

The history and geography of energy transitions

How has the global mix of energy sources changed over the past 220 years?

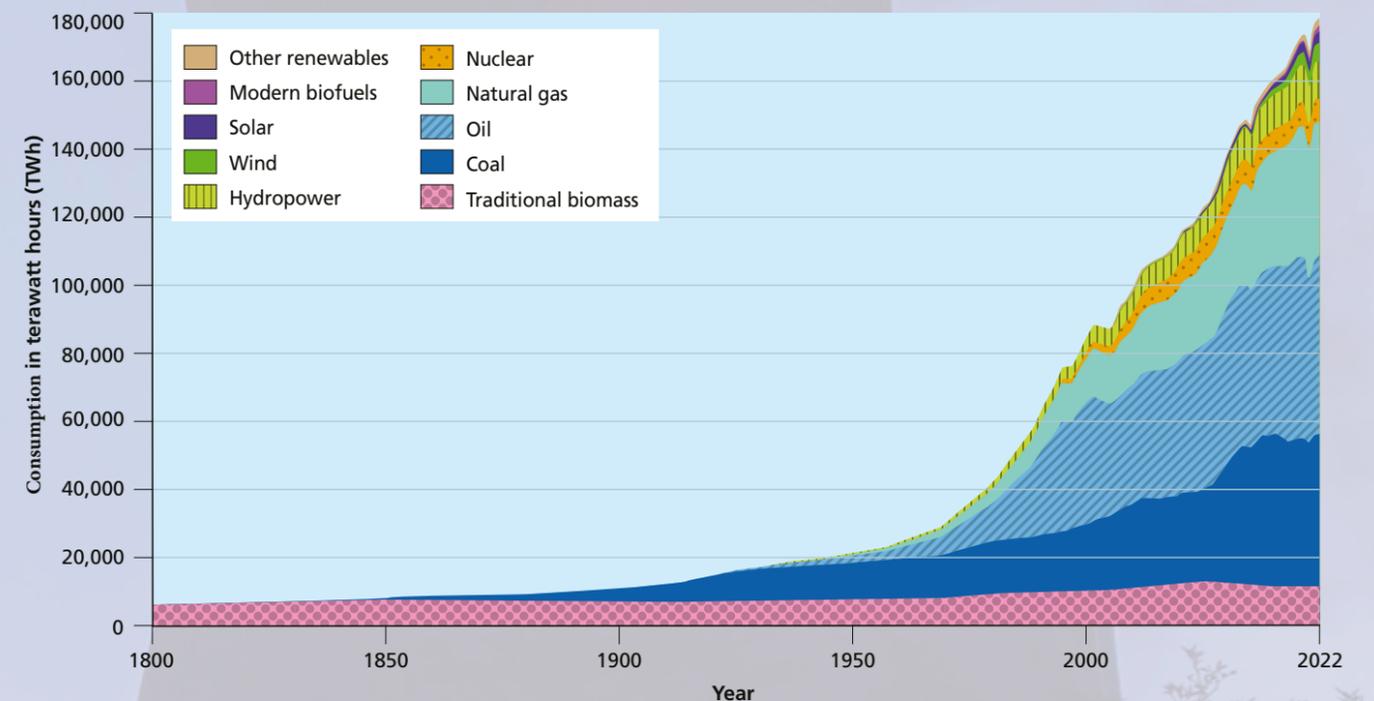
Global energy production is still overwhelmingly dominated by the burning of fossil fuels (oil, gas, coal) and this accounts for more than 75% of anthropogenic greenhouse gas emissions. To achieve carbon neutrality, the world must shift away from fossil fuels to a mix of cleaner energy sources to reduce carbon emissions and slow global

warming. Renewable energy sources are growing rapidly. What will this chart look like in 2050?

As governments address the challenges of securing a future dominated by low-carbon sources of energy (renewables and nuclear power), it is useful to explore the history of energy transitions over the past 200 years or so. Note that energy

transitions have a distinctive regional geography, with industrial-scale coal burning taking place first in Europe and North America.

Visit Our World in Data to explore a series of charts showing where our energy comes from at the global scale and how the global energy mix is changing: www.tinyurl.com/yfjwb2nd



Source: Our World in Data

Figure 1 Global primary energy consumption by source, 1800–2022

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Timeline of energy transitions:

- 1769**: James Watt patents the first coal-powered steam engine — the Industrial Revolution was largely powered by coal.
- 1859**: The oil rush in the USA began in Titusville, Pennsylvania in 1859, when Edwin Drake drilled the first commercial oil well in North America. The oil industry was well established in the USA by the 1870s, with rapid expansion across Texas and California.
- 1936**: The iconic Hoover Dam on the Colorado River (1936) was a milestone in hydropower generation, but coal, oil and gas still dominated energy production for the rest of that century.
- 1940**: Demand for coal increased as coal-fired power stations dominated the production of electricity. By 1940, coal accounted for over 50% of the global energy mix.
- 1979**: After the oil crisis of 1973, Denmark began exploring the potential of wind energy. The first commercial wind turbine was erected in Denmark in 1979. In 2002 Denmark established what was then the world's largest offshore wind farm, Horns Reef 1, in the North Sea.
- 1991**: In Cornwall, the UK's first wind farm becomes operational with ten 400 kilowatt turbines.
- 2010**: A documentary is released in Germany called *The Fourth Revolution: Energy*. It sets out a vision of a global society and economy using only energy from renewable sources.
- 2019**: After decades of relying on coal for energy, for the first time, in both the UK and the USA, more energy was generated from renewables than fossil fuels.
- 2022**: The rise in oil consumption was a key feature of the second half of the twentieth century. In 2022, global crude oil production was about 80.75 million barrels of crude oil. This was produced by 98 countries, but just five accounted for more than half of this total:
 - USA 14.7%
 - Saudi Arabia 13.2%
 - Russia 12.7%
 - Canada 5.6%
 - Iraq 5.5%
- 2030**: The 2015 Paris Agreement is a legally binding international treaty that commits most countries to addressing climate change. Its key goal is to keep 'the increase in the global average temperature to well below 2°C above pre-industrial levels' and to try to 'limit the temperature increase to 1.5°C above pre-industrial levels'. To limit global warming to 1.5°C, greenhouse gas emissions must peak before 2025 and decline 43% by 2030. We are not on course to meet these targets.

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