

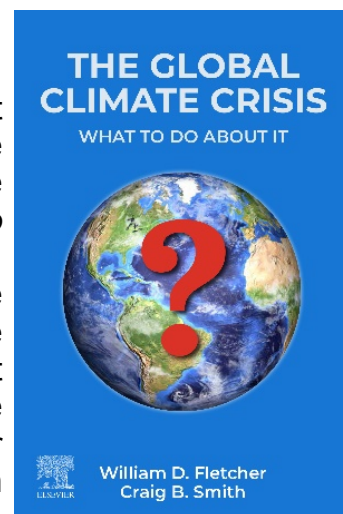
REACHING NET ZERO: 2023 END-OF-YEAR UPDATE

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New edition

We have prepared a totally updated 2nd edition of *Reaching Net Zero* that will be available March 2024, reflecting the many changes that have occurred in the 3 years since the 1st edition was published. We have changed the title of the 2nd edition to: ***The Global Climate Crisis: What to do about it.***

It summarizes how our rapidly changing climate is affecting the world, what lies ahead, and what we can and need to do. If you are interested in receiving an advance copy, please let us know. Be aware that Elsevier publishes text books and scientific publications and has priced the book according to their guidelines. The 1st edition cost \$160/copy, but for the 2nd edition the publisher lowered the price to \$130/copy. With discounts, it is available for less than \$100.



Update reports

Our last update, "*Reaching Net Zero: 2023 Mid-Year Update*," was published in July 2023 and is available on our website, www.theglobalclimatecrisis.com. The following is a brief summary of important developments since our last report.

Greenhouse gas emissions

On January 1, 2024, according to the NOAA monitoring station on Mauna Loa, Hawaii, CO₂ concentration in the atmosphere reached an average of 424 parts per million (ppm) and a peak value of 426 ppm. The atmospheric concentration of CO₂ continues its steady climb, consistently since 1958 when the first measurements were made.⁽¹⁾

Global emissions of greenhouse gas emissions through 2022 are shown in Figure 1. It is estimated that global greenhouse gas emissions will reach a new record in 2023. Emissions of CO₂ will likely exceed 40+ billion metric tons. Coal use has been declining globally except for China and India. Emissions of methane have been increasing with greater use of natural gas. It is only a matter of a year or two before global emissions reach 60GmtCO_{2e}/year.

