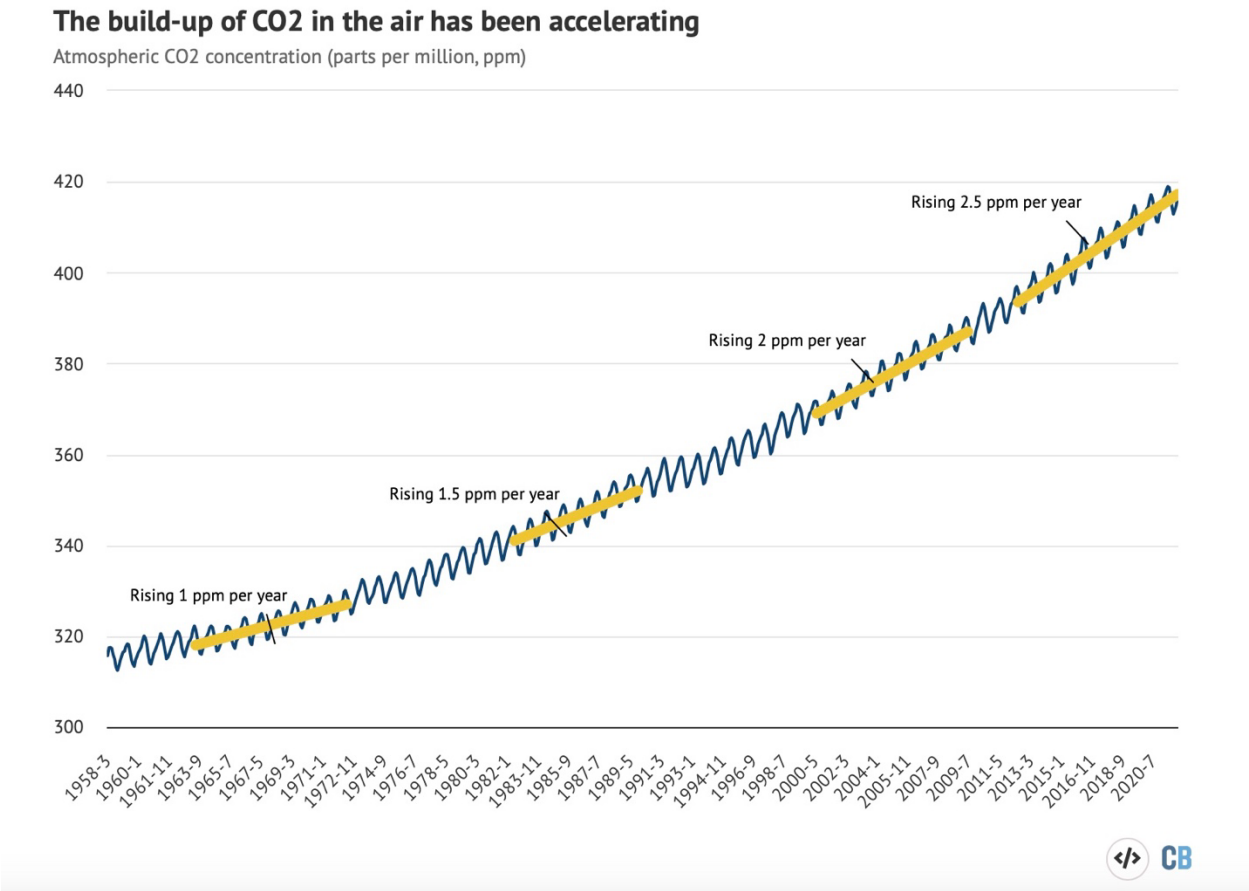
David Comings, M.D. interview

I am a physician/scientist with a specialty in genetics. I spent my career as Head of the Department of Medical Genetics at the City of Hope Medical Center in Duarte, California. During that time, I published over 490 peer reviewed papers. I say that simply to show my interest in doing research.

