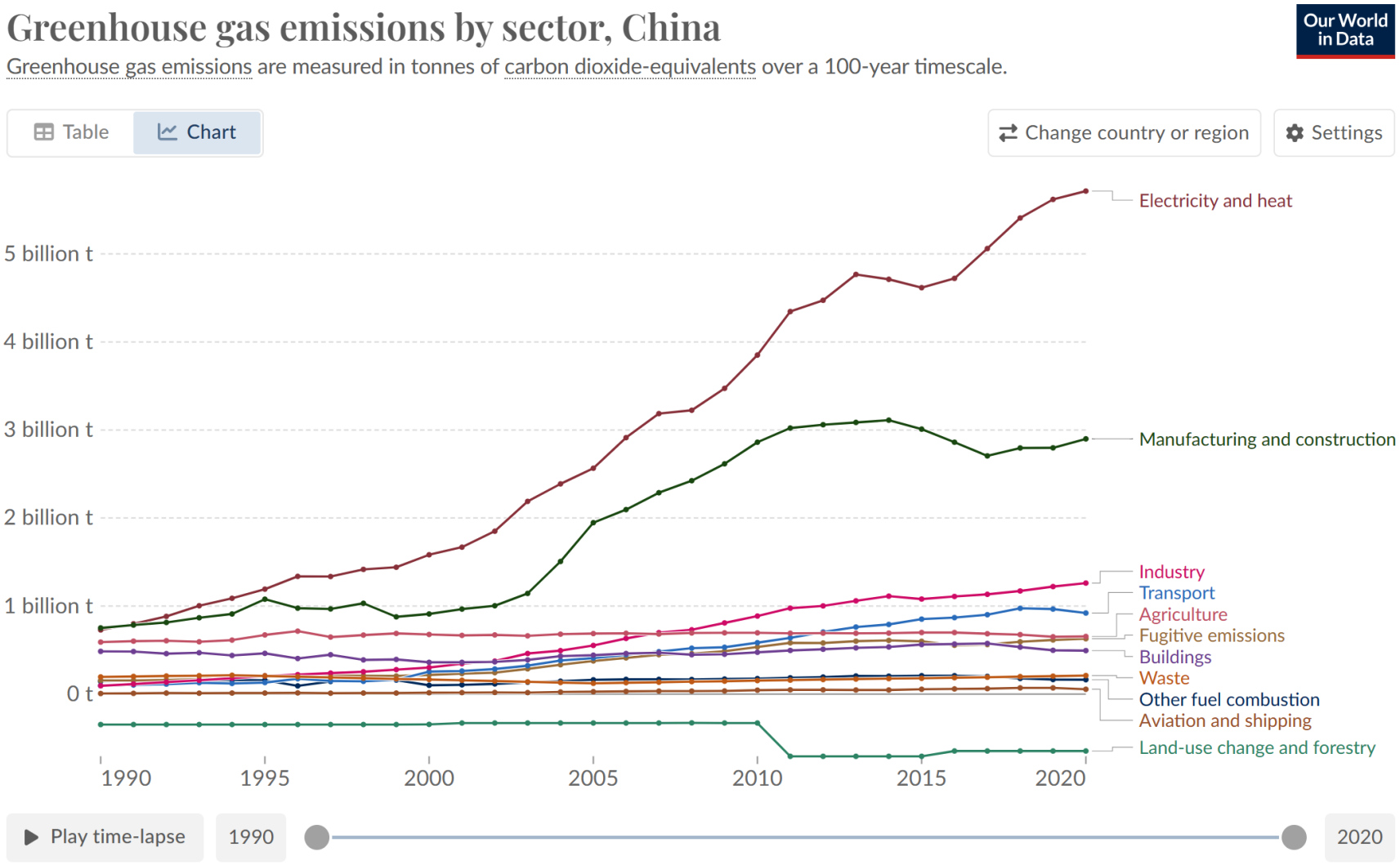
Sectoral Greenhouse Gas Emissions in France, 1990-2020



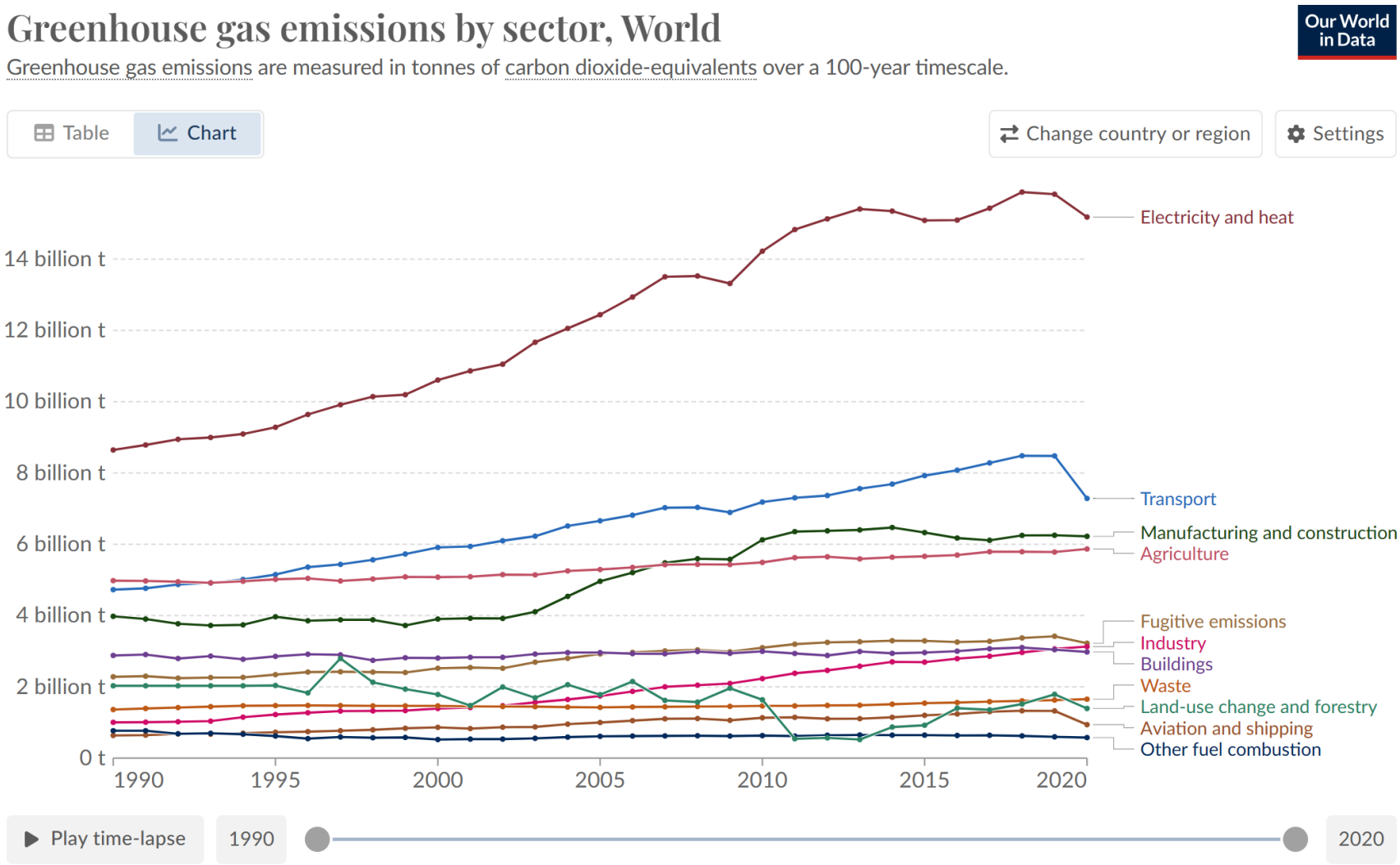
Sectoral Greenhouse Gas Emissions in the US, 1990-2020