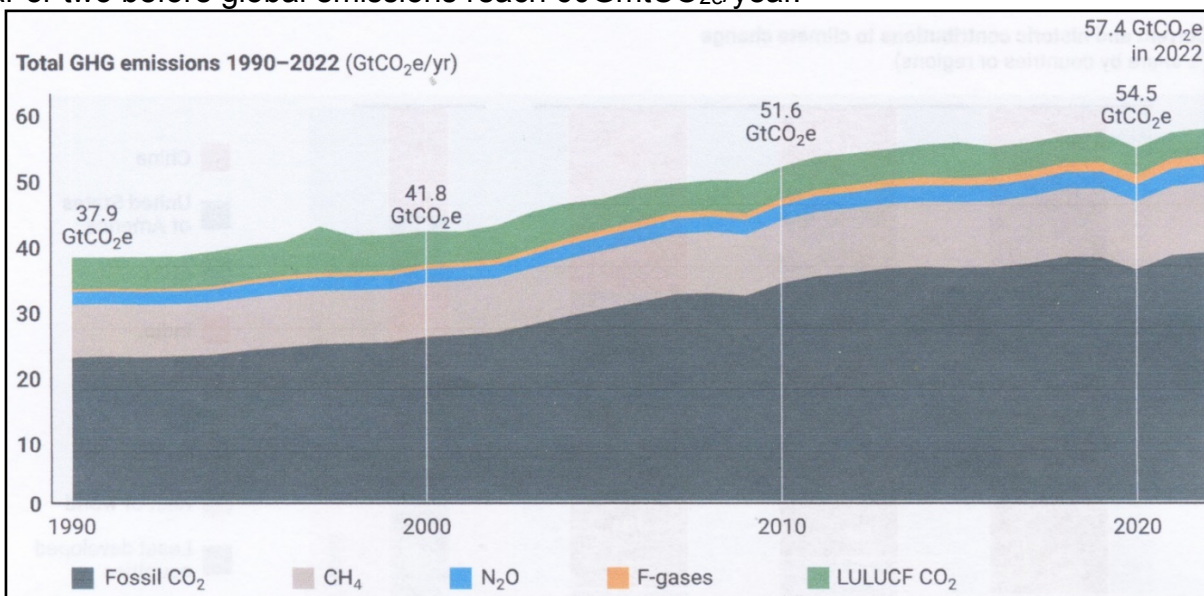
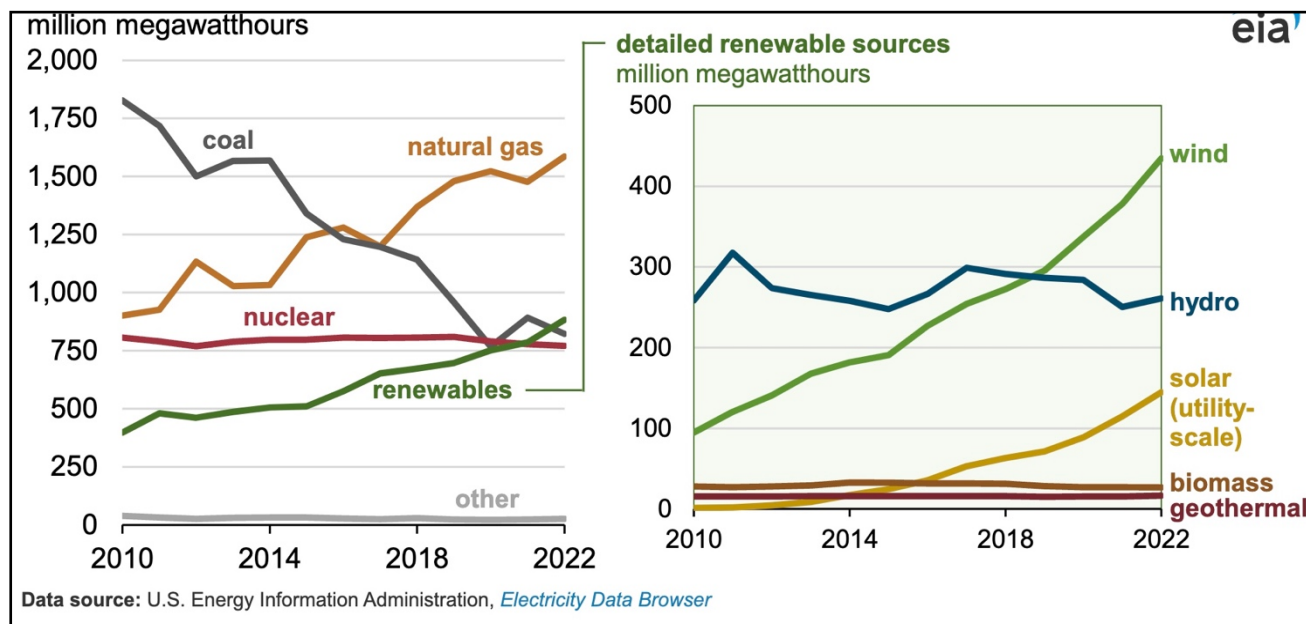


Figure 1: Total GHG emissions.

In the U.S., total emissions are estimated to 6,340 million metric tons in 2021, down from a peak of around 7,700 million metric tons in 2007, primarily due to declining use of coal. (See Figures 2 and 3). Figure 3 shows the U.S electric power sector, with the sharp decline of coal over the last decade, the rise of natural gas, and the fact that renewables (wind, hydro, and solar) now surpass coal and nuclear as sources of electricity.



