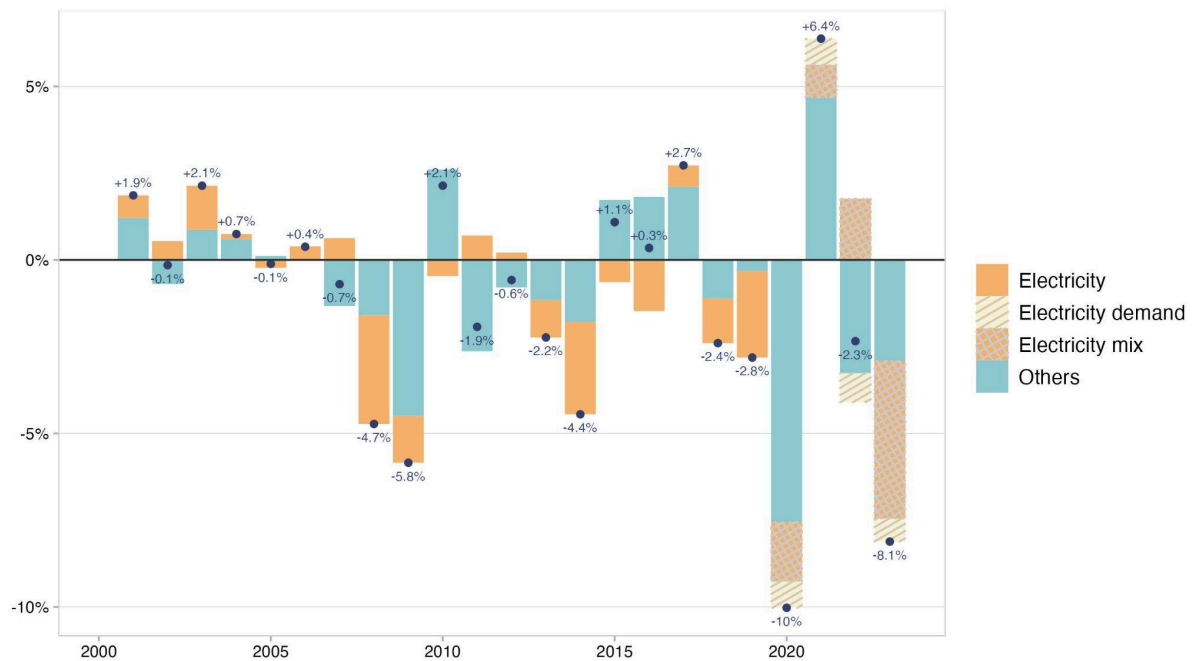# CREA

EU's CO2 emissions from fossil fuels drop 8% to reach lowest levels in 60 years

Key findings

The EU's progress in reducing emissions accelerated in 2023, with the second steepest reduction after 2020 which was heavily influenced by the COVID-19 pandemic. More than half of the 2023 reduction stems from a cleaner electricity mix.

- The **EU's CO2 emissions from fossil fuels saw a year-on-year drop of 8%** in 2023, reaching levels unseen since the early 1960s. This is the second steepest decline observed since the emissions drop in 2020 which was heavily influenced by the COVID-19 pandemic.

- **More than half of the decline (56%) stems from a cleaner electricity mix**, with the continuous rise of wind and solar capacity as well as a rebound in hydropower and nuclear availability.

- The EU achieved a notable **25% year-on-year reduction in CO2 emissions from power generation**, while other sectors declined by 4%.

- **EU's CO2 emissions from coal have halved since 2015**, and saw a year-on-year decrease of 25%. Gas-related emissions declined by 11%, and oil emissions by 2%, compared to the previous year.

Year-on-year change of EU CO2 emissions from fossil fuels

Source: CREA analysis based on ENTSOG, ENTSOE, EUROSTAT and IPCC. Starting from 2020, the contribution of the electricity sector is decomposed into change of electricity mix and change in electricity demand.

Cleaner power generation accounts for over half of the decline in CO2 emissions

CREA's early estimates show an 8% year-on-year decline in the EU's CO2 emissions from fossil fuels in 2023 — the second most significant drop after 2020.