After I retired, I turned my research interests to climate change and global warming and followed the scientific literature on this subject. I kept a running account of what I learned in a document called *How to Combat Global Warming*. It eventually ran to 396 pages with 42 pages of references. It and the text of this pod cast, and other items are available for free download at www.thecomingsfoundation.org.

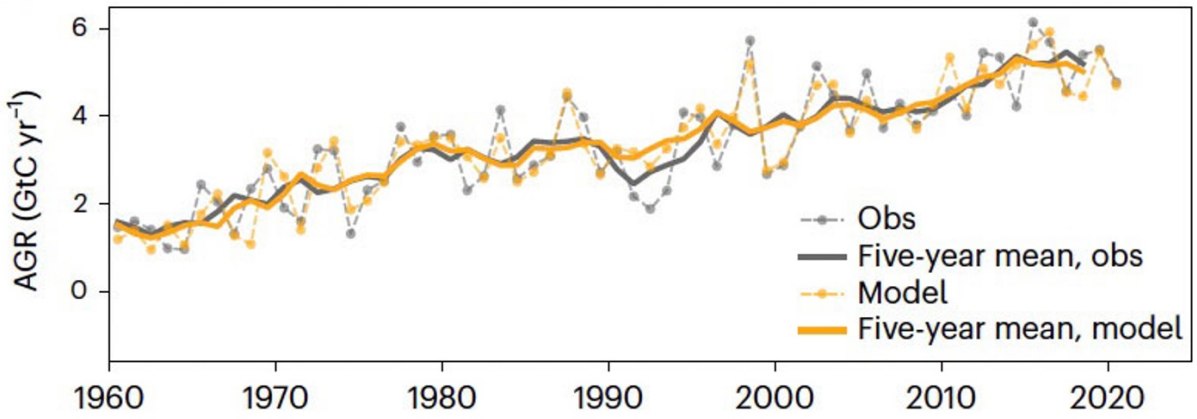
One day a truly mind-boggling illustration came to my attention.

But first, a bit of background. In 1958 David Keeling set up a station on the top of Mauna Loa in Hawaii, to monitor the levels of Carbon Dioxide in the atmosphere. After he died, the monitoring station was taken over by his son, Dr. Ralph Keeling of the Scripts Oceanographic Institute in La Jolla, California. The record is called the Keeling Curve. As would be expected, because of the burning of fossil fuels the Keeling Curve showed a progressive increase in the level of atmospheric CO_2 over time. The level has risen from 315 parts per million in 1958, to 420 parts per million today. Since we are continuing to burn fossil fuels, this continued rise was expected. But what I did not expect to see, in the latest version of the curve, was that the **rate** of increase was also increasing. (Figure 1).



As an example,

in 1967 - 1.0 ppm/year,
in 1987 - 1.5 ppm/year,
in 2007 - 2.0 ppm/year,
in 2017 - 2.5 ppm/year,
in 2023 - 2.8 ppm/yr.
1 ppm = parts per million.



This trend was confirmed by a recent paper from the Keeling group. In this study the variable was Atmospheric Growth Rate in gigatons C/year. A gigaton is a billion tons. This showed that the rate of accumulation of carbon increased from 1.8 gigatons/yr in1960 to 4.6 gigatons/yr in 2020.

Thus, two different variables gave the same result. They showed that:

Not only is the amount of carbon dioxide in the atmosphere increasing, but the rate at which it accumulates is also increasing

I will pause for a moment to let that sink in then repeat it.

Not only is the amount of carbon dioxide in the atmosphere increasing, but the rate at which it accumulates is also increasing

This is very rarely talked about. It is clear that until we bring emissions to NET ZERO, the amount of CO_2 in the atmosphere will continue to increase. But why is the rate also increasing? To me, that was extremely disturbing.

I can see three reasons.

1.The rate of CO_2 emissions from burning fossil fuels is being underestimated. I find this unlikely because the amount of fossil fuels produced and burned can be accurately determined.