Sectoral Greenhouse Gas Emissions in China, 1990-2020

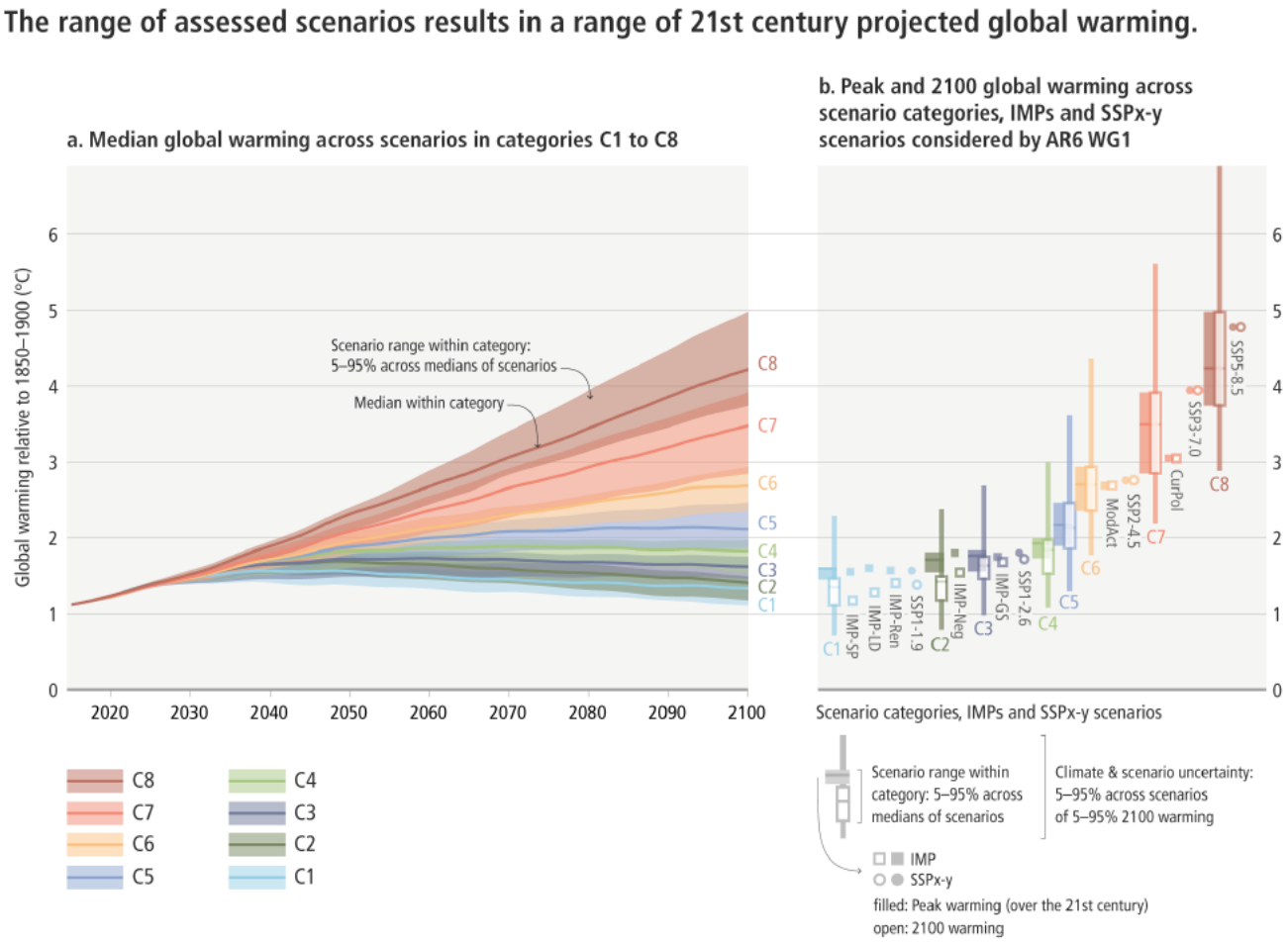


Sectoral Greenhouse Gas Emissions Worldwide, 1990-2020

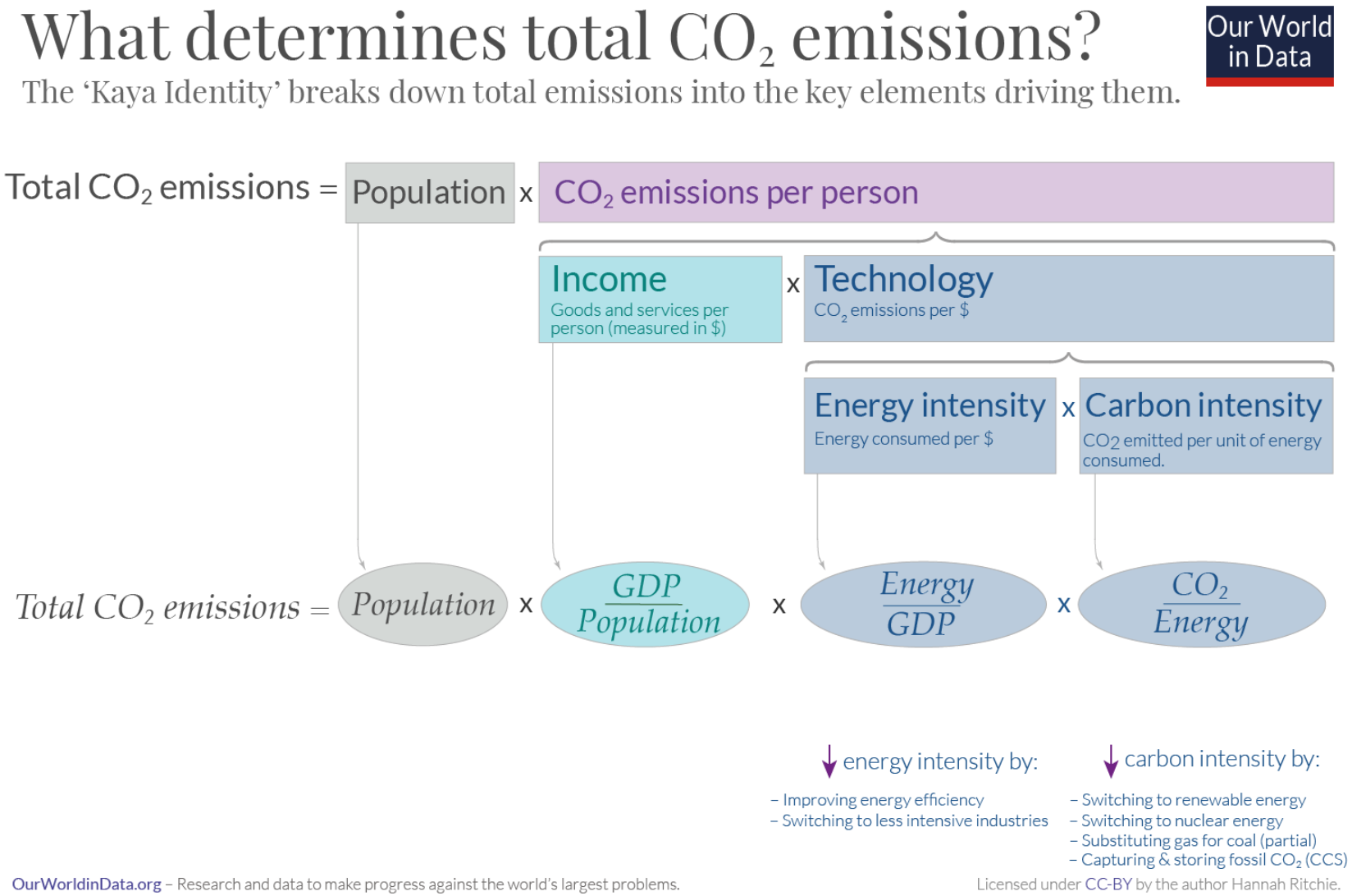


Warming scenarios up to the year 2100

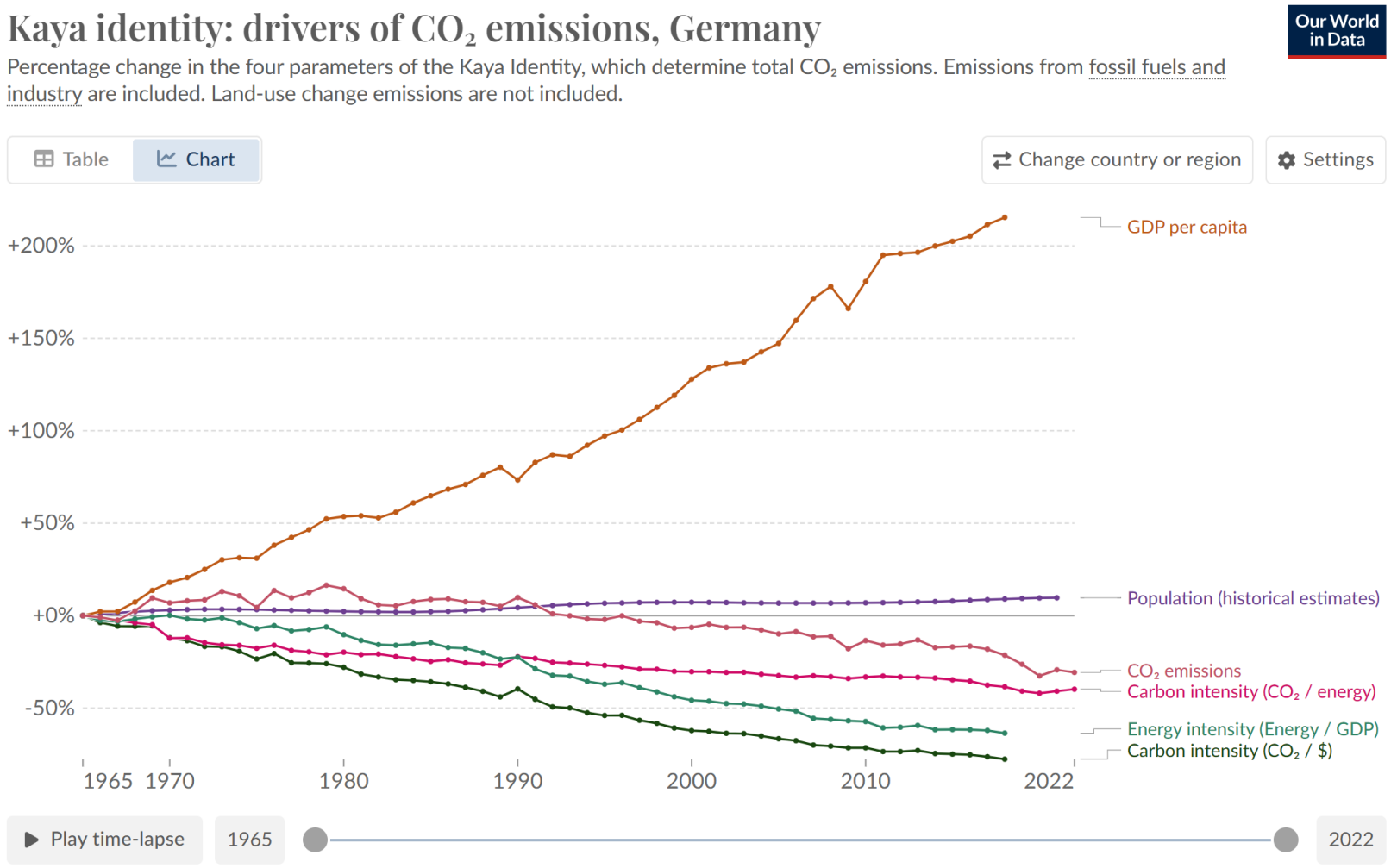
We are not on the way to achieving the climate protection targets set by our politicians.
Source: IPCC (2022) AR6 – WG III, SPM, Fig. Box SPM.1, Figure 1, p. SP;M 29.



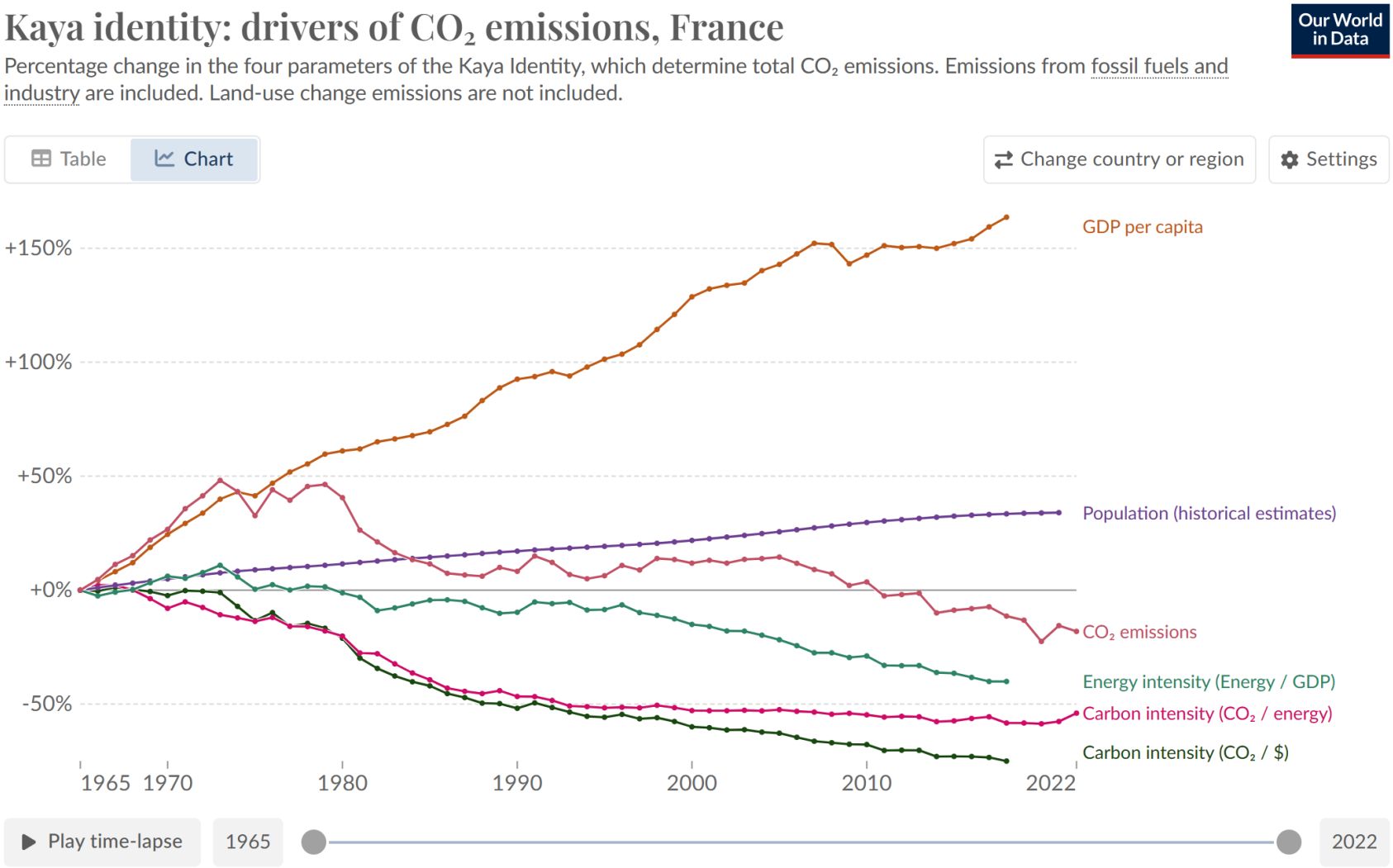
KAYA Identity Hints at Starting Points for Climate Policy



