# CAN WE DOUBLE THE $CO_2$ CONTENT OF THE ATMOSPHERE?

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## ABSTRACT

This paper addresses the validity of the 'war' on carbon dioxide ("$CO_2$"), the world's most important food. Climate alarmists believe that a doubling of atmospheric $CO_2$ will result in a temperature increase of about 2 degrees Celsius. However, the evidence presented clearly shows that it is impossible to double the atmosphere's $CO_2$ content because the reserves of hydrocarbon fuels are a fraction of what is required. The atmosphere will continue to be $CO_2$ impoverished.

## INTRODUCTION

Climate alarmists claim that a doubling of the carbon dioxide ("$CO_2$") content of the atmosphere will result in a temperature increase of about 2 degrees Celsius[1,2]. Such temperature forecasts are based solely on the projections of over one hundred climate models, which wrongly assume that $CO_2$ is a significant driver of climate[2].

This paper ignores the controversy over whether $CO_2$ is a significant driver of climate or whether a temperature increase of $2^oC$ will be beneficial or detrimental to mankind's lifestyle. Its primary purpose is to provide the evidence showing that the consumption of coal, oil, and gas ("hydrocarbon fuels") will never double the $CO_2$ content of the atmosphere.

First, a simple water-tank model is used to simulate the operation of a 2-phase system. Then evidence is provided that supports the operation of this system in determining the distribution of $CO_2$ between the atmosphere and oceans. It will then become readily apparent that consuming all of the planet's reserves of hydrocarbon fuels will not double the atmosphere's $CO_2$ content.

## PHASE EQUILIBRIUM

The following diagram depicts two, interconnected tanks of water with one tank 50 times larger than the smaller tank. The water in the smaller tank represents the $CO_2$ in the atmosphere while the water in the larger tank represents the $CO_2$ in the oceans. The $CO_2$ available to support life is stored in two chambers; the oceans and the atmosphere. The oceans contain about 50 times as much $CO_2$ as the atmosphere.

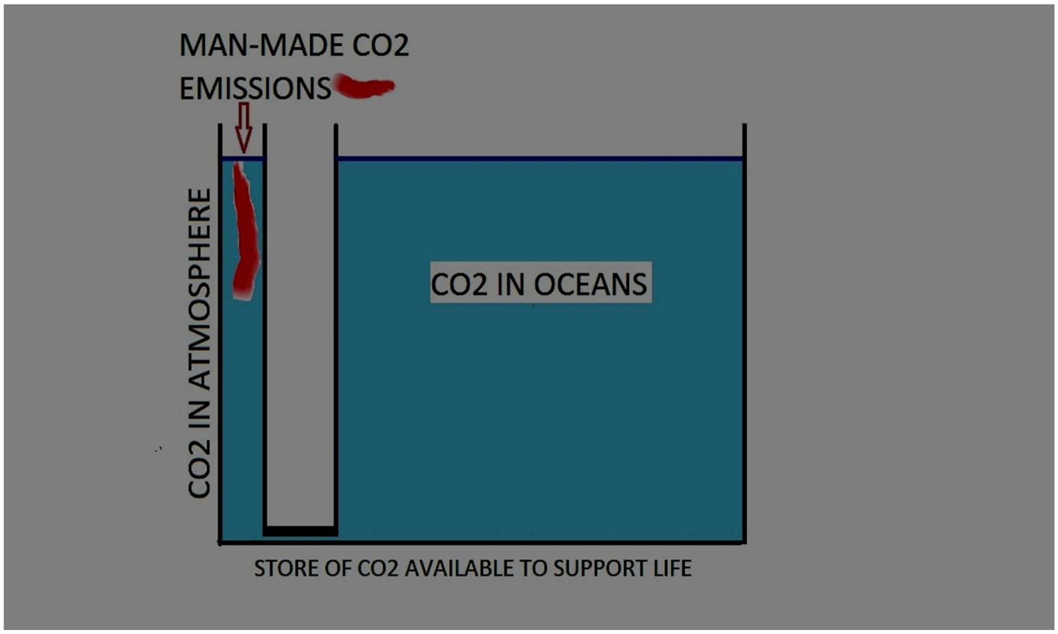

Figure 1 – A water-tank model to simulate the behaviour of a gas in a two-phase system.

When water ($CO_2$) is added to the smaller tank, the level will increase briefly but equilibrium conditions (i.e. equal level in both tanks) will be restored very quickly as water flows through the connecting pipe.

However, the added water (representing man-made $CO_2$ – red) will persist in the smaller tank for a very much longer period of time, known as the "residence time". The residence time of $CO_2$ in the atmosphere has been reported to be 5 or more years. It must be emphasized that the residence time is not the time to reach equilibrium conditions ("equilibrium time"), as demonstrated in the water-tank analogy. The residence time is the time it takes for the man-made $CO_2$ to become evenly distributed between the two storage chambers; that is, the atmosphere and oceans. In other words, it is a mixing time.

Because of the confusion between "residence time" and "equilibrium time", it has been wrongly assumed that man-made $CO_2$ is responsible for most of the atmospheric $CO_2$ increases since 1940.

**$CO_2$'S "EQUILIBRIUM TIME"**

It is possible to estimate the equilibrium time by using data available on one of NOAA's web sites:
http://www.esrl.noaa.gov/gmd/ccgg/trends/

Specifically, the Keeling curve shows the seasonal uptake of $CO_2$ as a result of the greening of the Northern Hemisphere. This decrease of $CO_2$ is then followed by a period of recovery at a rate considerably greater than that attributable to man-made emissions.

http://www.esrl.noaa.gov/gmd/ccgg/trends/weekly.html

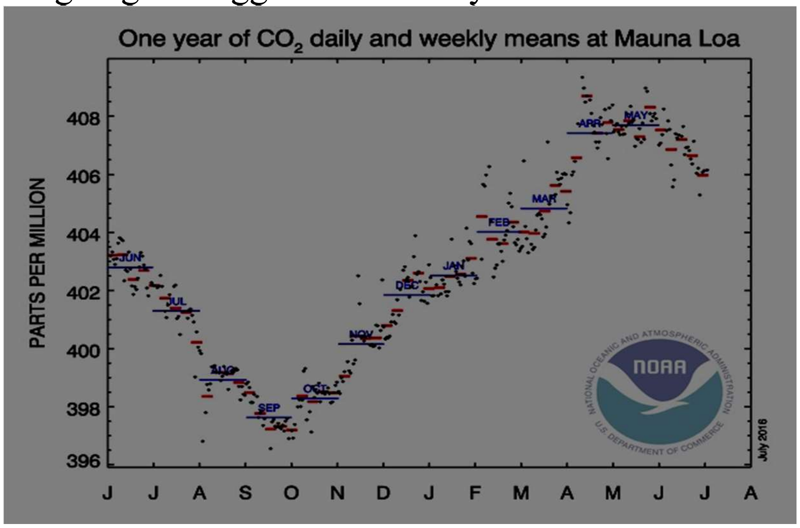


Figure 2 - Annual Mean Growth Rate for Mauna Loa, