

Energy Use Trends – Canada and the World

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Key Graphs for All Levels (Lesson 2–6)

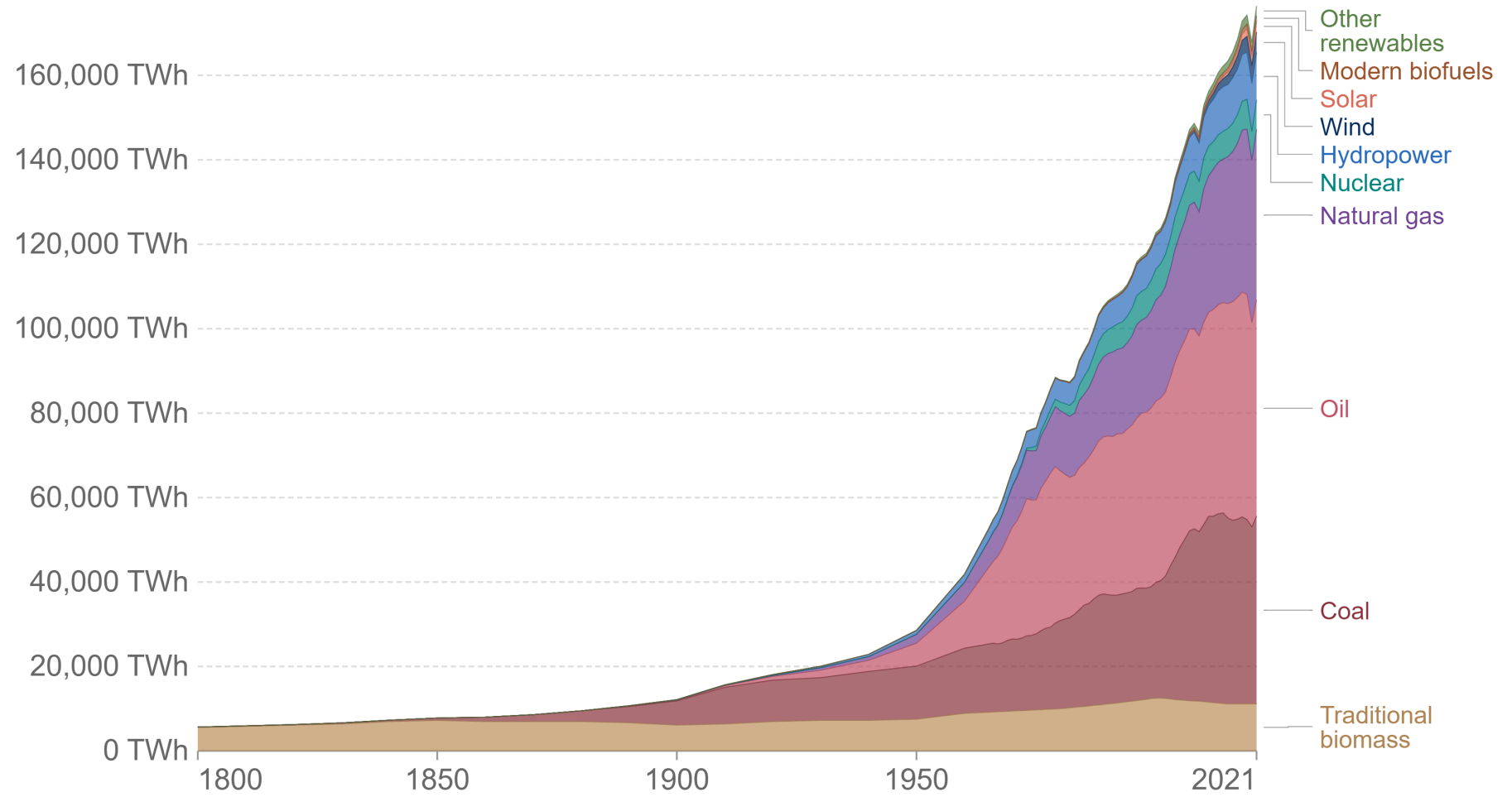
How has energy use and source changed worldwide?

<https://ourworldindata.org/grapher/global-energy-substitution?time=earliest..2021>

Global primary energy consumption by source

Our World in Data

Primary energy is calculated based on the 'substitution method' which takes account of the inefficiencies in fossil fuel production by converting non-fossil energy into the energy inputs required if they had the same conversion losses as fossil fuels.



Source: Our World in Data based on Vaclav Smil (2017) and BP Statistical Review of World Energy

OurWorldInData.org/energy • CC BY

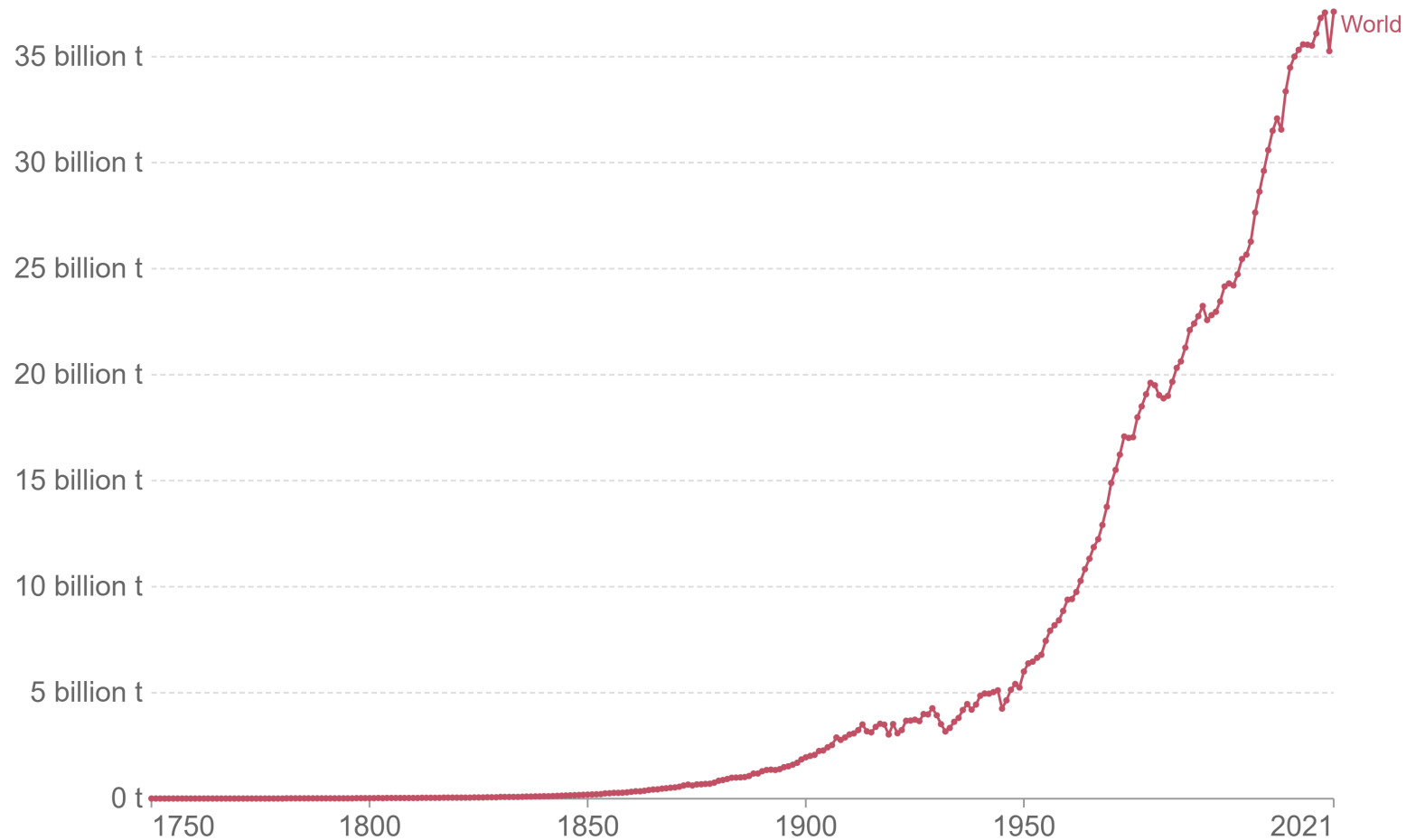
What do you notice about the changes in CO₂ from 1750 to today?

<https://ourworldindata.org/co2-emissions>

Annual CO₂ emissions

Our World
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Carbon dioxide (CO₂) emissions from fossil fuels and industry¹. Land use change is not included.



Source: Our World in Data based on the Global Carbon Project (2022) OurWorldInData.org/co2-and-other-greenhouse-gas-emissions/ • CC BY

1. Fossil emissions: Fossil emissions measure the quantity of carbon dioxide (CO₂) emitted from the burning of fossil fuels, and directly from industrial processes such as cement and steel production. Fossil CO₂ includes emissions from coal, oil, gas, flaring, cement, steel, and other industrial processes. Fossil emissions do not include land use change, deforestation, soils, or vegetation.

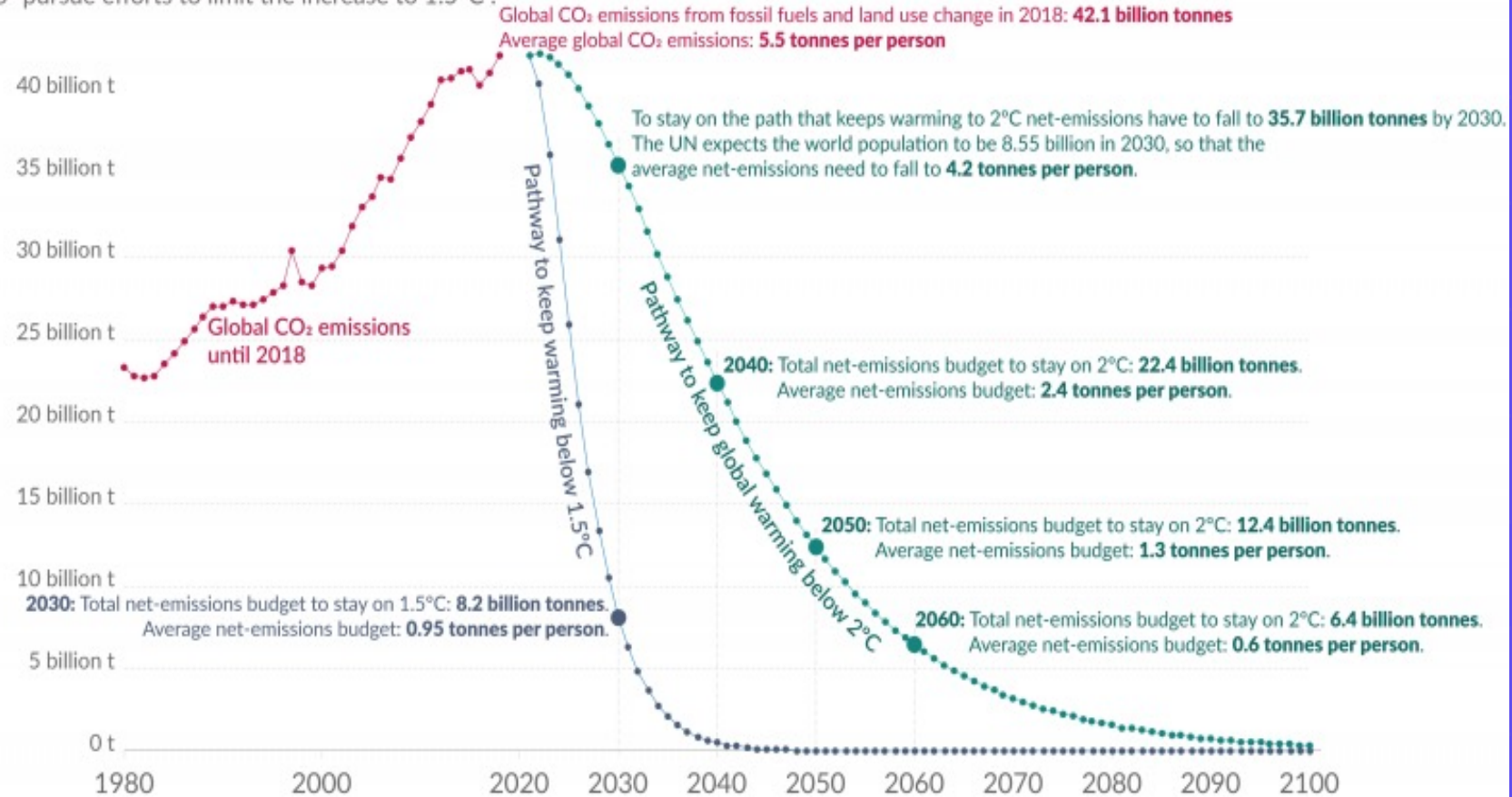
What will have to change for CO₂ emissions to drop to meet the Paris Agreement targets?

<https://ourworldindata.org/worlds-energy-problem>

CO₂ pathways to reach the Paris Agreement

Our World
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Pathways are based on the necessary reductions of net CO₂ emissions if global emissions peak in 2021 and decline thereafter. The Paris Agreement's goal is to keep the increase in global average temperature to well below 2°C above pre-industrial levels and to "pursue efforts to limit the increase to 1.5°C".



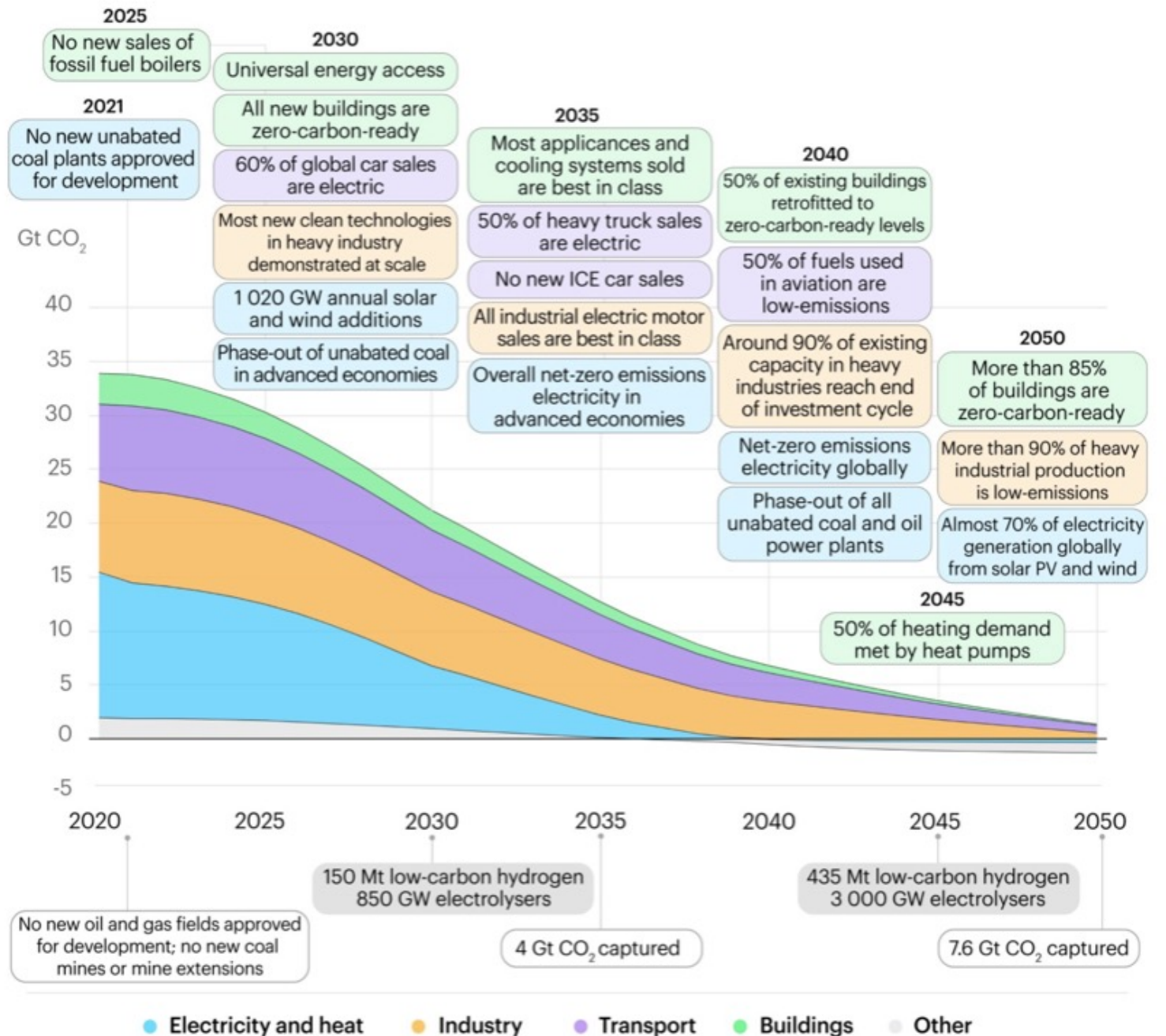
Source: The pathways are based on the global cumulative CO₂ emission budgets from the IPCC Special Report on 1.5°C and refer to carbon budgets that give a >66% chance of staying below the respective temperature increases: 420 GtCO₂ for a 66% of 1.5°C and 1170 GtCO₂ for a 66% of 2°C.

Mitigation curves describe approximately exponential decay pathways such that the quota is never exceeded. They were calculated and published by Robbie Andrew.

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How do these proposed actions and changes align with what you heard about in your interviews?



<https://www.weforum.org/agenda/2021/06/net-zero-emissions-2050-milestones/>



Additional Graphs for Lessons 3–6

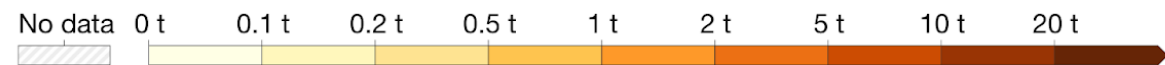
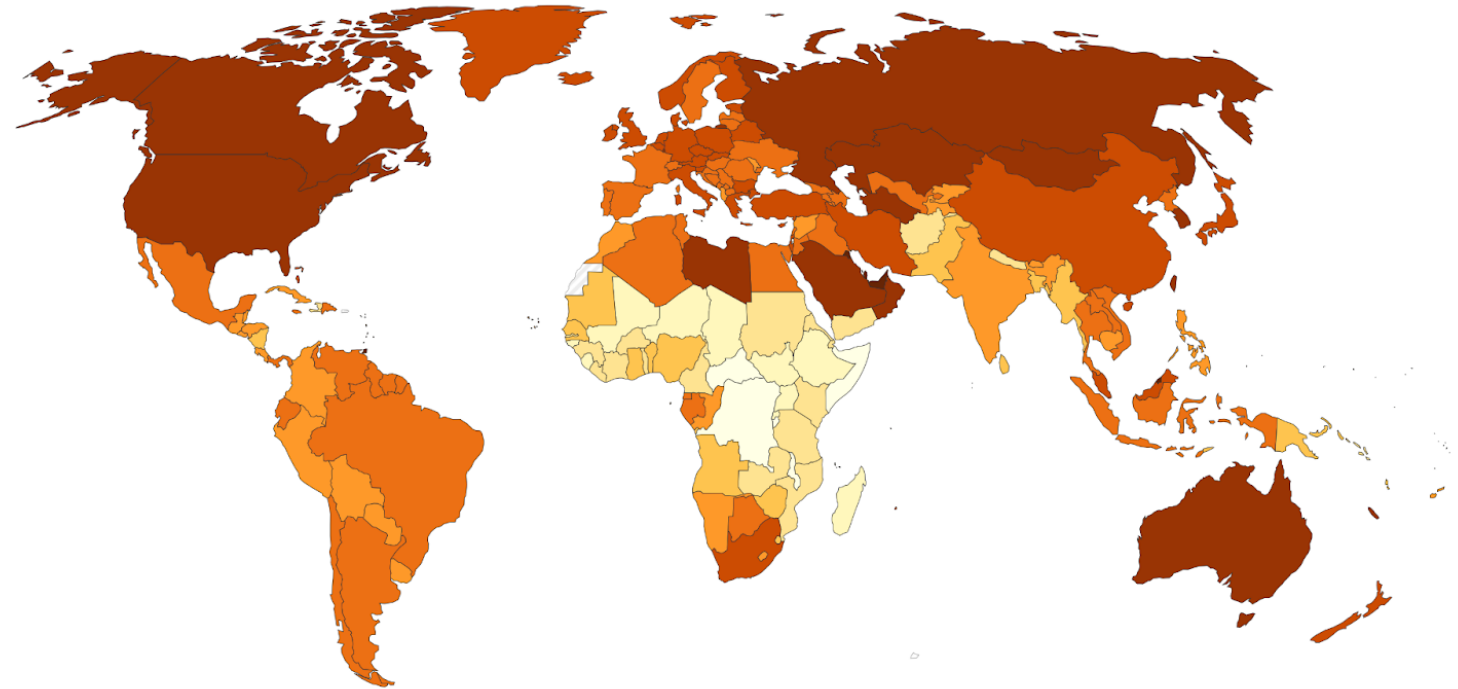
How do the emissions per person (per capita) compare? Why do you think these are so different?

<https://ourworldindata.org/co2-emissions>

Per capita CO₂ emissions, 2021

Carbon dioxide (CO₂) emissions from fossil fuels and industry¹. Land use change is not included.

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in Data



Source: Our World in Data based on the Global Carbon Project (2022) [OurWorldInData.org/co2-and-other-greenhouse-gas-emissions/](https://ourworldindata.org/co2-and-other-greenhouse-gas-emissions/) • CC BY

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Additional Graphs for Lessons 5–6

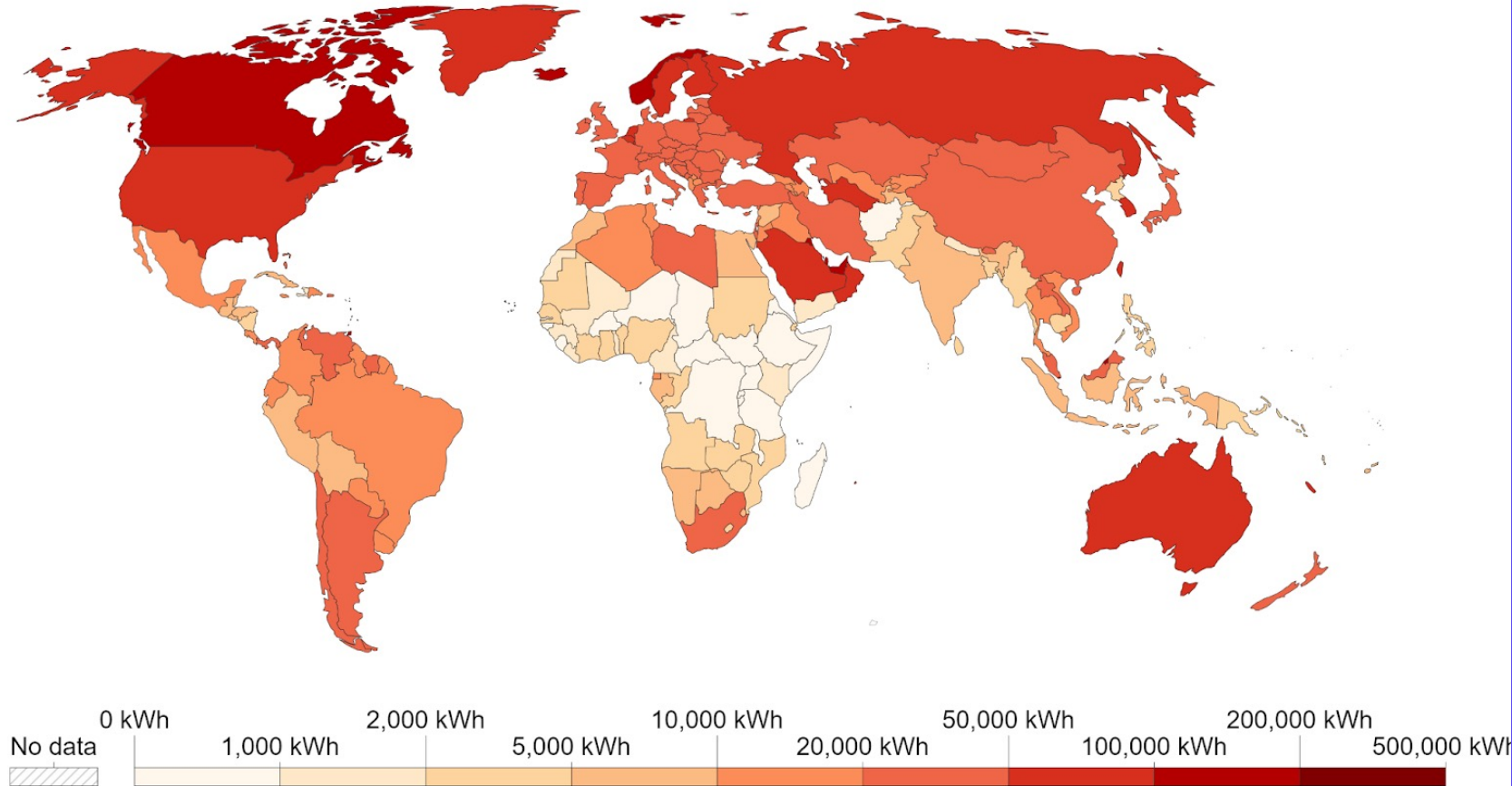
How does energy use per person (per capita) compare? Why?

<https://ourworldindata.org/energy>

Energy use per person, 2021

Energy use not only includes electricity, but also other areas of consumption including transport, heating and cooking.

Our World
in Data



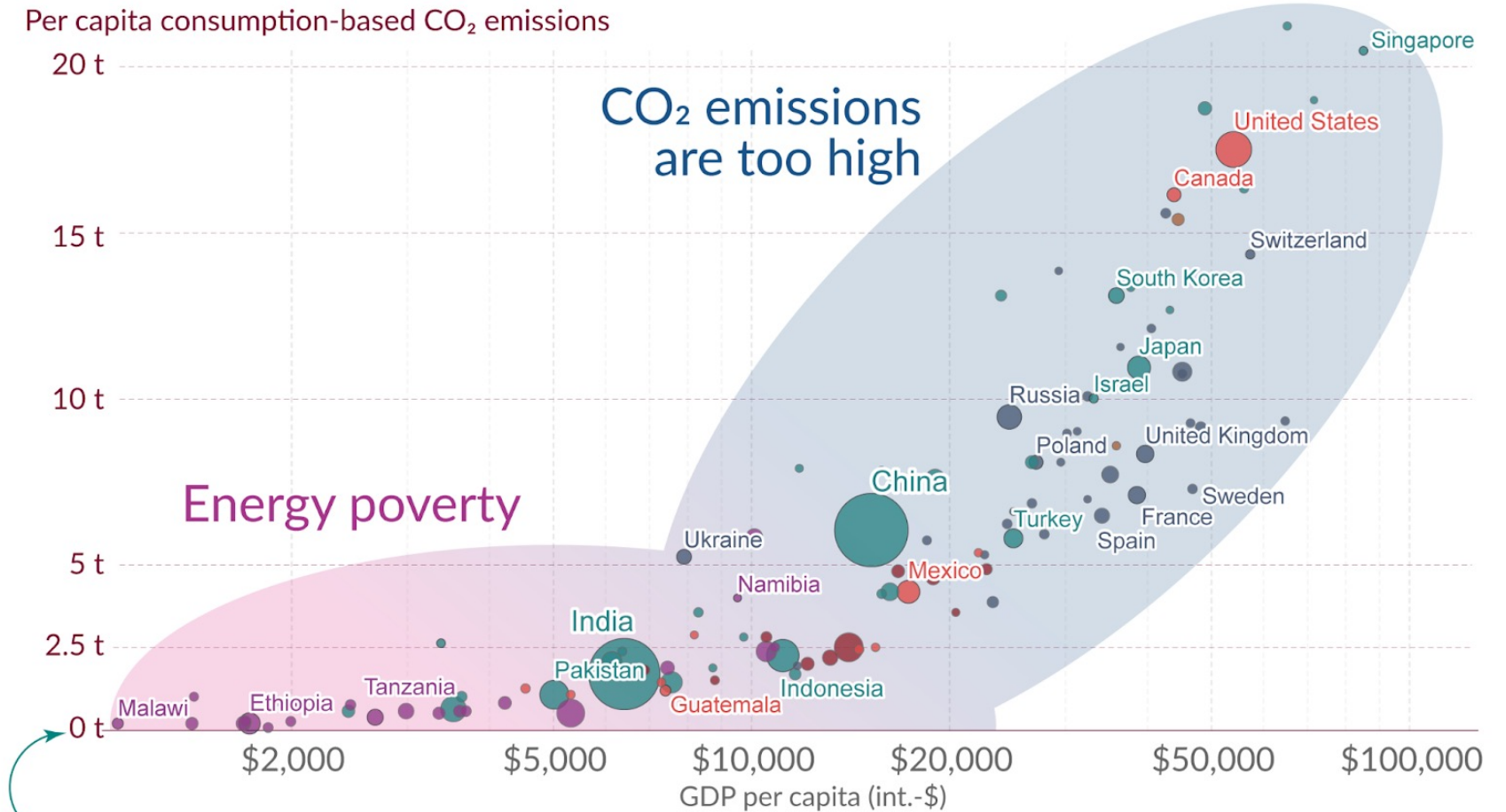
Source: Our World in Data based on BP & Shift Data Portal

OurWorldInData.org/energy • CC BY

Note: Energy refers to primary energy – the energy input before the transformation to forms of energy for end-use (such as electricity or petrol for transport).

What is energy poverty? When we think of emissions targets, should all countries be treated equally?

CO₂ emissions per capita vs GDP per capita



To end climate change the long-run goal is that net-emissions decline to zero.

Data for 2017: Global Carbon Project, UN Population, and World Bank.