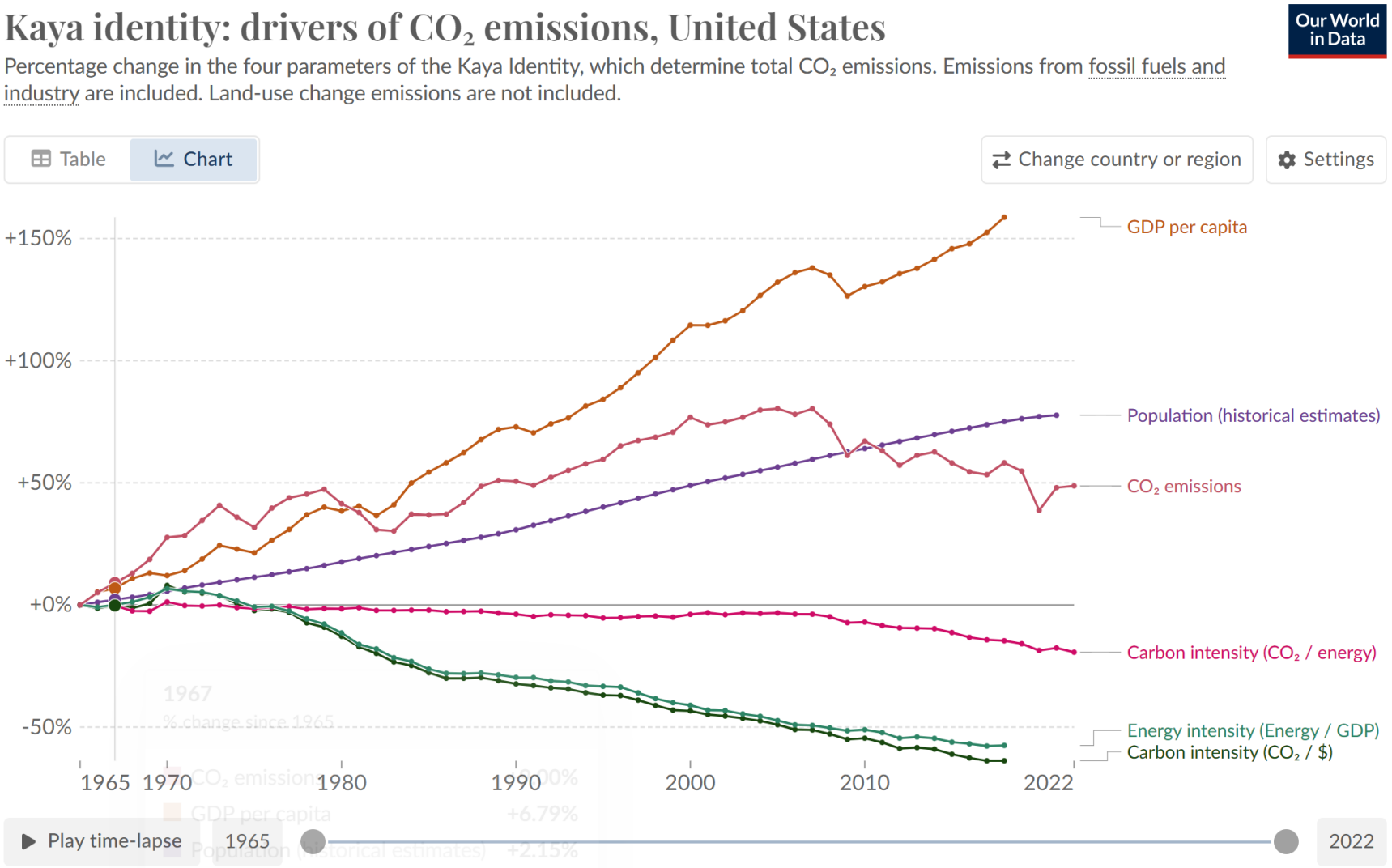
KAYA: The German Development Since 1965



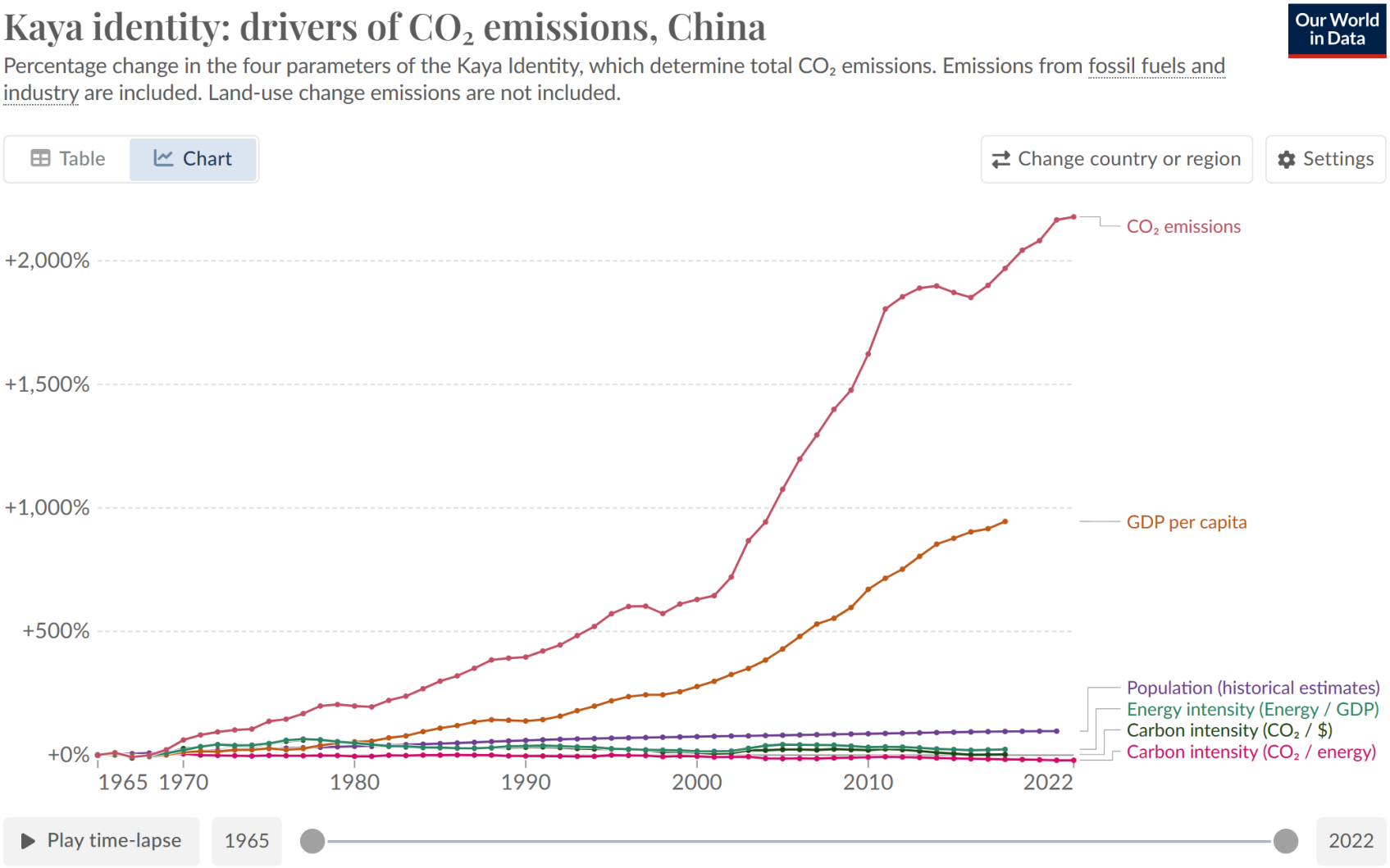
KAYA: The French Development Since 1965



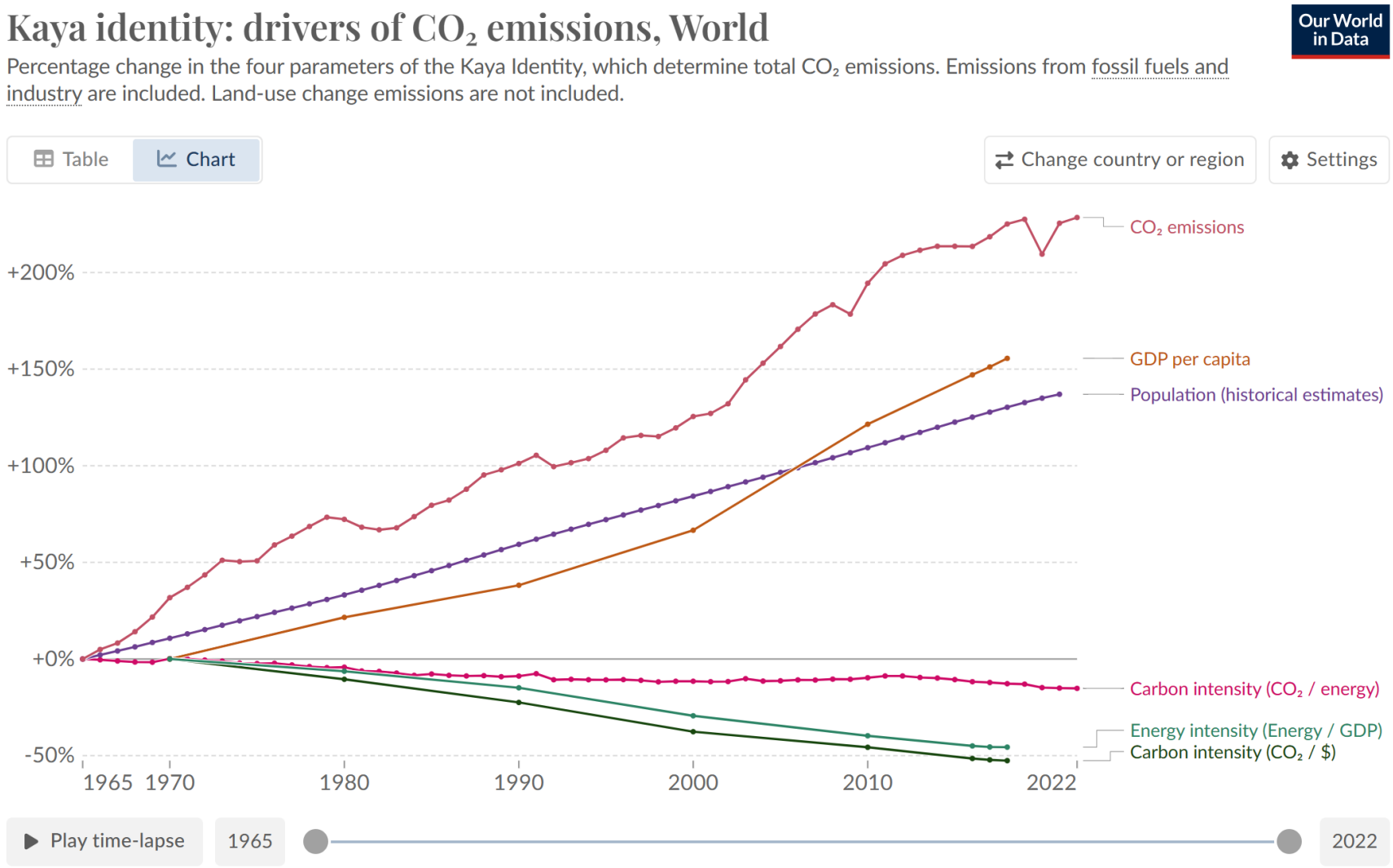
KAYA: The US Development Since 1965



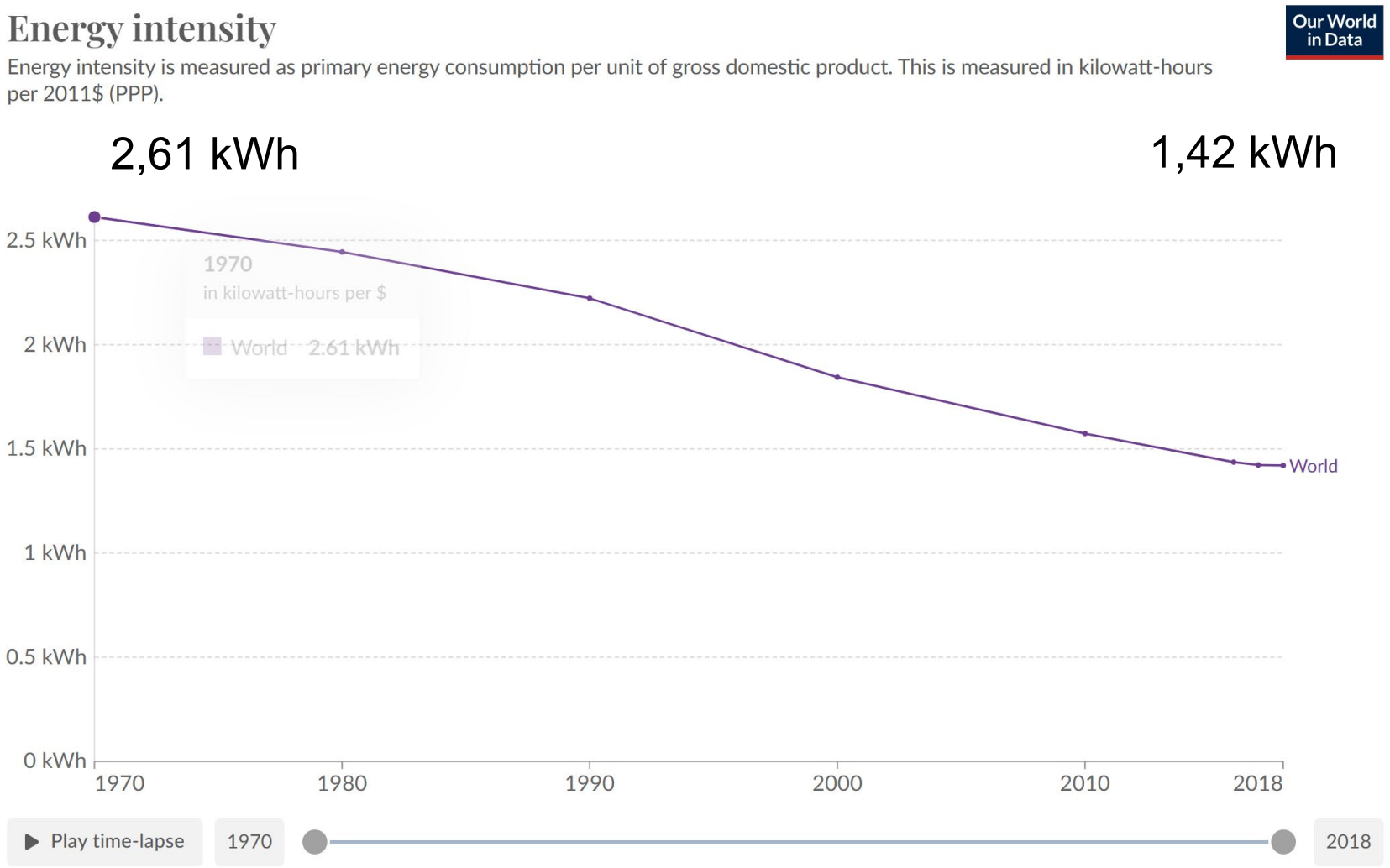
KAYA: The Chinese Development Since 1965



KAYA: The Global Development Since 1965

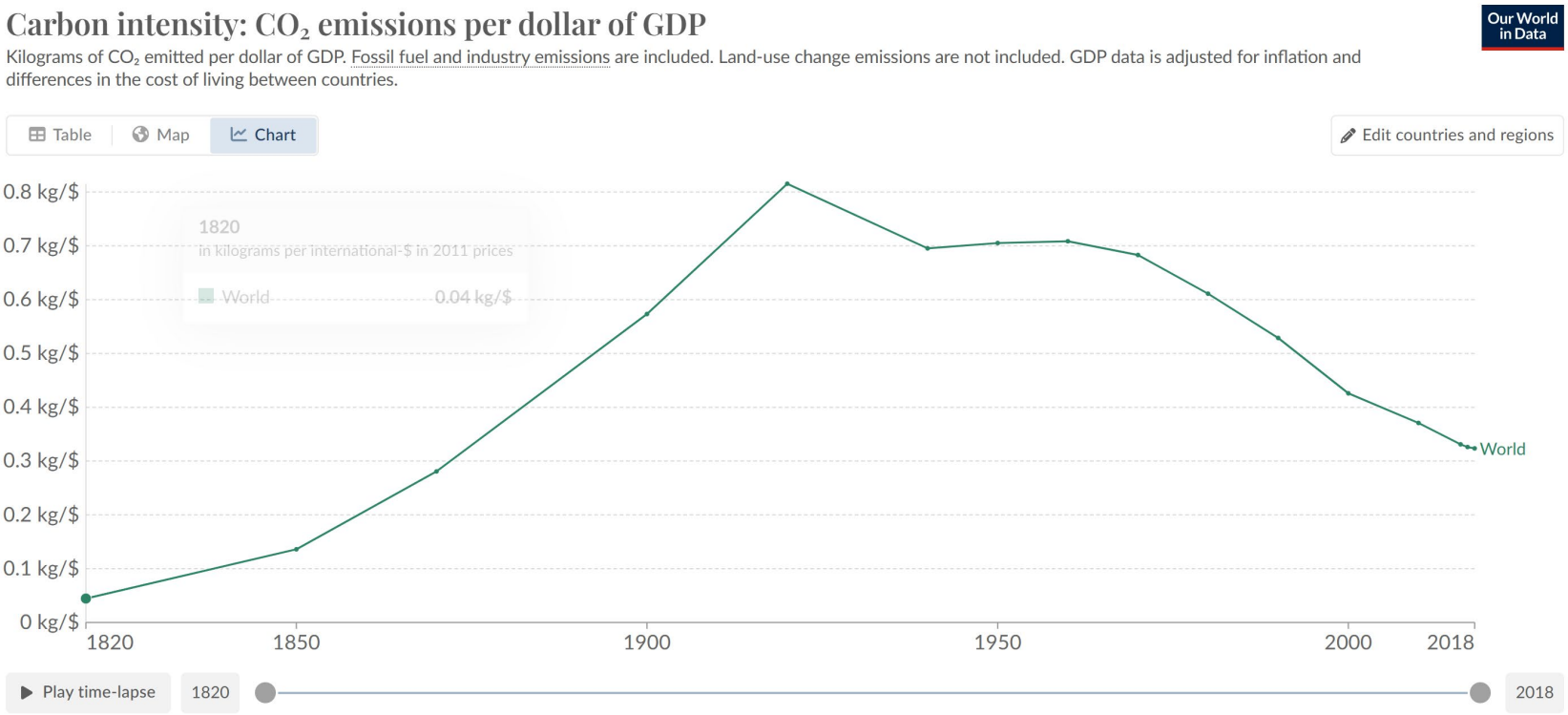


Global Energy Intensity has been Falling Since 1970 (by ca. 45%)



Global Carbon Intensity has been Falling Since 1960

Global carbon intensity decreased by ca. 55% from 0,71 kg/$ in 1960 to 0,32 kg/$ in 2018.



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3. The approach by Nordhaus
4. Further elaboration of the Nordhaus approach

Nobel Prize Speech AER 2019 (I)

Nordhaus characterizes his field of climate economics as follows: The core problem is a global public good (or evil), a negative externality, i.e. a social dilemma (2-PD).

William D. Nordhaus

„It involves the spillovers or externalities of economic growth, focusing on the economics of technological change and the modeling of climate-change economics. These topics might at first view seem to live in separate universes. The truth is that they are **manifestations of the same fundamental phenomenon, which is a global externality or global public good**. Both involve science and technology, and both involve the inability of private markets to provide an efficient allocation of resources.“ (p. 1991, emphasis by I.P.)

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Nobel Prize Speech AER 2019 (II)

Nordhaus points out that the climate problem is still a long way from a solution.

William D. Nordhaus

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„Technological change raised humans out of Stone Age living standards. Climate change threatens, in the most extreme scenarios, to return us economically whence we came. Humans clearly have succeeded in harnessing new technologies. But **humans are clearly failing, so far, to address climate change**."
(p. 1991, emphasis by I.P.)

„There are no effective international agreements as of 2019 to limit the emissions of carbon dioxide (CO_2) and other greenhouse gases."
(p. 1994)

Nobel Prize Speech AER 2019 (III)

Nordhaus puts the climate problem in the context of global public goods:

William D. Nordhaus

„The theory of public goods applies as well to climate change. Here, we are speaking of a negative externality or “public bad” in the form of greenhouse-gas (GHG) emissions rather than a public good of improved knowledge. **Climate change is a particularly thorny externality because it is global.** Global externalities, whose impacts are indivisibly spread around the entire world, are not new. In earlier centuries, countries faced religious conflicts, marauding armies, and the spread of infectious diseases such as the plague. In the modern world, the older global challenges have not disappeared, while new ones have arisen—including not only global warming but others such as the threat of nuclear proliferation, international financial crises, and the growing threat of cyberwarfare. **Global externalities are different from local or national public goods because they resist the control of both markets and national governments**“.
(p. 1992, emphasis by I.P.)

Nobel Prize Speech AER 2019 (IV)

Nordhaus emphasizes two dimensions in which the climate problem is exceptional: in the cross-sectional dimension, it concerns the everyday life of all people currently living. In the longitudinal dimension it extends over the coming centuries.

William D. Nordhaus

„**Global warming is the most significant of all environmental externalities.** It menaces our planet and looms over our future like a Colossus … It is particularly pernicious because it involves so many activities of daily life, affects the entire planet, does so for decades and even centuries, and, most of all, because none of us acting individually can do anything to slow the changes.“
(p. 1992, emphasis by I.P.)

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Nobel Prize Speech AER 2019 (V)

Nordhaus identifies the climate problem as a governance problem: it requires collective action on an unprecedented scale.

William D. Nordhaus

„**Governance is a central issue in dealing with global externalities because effective management requires the concerted action of major countries**. … It must be emphasized that global environmental concerns raise completely different governance issues from national environmental concerns. For national public goods, the problems largely involve making the national political institutions responsive to the diffuse national public interest rather than concentrated national private interests—responsive to public health rather than private profits. For global public goods, the problems arise because individual nations enjoy only a small fraction of the benefits of their actions. In other words, even the most democratic of nations acting noncooperatively in its own interest would take minimal action because most of the benefits of cooperation spill out to other nations. **It is only by designing, implementing, and enforcing *cooperative multinational policies* that nations can ensure effective climate-change policies.**“ (p. 1992 f., emphasis in original)

Nobel Prize Speech AER 2019 (VI)

Nordhaus characterizes climate economics as a theory program that depends on consilience.

