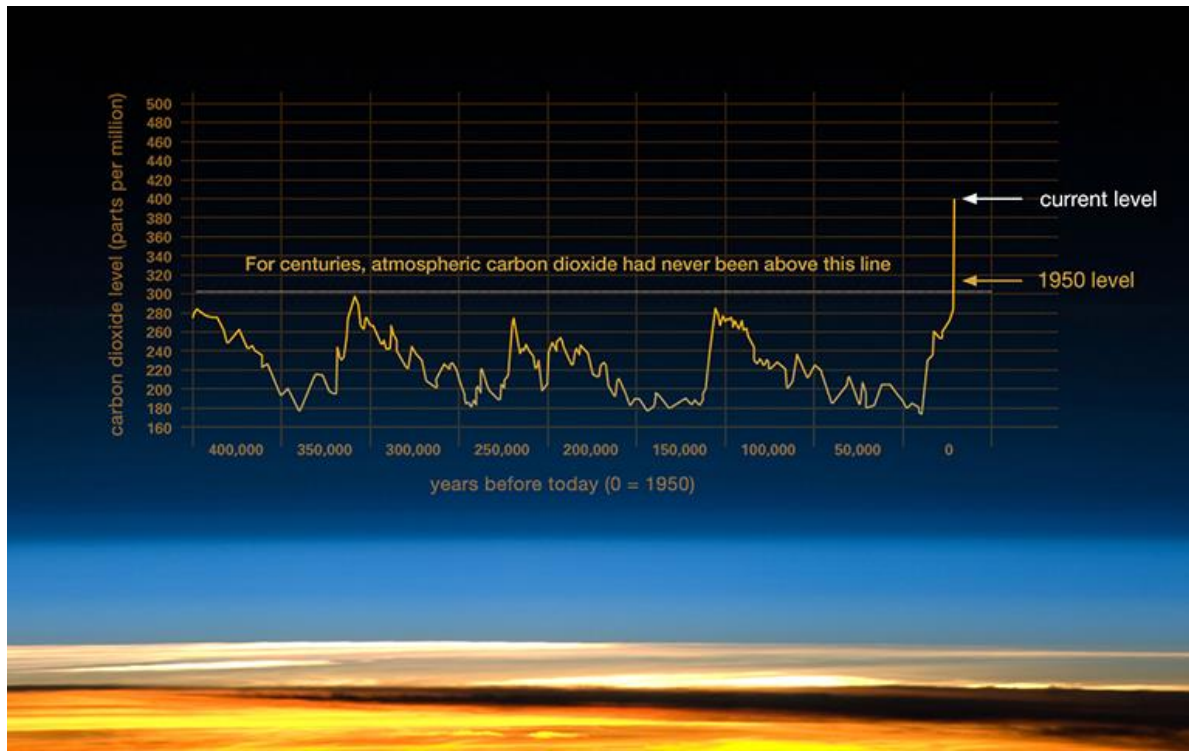
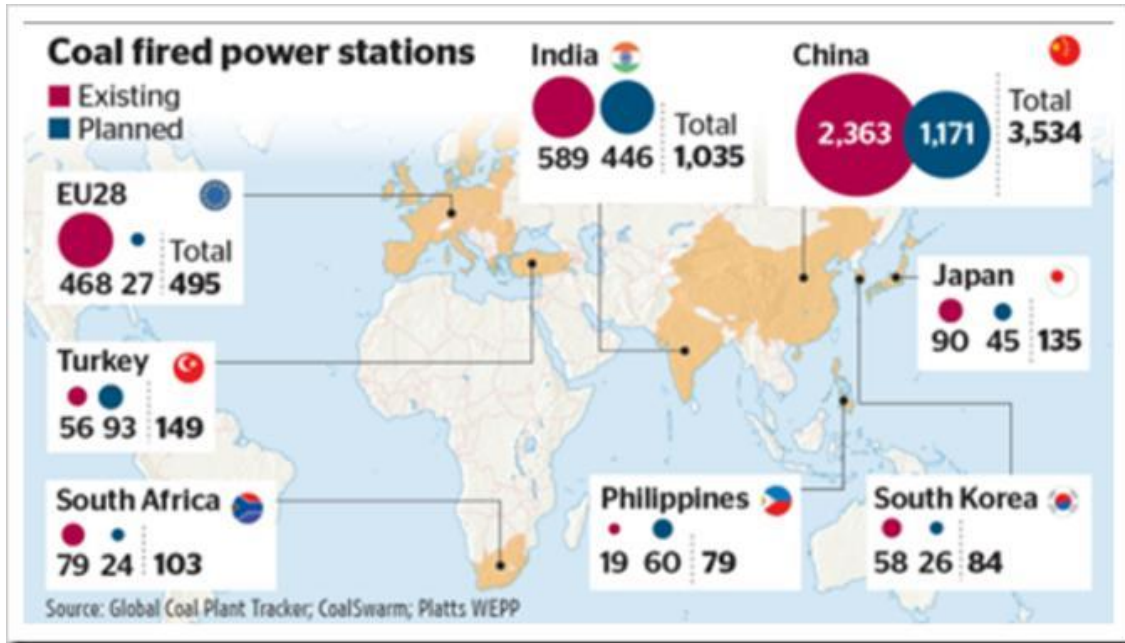


