Carbon dioxide - cause or consequence of man-made climate change?

Mathias Hüfner 2023

The climate crisis is a tricky thing. Because governments alone cannot save the world, but every single person must contribute. Maybe it would even be better if humanity disappeared. Nobody would miss her. The planet doesn't need them. Alone considering how many species we humans have wiped out. Ai Weiwei

It is widely accepted scientifically that there is a statistically significant human impact on global temperature rise. The increase in carbon dioxide levels by around 100 ppm over the last few decades is said to be responsible for this. As a countermeasure, politicians recommend global carbon dioxide trading.
But does such a one-dimensional view make sense at all? Can you do something about climate change with a product or do you have to refrain from doing something.
It makes a difference in the fight against climate change whether you see the increase in CO_2 as a cause or a consequence of human influence.

Ice core data showed that over the past 420,000 years until the onset of industrialization in the mid-1800s, atmospheric CO_2 levels varied between 190 ppm during peak ice ages and 280 ppm during inter-glacial periods. [1]) The carbon dioxide concentration over the last 10,000 years has remained relatively constant below 300 ppm. However, since industrialization, an increase of more than 120 ppm has been observed within just a few decades. This corresponds to an increase of 43%. In recent decades, more and more heat records have been recorded at various points on the earth's surface.
In physical terms, heat is an energy form of electromagnetic radiation with a frequency in the gigahertz range, as everyone knows from their "household microwave". In 1900, Max Planck found the decisive connection for the radiation of a black body as the product of the electron's quantum of action and its frequency. But mass is included in Planck's constant. If we accept the law of conservation of energy, which Hermann Helmholtz formulated as early as 1847, it follows that Planck's constant cannot be a natural constant, instead, with $\nu=1/\lambda$, the relationship $h_1/\lambda_1 = h_2/\lambda_2$ must apply, whereby the quantum of action of a whole molecule is much larger than that of an electron. In fact, the spectrum of the earth's radiation balance in Fig.1 reflects this relationship with regard to the two radiation maxima.
Our earth is a water planet. It is mainly covered with water with a proportion of 71%. Only 29% of its surface consists of landmass. The proportion of water vapor in the atmosphere is correspondingly high. But it varies considerably. Let's assume a proportion of water vapor in dry air. The hygrometer shows 50% relative humidity, clear, cloudless sky. This humidity corresponds to a water content of around **9.7 g/m³** at 20° C**.** If you convert this value into ppm, you get 12952 ppm. This is how much water vapor the air can absorb before the dew point is reached and the water vapor becomes visible as a mist. With a CO_2 content of 400 ppm, this corresponds to just 3% before the dew point. The comparison of the CO_2 spectrum with the water vapor spectrum shows in Fig. 1 in the heat radiation window a stronger radiation absorption of the water vapor compared to the CO_2 gas. When comparing the heat storage capacity of CO_2 and H_2O, the CO_2 gas performs less than 50% worse than water vapor. [2]) Even compared to nitrogen, the heat capacity is only 80%.

1 St. Rahmstorf, HJ Schellnhuber - *Der Klimawandel;;* Publisher CH Beck Knowledge 2019 ISBN 978-3-406-74376-4 p.23

2 https://www.chemie.de/lexikon/Liste_der_spezific_W%C3%A4rmekapazit%C3%A4ten.html (accessed on May 15, 2023)