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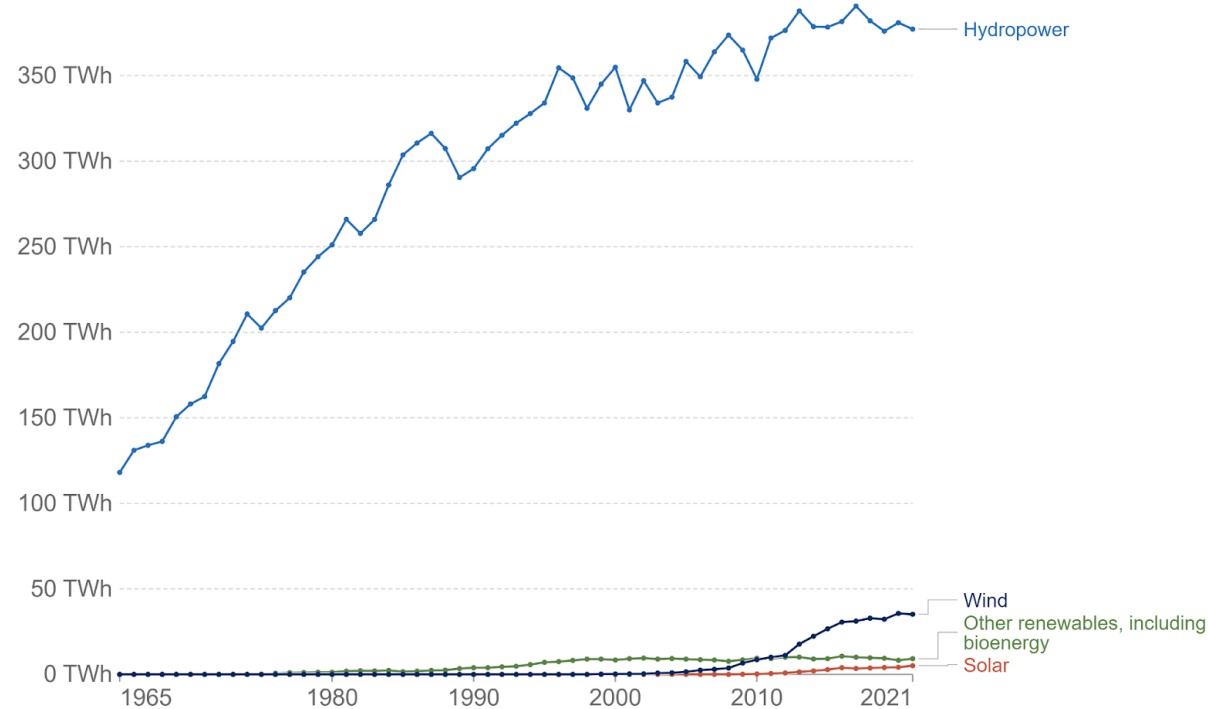
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<https://ourworldindata.org/worlds-energy-problem>

What do you notice about the differences in the trends in renewable energy source use in Canada vs. the USA? What may influence these differences?

