

China's emissions barely changed from 2021 to 2022, amid Covid-19 lockdowns and a real estate slump

Energy-related emissions in China were relatively flat between 2021 and 2022, decreasing by 0.2% or 23 Mt to around 12.1 Gt. Emissions from energy combustion alone grew by 88 Mt, entirely due to increased use of coal, but this was more than offset by declines in emissions from industrial processes. The overall yearly decline was the first since structural reforms drove emissions lower in 2015.

While China significantly ramped up domestic coal production and coal power capacity additions last year, actual coal consumption did not fully keep pace. Tempered by a large increase in solar PV and wind generation, coal accounted for around three-fifths of the fuel mix in electricity generation. Total electricity demand grew much slower than the average seen over the last decade. As such, emissions from coal-fired power increased by around 3%, in part due to the ramp-up of coal power plants during heat waves, as well as to increasing reliance on electricity or district heating fuelled by coal.

Industry sector emissions declined, but the effects of China's crackdown on debt-financed property and the ongoing real estate slump were not fully reflected in 2022 industry emissions. Construction new starts were down by around 40% year-on-year, while the production of steel and cement were just 2% and 10% lower than in 2021, respectively. As a result, China's industry sector emitted 161 Mt less than the year before, with a large share of this decline from process emissions. China's unprecedentedly large year-on-year decline pulled down global industry emissions.

In contrast to the global growth in transport sector emissions, China's transport emissions registered a 3.1% decrease in 2022. Covid-19 measures were strongly reinforced in comparison to 2021, including total lockdowns in major cities and restrictions on crossing prefecture or province boundaries. At the same time, electric car sales reached 6 million in 2022, preventing further emissions from diesel and gasoline cars.

United States emissions grew in 2022, driven by rising natural gas consumption

US emissions grew by 0.8% (or 36 Mt) to 4.7 Gt in 2022. The annual growth was much slower than 2021's spurt but still a deviation from the previous decade's declining trend. While most other countries shifted away from natural gas in the face of last year's price spikes, the United States increased its consumption.

Emissions from natural gas increased 89 Mt, more than supplanting the 69 Mt decline in coal emissions.

Emissions grew the most in the buildings sector, rising 26 Mt and far exceeding the last decade's annual average growth (around 7 Mt per year). The jump was mostly caused by cold weather during the early months of the year.

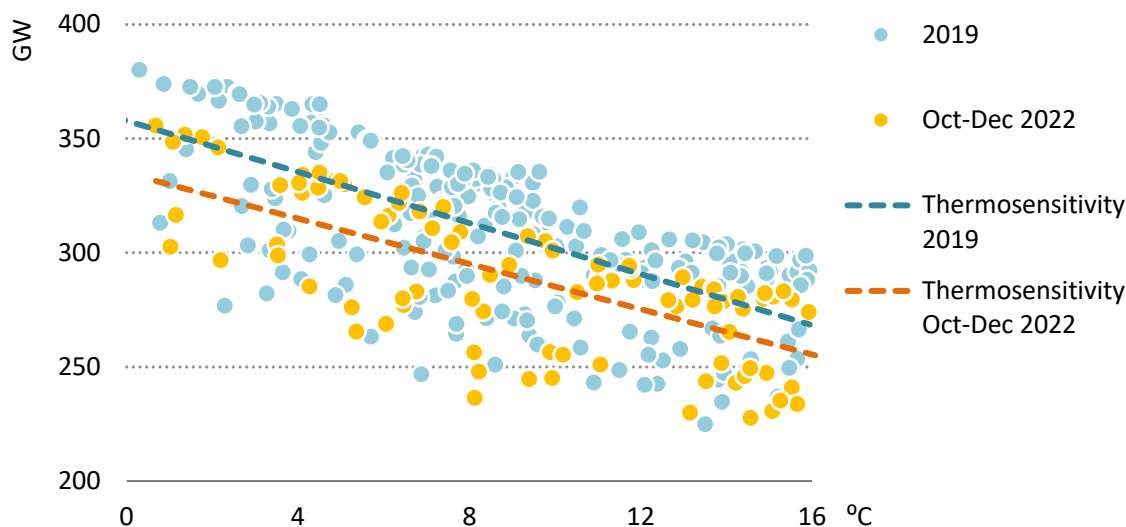
Power sector emissions decreased by 20 Mt, in large part thanks to solar PV and wind generation increasing by around 95 TWh. Without last year's rise in renewables, power sector emissions would have been around 65 Mt CO₂ higher. However, power generation contributed more than half of the growth in natural gas emissions, as the trend of coal-to-gas switching resumed after a strong coal rebound in 2021, with natural gas power plants meeting peak cooling demand during the summer's heat waves.