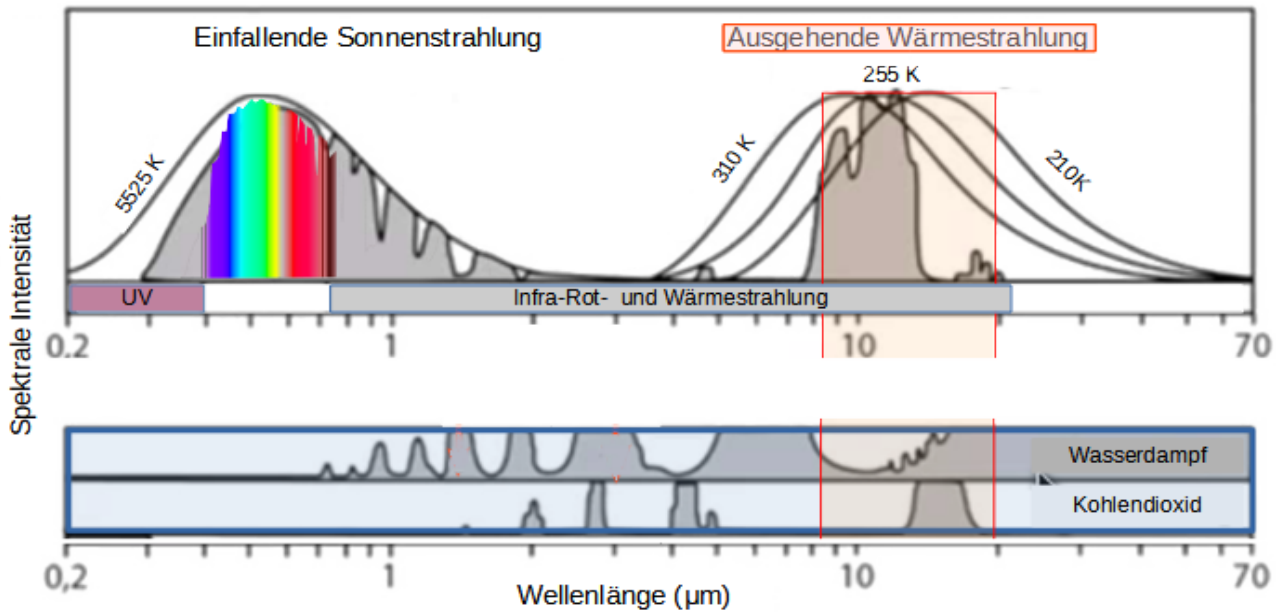

Figure 1: Spectral energy distribution of solar energy - reference https://commons.wikimedia.org/wiki/File:Atmospheric_Transmission.png

Myth: The greenhouse effect is caused by the CO_2 gas.

Svante August Arrhenius presented a theory on the greenhouse effect in 1895. [3]) CO_2 could absorb the infrared heat rays of the light emitted by the earth and increased CO_2 could heat the earth's climate. How to prove that was found a temperature of about 460° C prevails on the surface of Earth's sister planet. The Venusian atmosphere would be heated by a sustained greenhouse effect. CO_2, as its most important component, acts as a heater [4]). Without the greenhouse effect, the mean temperature on Venus would be -41° C, it is claimed. [5]) The emphasis in the warming effect is not on the gas, but on the reflection of the glass walls. The gas is just the plant fertilizer. Our clothing has the same warming effect, only with the difference that the heat source here is our body. In the case of an atmosphere, the denser medium is the cloud cover, which delays radiation into space. CO_2 gas does not form clouds. In the case of Venus, the heat must come from planetary volcanism, since Venus emits more heat than it absorbs from the Sun. So the central question is:

Where does the global warming come from in recent years.

There are two ways to do this:

1. Industrial primary energy conversion is a heat source.
2. The transformation of the environment allows the earth's surface to absorb more solar energy than in prey-industrial times.

3 S. A. Arrhenius - *On the Influence of Carbonic Acid in the Air upon the Temperature of the Ground.* In: *Philosophical Magazine and Journal of Science Series 5, Volume 41, April 1896, pages 237-276.* (English). https://www.rsc.org/images/Arrhenius1896_tcm18-173546.pdf

4 U. Weber - *Warum hat die Venus gar kein hemisphärisches Temperaturproblem?* https://eike-klima-energie.eu/2022/04/05/why-do-the-venus-has-no-hemispheric-temperature-problem/

5 *Das Wetter unseres Nachbarplaneten Venus;;* https://www.dwd.de/DE/wetter/thema_des_tages/2022/10/4.html

The carbon dioxide cycle and the industrial heat source

The main source of the increase in carbon dioxide in the atmosphere is the combustion of hydrocarbons. Now the world would be in equilibrium if no more hydrocarbons were consumed than the plants on earth produce in a unit of time. Plants and photosynthetic bacteria absorb carbon dioxide from the atmosphere and convert it into carbohydrates such as glucose through photosynthesis, exposure to light and absorption of water . Energy is consumed and the atmosphere is cooled by the evaporation of water.

