Annual report shows fossil CO_2 emissions at record high in 2023

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Global carbon emissions from fossil fuels have risen again in 2023—reaching record levels, according to new research from the Global Carbon Project science team.

The annual Global Carbon Budget projects fossil carbon dioxide (CO_2 emissions of 36.8 billion metric tons in 2023, up 1.1% from 2022. The 2023 edition (the 18th annual report) was published in the journal *Earth System Science Data*.

Fossil CO_2 emissions are falling in some regions, including Europe and the U.S., but rising overall—and the scientists say global action to cut fossil fuels is not happening fast enough to prevent dangerous climate change.

Emissions from land-use change (such as deforestation) are projected to decrease slightly but are still too high to be offset by current levels of reforestation and afforestation (new forests).

The report projects that total global CO_2 emissions (fossil + land-use change) will be 40.9 billion metric tons in 2023.

This is about the same as 2022 levels, and part of a 10-year "plateau"—far from the steep reduction in emissions that is urgently needed to meet global climate targets.

The research team included the University of Exeter, the University of East Anglia (UEA), CICERO Center for International Climate Research, Ludwig-Maximilian-University Munich and 90 other institutions around the world.

"The impacts of climate change are evident all around us, but action to reduce carbon emissions from fossil fuels remains painfully slow," said Professor Pierre Friedlingstein, of Exeter's Global Systems Institute, who led the study.

"It now looks inevitable we will overshoot the 1.5°C target of the Paris Agreement, and leaders meeting at COP28 will have to agree rapid cuts

in fossil fuel emissions even to keep the 2°C target alive."

How long until we cross 1.5°C of global warming?

This study also estimates the remaining carbon budget before the 1.5°C target is breached consistently over multiple years, not just for a single year.

At the current emissions level, the Global Carbon Budget team estimates a 50% chance global warming will exceed 1.5°C consistently in about seven years.

This estimate is subject to large uncertainties, primarily due to the uncertainty on the additional warming coming from non-CO_2 agents, especially for the 1.5°C targets which is getting close to the current warming level.

However, it's clear that the remaining carbon budget—and therefore the time left to meet the 1.5°C target and avoid the worse impacts of climate change—is running out fast.

Professor Corinne Le Quéré, Royal Society Research Professor at UEA's School of Environmental Sciences said, "The latest CO_2 data shows that current efforts are not profound or widespread enough to put global emissions on a downward trajectory towards Net Zero, but some trends in emissions are beginning to budge, showing climate policies can be effective."

"Global emissions at today's level are rapidly increasing the CO_2 concentration in our atmosphere, causing additional climate change and increasingly serious and growing impacts."

"All countries need to decarbonize their economies faster than they are

at present to avoid the worse impacts of climate change."

Other key findings from the 2023 Global Carbon Budget include:

- Regional trends vary dramatically. Emissions in 2023 are projected to increase in India (8.2%) and China (4.0%), and decline in the EU (-7.4%), the U.S. (-3.0%) and the rest of the world (-0.4%).
- Global emissions from coal (1.1%), oil (1.5%) and gas (0.5%) are all projected to increase.
- Atmospheric CO_2 levels are projected to average 419.3 parts per million in 2023, 51% above pre-industrial levels.
- About half of all CO_2 emitted continues to be absorbed by land and ocean "sinks," with the rest remaining in the atmosphere where it causes climate change.
- Global CO_2 emissions from fires in 2023 have been larger than the average (based on satellite records since 2003) due to an extreme wildfire season in Canada, where emissions were six to eight times higher than average.
- Current levels of technology-based Carbon Dioxide Removal (ie excluding nature-based means such as reforestation) amount to about 0.01 million tons CO_2, more than a million times smaller than current fossil CO_2 emissions.

The Global Carbon Budget report, produced by an international team of more than 120 scientists, provides an annual, peer-reviewed update, building on established methodologies in a fully transparent manner.

More information: Pierre Friedlingstein et al, Global Carbon Budget 2023, *Earth System Science Data* (2023). DOI: 10.5194/essd-15-5301-2023

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