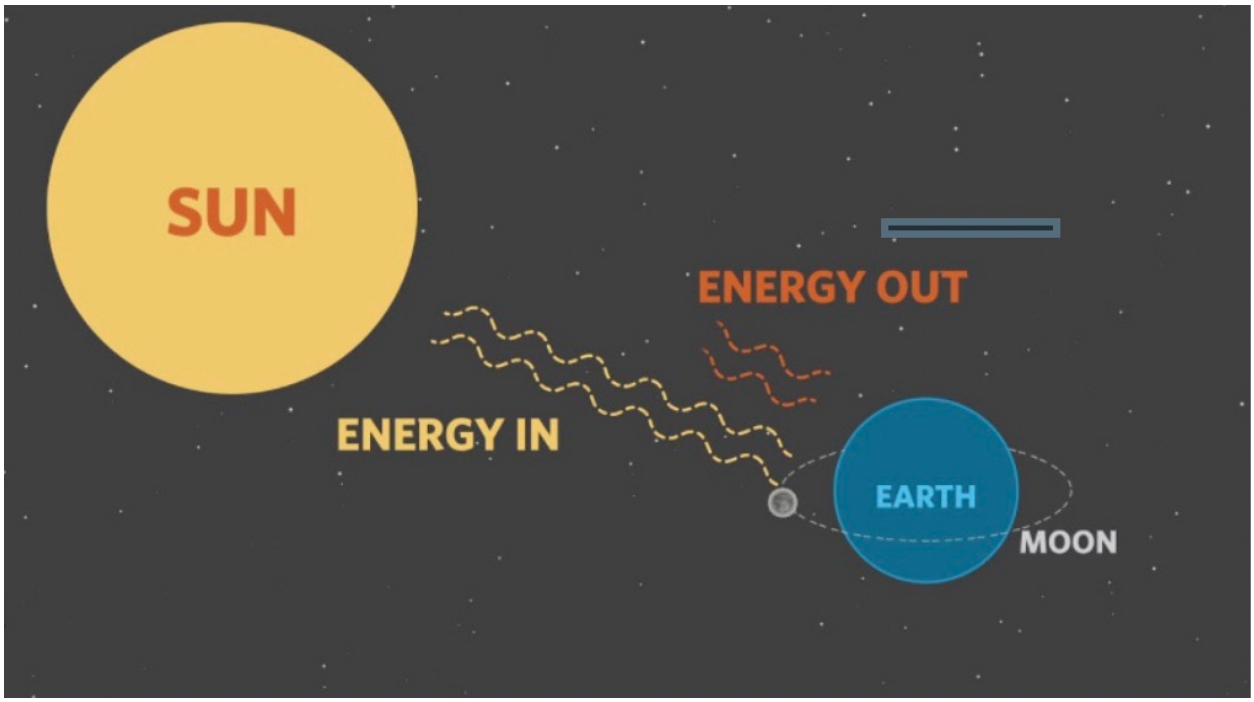
China had a brief period of rapid increase in CO_2 emissions but that as leveled off.

The rate of emissions by the United States has progressively decreased in recent years because we have dramatically cut back on the use of coal. Unfortunately, Trump wants to increase this again. A very very Bad idea!

In addition, the rate of fossil fuel CO_2 emissions for the whole world is beginning to decrease.

2. The current amount of global warming has set off a number of other sources of CO_2 emissions, such as massive forest fires across the globe, the melting of the permafrost, the burning of peatland, the loss of albedo, and others. When a country like the U.S. or Canada experiences a massive wildfire, it totally wipes out over a year's worth of trying to decrease CO_2 emissions from the burning of fossil fuels.

3. This increase in rate is caused by the earth's heat imbalance.



The earth's heat imbalance refers to the fact that more heat is coming into the earth from the sun, than is going back out. This is due to two factors:

First, the high level of CO_2 in the atmosphere is trapping the heat. This is the well-known greenhouse effect of atmospheric carbon dioxide. This continues to increase making the earth's heat imbalance progressively worse.

Second, there is a progressive loss of albedo of the earth.

Albedo refers to the rate of reflection, like a mirror reflects. This loss of reflection is due to due to the melting of sea ice and polar glaciers which are highly reflective.