Energy crisis pushed European Union to cut emissions through clean power and demand reduction measures

Despite the coinciding challenges of oil and gas market disruptions, hydro shortfalls due to drought, and numerous nuclear plants going offline, the European Union reduced its emissions by 2.5% (or 70 Mt), thanks to a mild winter, effective energy conservation measures, fuel switching, behaviour changes, and industrial production curtailments. Reduced natural gas emissions more than offset increases in emissions from coal and oil.

Buildings sector emissions declined the most, by 60 Mt, enabled by exceptionally mild weather from October to December 2022 – the second warmest start to winter in the last 30 years – and collective energy conservation measures. Average electricity consumption was lower, even accounting for weather, and electricity use was less sensitive to temperature changes in 2022 than in 2019, pointing to the role of behaviour change. EU heat pump sales reached 2.8 million, more than doubling in several countries from the previous year. Meanwhile industry sector CO₂ emissions declined by 42 Mt.

Figure 7: Daily average electricity load at different temperatures in the European Union, 2019 and 2022



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Notes: Thermosensitivity shows the line of best fit between average daily electricity load and average daily temperature. 2019 is shown as an indicative historic year before the pandemic.

Source: Analysis based on IEA [Weather for Energy Tracker](#) and [Real Time Electricity Tracker](#).

Power sector emissions increased by 28 Mt even though electricity demand declined, as a temporarily higher reliance on coal increased carbon intensity. A 15% increase in wind and solar PV generation helped prevent further coal use with wind and solar PV for the first time jointly overtaking gas as well as nuclear as the top source of Europe's electricity generation. This record-breaking increase in solar PV and wind generation avoided almost 75 Mt CO₂ of emissions. Without hydro generation decreasing by 21% year-on-year and nuclear by 17%, another 80 Mt could have been averted.

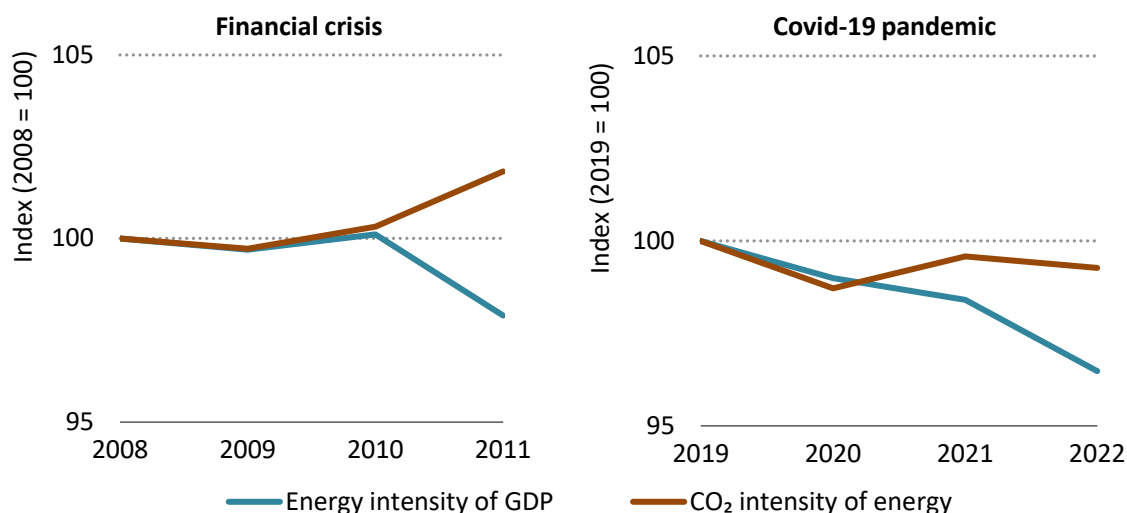
Despite the global energy crisis, recovery from the Covid-19 pandemic is proving more sustainable than past crises

Countries responded to the high energy prices and energy security concerns caused by Russia's invasion of Ukraine with energy conservation measures, fuel switching, and an acceleration of clean energy technology deployment.

Emissions trends now stand in contrast to those seen after the 2008 global financial crisis. Energy intensity of GDP is now 3.5% below 2019 pre-pandemic levels, compared to 2% below three years after the onset of the financial crisis. CO₂ intensity of energy use in 2022 was lower than before the pandemic, after a short-lived rebound in 2021, unlike the increase that emerged in the early 2010s.

The large green spending component of stimulus packages appears to be making a lasting impact on controlling emissions growth. Between April 2020 and October 2022, economic recovery packages enacted by governments worldwide included USD 1 215 billion in clean energy investment support, as detailed in the IEA's [Government Energy Spending Tracker](#). This is well over twice the financial commitments made to green recovery measures after the financial crisis.