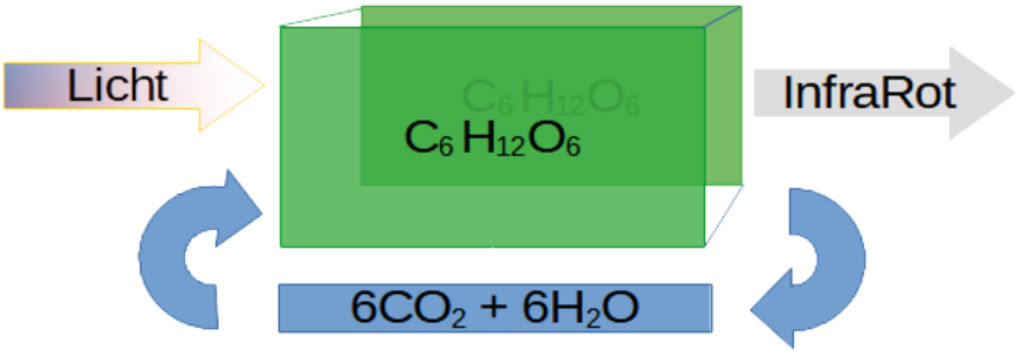

Figure 2: natural energy storage

Figure 2 shows the simplified net reaction equation for photosynthesis [6]). **Long-wave IR** (approx. from 780 nm) is largely reflected by plants. This light reflection is far higher than that of the green-yellow spectrum in the visible light range. This means that photosynthesis is an endothermic process. As with any **endothermic** chemical reaction, energy is required to form glucose and oxygen from carbon dioxide and water during photosynthesis. At night, some of the glucose is used up by plants during cellular respiration. In the process, water is evaporated, which helps to cool the environment. But the larger part goes into plant growth and binds the carbon dioxide. The entire fauna feeds on the plants and finally flora and fauna fossilize to form the hydrocarbon deposits that we have been exploiting to an increasing extent since the industrial revolution, and in doing so we are pushing back nature with its natural energy store by destroying forests and the earth's surface make them unusable for nature.
We can contrast this simple natural process with an equally simple artificial exothermic process of human societal development, deriving its energy from the combustion of fossilized hydrocarbons.

Figure 3: The industrial growth

In contrast to the long-term natural process of energy storage, combustion is a very short-term asymmetric process of energy release by industrial society, which generates the growth of financial capital, which, however, is a virtual entity and does not feed anyone. The Carnot cycle, which is largely used for secondary energy production, theoretically delivers only two-thirds of the total energy as mechanical energy. The last third is lost as heat. The real efficiency of coal-fired power plants is usually in the range of 30 to 40%,

6 G. Nate McDowell et al. - *Pervasive shifts in forest dynamics in a changing world* . In: Science . Vol 368, #964, 2020, doi : 10.1126/science.aaz9463 .

modern supercritical power plants can reach up to 45%. [7]) A thermonuclear power plant also only has an efficiency of 35%. Only when generating electricity by hydro-power is the efficiency at 80-90%.

Overall, according to statistics from Enerdata for 2019, only 4.7% of the world's energy production is attributable to non-thermal processes. Total energy production in 2019 was nearly 15 Gtoe (gigaton of oil equivalent).

In the period from 1950 to 1990 the world population grew from 2.5 to 5.3 billion people and the global temperature increase was 0.4º C and in the period from 1990 to 2020 the world population grew from 5.3 to 7.8 billion people and the global temperature rise was 0.5º C .