2. **The Earth's climate has undergone long cyclic periods of hot and cold (mostly cold) over eons of time.** These Ice Age cycles in more recent geologic history have typically lasted about 100,000 years, with mini-Ice Ages and warming cycles within each larger cycle.
3. **The most recent mini-Ice Age that took place in the Northern Hemisphere started about 20,000 years ago, and ended about 11,000 years ago.** So for much of recorded human history, we have enjoyed an unusually warm period that has been favorable to agriculture and the growth of our human civilization. That's the good news. The bad news is we don't know how long it will last, whether it will get hotter or colder, and what impact climate change will have on our lives.
4. **Although most of the warming-cooling cycles throughout geologic history (that goes back hundreds of millions of years) have occurred over very long periods of times (tens of thousands of years), some mini-Ice Ages have occurred rather suddenly.**
5. **The last mini-Ice Age to hit Europe and North America 20,000 years ago happened over a period of only 10 to 20 years!** The sudden and climate changes it produced cause many plants and animals to go extinct, and forces humans to migrate to warmer areas to survive.
6. **During the last mini-Ice Age, a glacier estimated to be 3,000 feet thick covered much of North America and the area where Chicago is now.** That's a covering of ice and snow more than twice the height of the tallest skyscrapers in Chicago. Image the effect if that happened today!
7. **CO₂ is a global warming gas because it causes the atmosphere to retain heat.** The concentration of CO₂ in recent years has not only been rising but also accelerating at an alarming rate. In 2012, it exceeded 400 parts per million (ppm) for the first time in recorded history. In 2019, it has exceeded 440 ppm. The last time it was that high was 3 to 5 million years ago! During the Age of the Dinosaurs 150 to 200 million years ago, scientists say the atmospheric concentration of CO₂ was about 5 times higher than today. But the planet also had a much warmer and wetter climate then.
8. **In the 1,000 years that preceded the Industrial Revolution of the 18th century, atmospheric carbon dioxide held steady at around 270 to 280 parts per million.** As coal powered the growth of industrialization and transportation, CO₂ levels began to creep up about 1 ppm per year. It continued to increase at that rate until the 1970s when it began to increase at an even faster rate, which scientists attribute to the exponential growth of the human population, energy consumption, industrialization, deforestation and vehicle usage. There has been no increase in volcanic activity or other natural sources of CO₂ that would account for such a rapid rise in CO₂ in the atmosphere.