Figure 8: Global emissions intensity of energy use and energy intensity of economic activity, 2008-2011 and 2019-2022



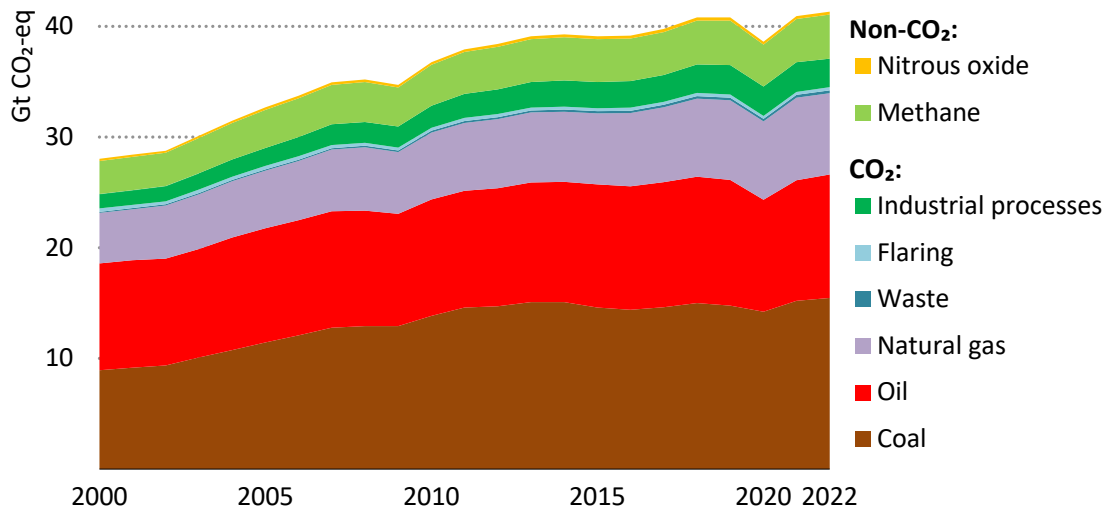
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Energy-related greenhouse gas emissions reached 41.3 Gt CO₂-eq in 2022

Total energy-related greenhouse gas emissions increased by 1.0% to an all-time high of 41.3 Gt CO₂-eq (see “Data sources and method” for global warming potential values). CO₂ emissions from energy combustion and industrial process accounted for 89% of energy-related greenhouse gas emissions in 2022.

Methane from energy combustion, leaks and venting represented another 10%, mostly coming from onshore oil and gas operations as well as steam coal production. [Methane emissions rose to nearly 135 Mt CH₄](#) or around 4 Gt CO₂-eq in 2022, despite high natural gas prices that increased the cost effectiveness of methane abatement technologies.

Figure 9: Global energy-related greenhouse gas emissions, 2000-2022



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Source: Flaring emissions are from IEA analysis based on the [World Bank Global Gas Flaring Reduction Programme](#).

This report is the first in the IEA’s new series called the [Global Energy Transitions Stocktake](#). The new tracker consolidates the IEA’s latest analysis in one location, making it freely accessible in support of the first Global Stocktake in the lead-up to COP28 Climate Change Conference in November.

Data sources and method

The IEA draws upon a wide range of respected statistical sources to construct estimates of energy demand, energy-related CO₂ and other greenhouse gas emissions for the year 2022. Sources include the latest monthly data submissions to the IEA Energy Data Centre, real-time data from power system operators across the world, statistical releases from national administrations, and recent data from the IEA Market Report series that covers coal, oil, natural gas, renewables, electricity and energy efficiency. Where data are not available on an annual or monthly basis, estimates are used.

The scope of CO₂ emissions in this report includes emissions from all uses of fossil fuels for energy purposes, including the combustion of non-renewable waste, as well as emissions from industrial processes such as cement, iron and steel, and chemicals production. Estimates of industrial process emissions draw upon the latest production data for iron and steel, clinker for cement, aluminium, and chemicals. CO₂ emissions from the combustion of flared gases are also included in estimates of global energy-related greenhouse gas emissions.

Non-CO₂ greenhouse gas emissions include fugitive emissions from oil, gas and coal supply. Methane and nitrous oxide emissions related to energy combustion are also evaluated, based on typical emissions factors for the corresponding end uses and regions. When converting non-CO₂ greenhouse gas emissions to equivalent quantities, a global warming potential over a 100-year period is used, with global warming potential values of 30 for methane and 273 for nitrous oxide.

Economic growth rates underlying this analysis are those published by the International Monetary Fund's January 2023 *World Economic Outlook* update. All monetary quantities are expressed in USD (2021) in purchasing power parity (PPP) terms.

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