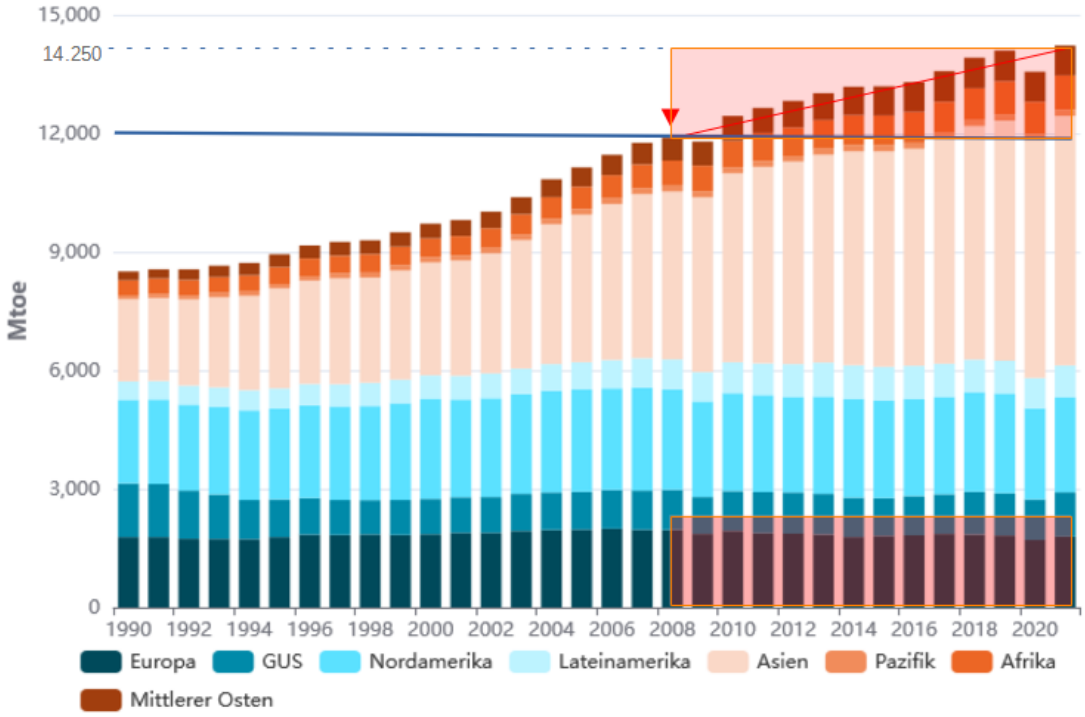

Figure 4: Global industrial energy conversion - Reference: Enerdata

First and foremost, the warming of the earth depends on the global development of the human population and its economic system.

Fig.5 shows the global primary energy growth in megaton oil equivalent. While there is no more growth in Europe, it has increased in Asia by the amount of Europe from 2008 to 2022. Even if we in Europe switched our energy conversion completely to renewable energies in the next 10 years, we would not be able to compensate for Asia's hunger for energy. Now that we know the global primary energy production, we can determine the area output per square meter that the waste heat contributes to global warming.

First we need to convert the oil units to kWh. 1 Mtoe = 11.63 TWh and 14250 Mtoe from Fig.5 are then 165727.5 TWh. The earth has a surface area of 5.1×10^{14} m². We need to divide 1657.275×10^{14} Wh by 5.1×10^{14} m² and get the Wh/m² per year. This results in around 325 Wh/m² per year. Now we have to divide this amount by the number of seconds in a year to get the change in area performance compared to the area performance of the sun. The year has about 31.5 million seconds, so we get a surface power of about 10.3 µW/m² for energy conversion in 2021. If we assume an efficiency of 35% for mechanical power. Then we

7 W. Roedel - *Physik unserer Umwelt: Die Atmosphäre;* 2nd edition, Springer, Berlin 1994, page 40

have an increase in area performance of only 6.7 µW/m². This bears no relation to what official climate models predict.

So we must consider the second possibility, environmental transformation.

To do this, we will design a very simple climate model as shown in Figure 6. We get the surface power of the sun from the solar constant of $I_{sol} = 1365 \pm 5\ W/m^2$. This is the surface power of the sun that shines on a black body at cloud level. The sun shines on the cross section of the earth, but since the earth has a spherical shape, it only hits the ratio of cross section to spherical surface on average, i.e. only a quarter of the radiation, around 341W/m². The magnitude ratio alone shows that industrial primary energy conversion has no effect on the climate.

The heat exchange between the earth's surface and clouds occurs more effectively by convection. This is called the weather. Convection models with their cellular structure still pose a mathematical challenge and therefore cannot be considered in this framework .