Modern renewable energy generation by source, Canada

Our World in Data

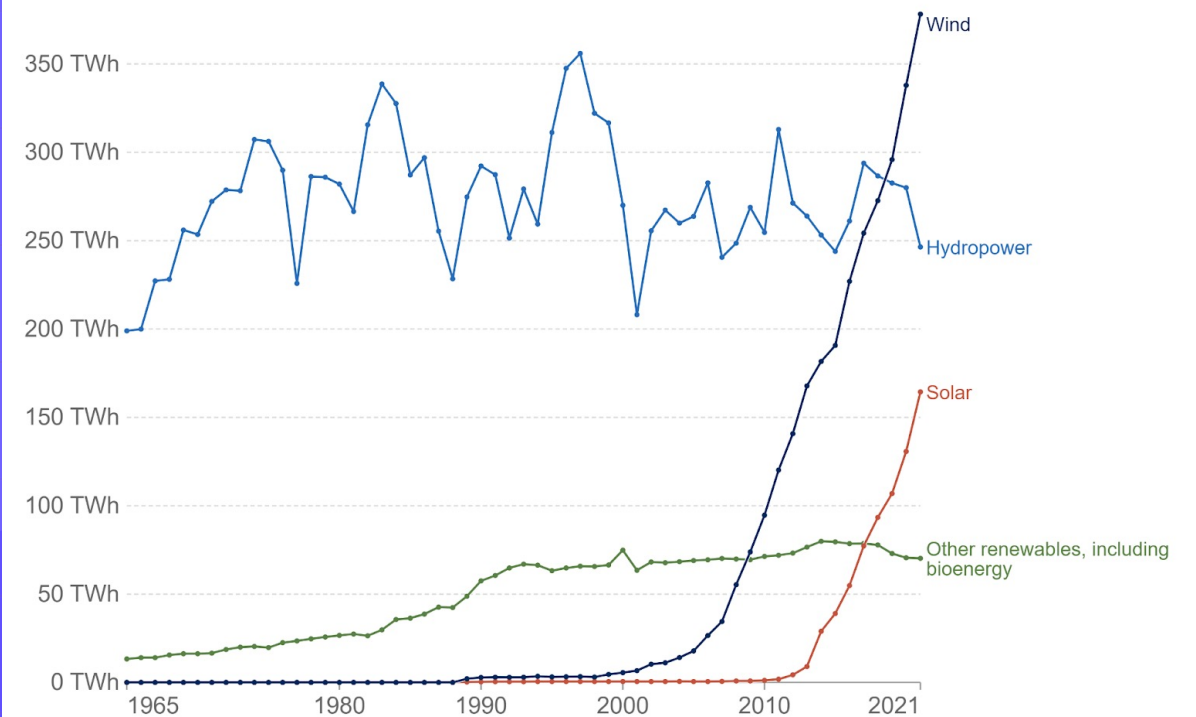


Source: Our World in Data based on BP Statistical Review of World Energy & Ember

OurWorldInData.org/renewable-energy • CC BY

Modern renewable energy generation by source, United States

Our World in Data



Source: Our World in Data based on BP Statistical Review of World Energy & Ember

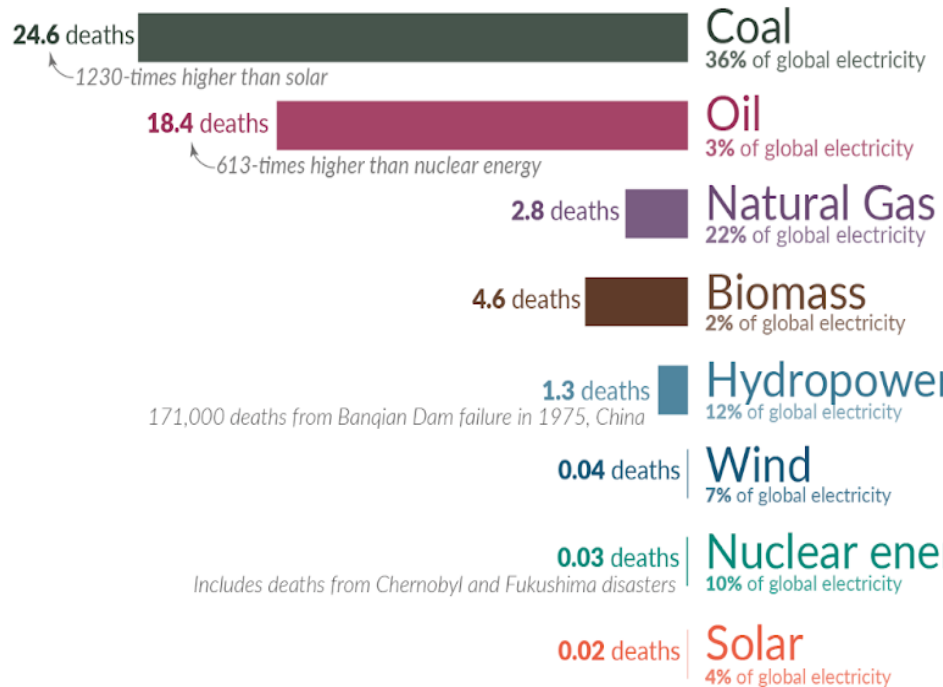
OurWorldInData.org/renewable-energy • CC BY

<https://ourworldindata.org/renewable-energy>

What are the **safest** and **cleanest** sources of energy?

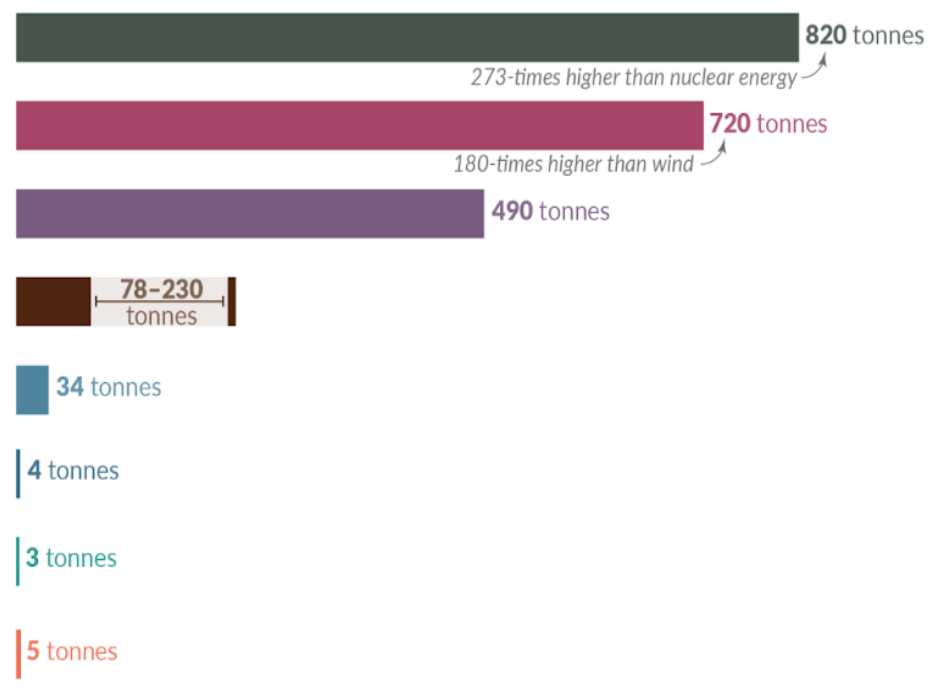
Death rate from accidents and air pollution

Measured as deaths per terawatt-hour of electricity production.
1 terawatt-hour is the annual electricity consumption of 150,000 people in the EU.



Greenhouse gas emissions

Measured in emissions of CO₂-equivalents per gigawatt-hour of electricity over the lifecycle of the power plant.
1 gigawatt-hour is the annual electricity consumption of 150 people in the EU.