The magnitude of this heat imbalance is gigantic. It is measured in zeta joules.

A joule of energy is the equivalent of raising one apple a yard.

90% of this heat imbalance goes into the ocean. This occurs at a rate of 200 zettajoules per year. One zetta joule is a 1 with 21 zeros after it. In more relatable terms, the heat energy entering the earth is,

Equivalent to 432,000 Hiroshima type atom bombs going off in the ocean every day.

I will also, let that sink in for a few seconds.

Our heat imbalance is equivalent to 432,000 Hiroshima type atom bombs going off in the ocean every day.

The level of heat imbalance has been increasing since 1974 as the level of CO_2 has been increasing.

Sea water holds about 50 ten times more CO_2 than the air.

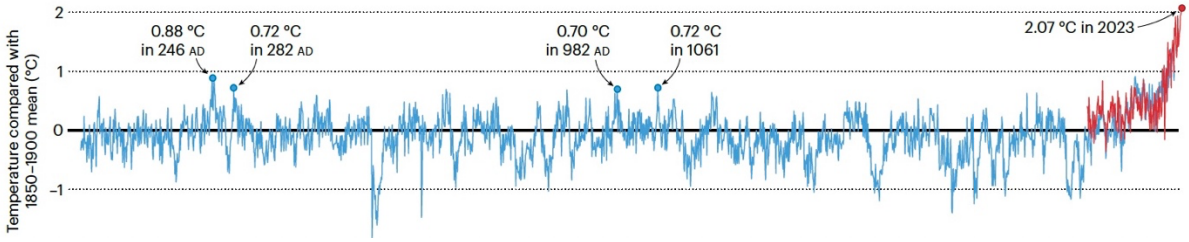
A warm ocean holds less CO_2. than a cold one and as the ocean temperature increases it releases this excess CO_2 to the atmosphere.

This is also a positive feedback loop. As the ocean heats up due o he heat imbalance, it releases more CO_2 into the atmosphere which results in more heat imbalance and heating of the ocean and still more CO_2 is released.

I suspect that this may be the major reason that the **rate** of CO_2 accumulation in the atmosphere is progressively increasing.

A warm ocean heats the air causing deadly heat waves killing thousands of people. The last few summers are the hottest on record for **2,000 years.**

This belies deniers who claim cycles of warm climate have always occurred, when in fact nothing like what is now happening, has occurred for 2,000 years.



There are many reasons why global warming is a serious threat to the world. This list includes some of them:

• progressively hotter air temperatures with millions projected to die of the excess heat.

• Increasing severity of hurricanes and of forest fires with many more billions in property losses.

• Droughts and crop failures with millions dying of starvation and leading to mass migrations of people.

• permafrost and methane hydrates contain trillions of tons of carbon largely in the form of methane. This amount of carbon is greater than that of all the fossil fuels burned and still in the ground.

• the permafrost with its huge amounts of CO_2 and methane is melting all over the arctic.

• in addition, more deeply buried fossil methane is melting and exploding producing distinctive shaped potholes.

• **methane is 25 times more potent of a greenhouse gas as CO_2. Over a 20-year period it is 84 times more potent, over 100 years 30 times more potent, and over 500 years 10 times greater than CO_2.**

• the melting of glaciers in antarctica will produce a foot or more rise in the level of seawater. By the end of the century this will have affected 200 million people living near the coast.

• **It is rarely appreciated that that the phytoplankton in the sea adsorb as much CO_2 and produce as much oxygen as all the plant life on land.**

• Some of the excess atmospheric carbon dioxide is adsorbed by the oceans and produces carbonic acid resulting in ocean acidification. This can result in the death of the many marine organisms that depend on calcium carbonate for their shells and skeletons, massive loss of coral reefs which play a critical role in the lives and health on many marine

organisms, decimation of industries that catch not only fish but marine organisms with shells such as clams and mollusks and crabs, and a decline in phytoplankton.