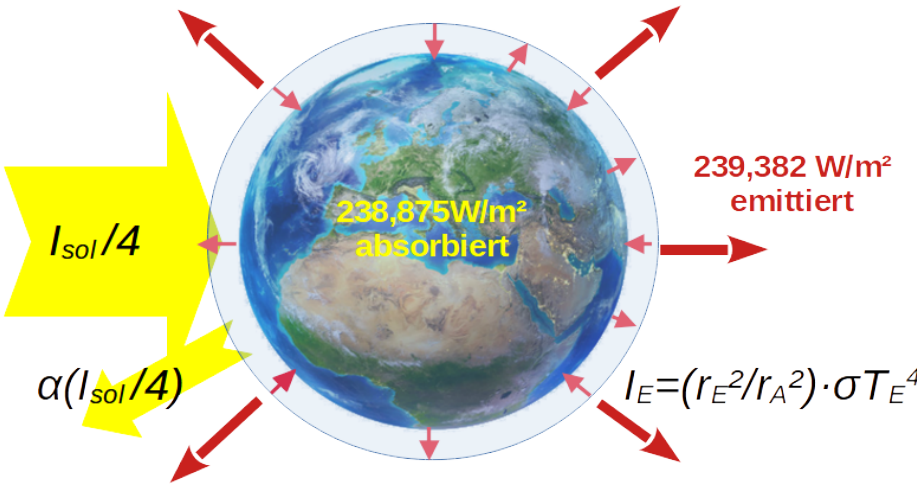

Abbildung 5: globales Klimamodell auf der Basis von Strahlung

Due to its reflectivity, only a fraction, which is determined by a factor α, reaches the surface performance of the sun that the earth could reach as a black body. This factor is called terrestrial albedo (from Latin *albus* ' white). For α = 0 we have described the reflectivity of the black body. All radiation is absorbed. For α = 1 we have a diffusely reflecting body that appears all white. The terrestrial albedo is the most important parameter in our climate model. It was determined to be 0.3 in the 1970s. This is used to calculate the average surface area of the sun

$$\frac{I_{sol}}{4} \cdot (1-\alpha) = 238{,}875\, W/m^2$$

With a temperature of 255 K from satellite measurements at an altitude of 5 km [8]) results according to Stefan-Boltzmann with the constant σ with $5.67 \times 10^{-8}\ W/m^2\ K^4$ then an average radiated power I_E taking into account the ratio of earth radius r_E without and r_A with atmosphere at 5 km altitude of 239.382 W/m² as a black body. Space does not reflect heat rays from Earth. If you now calculate the albedo back from this, you get a value of 0.2985 for the terrestrial albedo. This means that the earth has become darker and as a result it absorbs more solar energy.

8 C. Simmer - *Einführung in die Meteorologie, Teil3 Strahlung;* https://www2.meteo.uni-bonn.de/arbeiter/rlindau/download/met110/met110-111-III-2_RadungsBalance-der-Erde.pdf

Obviously the albedo has decreased since 1970 and thus increased the surface area of solar radiation on the earth's surface!

Figure 6: Morning sky to the west over the Saale valley with soot clouds in May 2023

It is difficult to assess this, since there are too few measured values and the measurement accuracy of such global values is uncertain. Analyzing the CO_2 value from the air is easier. But one must not make the mistake of regarding carbon dioxide gas, which is an excellent technical refrigerant, as the cause of climate change. Let's be realistic and observe our environment, like in Fig 6.

No fire without smoke

The textbook says that the hydrocarbons burn into carbon dioxide and water. For this, however, the combustion would have to be complete, which is often not the case in practice. As the saying goes , "No fire without smoke." Thanks to our modern gas heaters, the younger generation no longer got to know the chimney sweeper as the black, soot-smeared man, which is why they can't see the real causes of global warming.

Along with CO_2 and CO, smoke is an aerosol of soot and fly ash, of fog droplets such as water, oil and acid vapors. Negatively charged fog droplets with radii of 1 - 5 µm carry the fine dust aerosols, which are one order of magnitude smaller , into the upper atmosphere and distribute them there over the entire globe. If you have a rain barrel at home, these aerosols can be found on the bottom of the barrel when it is emptied before winter.