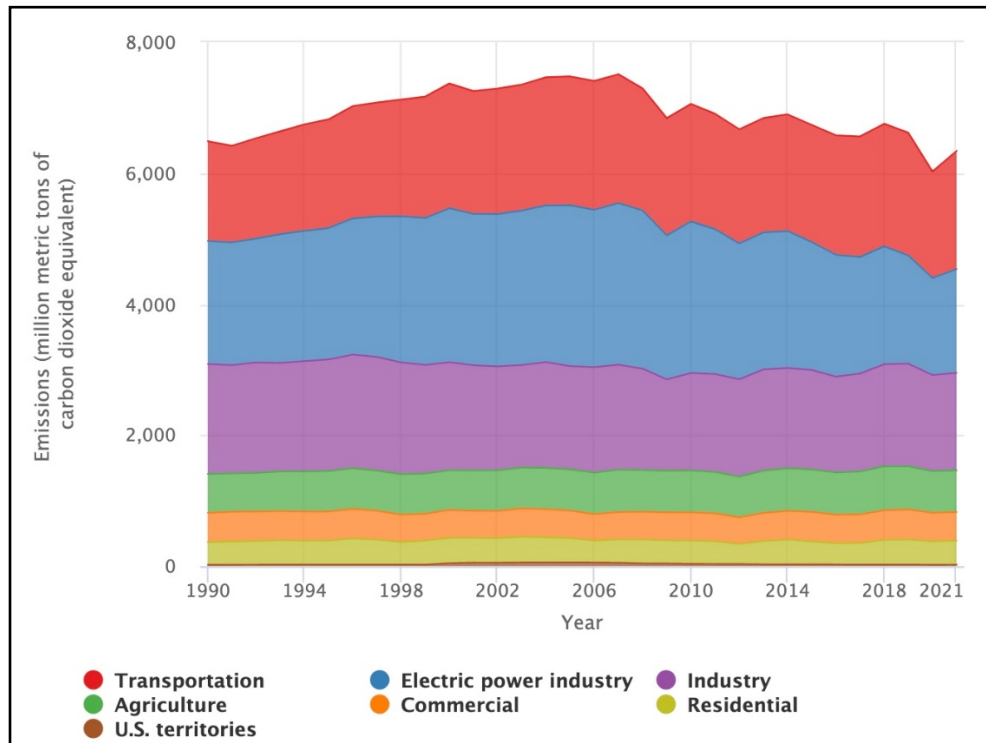


Figure 2: U.S. Greenhouse gas emissions by sector, 1990-2021⁽²⁾

Figure 3: U.S. electric power sector generation sources, 2010-2022

Global temperature increase

Although final results are not yet available at the time of this report, it is virtually certain that 2023 will be the hottest year on record. Through January to November, the world's average temperature reached 15.1°C (59.2°F), an increase of 1.46°C from 1850 preindustrial levels, or a rise of about 1°C per century.⁽³⁾ Thus the world is about to exceed the IPCC's long-established goal of not exceeding 1.5°C.⁽⁴⁾

The other alarming aspect of the current rate of temperature change is its speed—more than 10 times faster than the Paleocene-Eocene Thermal Maximum that happened 56 million years ago, when volcanic eruptions dumped so much CO₂ in the atmosphere that the average temperature increase went from about 27°C (80°F) to about 32°C (90°F). The difference is that this 5°C rise took 10,000 years.⁽⁵⁾

With increasing temperatures, the world is “moving perilously close to multiple risk tipping points,” according to a recent UN report on “Interconnected Disaster Risk.”⁽⁶⁾ The risks include groundwater depletion, deadly heat waves, droughts, more frequent wildfires, increased polar ice melt, and increased species extinction. Climate change could render many densely populated regions so hot that deadly heat waves would result.⁽⁷⁾

Oceans heating

The oceans are also setting new records. During the summer months, oceans have averaged 21°C (70°F), setting new records for three consecutive months.⁽⁸⁾ Nearshore ocean temperatures in Florida reached hot tub temperatures—38°C (101°F).

One concern is that scientists don't know exactly how rising ocean temperatures affect sea life. “Some animals may move down the water column to darker, colder waters. Others may move north—or south—depending upon where the cooler waters are. Many may flourish; others will perish. And some may not be affected in all,” according to Jarrod Santora, a fisheries biologist with the National Oceanic and Atmospheric Administration.⁽⁹⁾

Sea level rise

Sea level rise is an ongoing concern for coastal areas subject to flooding and erosion. The sea level around New Orleans is currently rising at the rate of 1/3 of an inch per year, or 3 feet per century, the highest rate measured in the United States. It is likely to rise even faster in the future.

This year, a new problem arose. Beginning in the spring, a wedge of saltwater pushed up the Mississippi River. Towns 20 to 30 miles inland from the ocean began experiencing high salt levels in drinking water. Salt fouled water heaters and other equipment. The problem is compounded by drought-caused low water levels and dredging that creates deep channels that facilitate saltwater intrusion. As sea level rise continues, it may become necessary to build large reverse osmosis filtration systems for water supplies, as is being done in Tampa Bay Florida.⁽¹⁰⁾

Antarctic sea ice:

Warming oceans are also causing sea ice to melt. In 2023, Antarctic ice had four consecutive months with the lowest sea ice on record, about 550,000 mi² less than the previous low of August 2019.⁽¹¹⁾

Antarctica icecaps melting

We know that sea ice forms a barrier to prevent icecaps in Antarctica from sliding into the sea. New research has given insight into the mechanisms that are causing this vital barrier to break down.⁽¹²⁾ The answer is complicated, but basically it has to do with how ocean currents move warmer water through crevices in the ice, thinning the ice shelf. This research is providing new understanding of the processes causing the decline of glaciers. Scientists warn, “It's not too late to prevent their collapse, but we're running out of time.”