More than half of this reduction (56%) can be attributed to cleaner electricity production, with the continuous growth of solar & wind as well as a rebound in hydropower and nuclear availability (see Appendix). A decrease in electricity demand contributed 8%, while reductions in other sectors, primarily industry and transport, accounted for the remaining 36%. Weather conditions in 2023 were even more favourable than in 2022 and explained 19% of the reduction in electricity demand.

Coal emissions fell by 25% while oil saw a less significant reduction of under 2%

Coal consumption — which had [bounced back in 2021 and 2022](#) — has now dipped below pre-pandemic levels. Emissions from coal have declined 25% compared to the previous year and nearly halved since 2015 (-48%). Fossil gas also saw a significant decline with estimated emissions falling by approximately 11%.

This decrease in fossil gas and coal consumption has largely been enabled by the expansion of solar and wind energy, the rebound of hydropower availability and a modest increase in nuclear energy, as well as the reduction in electricity demand.

Emissions from oil, which mainly come from transportation and industry and therefore cannot be displaced by growing renewable energy alone, have declined by less than 2%.

EU CO2 emissions from fossil fuels

Billion tonne CO2 per year | 365-day running average

Total
↓ 8.1% y-o-y

Oil
↓ 1.6% y-o-y

Gas
↓ 10.6% y-o-y

Coal
↓ 23.6% y-o-y
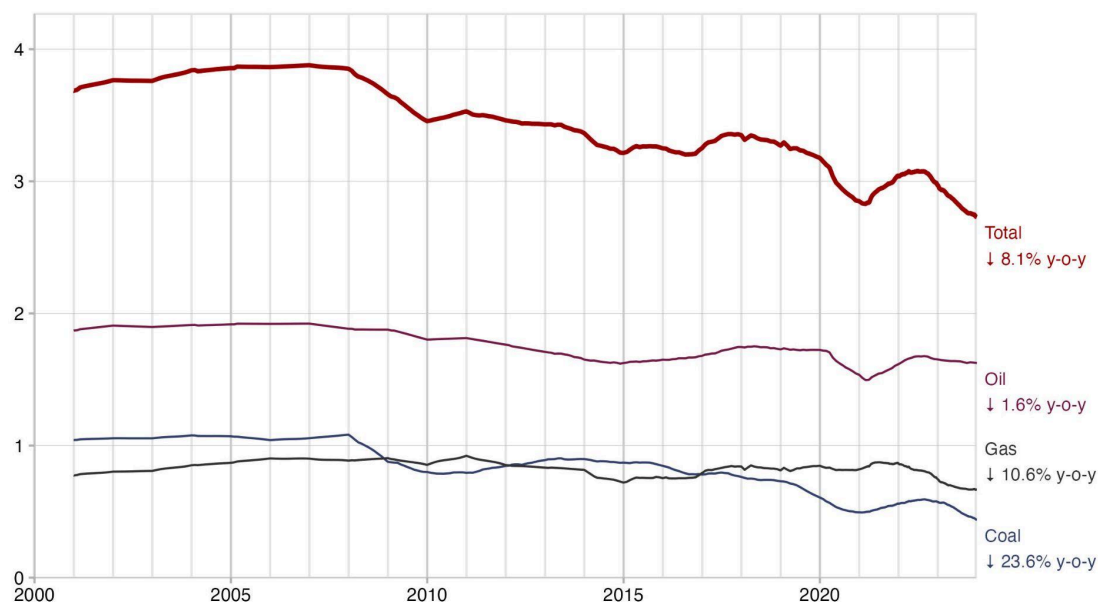
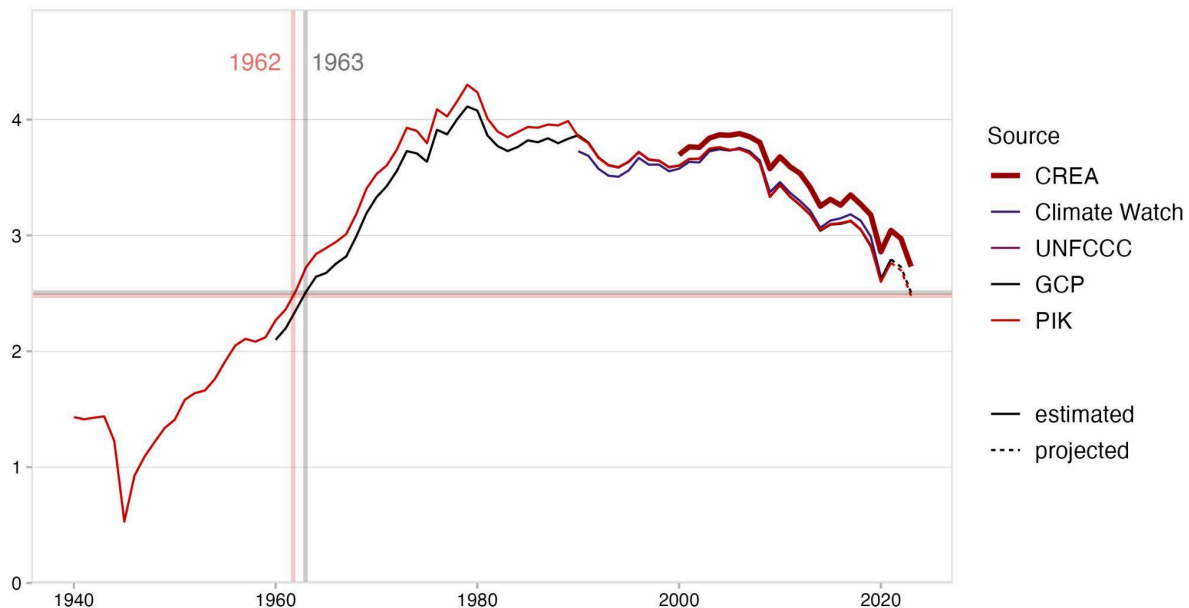**Source**: CREA estimates based on EUROSTAT, ENTSOE, IPCC and ENTSOG.