I will repeat that: **It is rarely appreciated that that the phytoplankton in the sea adsorb as much CO_2 and produce as much oxygen as all the plant life on land.**

• In the 2023 heat wave, 22% of the phytoplankton in the equatorial Atlantic and Pacific died off.

• as the oceans continue to heat up and acidify, this source of CO_2 sequestration and this source of oxygen production, and this critical base of the marine food chain, eventually responsible for feeding billions of humans, - will die off with catastrophic results.

• Studies suggest that as the temperature of the earth increases plants will switch from photosynthesis, with its sequestration of CO_2 and production of oxygen, to respiration with its production of CO_2 and consumption of oxygen. This would clearly be catastrophic.

So, what can we do the save the planet? Getting emissions to Net zero will be very important, but with the earth already in a positive feedback mode independent of emissions, that will not be enough.

Since a portion of the CO_2 stays in the atmosphere for a thousand years, it will be necessary to remove massive amounts of CO_2 and safely sequester it somewhere. By massive amounts we are talking about at least 10 gigatons per year until 2050 and then 20 gigatons or more each year after that.

The current emphasis is on removing CO_2 from the air and burying it underground. In my book, I outline 10 reasons why this will not only be inadequate, but potentially dangerous.

I outline in detail, four approaches to combating global warming that I predict can do the job, three of which each have the capacity to remove many gigatons of CO_2 from the atmosphere and safely sequester it. They are:

1.**Restoring the Earth's Albedo** using highly reflective paint on rooftops and other structures.

2.**Combating Ocean Acidification** using a hybrid electrolytic Ocean Alkalinization Enhancement technology placed on hundreds of catamarans. I anticipate that 500 such catamarans purchased and operated by all of the countries of the world with access to the ocean, and operating continuously for 5 to 10 years could reverse ocean acidification.

3.**Enhanced Weathering** using crushed ultramafic rocks such as olivine. These rocks adsorb CO_2 and safely bind it in mineral form above ground. These crushed rocks can be spread on all types of land utilizing a drone program that would allow ordinary citizens to participate in carbon dioxide removal.

In addition, the rate at which enhanced weathering occurs varies 29-fold in various parts of the world, such as cool dry temperate regions versus the "hot-spots" in the wet tropics. Using vertical "farming" techniques, large tracts of greenhouses can be built that provide optimal "hot spot" conditions for enhanced weathering, anywhere in the world, such as next to olivine deposits, thus cutting down on transportation costs.

***4. situ* CO_2 sequestration** which involves the injection of CO_2 from the air into basalt formations where it is mineralized and thus safely and permanently sequestered. It has been stated that world-wide this has the capacity to safely sequester trillions of tons of CO_2.

A new technique called COF 999 has been developed that is far more efficient and cheaper than previous techniques in pulling CO_2 from the atmosphere.

It should be noted that the vast amount of carbon in the world is stored in mineralized form while all the life on earth is accounting for only 0.00074%. The last two approaches are simply continuing that trend of storing excess CO_2 in mineral form.

I would also like to say something about wind power, that Trump wants to stop.

In addition to generating electricity wind power generates jobs. There are currently 150,000 people working in the U.S. Wind industry and hundreds of thousands are projected by 2050. Across the U.S. wind has generated more than 10% of the country's energy and it has **added more than $20 billion to the economy. Wind energy contributes to the U.S. avoiding over 340 million tons on CO_2 emissions per year equivalent to the output of 73 million cars. It generates $2 billion in state and local taxes and land lease agreement yearly. This helps to reduce the tax burden on homeowners and businesses.** Wind and solar projects are now more economically competitive than gas, geothermal, coal, or nuclear facilities. **Wind power is one of the cheapest sources of electrical power.** Any effort to discontinue expanding the use of wind power in the U.S. is massively misguided and a major mistake. It would definitely make the U.S. LESS GREAT.

The greatest extinction event to ever hit the earth was the Permian-Jurassic extinction. It was due to excessive volcanism causing high CO_2 levels. It was called the Great Dying with 81% of all marine species and 70% of all terrestrial species went extinct.