William D. Nordhaus

„Many areas of the natural and social sciences involve complex systems that link together multiple physical or intellectual sectors. This is particularly true for **environmental problems**, which **have deep roots in the natural sciences but also require social and policy sciences to solve in an effective and efficient manner**. A good example, which will be the subject of this essay, is climate-change science and policy, which involve a wide variety of disciplines such as atmospheric chemistry and climate science, ecology, economics, political science, game theory, and international law.“
(p. 1993 f., emphasis by I.P.)

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Nobel Prize Speech AER 2019 (VII)

Nordhaus illustrates his view of the climate problem with the help of a metaphor:

William D. Nordhaus

„[G]lobal warming is a major threat to humans and the natural world. I have used the metaphor that climate change is like a vast casino. By this, I mean that **economic growth is producing unintended but dangerous changes in the climate and earth systems**. These changes will lead to unforeseeable consequences. We are rolling the climatic dice, the outcome will produce surprises, and some of them are likely to be perilous. The message is that we need not roll the climatic dice—that there is time to turn around and walk back out of the casino.“
(p. 1996, emphasis by I.P.)

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Nobel Prize Speech AER 2019 (VIII)

Nordhaus summarizes the scientific findings in a concise way: GHG stands for „Greenhouse Gases“

William D. Nordhaus

„The most important and enduring source of global warming is the burning of fossil (or carbon-based) fuels such as coal, oil, and natural gas, which leads to emissions of carbon dioxide (CO_2). GHGs such as CO_2 accumulate in the atmosphere and stay there for a long time.

Higher atmospheric concentrations of GHGs lead to surface warming of the land and oceans. The initial warming effects are amplified through feedback effects in the atmosphere, oceans, and ice sheets. The resulting impacts include changes in temperatures as well as impacts on temperature extremes, precipitation patterns, storm location and frequency, snow packs, river runoff, water availability, and ice sheets. Each of these will have profound impacts on biological and human activities that are sensitive to the climate.“
(p. 1996)

Nobel Prize Speech AER 2019 (IX)

Nordhaus writes about the horizon of expectation until the end of this century: without climate policy, the earth will warm significantly.

William D. Nordhaus

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„Past climates—varying from ice-free conditions to snowball earth—were driven by natural forces. Current climate change is increasingly caused by human activities such as emissions of greenhouse gases (GHGs). CO_2 concentrations in the atmosphere were 280 parts per million (ppm) in 1750 and reached more than 413 ppm in 2018. Models project that unless forceful steps are taken to reduce fossil fuel use, concentrations of CO_2 will reach 700–900 ppm by 2100. According to climate models, this will lead to a warming averaged over the globe in the range of 3° –5° C by 2100, with significant further warming after that. So unless there are efforts to curb or offset CO_2 emissions sharply, we can expect continued accumulations of CO_2 emissions in the atmosphere, and the resulting global warming with all its consequences.“
(p. 1996)

Nobel Prize Speech AER 2019 (X)

Nordhaus compares studies on abatement costs (of avoiding GHG emissions).

William D. Nordhaus

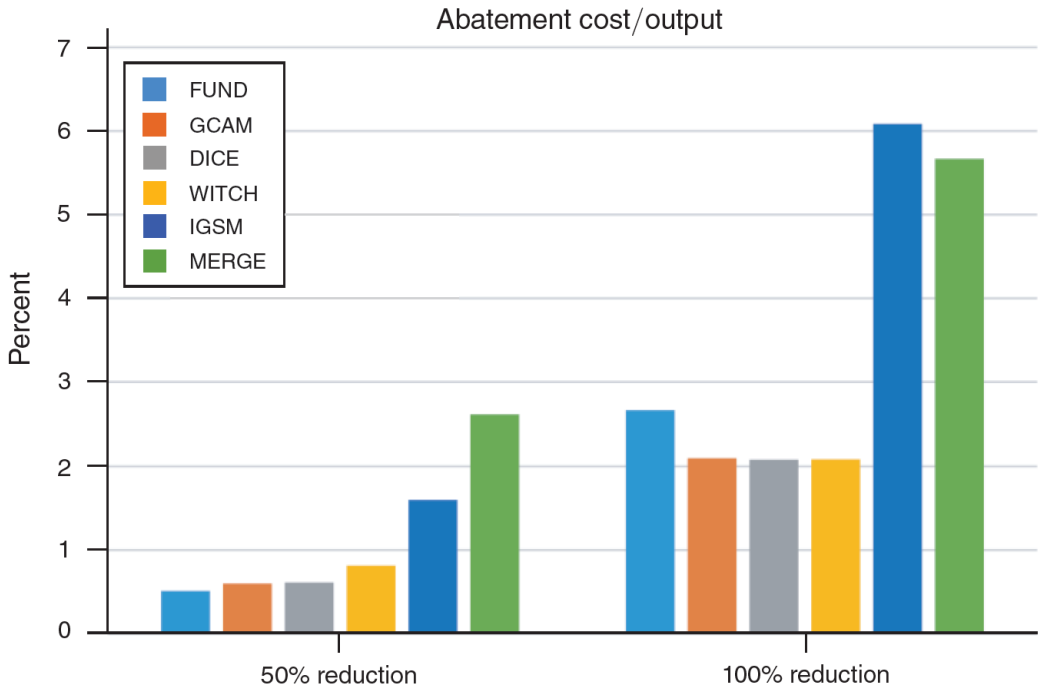

FIGURE 4. ABATEMENT COSTS, SIX STUDIES

Notes: The six models as well as the methods are described in Gillingham et al. (2018). Note that the policies are harmonized across countries and assume efficient polices and 100 percent participation.

Nobel Prize Speech AER 2019 (XI)

Nordhaus writes:

William D. Nordhaus

„These estimates come from a multi-model study that examines the costs of reducing emissions for different levels of reduction. The models differ on many dimensions such as resources, demand, growth, and the role of renewables. **Moreover, these estimates assume efficient policies and harmonized prices, with 100 percent participation of countries.** Realistic assumptions about policies and participation would raise the cost substantially, perhaps by a factor of two, depending on the details.

The figure shows the estimated costs for a 50 percent reduction and a 100 percent reduction. **The average cost is slightly above 1 percent of output for a 50 percent reduction and 3.5 percent of output for zero emissions.** It should be emphasized that the estimates for major reductions are highly speculative. Indeed, zero net emissions is unlikely to be feasible with today's technologies. However, the models give some sense of the range of costs for reducing emissions as estimated by today's energy models." (p. 1998; emphasis by I.P.)

Nobel Prize Speech AER 2019 (XII)

Nordhaus gives the following overview of impact studies:

William D. Nordhaus

„In the DICE model, the concept of damages includes non-market as well as market, and it has a correction for an insurance premium for high-consequence, low-probability events. **In the 2016 model, damages are estimated to be 2 percent of output at a 3° C global warming and 8 percent of output with 6° C warming.** But other summaries are all over the map. A recent meta-analysis by Howard and Sterner (2017) finds high estimates, with their preferred damage estimate being approximately 3.5 times the damages underlying the DICE model.“
(p. 2000, emphasis by I.P.)

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Nobel Prize Speech AER 2019 (XIII)

Nordhaus opposes the political practice of setting arbitrary temperature targets for global climate policy. Instead, he prefers cost-benefit analyses.

William D. Nordhaus

„However attractive a temperature target may be as an aspirational goal, **the target approach is questionable because it ignores the costs of attaining the goals**. If, for example, attaining the 1.5° C goal would require deep reductions in living standards in poor nations, then the policy would be the equivalent of burning down the village to save it. If attaining the low-temperature path turns out to be easy, then of course we should aim for it.

These points lead to an approach known as **cost-benefit analysis**, in which climate policy is set by balancing costs and benefits. Cost-benefit approaches pose deep problems … because they require putting all changes, plus and minus, into a common metric. Moreover, many impacts are ones that may be difficult to measure, or ones that we may be reluctant to monetize. However, in the view of most economists, **balancing of costs and benefits is the most satisfactory way to develop climate policy**.“ (p. 2001; emphasis by I.P.)

Nobel Prize Speech AER 2019 (XIV)

Nordhaus summarizes the literature of integrated assessment models as follows:

William D. Nordhaus

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- „One major finding of integrated assessment models is that policies to slow emissions should be introduced *as soon as possible*.
- A second finding is *uniformity of price*—that the most effective policies are ones that equalize the incremental or marginal costs of reducing emissions. Equivalently, in a market context, that means that the carbon prices should be equalized in every sector and in every country.
- Effective policies should have the highest possible *participation*; that is, the maximum number of countries and sectors should be on board as soon as possible. Free-riding should be discouraged.
- Finally, an effective policy is one that *ramps up over time*—both to give people time to adapt to a high-carbon-price world and to tighten the screws increasingly on carbon emissions.

Most experts agree on these central principles—universal participation, equalizing marginal costs or carbon prices in all uses in a given year, full participation, and increasing stringency over time. However, experts disagree on the stringency of policies.“
(p. 2002, emphasis in original)

Nobel Prize Speech AER 2019 (XV)

With his DICE model, Nordhaus simulates different scenarios:

William D. Nordhaus

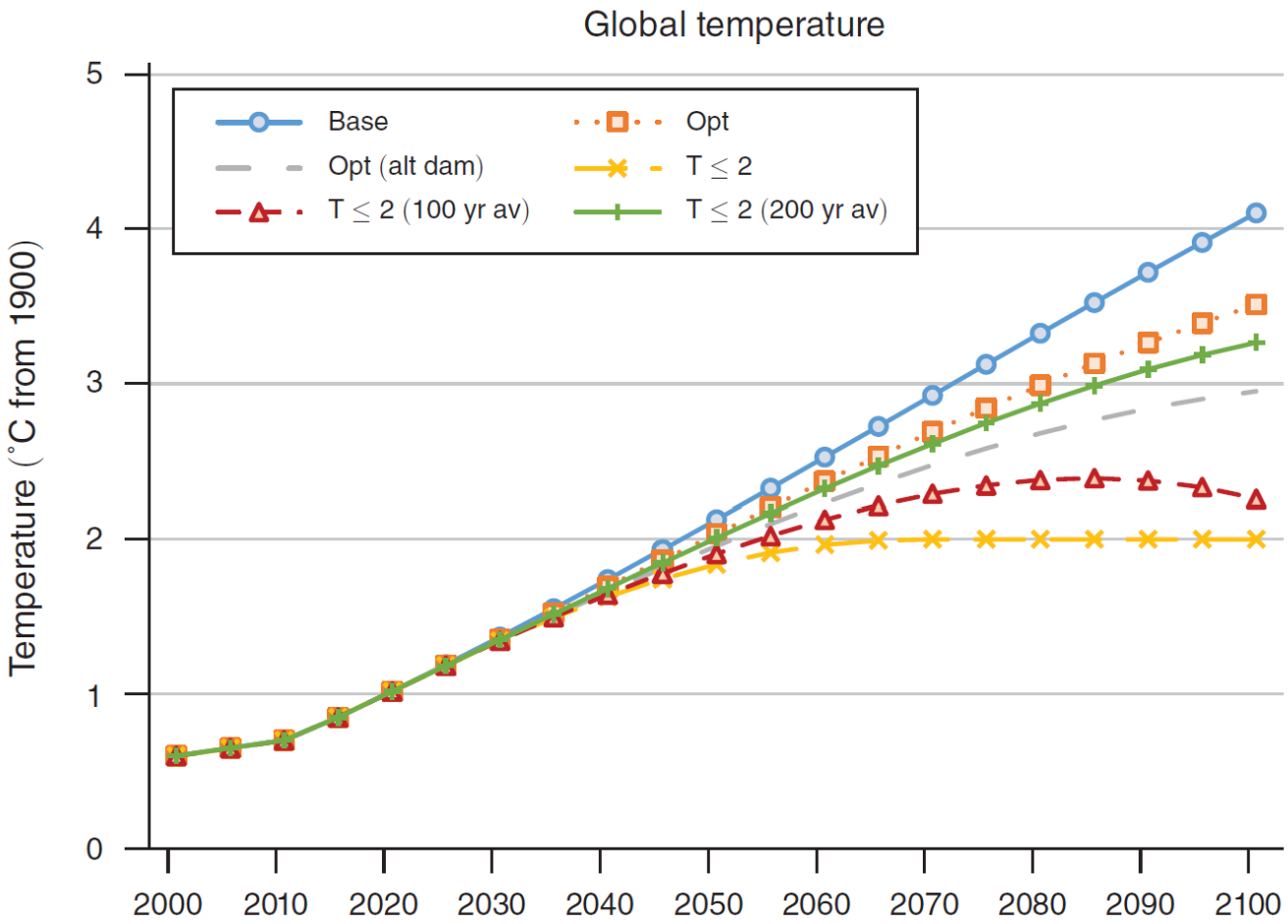

FIGURE 5. TEMPERATURE TRAJECTORIES FOR DIFFERENT OBJECTIVES

Nobel Prize Speech AER 2019 (XVI)

He writes:

William D. Nordhaus

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„These simulations estimated the temperature trajectories for six sets of cases: no policy, a cost-benefit optimum with standard damages and an alternative set of damages, and three temperature-limiting strategies where the limit is 2° C. The temperature limits are a hard cap of 2° C and two paths where temperature is limited over a 100-year and a 200-year averaging period. Figure 5 shows the associated temperature trajectories. The base path (which is essentially the path the globe is following) continues to have rising temperature, passing 4° C by 2100. In the DICE model, it is essentially **infeasible to attain the stringent temperature target of 1.5° C, and the 2° C path requires negative emissions in the near term**. Another finding, much more controversial, is that the **cost-benefit optimum rises to over 3° C in 2100**—much higher than the international policy targets. Even with the much more pessimistic alternative damage function, the temperature path rises to 3° C in 2100.“
(p. 2002, emphasis by I.P.)

Nobel Prize Speech AER 2019 (XVII)

Nordhaus writes about pricing CO_2:

William D. Nordhaus

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„Economics points to one inconvenient truth about climate-change policy: **for any policy to be effective, it must raise the market price of CO_2 and other GHG emissions**. Putting a price on emissions corrects for the underpricing of the externality in the marketplace. Prices can be raised by putting a regulatory limit on the amount of allowable emissions and allowing trading ("cap-and-trade"), or by levying a tax on carbon emissions (a "carbon tax").
Raising the price on carbon will achieve four goals. **First**, it will provide signals to consumers about which goods and services are carbon-intensive and should therefore be used more sparingly. **Second**, it will provide signals to producers about which inputs are carbon-intensive (such as coal and oil) and which are low-carbon (such as natural gas or wind power), thereby inducing firms to move to low-carbon technologies. **Third**, it will give market incentives for inventors, innovators, and investment bankers to invent, fund, develop, and commercialize new low-carbon products and processes. **Finally**, a carbon price will economize on the information required to undertake all these tasks."
(p. 2003; emphasis by I.P.)