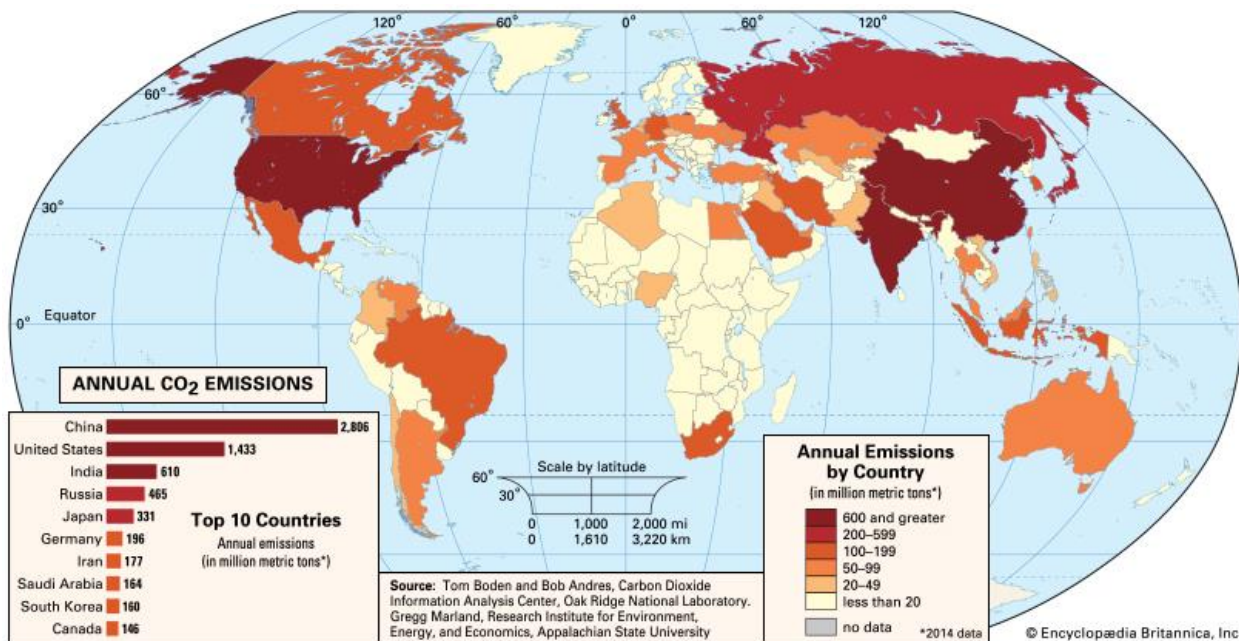


9. **The world population is currently around 7.7 BILLION people.** The world population at the start of the Industrial Revolution in 1800 was only 1 billion, a number that took humanity 10,000 years to achieve. By 1930, the world population doubled to two billion, then three billion by 1960, then four billion by 1974, and five billion by 1987. That's an exponential growth rate that is unsustainable. All of these people are leaving a HUGE carbon footprint on the planet.

10. As the world has industrialized, more and more people who used to live in rural areas have moved to cities seeking jobs and opportunity. And as their standard of living has risen, they have been buying cars like crazy. Twenty years ago everybody in China rode bicycles. Today, China is the world's biggest market for auto sales, exceeding the U.S. and Europe. As a result of all this growth, **the world vehicle population is now over ONE BILLION cars and trucks, and 99.6 percent of them burn gasoline or diesel fuel.** As of 2018, there are only about 4 million electric vehicles worldwide. In the **U.S., transportation accounts for about 28 percent of total CO2 emissions, while power generation also accounts for 28 percent.**



11. **Coal-fired power plants continue to be a major source of manmade CO₂.** China has nearly 2,400 coal-fired power plants with more than 1,000 new plants planned for construction in the years ahead. India is next on the list with almost 600 coal-fired power plants, followed by Europe with 470. Currently, there are about 360 coal-fired power plants in the U.S. However, since 2010 nearly a third of these coal-fired plants have been shut down or converted to less expensive and cleaner burning natural gas (which produces only about one-fifth as much CO₂ as coal when it is burned). The rapid growth of wind and solar power has also reduced the demand for coal.



12. Political agreements have been made to address the issue, but not everyone is onboard and some are reversing direction. **The Paris Agreement of 2015 created a voluntary plan of action for governments around the world to reduce their use of fossil fuels to reduce CO2 emissions.** The goal of the agreement was to reduce global warming caused by manmade CO2 to less than 2 degrees C (about 4 degrees F) in the near future, with the eventual goal of stopping and stabilizing temperature increases. Although 197 nations signed the agreement (including the U.S. and China that together account for 40 percent of all global emissions), some including Russia, Turkey and Iran have not formally adopted the plan. **Also, in 2018 President Trump decided to withdraw the U.S. from the agreement citing the need for continued energy growth.** Most saw the move as a political favor to his supporters in the fossil fuel industry.

So what conclusions can be made from this information?

It's obvious that human activity over the past 200 years, and especially the most recent 20 years has had and will continue to have a major impact on CO2 emissions, Global Warming and Climate Change.

Scientists have documented an increase in average global temperatures of around 1.5 degrees F per year over the past five years. This is a significant trend that is already having serious consequences.

More heat in the atmosphere means more energy and moisture in the atmosphere. This, in turn, means much more rain for some areas (those once in 500 year floods are now happening every few years!), more drought in other areas, more forest fires in the western U.S., and more (and stronger) tornadoes and hurricanes causing more deaths, injuries, destruction and financial loss from climate-related disasters.