If the climate model RCP8.5 [9]) predicts an increase of 8.5 W/m² by 2100, that would mean that we would have 247.375 W/m². The terrestrial albedo would increase as a result of carbon input into the atmosphere 0.275 drop. Interestingly, the gas is not explicitly mentioned there, but a CO_2 equivalent. With the proportion of soot in the environment, the proportion of m CO_2 gas naturally also increases. But the soot has to be fought .

9 Volker Mrasek- https://www.deutschlandfunk.de/klima-asynchrone-erderwaermung-100.html

Fig.7 shows the albedo of the earth's surface. While water has an albedo of around 0.1, forested areas have an albedo of 0.25, clouds around 0.9, and freshly fallen snow around 0.95. If the albedo has decreased in recent years, it primarily affects the polar and high mountain regions.

With a little physical knowledge we understand the function of the above climate model s. Air and ship traffic without soot filters carry the soot particles into the atmosphere in the form of very fine mist droplets . Further condensation causes raindrops to become larger and larger. The consequences are heavy rain in localized regions and drought in the adjacent areas. The clouds absorb more heat. The consequences are less snowfall in winter. Glaciers and snow surfaces are getting dark faster and faster, so they absorb more radiation energy and melt. The sea level will rise.

It is in Germany, with a share of 2% in the total energy conversion in the world, hardly expedient , now rushed with the conversion from soot- free Gas heaters to heat pumps to want to save the global climate and to replace nuclear power plants that are still operational with lignite power plants. This only blows new soot into the atmosphere, but it is an investment boost in the sense of finance capital. The cessation of domestic air traffic, a speed limit on Germany's autobahns and a shift in transit freight traffic to rail and the general reduction in transport routes would n certainly be more effective e climate protection measures than those in the building sector . According to analyzes by the Austrian Ministry for Climate Protection, the transport of goods is responsible for 75% to 90% of the energy consumption in the supply chain. [10]) This statement should also be applicable to Germany.

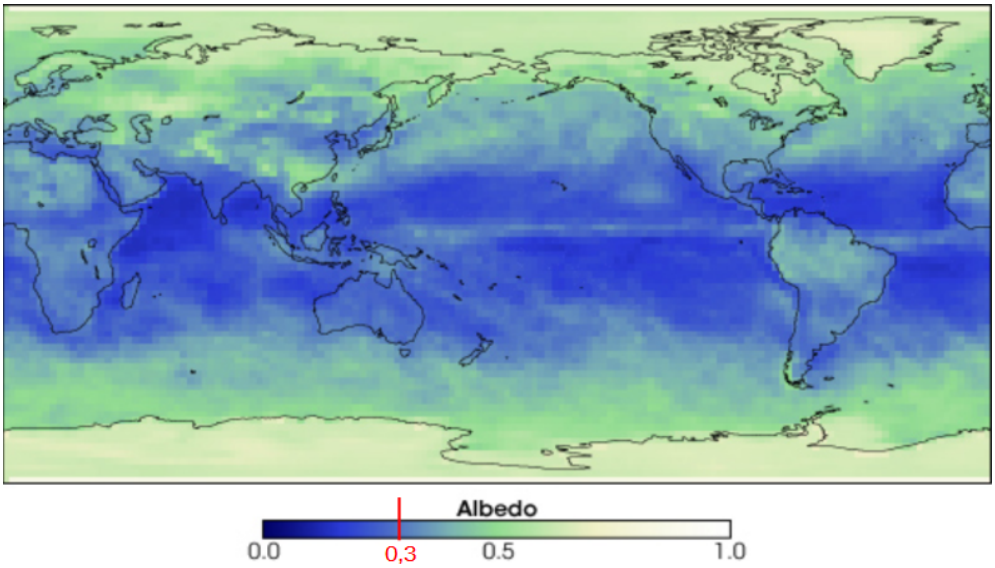

Figure 7: Terrestrial albedo from space as measured in March 2005 - Reference NASA

10 J. Schrampf, G. Hartmann - *Energiebedarf in Lieferketten;* htpps://www.bmk.gv.at/Downloads/Energiebedarf-in-lieferketten_UA-2.pdf