Nobel Prize Speech AER 2019 (XVIII)

Nordhaus on cost estimates of the negative externality of CO_2 :

William D. Nordhaus

„[O]ne of the most amazing results of IAMs is the ability to **calculate the optimal carbon price. This is now called the "social cost of carbon" or SCC**. This concept represents the economic cost caused by an additional ton of carbon dioxide emissions (or more succinctly carbon) or its equivalent. In a more precise definition, it is the change in the discounted value of consumption denominated in terms of current consumption per unit of additional current emissions. **In an optimized climate policy** (abstracting away from various distortions), **the social cost of carbon will equal the carbon price or the carbon tax**."
(p. 1991, emphasis by I.P.)

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Nobel Prize Speech AER 2019 (XIX)

Nordhaus writes about the SSC (Social Cost of Carbon) values of his DICE model:

William D. Nordhaus

„Estimates of the SCC differ across models and vintages (see Nordhaus 2014, 2017). Table 1 shows calculations for the most recent published version of the DICE model, DICE-2016R3. **The optimal carbon price is estimated to be $36/ton CO_2 in the standard model.** However, the SCC varies greatly depending upon the policy target. For both damage functions and less ambitious temperature targets, the SCC is in the $43–$108 per ton range for 2020. **For targets of 2° C and below with short averaging periods, the SCC is in the $158–$279 per ton range for 2020.**“
(p. 2004, emphasis by I.P.)

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Nobel Prize Speech AER 2019 (XX)

Nordhaus: Where do we stand?

William D. Nordhaus

„The natural question is, “How are we doing? What is the current market price of carbon? Is it near the DICE model finding of $36/ton? Or near the temperature-limiting level of $100–$250 per ton?”

The answer is that **the world is nowhere near the lowest of these figures**. The actual global carbon price is at most one-tenth of that. Carbon prices in the United States and most other countries are virtually zero, so there is a huge gap between reality and global aspirations. Whether we adopt the economists’ approach of cost-benefit analysis, or the Paris Accord’s target of 2° C, we must be realistic and realize that the world is not close to attaining those goals. **Effective policies have not been introduced, either in any major country or for the world as a whole**.“
(p. 2005 f.; emphasis by I.P.)

Nobel Prize Speech AER 2019 (XXI)

Nordhaus once again emphasises the governance dimension:

William D. Nordhaus

„Why have *global* policies on climate change been so ineffective compared to many other *national* policies (for pollution, public health, and water quality as examples)? Why have landmark agreements such as the Kyoto Protocol and the Paris Accord failed to make a dent on emissions trends? The reason is free-riding. This is the tendency for countries to seek their own national interests.“
(S. 2006, emphasis in original)

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Nobel Prize Speech AER 2019 (XXII)

Nordhaus points to the structure of the game:

William D. Nordhaus

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„Some contests are zero-sum games, as when nations compete in the Olympics. Others are negative-sum games, as when nations go to war. However, **many global issues are cooperative games, where the sum of nations' incomes or welfare is improved if countries step away from nationalistic policies and take cooperative policies.** The most important example of cooperation is treaties and alliances that have led to the sharp decline in the lethality of battle deaths in recent years. Another important example is the emergence of low-tariff regimes in most countries. By reducing barriers to trade, all nations have seen an improvement in their living standards.
However, alongside the successful outcomes lie a string of failures. Nations have failed to stop nuclear proliferation, overfishing in the oceans, littering of space, and transnational cybercrime. **In many of these failures, we see the syndrome of free-riding.** When there are international efforts to resolve a global problem, some nations inevitably contribute very little."
(p. 2006 f.; emphasis by I.P.)

Nobel Prize Speech AER 2019 (XXIII)

Nordhaus explains this with the example of NATO:

William D. Nordhaus

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„For example, the North Atlantic Treaty Organization (NATO) defends its members against attacks. Countries agree to participate in the costs. However, the United States in 2018 spent 70 percent of the total defense spending. Many countries spend only a tiny fraction of their GDP on defense, Luxembourg being the extreme case, spending only 0.5 percent of GDP on defense. **Countries that do not participate in a multiparty agreement on public goods get a free ride on the costly investments of other countries.**“
(p. 2007; emphasis by I.P.)

Nobel Prize Speech AER 2019 (XXIV)

Nordhaus explains the incentive problem of this social dilemma:

William D. Nordhaus

„**Free-riding is a major hurdle in the solution of global externalities**, and it lies at the heart of the failure to deal with climate change. No single country has an incentive to cut its emissions sharply. Suppose that when country A spends $100 on abatement, global damages decline by $200. However, country A might get only $20 of the benefits, so it would tend to decline the responsibility. Hence, if there is an agreement, **nations have a strong incentive not to participate**. If they do participate, there is a further incentive to miss ambitious objectives. The outcome is a noncooperative free-riding equilibrium in which few countries undertake strong climate-change policies—a situation that closely resembles the current international policy environment.

The message is, **nations speak loudly but carry no stick at all**.“ (S. 2007; emphasis by I.P.)

Nobel Prize Speech AER 2019 (XXV)

Nordhaus points to two special factors that make the climate problem so difficult:

William D. Nordhaus

„In the case of climate change, there are additional factors that impede a strong agreement. There is a tendency for the current generation to ride free by pushing the costs of dealing with climate change onto future generations. **Generational free-riding** occurs because most of the benefits of costly emissions reductions today would accrue many decades in the future.

The double free-riding difficulties are aggravated by **interest groups** that **muddy the water** by providing misleading analyses of climate science and economic costs. Contrarians highlight anomalies and unresolved scientific questions while ignoring the strong evidence supporting the underlying science and current projections of climate change.“
(p. 2007, emphasis by I.P.)

Nobel Prize Speech AER 2019 (XXVI)

Nordhaus writes about the Kyoto Protocol:

William D. Nordhaus

„The Kyoto Protocol was an ambitious attempt to construct an international architecture to harmonize the policies of different countries. But countries did not find it economically advantageous to make the necessary emissions reductions. **The United States withdrew very early.** The Protocol did not attract any new participants from middle-income and developing countries. As a result, there was significant attrition in the coverage of emissions under the Kyoto Protocol.

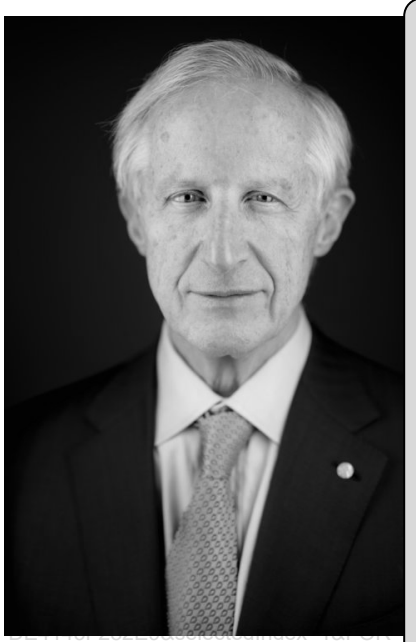
Also, emissions grew more rapidly in noncovered countries, particularly developing countries like China. The protocol as first designed would have covered two-thirds of global emissions in 1990, but the actual scope in 2012 was barely one-fifth of world emissions. It died a quiet death, mourned by few, on December 31, 2012. **Kyoto was a club that no country cared to join.**“

(p. 2008, emphasis by I.P.)

Nobel Prize Speech AER 2019 (XXVII)

Nordhaus writes about the Paris Agreement:

William D. Nordhaus



„The Kyoto Protocol was followed by the Paris Accord of 2015. This agreement led to a target for climate policy to limit climate change to 2° C above pre-industrial levels. The Paris Agreement requires all countries to make their best efforts through "nationally determined contributions." … An important point is that the Paris Accord is *uncoordinated* and *voluntary*. It is uncoordinated in the sense that its policies, if undertaken, would not limit climate change to the target 2° C. Moreover, while countries agree to make best efforts, there are no penalties if they withdraw or fail to meet their obligations. The world is therefore just where it stood in 1994, recognizing the dangers of climate change without effective policies to stop it."
(p. 2008, emphasis in original)

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Nobel Prize Speech AER 2019 (XXVIII)

Nordhaus concludes that so far climate policy has had little effect. He makes it clear that the trend towards decarbonization (a) has hardly been changed by climate policy and (b) lags far behind the needs.

William D. Nordhaus

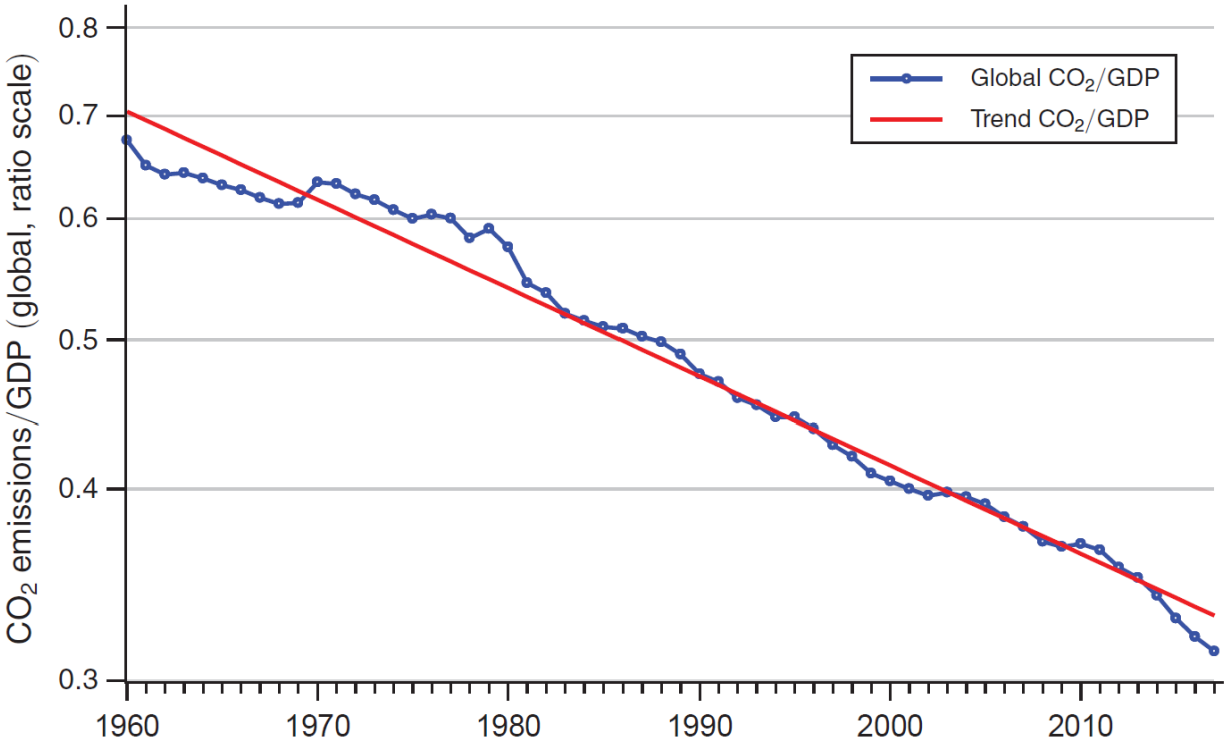
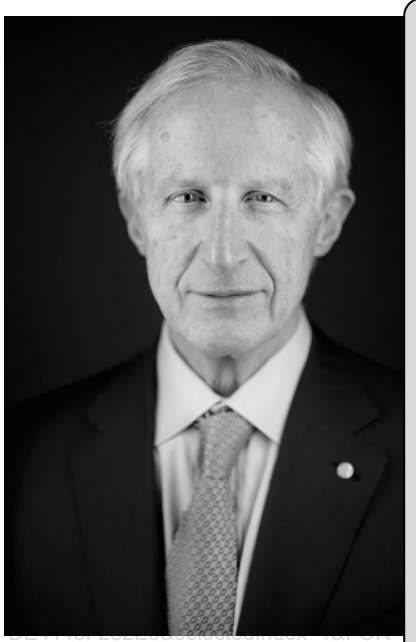


FIGURE 6. TREND IN GLOBAL DECARBONIZATION, 1980–2017

Nobel Prize Speech AER 2019 (XXIX)

Nordhaus proposes a climate club: States agree on carbon pricing and punish freeriders.

William D. Nordhaus



„So what is the idea of a climate club? The notion is that *nations can overcome the syndrome of free-riding in international climate agreements if they adopt the club model rather than voluntary arrangements.* A climate club is an agreement by participating countries to undertake harmonized emissions reductions, but the central new feature is that nations would be penalized if they did not meet their obligations. The club proposed here centers on an "international target carbon price" that is the focal provision of the agreement. For example, countries might agree that each country will implement policies that produce a minimum domestic carbon price of \$25 per ton of CO_2."
(p. 2010 f., emphasis in original)

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Nobel Prize Speech AER 2019 (XXX)

Nordhaus draws the following conclusion:

William D. Nordhaus

„First, people around the world need to understand and accept the gravity of the impacts of global warming on the human and natural world. … Second, nations must establish policies that raise the price of CO_2 and other greenhouse-gas emissions. … Moreover, we need to ensure that actions are global and not just national or local. … Finally, it is clear that rapid technological change in the energy sector is central to the transition to a low-carbon economy. … [G]overnments must support and the private sector must intensively pursue low-carbon, zero-carbon, and even negative-carbon technologies.

Therefore, knowledge, proper pricing, coordinated action, and new technologies—these are the steps that are necessary if we are to tame this Colossus that threatens our world."
(p. 2013)

Summary

Nordhaus is a prominent representative of climate economics:

William D. Nordhaus

1. Climate protection is a global public good
2. We are currently very far from solving this problem because we are taking the wrong approach.
3. The political goals are unrealistic and overambitious
4. The measures taken so far are hardly effective
5. We need consistent pricing of greenhouse gases
6. A whole new governance structure is needed to ensure effective climate protection as a global public good
7. Climate clubs would be a possible solution

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Update 2024

Barrage, L., & Nordhaus, W. (2024). Policies, projections, and the social cost of carbon: Results from the DICE-2023 model. Proceedings of the National Academy of Sciences, 121(13), e2312030121.

William D. Nordhaus

„We conclude with three results relevant for climate policy. First, both current policies (base run) and the extended Paris Accord fall short of limiting global warming to 2° C or to the cost–benefit optimal level. Second, the economic stakes in global climate policy are substantial, with estimated net present value of economic benefits around $120 trillion from the cost–benefit optimal policy. Third, once differences in discounting are considered, the baseline DICE-2023 estimate of the social cost of carbon ($66/tCO2 for 2020) aligns closely with other recent estimates“.