More heat in the atmosphere also means more melting of polar ice caps and a corresponding rise in worldwide sea levels. Glaciers have been melting and shrinking at an accelerating rate, with some disappearing entirely. Maybe you should rethink buying that beach front property in Florida because half the state may be underwater in the not too distant future!

IF anything can be done to mitigate Global Warming and Climate Change (and I'm not sure we can considering the number of people and vehicles on our planet, our dependence on fossil fuels, and the money and politics behind the fossil fuel industry) , **we had better be doing it sooner rather than later.**

Some say we may have already passed the tipping point and that anything we do individually or collectively going forward will be too little too late. I hope this is not true because I want my grandchildren and great grandchildren (and myself) to continue living in a world that is hospitable to human existence and civilization.

Reducing our reliance on coal-fired power plants by converting them to cleaner burning natural gas, or replacing them with wind, solar and yes nuclear power generation can reduce global CO2 emissions.

Nuclear has its own drawbacks and risks, but in terms of CO2 it is a clean energy source.

Electric vehicles that get their power from clean or relatively clean sources is another step we can take to reduce CO2 emissions. Electric car battery technology has come a long way in recent years and continues to improve. Some of today's electric cars can drive over 300 miles on a single charge, and others are coming that will go much further than that. Electric car sales are also increasing, with over a million sold worldwide last year. More electric cars are now being sold in China than any other country. But until there is a significant shift away from the internal combustion engine to battery or fuel cell powered transportation, those one billion plus vehicles that are on the road now will continue to be a major source of CO2.

Stopping the destruction of tropical rain forests, smarter land use policies, reducing urban sprawl, making homes and buildings more energy efficient, changing vehicle usage patterns to increase public transportation options and vehicle ride sharing are additional changes that are being made to reduce our carbon footprint and CO2 emissions. Less hot air from politicians would also help!

Additional Food for Thought Regarding Global Warming

The Earth's atmosphere is about 78 percent nitrogen, 21 percent oxygen and the rest is trace gases including argon, methane, nitrogen oxide and carbon dioxide (only 0.04 percent). The current average year-round temperature for our planet, according to NASA data, is 58.3 degrees F (which is up from 57 to 57.5 degrees from the 1940s through 1970s).

Because CO2 traps and holds heat, the more CO2 in the atmosphere, the more heat is retained and the higher the average temperature of the planet.

The planet Venus, which is almost the same size as Earth but is closer to the Sun, has an atmosphere that is 96 percent carbon dioxide. This has created a runaway greenhouse effect that has raised the average temperature on Venus to 846 degrees F, hot enough to melt lead!

Methane Is An Even Greater Threat to Global Warming

Methane is an even greater threat to Global Warming because it traps and holds heat 21 times as much as carbon dioxide. Methane (natural gas) is a byproduct of oil drilling and production, organic material breaking down in landfills, and natural gas emissions from rice paddies, animal manure, cow farts, peat bogs, swamps, lakes and thawing permafrost. Although methane accounts for nearly 10 percent of all global greenhouse gases, it has been increasing, from 700 parts per billion (ppb) in 1750 to 1,818 ppb in 2011. To make things worse, methane can persist in the atmosphere for up to 100 years or more.

[Click Here](#) for more information from the EPA about greenhouse gases.

Jet Vapor Trails Are Also Warming The Planet

Jet aircraft contrails are also playing a role in Global Warming. When combustion byproducts (water vapor and CO₂) exit a jet engine and hit the cold upper atmosphere, the water vapor condenses and forms a vapor trail cloud. The vapor trails produced by commercial jet traffic can trap enough heat to cause a localized increase in temperature. After the 9/11 terrorist attacks on the Twin Towers in New York City, all air traffic was temporarily grounded for three days while officials sorted things out. Meteorologists noted a drop in temperature during this period in areas near major air hubs due to the lack of vapor trails in the sky.

[Click Here](#) to read about what happened when jet traffic was temporarily grounded following 9/11.

Some scientists have also said that jet vapor trails alone may account for much of the global rise in temperatures since the 1970s!

March 2019

Trump Wants to Slash Global Warming Research Budget

The Trump administration wants to slash climate and ocean research programs as well as education initiatives, grants, and other activities throughout the National Oceanic and Atmospheric Administration (NOAA). The administration has proposed cutting NOAA's budget to about \$4.5 billion for fiscal year (FY) 2020, a drop of about 18 percent, nearly \$1 billion, compared with the agency's FY 2019 enacted budget.