We are currently increasing our atmospheric CO_2 level at a rate 10 times faster than what occurred during the Permian-Jurassic extinction.

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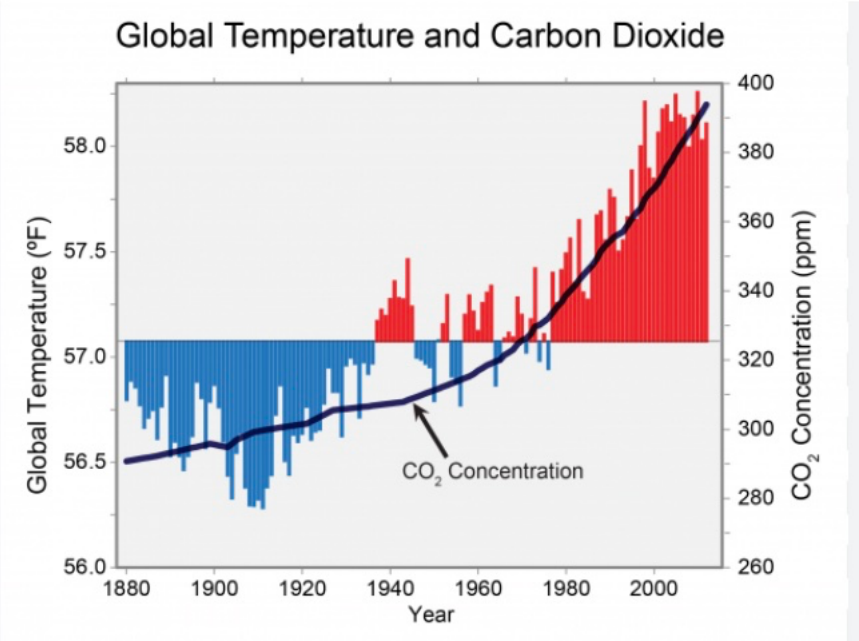

The Biden administration did everything in its power to slow the rate global warming. By contrast, the Trump administration is doing everything it's power to speed it up. They seem to be in a hurry to have the earth match the Permian-Jurassic extinction.

The tragedy of global warming is that it will have relatively little effect on the climate change denying politicians who are in their 60's. 70's and 80's. and currently run our government. They will all be dead 10 to 25 years. By contrast, if no attempt is made to bring it under control, global warming will have a devastating effect on our youth who will live another 40 to 60 years and into a time when the earth will have reached a mean temperature of 3.7oC or more over preindustrial times - with catastrophic results.

If you would like a taste of what that would be like, I recommend David Wallace-Wells book *The Uninhabitable Earth*.

A study of 10,000 young people ages 16- to 25-years-old, showed that, 83% believe politicians have failed to take care of the planet and they are feeling betrayed.

By sending free copies my book, *If I were a Billionaire these are the Four Things I Would do to Combat Global Warming and Help Save the Planet* with a subtitle of *The Science of Global Warming,* to all the politicians in Washington, DC, both Republican and Democrat, and to Trump and all of his appointees, I am hoping to convert them from climate change deniers to developing a project, similar to or greater than the Manhattan or Apollo projects, to once and forever rid the world of the devastations of global warming.

Grass root support for this proposal would greatly help.

It the Trump administration continues in its climate change denial, the four-year gap in combating global warming by the world's second largest emitter of carbon dioxide will be nothing short of disastrous.

A brief plug. My book is only 168 pages, 23 of which list the 193 literature references. It also has 92 illustrations, remembering the old phrase a picture is worth a thousand words. Thus, it is a quick read of less than 2 hours and contains everything I have disussed plus much more. It is available on Amazon for only $14.95. The kindle version is $9.95.

In addition to the version available on Amazon, I am having a similar version printed locally. This is the version I plan to send to all the members of Congress hoping to reverse the disastrous negative approach to climate change of the Trump administration.

I am a retired scientist on a fixed salary. If any listeners are a concerned about this as I am and would like to help, there is a donation page on the website www.thecomingsfoundation.org