Lowest levels in 60 years

Using our CO2 tracker to project historical emission datasets, CREA analysis finds that EU CO2 emissions from fossil fuels have reached their lowest point in 60 years — comparable to levels last seen in the early 1960s.

Further investments in renewable energy infrastructure and technologies, encompassing wind, solar, hydropower, and other clean energy sources, will help achieve a continued reduction in CO2 emissions. Reductions in fossil fuel consumption made possible through investments in renewable energy will lower the EU's reliance on petrostates such as Russia whose earnings from the export of fossil fuels are used to wage the war on Ukraine.

EU CO2 emissions from fossil fuels

Projection of historical sources using CREA CO2 tracker, in billion tonne CO2 per year

Source: Climate Watch and CREA estimates based on EUROSTAT, ENTSOE, IPCC and ENTSOG. Agriculture and LULUCF are not included. GCP and PIK times series are extended to 2024 using CREA's estimates.

Appendix

EU CO2 emissions from fossil fuels by sector
Billion tonne CO2 per year | 365-day running average

Total
↓ 8.1% y-o-y

Others
↓ 3.7% y-o-y

Power Generation
(Fossil gas and Coal)
↓ 25.1% y-o-y
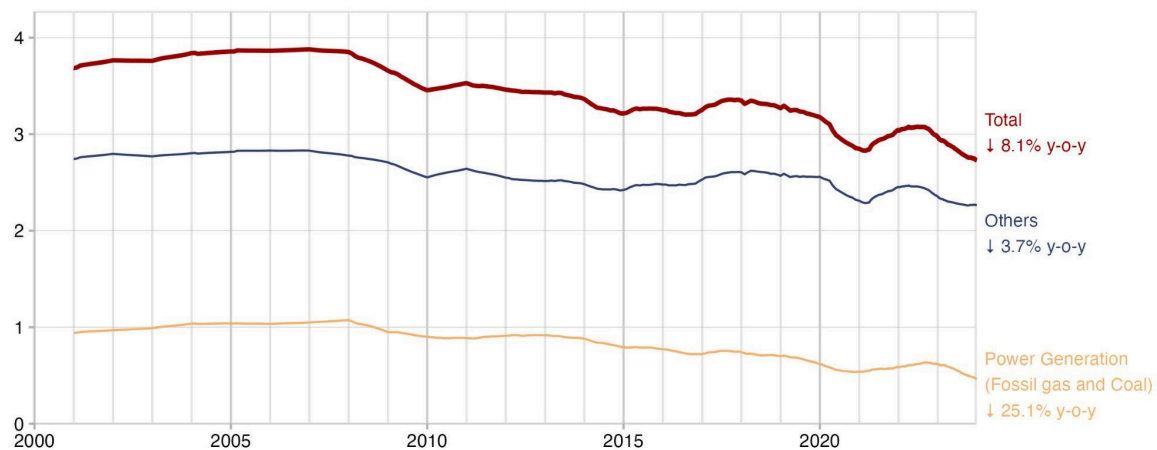
Source: CREA estimates based on EUROSTAT, ENTSOE, IPCC and ENTSOG.