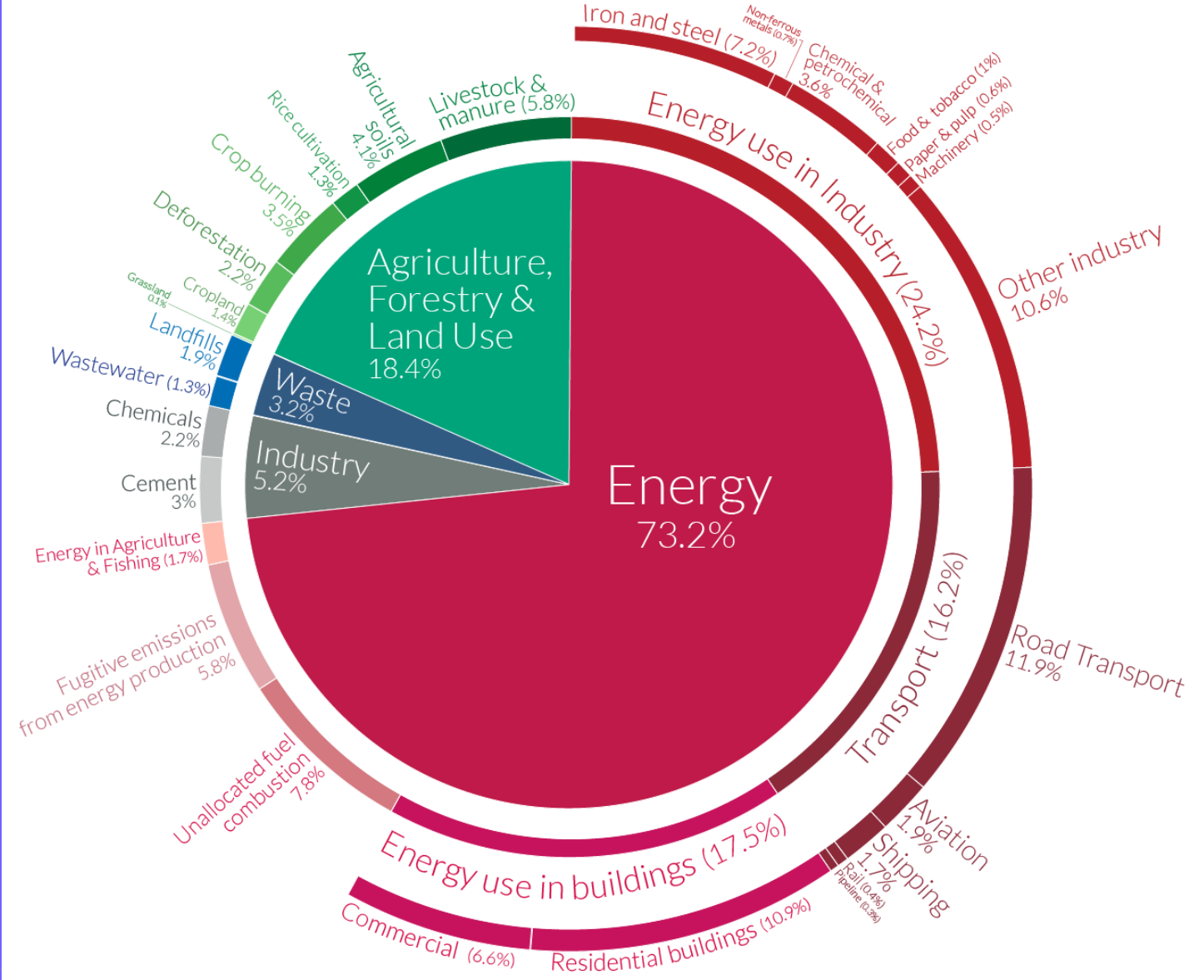
Death rates from fossil fuels and biomass are based on state-of-the-art plants with pollution controls in Europe, and are based on older models of the impacts of air pollution on health. This means these death rates are likely to be very conservative. For further discussion, see our article: [OurWorldinData.org/safest-sources-of-energy](https://ourworldindata.org/safest-sources-of-energy). Electricity shares are given for 2021. Data sources: Markandya & Wilkinson (2007); UNSCEAR (2008; 2018); Sovacool et al. (2016); IPCC AR5 (2014); Pehl et al. (2017); Ember Energy (2021).

Which energy sources are both clean and safe (fewer accidents)? Why?

<https://ourworldindata.org/safest-sources-of-energy>

Global greenhouse gas emissions by sector

This is shown for the year 2016 – global greenhouse gas emissions were 49.4 billion tonnes CO₂eq.

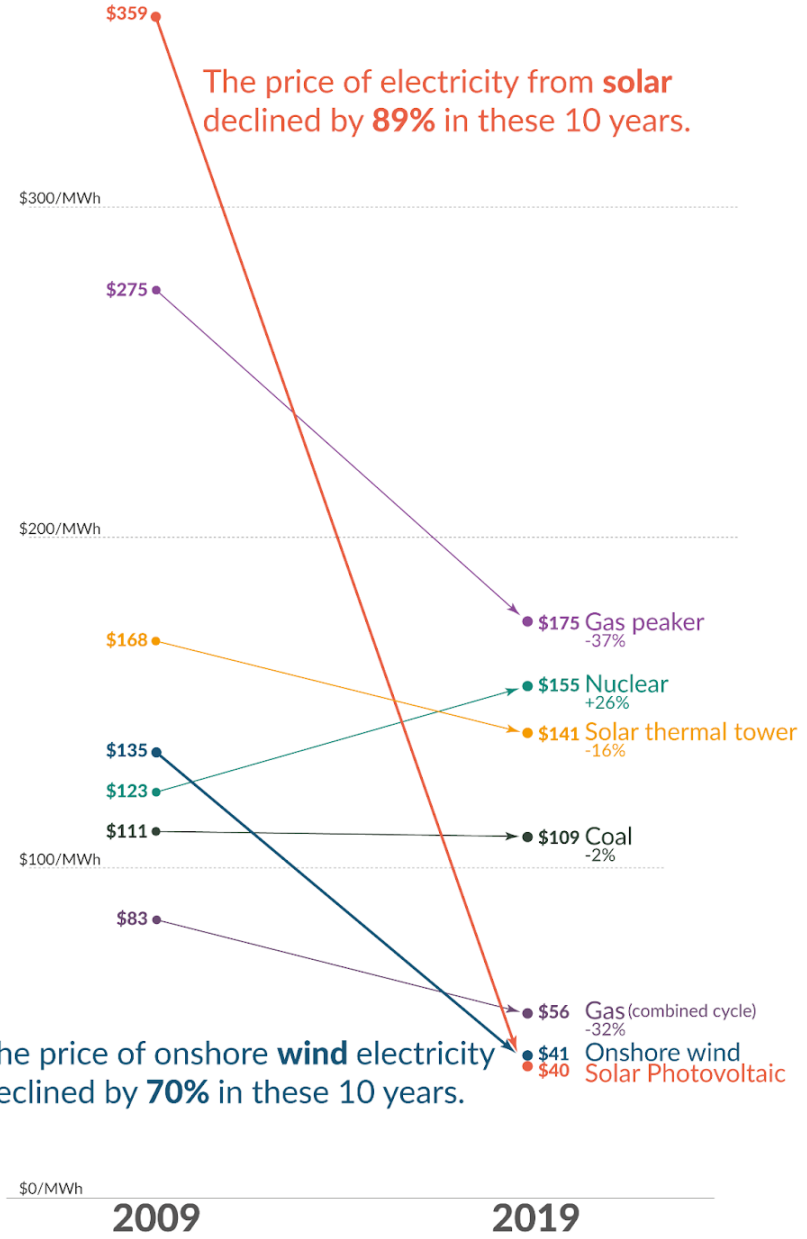


Which sectors produce the greatest amounts of greenhouse gas emissions?

<https://ourworldindata.org/ghg-emissions-by-sector>

The price of electricity from new power plants

Electricity prices are expressed in 'levelized costs of energy' (LCOE). LCOE captures the cost of building the power plant itself as well as the ongoing costs for fuel and operating the power plant over its lifetime.



Which energy sources have decreased their costs of building and supplying energy? Why?

<https://ourworldindata.org/ghg-emissions-by-sector>