The proposed budget would terminate most climate research programs within the agency's Climate Program Office and eliminate climate competitive research funding. Among other cuts, the budget would terminate the National Centers for Coastal Ocean Science, the National Sea Grant College Program, and some Arctic research, decrease funding for ocean exploration and research efforts; and eliminate coastal zone management grants.

Trump also wants to kill any CO₂ research within NASA's budget. The proposed 2019 budget of \$1.78 billion is an almost 6.5 percent less from the \$1.92 billion allocated in FY 2017. The budget cuts five Earth science missions, including the Orbiting Carbon Observatory 3 (OCO-3), which would observe carbon dioxide in Earth's atmosphere.

Instead of taking action to do more research on global warming and climate change, the Trump administration has decided to stick its head where the sun don't shine and pretend the problem does not exist. God help us!

November 2019

Average Global Greenhouse Gas Levels Hit Yet Another Record High

The [World Meteorological Organization \(WMO\)](#) reports that levels of heat-trapping greenhouse gases in the atmosphere have reached another new record high. The impact of this continuing trend will be more climate change, higher temperatures, more extreme weather, water stress, sea level rise and disruption to marine and land ecosystems.

The WMO Greenhouse Gas Bulletin showed that globally averaged concentrations of carbon dioxide (CO₂) reached **407.8 parts per million** in 2018, up from 405.5 parts per million (ppm) in 2017.

The increase in CO₂ from 2017 to 2018 was very close to that observed from 2016 to 2017 and just above the average over the last decade. Global levels of CO₂ crossed the symbolic and significant 400 parts per million benchmark in 2015. CO₂ remains in the atmosphere for centuries and in the oceans for even longer.

Concentrations of methane and nitrous oxide also surged by higher amounts than during the past decade, according to the WMO network which includes stations in the remote Arctic, mountain areas and tropical islands.

Since 1990, there has been a **43 percent increase** in total "radiative forcing" (the warming effect on the climate) by long-lived greenhouse gases. **CO₂ accounts for about 80 percent of this**, according to figures from the US National Oceanic and Atmospheric Administration quoted in the WMO Bulletin.

"There is no sign of a slowdown, let alone a decline, in greenhouse gases concentration in the atmosphere despite all the commitments under the Paris Agreement on Climate Change," said WMO Secretary-General Petteri Taalas. "We need to translate the commitments into action and increase the level of ambition for the sake of the future welfare of the mankind," he said.

"It is worth recalling that **the last time the Earth experienced a comparable concentration of CO₂ was 3-5 million years ago**. Back then, the temperature was 2-3°C warmer, sea level was 10-20 meters higher than now," said Mr Taalas.

Global emissions are not estimated to peak by 2030 but will continue to increase if current climate policies and promises are not met. We are falling behind the greenhouse gas targets that were set at the Paris Agreement. The difference between "where we are likely to be and where we need to be" is known as the emissions gap.

November 2019

U.N. Warns Climate Chaos is Coming if Nations Don't Drastically Reduce CO2 Emissions Now

The [United Nations Environment Programme](#) issued a report that predicts the world will heat up another 3.2 degrees C (5.7 degrees F) within 10 years if carbon emissions are not curtailed five-fold. Current efforts to reduce carbon emissions are falling far short of what they have to be to limit average global temperatures increases to 1.5 degrees C by 2030. Scientists say if the temperature continues to rise beyond 1.5 degrees by 2030 there will be severe consequences for everyone.

To minimize the impact of global warming, greenhouse gas emissions need to be cut 7.6 percent a year for the next 10 years. But over the past decade, carbon dioxide emissions from the use of fossil fuels have risen on average by 1.5 percent a year. In 2018, the total reached 55 gigatonnes, a 2.0 percent increase over 2017.

The 20 wealthiest countries that make up the G20 are responsible for 78 percent of all emissions. But so far, only the EU, the UK, Italy and France have committed to long-term net zero targets. President Trump pulled the U.S. out of the Paris Agreement, and seven G20 members, including Australia, Brazil and Canada, need to take more action to meet their current carbon emission target. Russia, China and India also have to make more effort to reduce their consumption of fossil fuels.

China has the world's second largest economy and their greenhouse emissions continue to grow, although they appear to be on track to peak before 2030, which is the target date that China set for itself. China has invested heavily in renewable energy such as solar and wind, and it leads the world in electric vehicle infrastructure. However, the U.N. report says per capita emissions in China are now in the same range as the European Union due to the huge growth in China's car population.



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