Methodology

Throughout this briefing, CO2 emissions refer to CO2 emissions from fossil fuels only and from the power generation, industry and transport sectors. Agriculture and Land Use, Land-Use Change and Forestry (LULUCF) are not included, nor are methane emissions.

We use 'fossil gas' throughout this briefing to refer to fossil methane, i.e. natural gas of fossil origin.

CO2 emissions

The data used for power generation by fuel type and CO2 emissions is from CREA's platform that can be accessed here. The charts can be viewed on our live EU CO2 emission tracker.

Emissions are estimated from power output based on average emissions from coal and gas-fired generation by country. These are derived by aligning the daily power generation data with earlier Eurostat monthly data on hard coal, lignite and gas use for power generation.

Gas consumption is obtained from daily data on gas flows from ENTSOG, the European gas network operator. We calculate 'apparent consumption', which is the residual of imports from outside the EU, domestic production and flows into and out of storage.

For total oil consumption and for coal consumption outside the power sector, we extend the latest monthly data from EUROSTAT for each country, based on the average deviation from the 2019–2021 average in the past three months. For oil, consumption is based on observed gross inland deliveries, a measure of implied oil consumption based on refinery output, imports, exports and stock changes, as well as deliveries of crude oil and natural gas liquids to non-refinery users, along with several smaller flows (see full definition). For coal, usage is based on final consumption reported by (industrial) users and sales to residential and commercial consumers reported by sellers. Currently, data is available for most countries until the end of August 2022.

CO_2 emissions are estimated from data on fuel consumption, using the Intergovernmental Panel on Climate Change (IPCC) default emissions factors.

Power generation

We collect daily power generation data from the transparency platform of ENTSO-E, the European power grid operator. Note that this dataset may not fully cover the EU-27 region due to missing data points. While trends have shown to be well aligned with other sources (e.g. EMBER), the absolute amounts of electricity demand are likely to be underestimated.

Decomposition of power sector CO2 emission decline

We use a logarithmic-based decomposition, starting with:

$$E = G.I$$

where E represents CO2 emissions, G is the total electricity generation, and I is the average emission intensity.

The change in emissions between 2023 and 2022 can be expressed as:

$$\frac{E_{2023}}{E_{2022}} = \frac{G_{2023}}{G_{2022}} \cdot \frac{I_{2023}}{I_{2022}}$$

Applying logarithm on both side, we obtain:

$$ln\left(\frac{E_{2023}}{E_{2022}}\right) = ln\left(\frac{G_{2023}}{G_{2022}}\right) + ln\left(\frac{I_{2023}}{I_{2022}}\right)$$

Or in other terms,

$$1 = \frac{ln\left(\frac{G_{2023}}{G_{2022}}\right)}{ln\left(\frac{E_{2023}}{E_{2022}}\right)} + \frac{ln\left(\frac{I_{2023}}{I_{2022}}\right)}{ln\left(\frac{E_{2023}}{E_{2022}}\right)}$$

Where the first term of the right-hand side can be understood as the contribution of the power generation change and the second one as the contribution of the change in emission intensity (i.e. change in electricity mix).

About CREA

The Centre for Research on Energy and Clean Air (CREA) is an independent research organisation focused on revealing the trends, causes, and health impacts, as well as the solutions to air pollution. CREA uses scientific data, research, and evidence to support the efforts of governments, companies, and campaigning organisations worldwide in their efforts to move towards clean energy and clean air, believing that effective research and communication are the key to successful policies, investment decisions, and advocacy efforts. CREA was founded in December 2019 in Helsinki and has staff in several Asian and European countries. Our work is funded through philanthropic grants and revenue from commissioned research. In our statement of support for Ukraine, CREA absolutely condemns the Russian military's unprovoked and unjustified attack against another sovereign nation, Ukraine. The assault goes against the fundamental values of human well-being, safety, and dignity that our organisation seeks to advance. We urgently call for an end to the assault and stand in solidarity with the Ukrainian and Russian people calling for just peace.