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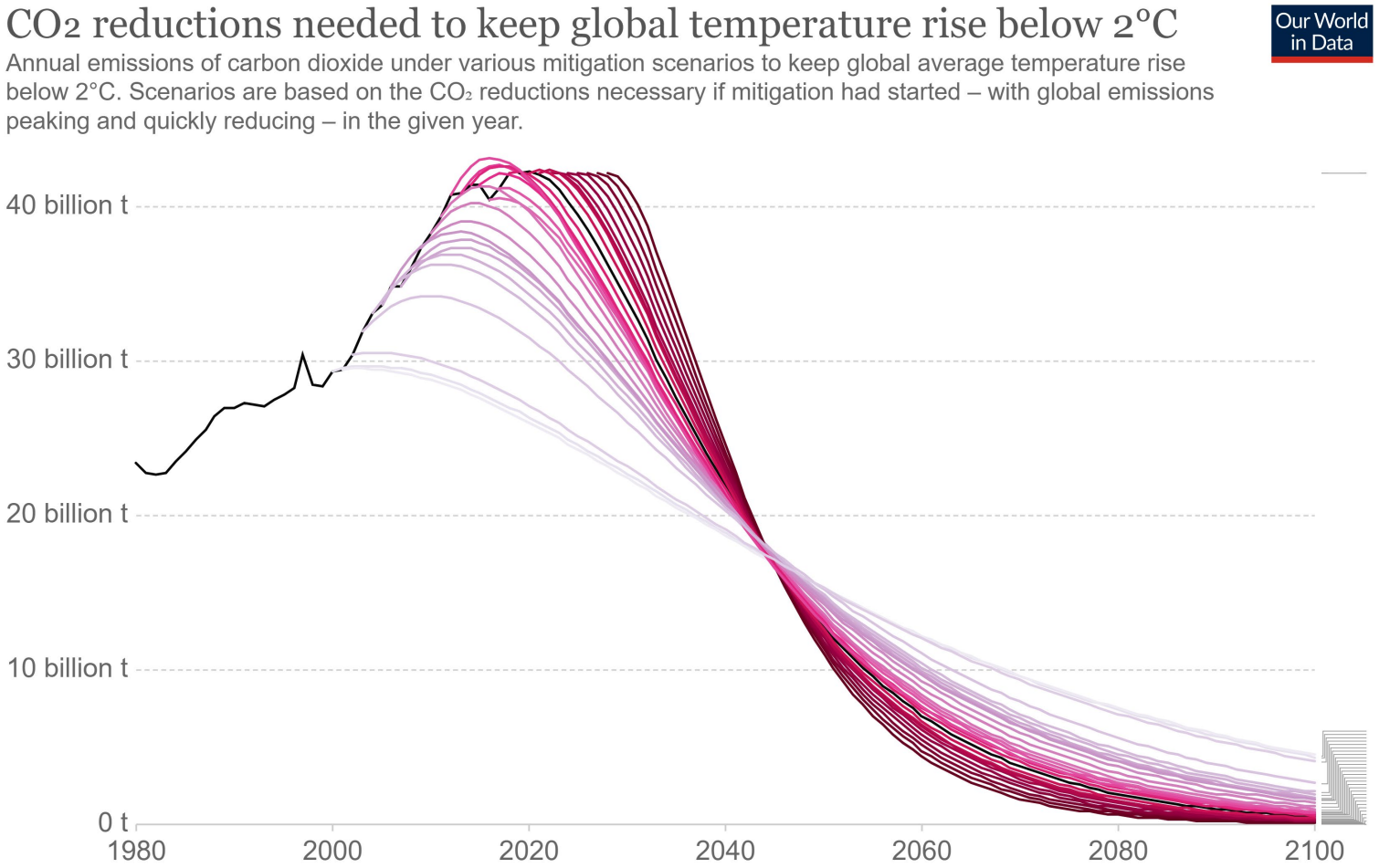
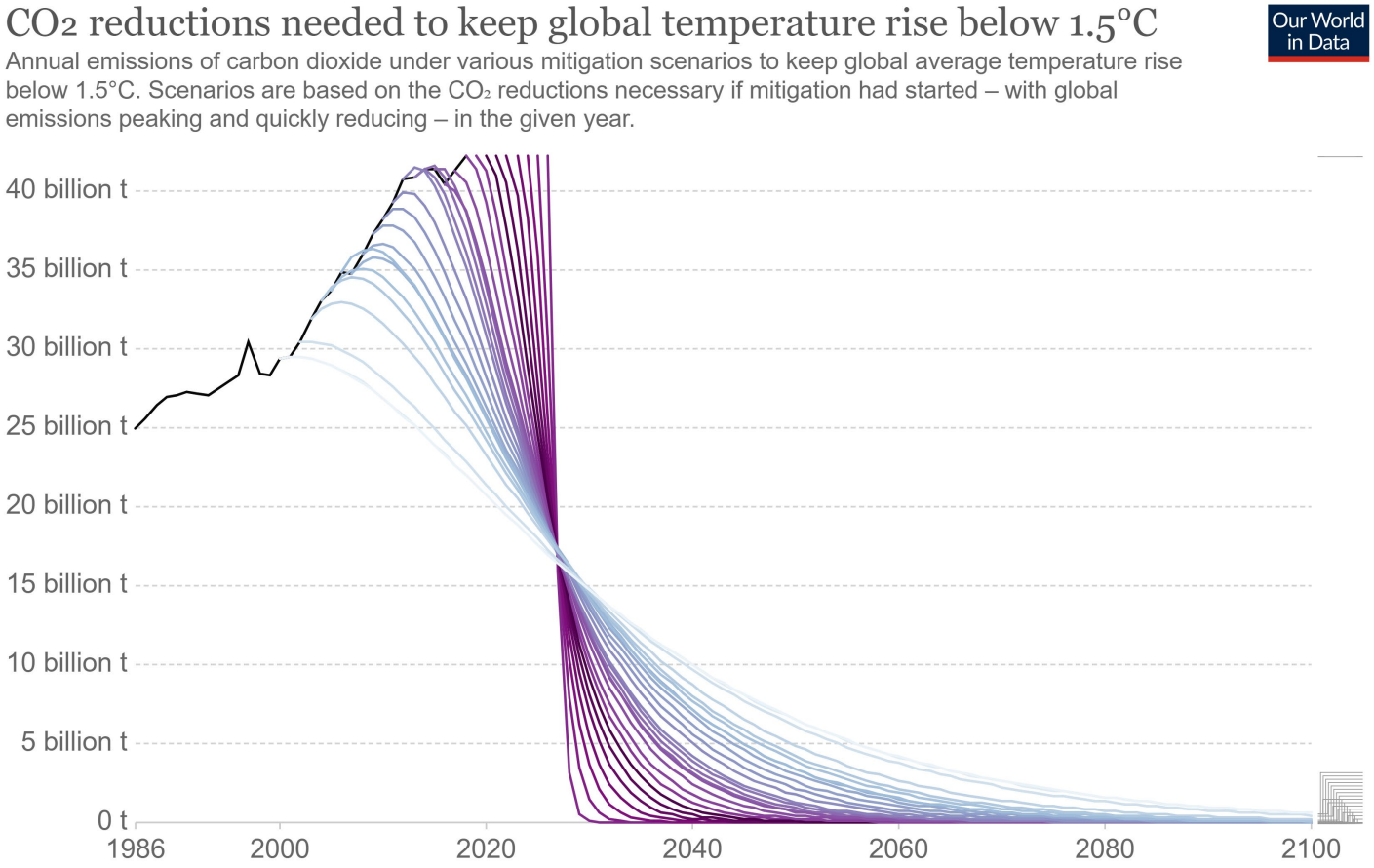
Structure of Today‘s Lecture

1. The Open Letter
2. Background information on the climate problem
3. The approach by Nordhaus
4. Further elaboration of the Nordhaus approach

Reduction Scenarios for 2° C



Reduction Scenarios for 1,5° C



Impact Estimates for Climate Damage: Meta-Study

Source: Nordhaus und Moffat (2017; S. 15) – http://www.nber.org/papers/w23646

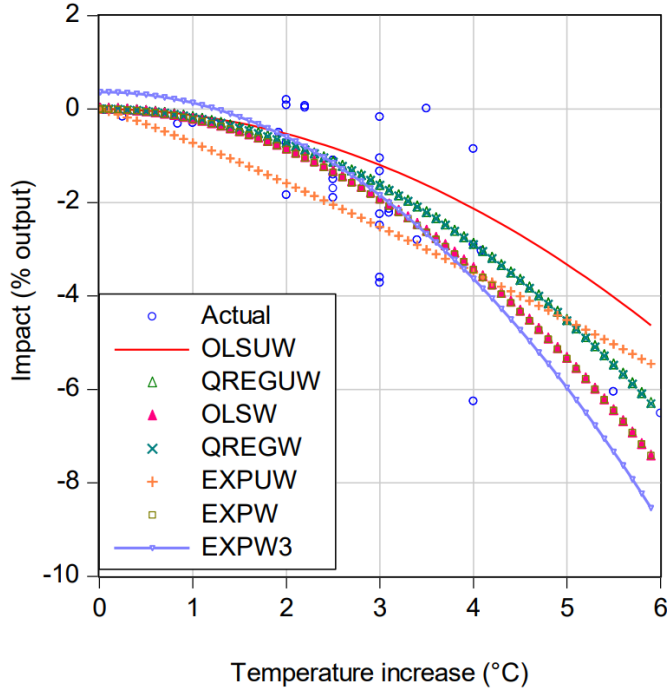


Figure 2. Scatter plot of actual and alternative specifications[viii]

Key for predicted is OLS = ordinary least squares; QREG = median regression; UW = unweighted; W = weighted; EXP = with fitted exponent. EXPW3 adds a linear term to the polynomial. Impact = from studies.

„The authors' preferred regression is the median quadratic weighted regression. The impact is -1.63 (+ 1.77) % of income at 3° C warming and -6.53 (+ 1.95) % of income at a 6° C warming. Note that the errors reported here represent forecast errors in the preferred equation. If we include all specifications …, the impact is -1.8 (+ 0.74) % of income at 3° C warming and -6.7 (+ 3.0) % of income at a 6° C warming. We note as well that the weighted regressions give larger negative predictions (damages) than the unweighted regressions.

We make a judgmental adjustment of 25% to cover unquantified sectors. This adjustment is described in detail in Nordhaus and Sztorc (2013) and in the Appendix. With this adjustment, the estimated impact is -2.04 (+ 2.21) % of income at 3° C warming and -8.16 (+ 2.43) % of income at a 6° C warming." (p. 15 f.)

An Alternative View on Climate Economics (I)

Unlike Nordhaus, Howard and Sterner (2017; p. 200) produce higher estimates of climate damage. DOI 10.1007/s10640-017-0166-z

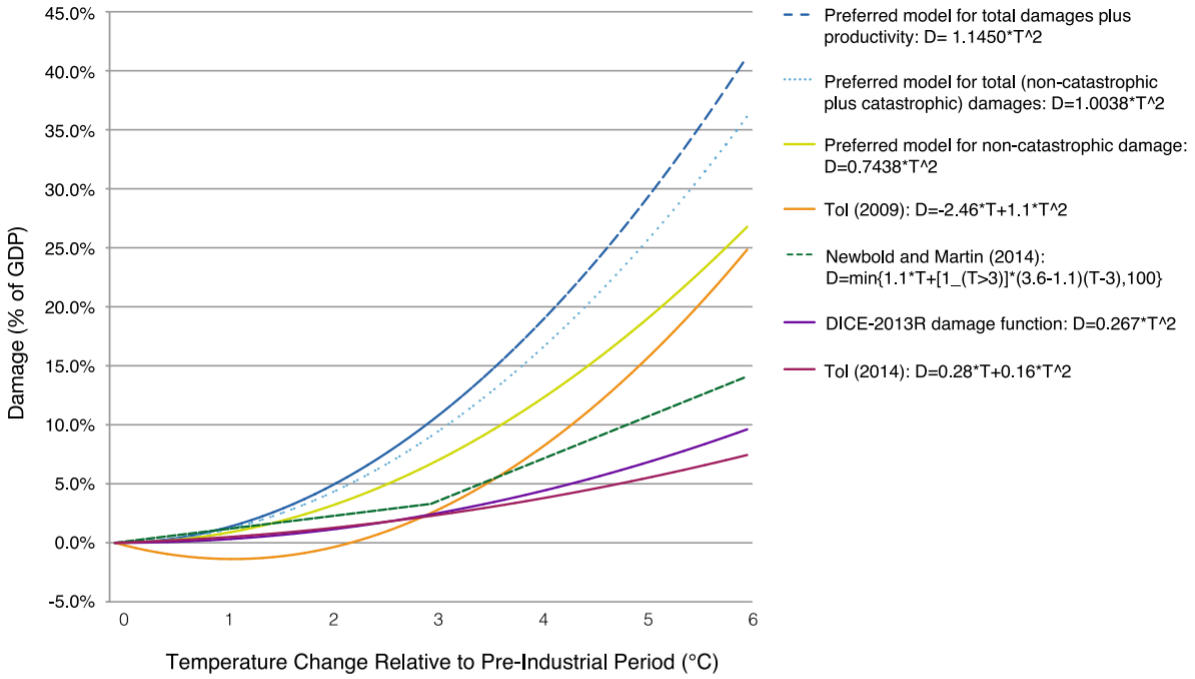


Fig. 1 Temperature–damage relationship for previous meta-analyses and the preferred regression [regression (4) on Table 2] from our study. This figure compares damage functions corresponding to previous meta-analyses to damage functions corresponding to the preferred regression [i.e., regression (4) in Table 2]. Following Nordhaus (2013), we multiply the coefficients of the preferred regression specification corresponding to non-catastrophic impacts (*t*2 and *prod_t*2) by 25% when constructing the damage functions to account for potential omitted non-catastrophic impacts of climate change

An Alternative View on Climate Economics (II)

Unlike Nordhaus, Howard and Sterner (2017; p. 218) produce higher estimates for negative CO_2 externalities. DOI 10.1007/s10640-017-0166-z

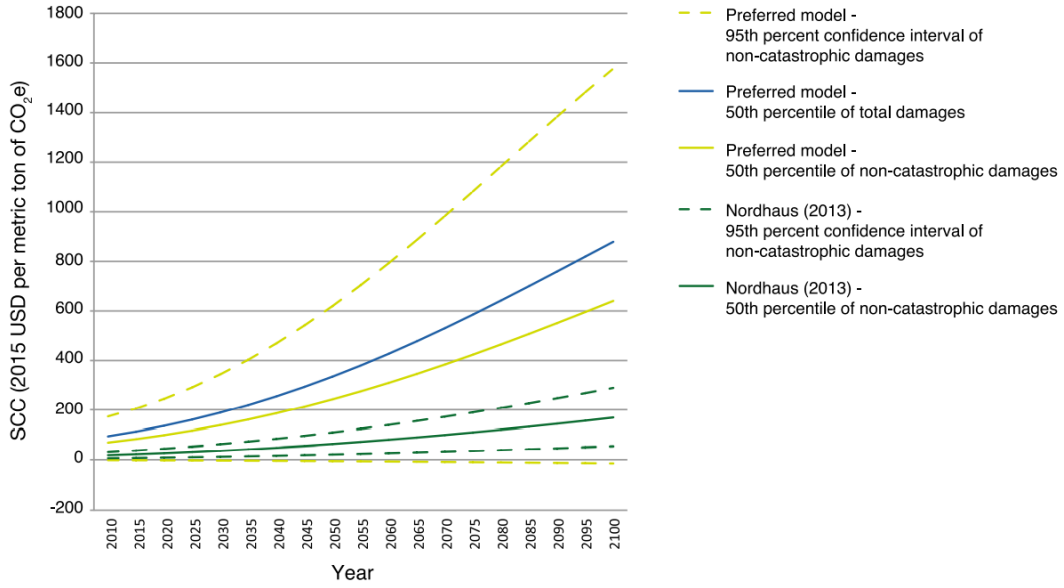


Fig. 3 Social cost of carbon over time calculated using Nordhaus (2013) and the preferred regression [regression (4) in Table 2], including climate impacts on economic productivity in non-catastrophic climate impacts. This figure compares the social cost of carbon over time from baseline runs of DICE-2013R (Nordhaus 2013) to runs replacing the DICE damage function with the preferred regression [i.e., Regression (4) in Table 2] with productivity impacts included. Following Nordhaus (2013), we multiply the coefficients corresponding to non-catastrophic impacts (t2 plus prod_t2) by 25% when constructing the damage functions to account for potential omitted non-catastrophic impacts of climate change. If we excluded productivity impacts in the figure above, it would shift down the damage functions corresponding to the preferred specification and narrow its corresponding 95th percent confidence interval

An Alternative View on Climate Economics (III)

nature climate change

Article

https://doi.org/10.1038/s41558-023-01636-1

New damage curves and multimodel analysis suggest lower optimal temperature

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Check for updates

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Economic analyses of global climate change have been criticized for their poor representation of climate change damages. Here we develop and apply aggregate damage functions in three economic Integrated Assessment Models (IAMs) with different degrees of complexity. The damage functions encompass a wide but still incomplete set of climate change impacts based on physical impact models. We show that with medium estimates for damage functions, global damages are in the range of 10% to 12% of GDP by 2100 in a baseline scenario with 3 °C temperature change, and about 2% in a well-below 2 °C scenario. These damages are much higher than previous estimates in benefit-cost studies, resulting in optimal temperatures below 2 °C with central estimates of damages and discount rates. Moreover, we find a benefit-cost ratio of 1.5 to 3.9, even without considering damages that could not be accounted for, such as biodiversity losses, health and tipping points.