Pope Francis' letter

On October 4, 2023, Pope Francis issued an urgent plea for greater efforts to deal with the climate crisis. In a 7,000-word document, the Pope points out there has been little progress on this critical issue since the encyclical on the environment he wrote eight years ago. His report is strongly based on the latest scientific reports (which are documented) and explain the causes of a crisis that he says is spiraling out of control and requires “swift collective action to abandon fossil fuels before it’s too late.” With the 28th “Conference of Parties “ (COP28) a month away, he urges world leaders “to transcend their petty interests” and replace fossil fuels with renewable energy. He chastises the large emitters, including the U.S., for policies that cause suffering in poor countries that have made minimal contributions to global emissions.⁽¹³⁾

Sir David Attenborough's video

In a video, just over one minute long, Sir David Attenborough, famed British biologist and natural historian, shares his concerns about climate change. He states, “Our atmosphere now contains concentrations of carbon dioxide that have not been equaled for millions of years.” He warns that we are close to reaching tipping points that could send global temperatures to new record highs. He warns, “We will face the collapse of everything that gives us our security—food production, access to fresh water, habitable ambient temperatures, and ocean food chains. And if the natural world can no longer support the most basic of our needs, then much of the rest of civilization will quickly break down.” He goes on to say, “Please make no mistake. Climate change is the biggest threat to global security that modern humans have ever faced.”⁽¹⁴⁾

Meeting between President Biden and President Xi Jinping

In a recent meeting between U.S. President Biden and China President Xi Jinping, greater cooperation to address climate change was one of the topics of discussion. There was an agreement to take steps to reduce emissions of methane and other greenhouse gases. China is the world’s largest emitter of methane and effective methods to reduce methane emissions are important if the world is going to have any success in slowing global warming in the near term.

In a joint statement issued in Beijing and Washington, they said that the two countries would work together to rise up to one of the greatest challenges of our time. As author Moritsugu writes, “They reiterated a pledge made by the *Group of 20*, of which both (countries) are members, to pursue efforts to triple global renewable energy capacity by 2030.” In addition, the two countries have agreed to “restart talks on energy policies and launch a working group on enhancing climate action in what they called the critical decade of the 2020s.”⁽¹⁵⁾

U.S. climate report

On November 14, 2023, the White House released the Fifth National Climate Change Assessment (the last assessment report was issued in 2018). News reports concluded that in the U.S., efforts to “adapt to climate change and to curb the burning of fossil fuels have expanded since the last assessment...But without deeper cuts in global net greenhouse gas emissions and accelerated adaptation efforts, severe climate risk to the United States will continue to grow.”⁽¹⁶⁾

Six key findings from the report were cited:

- The more the planet warms, the greater the impacts.
- Heat waves, wildfires and other extreme events are hitting California and the Southwest hard.
- U.S. emissions have decreased while the economy and population has grown.
- Climate change exacerbates inequities.
- Climate action has increased in every region of the U.S.
- Meeting U.S. mitigation targets means reaching net-zero emissions.

UN 2023 Gap Report⁽¹⁷⁾

The title of the latest United Nations Emissions Gap Report provides a stark reminder of just how far global warming has progressed: “*Broken Record—temperatures hit new highs, yet world fails to cut emissions (again)*.” This, the 14th *Emissions Gap Report*, was intentionally published ahead of COP28 to provide an independent science-based assessment of the gap between pledged greenhouse gas reductions and the reality of what is needed to reach the IPCC temperature goals.

Concerning global warming, the report had this to say: “The world is witnessing a disturbing acceleration in the number, speed and scale of broken climate records. At the time of writing, 86 days have been recorded with temperatures exceeding 1.5° C above preindustrial levels... ..These records were accompanied by devastating extreme events, which the IPCC has warned us are merely a meek beginning.”

The report went on to say that global greenhouse gas emissions had also set a new record. In 2022 (data for 2023 is not yet available), total greenhouse gas emissions reached 57.4 GtCO_{2e}. This indicates that all sectors (other than transportation) have rebounded from the decrease in emissions that resulted from the Covid 19 pandemic. (See Figure 2). Globally, 10% of the world’s population having the highest income levels accounted for nearly half of the emissions. The bottom 50% of the world’s population contributed only about 12% of total emissions.