The Practical Benefit of Climate Economics

Source: Tol (2020): The distributional impact of climate change - doi: 10.1111/nyas.14497

Richard S.J. Tol

„Estimates of the economic impact of climate change are important because they form the basis for estimates of the benefits of climate policy and, in the form of the social costs of carbon, directly compare to the costs of greenhouse gas emission reduction. … **The distribution of impacts between countries informs international climate negotiations, especially on the discussion around loss and damage and the implied historical responsibility and liability.** It should also guide the allocation of the monies in the Adaptation Fund and other international development assistance. The distribution of impacts within countries informs the targeting of national adaptation projects and other policy interventions to reduce vulnerability to climate change.“
(p. 1, emphasis by I.P.)

The Economic Dimension of the Climate Problem (I)

Tol (2018): The Economic Impacts of Climate Change – doi: 10.1093/reep/rex027

Richard S.J. Tol

„There are currently 27 published estimates of the total economic impact of climate change (measured in terms of welfare-equivalent income loss) contained in 22 studies … **To put these estimates in context, they indicate that a global mean temperature increase of 2.5° C would make the average person feel as if she had lost 1.3 percent of her income** (1.3 percent is the average of the 11 impact estimates for warming of 2.5° C).“ (p. 5)

The Economic Dimension of the Climate Problem (II)

Tol (2018): The Economic Impacts of Climate Change – doi: 10.1093/reep/rex027

Richard S.J. Tol

Table 1 Estimates of the welfare impact of climate change

Study	Warming (°C)	Impact (% GDP)			
		Best	SD	Low	High
d'Arge 1979	−1.0	−0.6			
Nordhaus 1982	2.5	−3.0		−12.0	5.0
Nordhaus 1991	3.0	−1.0			
Nordhaus 1994b	3.0	−1.3			
Nordhaus 1994a	3.0	−3.6		−21.0	0.0
	6.0	−6.7			
Fankhauser 1995	2.5	−1.4			
Berz undated	2.5	−1.5			
Tol 1995	2.5	−1.9			
Nordhaus and Yang 1996	2.5	−1.4			
Plambeck and Hope 1996	2.5	−2.9		−13.1	−0.5
Mendelsohn et al. 2000	2.5	0.0			
	2.5	0.1			
Nordhaus and Boyer 2000	2.5	−1.5			
Tol 2002	1.0	2.3	1.0		
Maddison 2003	2.5	0.0			
Rehdanz and Maddison 2005	0.6	−0.2			
	1.0	−0.3			
Hope 2006	2.5	−1.0		−3.0	0.0
Nordhaus 2006	3.0	−0.9	0.1		
	3.0	−1.1	0.1		
Nordhaus 2008	3.0	−2.5			
Maddison and Rehdanz 2011	3.2	−5.1			
Bosello et al. 2012	1.9	−0.5			
Roson and van der Mensbrugghe 2012	2.9	−2.1			
	5.4	−6.1			
Nordhaus 2013	2.9	−2.0			

The Economic Dimension of the Climate Problem (III)

Tol (2018): The Economic Impacts of Climate Change – doi: 10.1093/reep/rex027

Richard S.J. Tol

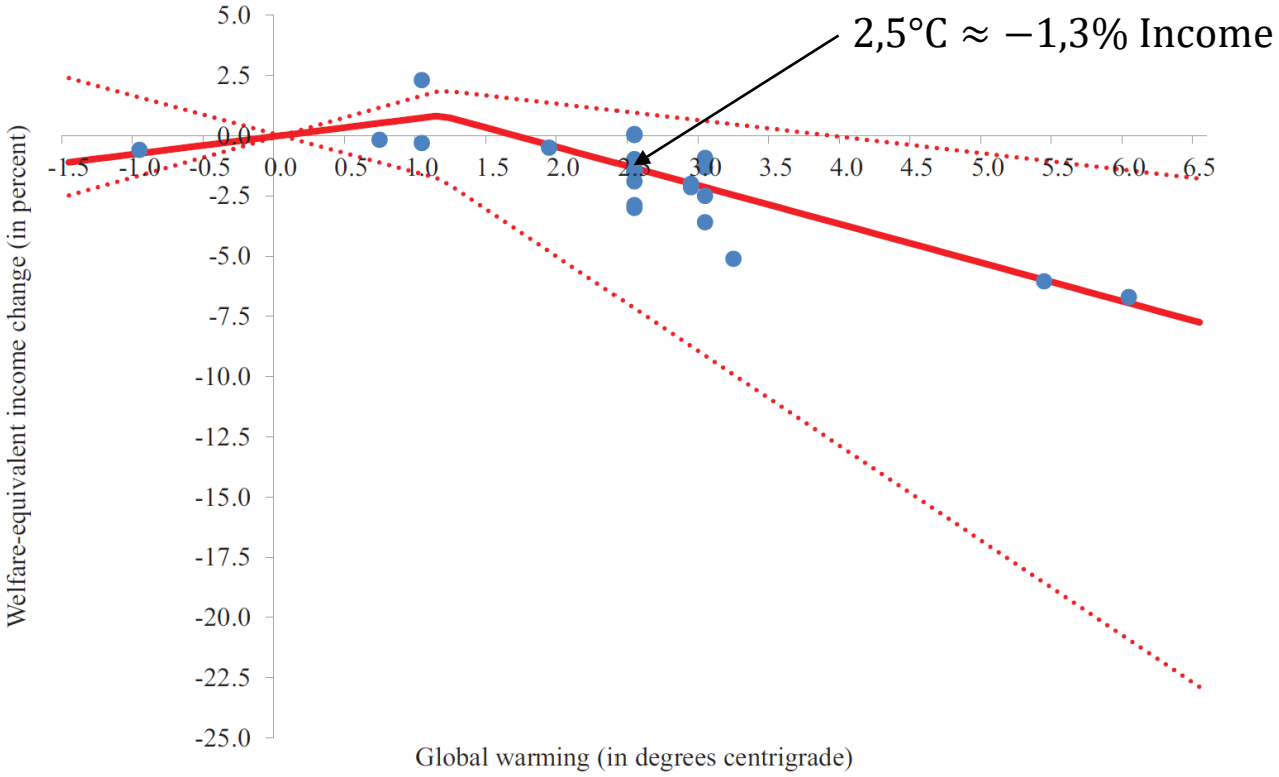

Figure 1 The global total annual impact of climate change

Notes: Impact is expressed in welfare-equivalent income change as a function of the increase in the global annual mean surface air temperature since preindustrial times. The dots represent the estimates reported in table 1, the solid line indicates the best-fit piecewise linear function, and the dotted lines indicate the 95 percent confidence interval.

Source: Data are available at http://users.sussex.ac.uk/~rt220/totalimpactreep.xlsx.

The Economic Dimension of the Climate Problem (IV)

Tol (2018): The Economic Impacts of Climate Change – doi: 10.1093/reep/rex027

Richard S.J. Tol

„Clearly, 27 estimates are a thin basis for drawing definitive conclusions about the total welfare impacts of climate change. Moreover, the 11 estimates for warming of 2.5° C indicate that researchers disagree on the sign of the net impact: 3 estimates are positive and 8 are negative. Thus it is unclear whether climate change will lead to a net welfare gain or loss. At the same time, however, despite the variety of methods used to estimate welfare impacts, researchers agree on the order of magnitude, with the welfare change caused by climate change being equivalent to the welfare change caused by an income change of a few percent. That is, these estimates suggest that a century of climate change is about as good/bad for welfare as a year of economic growth." (p. 5 f.)

„This suggests that there are bigger problems facing humankind than climate change. For example, the people of Greece lost a third of their income in five years' time, arguably due to poor monetary policy. The people of Syria lost even more in a shorter period. Climate change may not even be our biggest environmental problem, as many people are killed by indoor and urban air pollution." (Footnote, p. 6)

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Economic Consequences of Global Warming up to the Year 2200

Source: Tol (2020): The distributional impact of climate change - doi: 10.1111/nyas.14497
„These numbers should be read as follows: a global warming of 2.5 ◦C would make the average person feel as if she had lost 1.3% of her income, and 1.3% is the average of the 11 dots at 2075.“ (p. 2)

Richard S.J. Tol

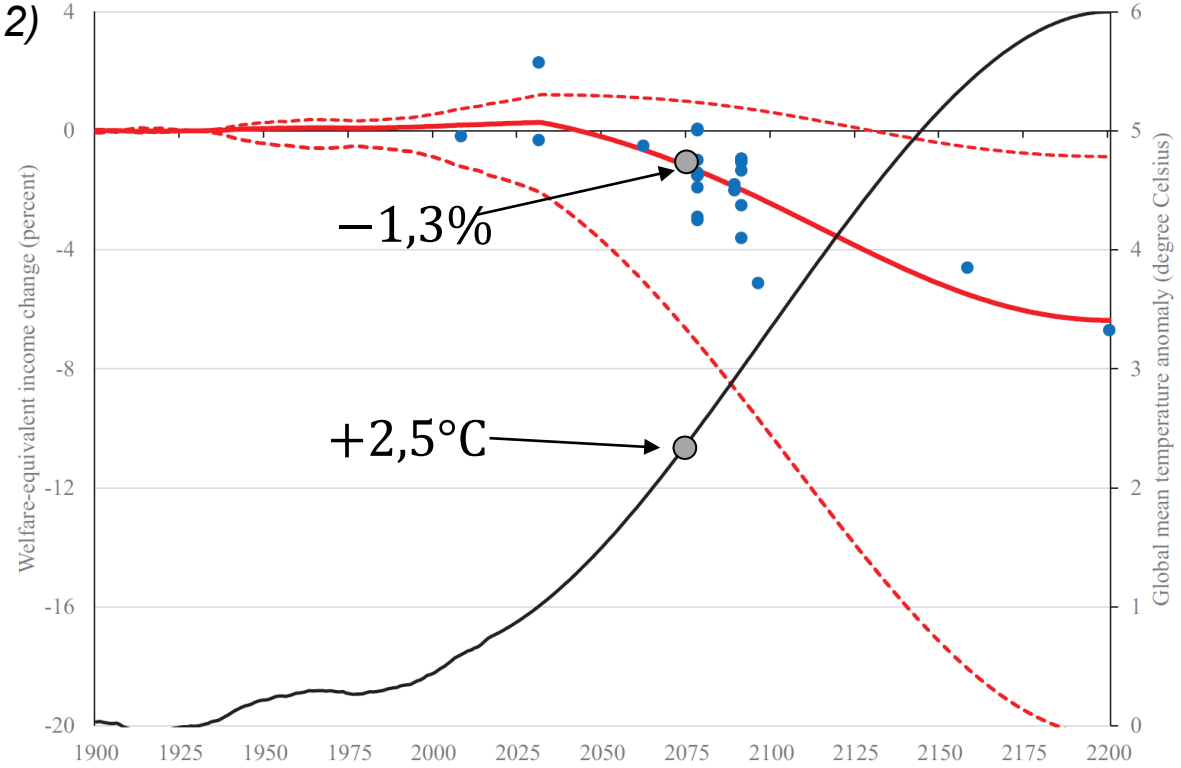


Figure 1. The global total annual impact of climate change over time. Primary estimates are shown as dots. The central, solid line is the Bayesian model average, and the dashed line is the 90% confidence interval. For reference, the observed 30-year average temperature (1900–2018) and the projected temperature (2019–2200, RCP8.5) are shown on the right axis.

Costs and Benefits of Paris Agreement

Source: Tol, Richard S.J. (2023): COSTS AND BENEFITS OF THE PARIS CLIMATE TARGETS, in: Climate Change Economics, Vol. 14, No. 4 (2023), DOI: 10.1142/S2010007823400031

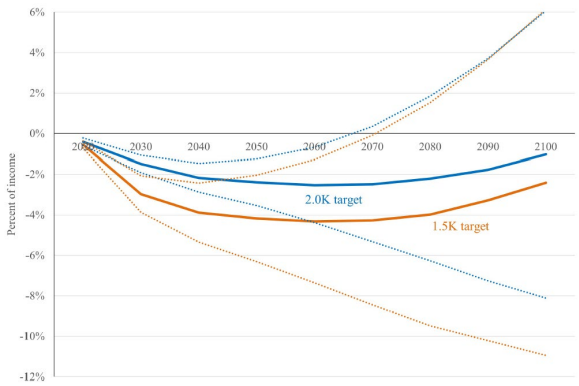


Figure 5. Net benefits of meeting the Paris targets of 2.0°C and 1.5°C global warming.

Richard S.J. Tol

„The temperature targets in the Paris Agreement cannot be met without very rapid reduction of greenhouse gas emissions and removal of carbon dioxide from the atmosphere. The latter requires large, perhaps prohibitively large subsidies. The central estimate of the costs of climate policy, unrealistically assuming least-cost implementation, is 3.8–5.6% of GDP in 2100. The central estimate of the benefits of climate policy, unrealistically assuming high no-policy emissions and constant vulnerability, is 2.8–3.2% of GDP. The uncertainty about the benefits is larger than the uncertainty about the costs. The Paris targets do not pass the cost-benefit test unless risk aversion is high and discount rate low. “

Economic Modelling of the Distant Future (I)

Alvarez und Rossi-Hansberg (2021): The Economic Geography of Global Warming; Source: http://www.nber.org/papers/w28466

The authors distinguish between amenity and productivity. In both respects, the Global North is rather positively affected, the Global South negatively.

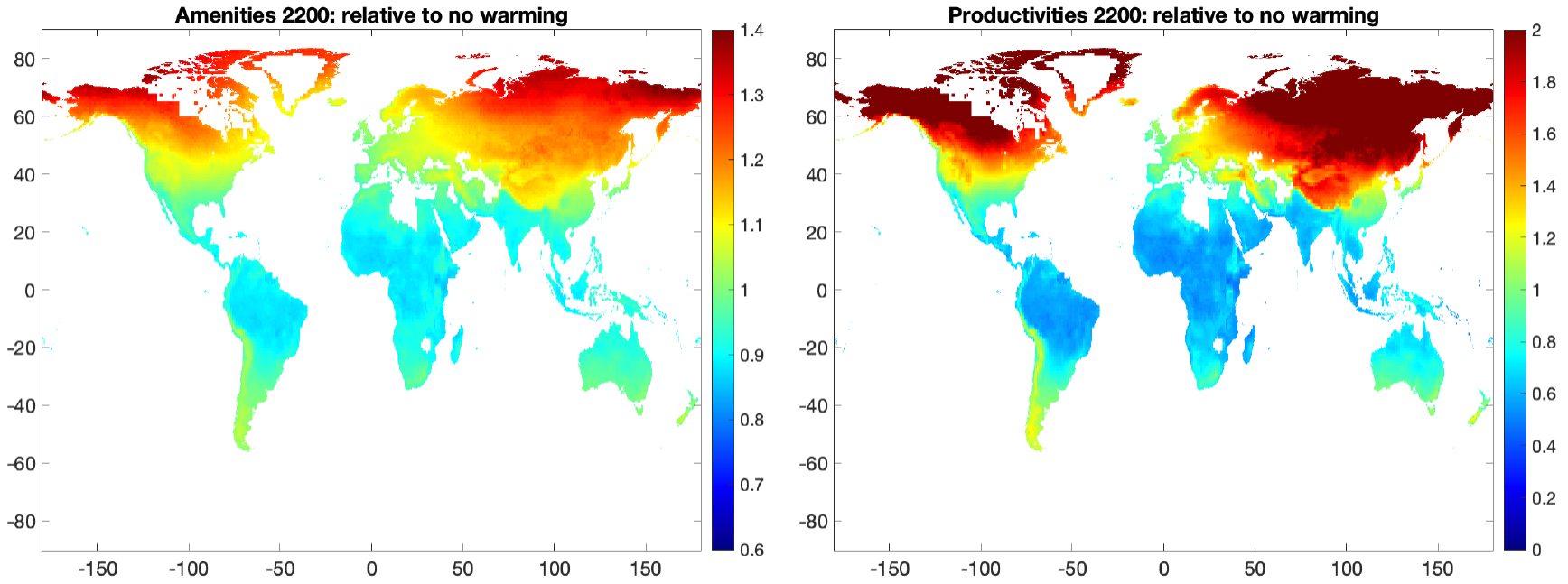
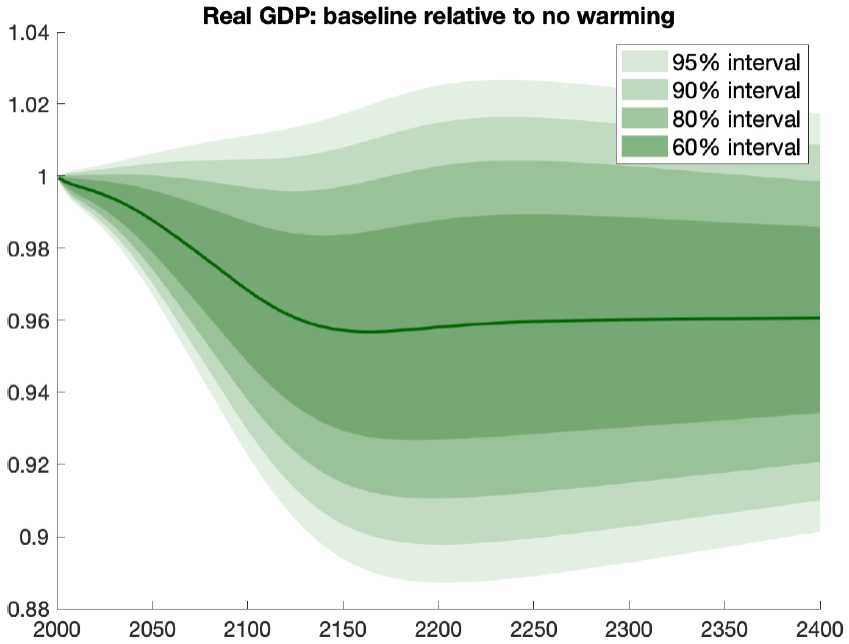


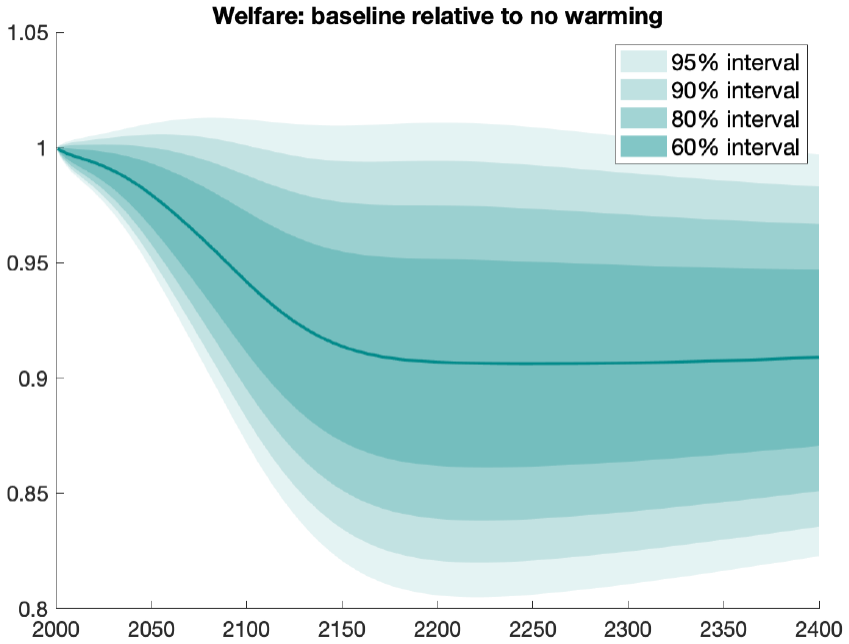
Figure 6: Gains and losses in amenities and productivities from global warming in the year 2200.

Economic Modelling of the Distant Future (II)

Alvarez und Rossi-Hansberg (2021): The Economic Geography of Global Warming; Source: http://www.nber.org/papers/w28466

The authors distinguish between the negative consequences for economic production (GDP, gross domestic product) and the negative consequences for consumption (welfare). For the year 2200, the former is estimated at 4% and the latter at 10%.





Economic Modelling of the Distant Future (III)

Alvarez und Rossi-Hansberg (2021; p. 3 f.): „[T]he hottest regions in South America, Africa, India and Australia experience welfare losses of 15% and the coldest regions in Alaska, Northern Canada, and Siberia undergo welfare gains as high as 14%. On average, the world is expected to lose 6% in terms of welfare … By 2200, the average loss in welfare is 10% and in output larger than 4%“.

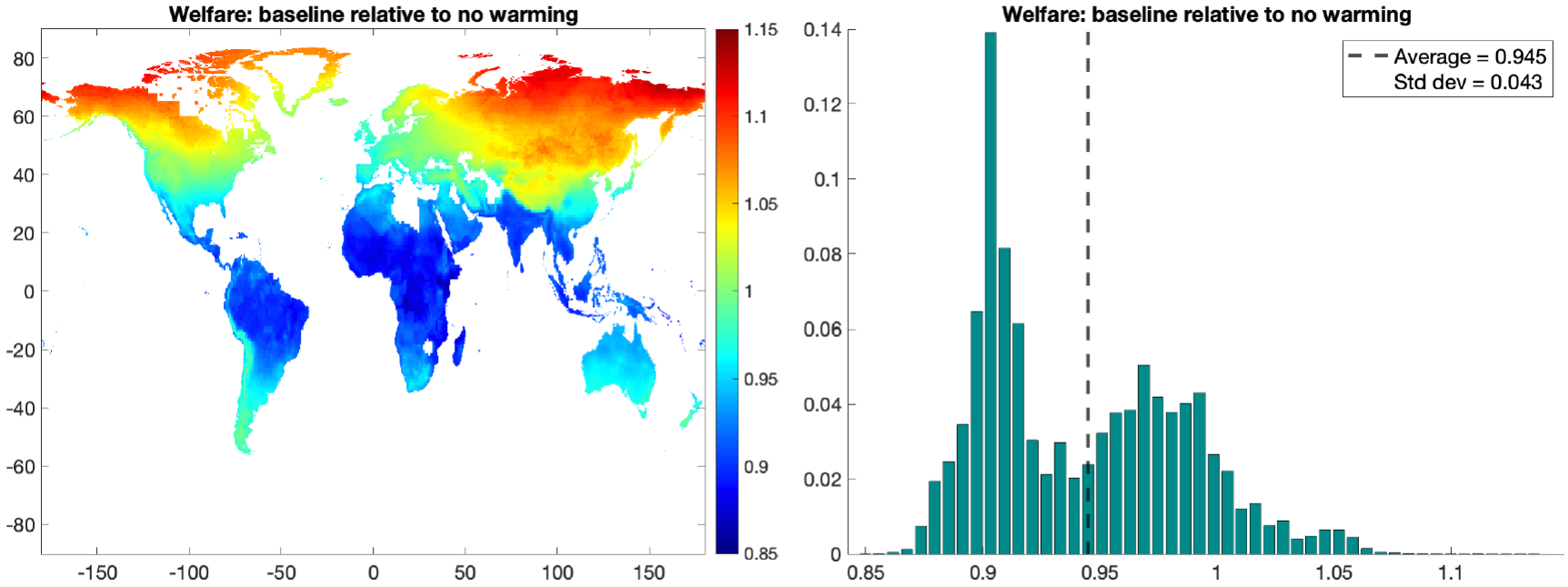


Figure 8: Welfare losses due to global warming.

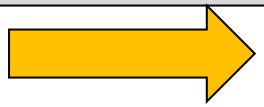
Economic Modelling of the Distant Future: Policy Implications

Alvarez und Rossi-Hansberg (2021): The Economic Geography of Global Warming;
Quelle: http://www.nber.org/papers/w28466

„Clean energy subsidies have only a modest effect on carbon emissions and the corresponding evolution of global temperature“ (p. 4; green paradoxon via price effects!)

„[C]arbon taxes primarily delay the use of the carbon on Earth, rather than decreasing its total use. This has the effect of flattening the temperature curve, with lower temperatures for long periods of time, but with little impact over the very long-run.“ (p. 5)

„If abatement technologies are forthcoming, delaying carbon consumption has tremendously positive effects since the effect of future emissions is abated using the new technology. Thus, our results strongly suggest that carbon taxes should be combined with incentives to invent effective abatement technologies.“ (p. 5)



„Global warming presents a daunting challenge for humanity. Designing the best tools to address it requires modern micro-founded economic models that incorporate multiple forms of adaptation and the rich spatial heterogeneity of the world. Our hope is that this paper contributes to this effort.“ (p. 46)

On the Current Sssessment of Climate Economics

Halstead, John (2021) Climate Change & Longtermism, im Internet unter:
https://whatweowethefuture.com/wp-content/uploads/2023/06/Climate-Change-Longtermism.pdf

- Climate change hits the poorest the hardest: low-income countries with a low historical emissions responsibility bear the greatest burden - for example through floods, droughts and heat stress.

- Future generations could be worse off: Many countries have never experienced sustainable gains in prosperity and could be set back even further by climate change.

- Moral responsibility: There is a clear ethical duty to reduce emissions and promote the economic development of poorer countries.

- **Global average incomes are likely to continue to rise: Despite climate damage, models predict a significant increase in global per capita income by the end of the century.**

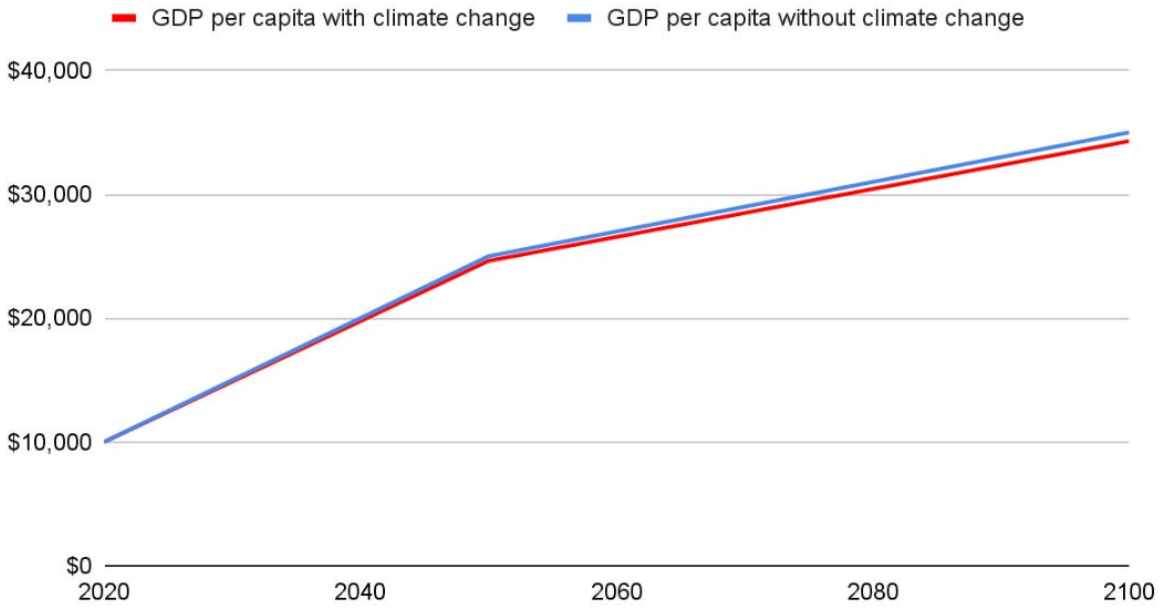
- **Models show limited economic damage: Even with 4° C warming, bottom-up models estimate a decline in global GDP of around 5% - with food production per capita rising at the same time.**

It's All About the Proportions!

Source: John Halstead (2024) –
https://nosology.substack.com/p/how-bad-will-climate-change-be-or

Bottom-up model costs: damages for **most likely warming** of 2.5ºC

On Takakura et al (2019), a representative bottom-up model, global GDP per capita looks like this for 2.5ºC and on SSP4.



Kann man der Klima-Ökonomik trauen?

Source: John Halstead (2024) –
https://nosology.substack.com/p/how-bad-will-climate-change-be-or

Overall judgement on climate-economy models

- For **most likely warming** of 2.5ºC, **all models imply *much* higher living standards by 2100**, despite climate change.
- For **worst-case but very unlikely warming** of 5ºC, **all models imply higher living standards by 2100**, despite climate change.
- Even though incomplete, bottom-up models still show that, according to the most recent scientific literature, **non-tipping point and non-conflict-related climate impacts via agriculture, heat stress, mortality, sea level rise, floods, and labour productivity are small relative to other drivers of living standards**. This is at odds with many popular narratives.
- I put no weight on any of the top-down weather studies.
- I put no weight on extant expert surveys.
- 'Climate economics scepticism' without argument is not acceptable.