The emissions gap, depending upon the temperature goal sought and the selected deadline (2030, 2035, or 2050), ranges from about 24 GtCO_{2e} to 56 GtCO_{2e}. The means of reducing the gap depends upon the commitments made by individual countries to reduce their emissions, the so-called Nationally Determined Contributions (NDCs). The report considers various “scenarios” of how well each country is doing in meeting its NDC, or if it is planning to increase it. If current policies are continued, global warming is estimated to be limited to 3°C. If on the other hand, all unconditional and conditional pledges are met by 2030, global warming could be limited to 2.5°C. However, the report concludes, “Even in the most optimistic scenario considered in this report, the chance of limiting global warming to 1.5°C is only 14%.”

Conference of Parties: COP28⁽¹⁸⁾

A good summary of COP 28 was given by writer Kennedy Maize, who noted, “Nothing was resolved at the COP 28 Conference on Climate Change except the growing conviction that the days of fossil fuels are numbered.” There were three major topics during the conference.⁽⁹⁹⁾

The first was a push to phase out fossil fuels. As might be expected this was vigorously opposed by the countries that are the major producers and users of fossil fuels. This debate went back-and-forth until the final hours of the conference. In the end, the best the participants could do was to commit to “transitioning away from fossil fuels and energy systems, in a just, orderly, and equitable manner, accelerating action in this critical decade, so as to achieve net zero by 2050.” As we have noted previously, this is an impossibility, and will not happen. In addition, participants added “phasing out inefficient fossil fuel subsidies that do not address poverty or just transitions, as soon as possible.”

Second major topic was that of loss and damage. The developing world has benefited from fossil fuels for the past 200 years and is now telling developing countries with fossil fuel resources that they should not use them. As one might realize, that is not a winner. The best that the delegates meeting in Dubai could do was again discussing a fund that would help compensate vulnerable countries coping with climate change. The UAE and Germany each committed to contribute \$100 million to the fund. The U.S. said it would participate, but did not specify an amount. In all likelihood billions of dollars will be needed for this cause. Unfortunately the commitment to create such a fund lacks any specifics on financial targets, how it would be funded and how funds would be deployed.

The third topic was that of nuclear power. Participants at the conference discussed the fact that nuclear plants emit no greenhouse gases, can operate continuously and generate large amounts of

electricity. The COP28 recommendations included a plea for tripling of low emission electric generating technologies using wind and solar renewables. Nuclear advocates at the conference then jumped on the concept of tripling nuclear power sources by 2050. One report stated that the United States and 21 other countries pledged to tripling nuclear energy capacity by 2050. This was not a COP28 recommendation endorsed by 198 nations. As we have pointed out elsewhere, this is highly unlikely. Building large numbers of nuclear power plants will take much longer, and cost much more than cheaper renewable alternatives. In addition, public acceptance and management of radioactive waste are two negatives that will limit a nuclear response. (See our op-ed on nuclear power in *The Hill*).⁽¹⁹⁾

Final perspective: news media reported that U.S. oil production is at a record high, India and China continue to expand coal production, and oil producers continue to invest billions in exploration and new projects to meet an ongoing demand for oil and gas that will result if no significant effort to phase out fossil fuels comes to pass.

Climate change impacts

For the U.S., 2023 was a record-breaking year for billion-dollar weather disasters. There was a total of 28, with nearly 500 deaths and costs of \$92.9 billion. In the U.S. and globally, weather disasters included severe storms (hurricanes and cyclones), floods, wildfires, droughts, and heat waves.⁽²⁰⁾

For example, a cyclone in southern Brazil washed away houses, killed 32 people, and left 2,300 homeless.⁽²¹⁾ Mediterranean storm *Daniel* caused devastating floods in Libya that claimed more than 11,000 lives when two dams collapsed. There were 2,000 dead in one city alone, as the floods washed away entire neighborhoods, leaving dead bodies scattered on the Mediterranean beaches.⁽²²⁾ The horrific wildfire that literally wiped out the town of Lahaina in Maui is another example, with over 100 known dead.

Every week, somewhere in the world, we read of new disasters. What will it take before the world gets serious about reducing greenhouse gas emissions?

2nd edition summary

In October 2023 we published a 2-part article in *The Messenger*. It summarizes some but not all the key points in the forthcoming second edition of our book. Here are links:

Part 1: *With Climate Change, Failure Is an Option — One We'll Have to Live With*

<https://themessenger.com/opinion/climate-change-failure-emissions-fossil-fuels-regulations-energy-transition>

Part 2: *What It Takes To Stop Climate Change*

<https://themessenger.com/opinion/stop-climate-change-energy-net-zero-emissions-fossil-fuel-global-warming>

Footnotes

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- (22) Mourad, Yousef, "10,000 still missing in the flooded Libyan city," **Los Angeles Times**, Pg A-3, 9/16/23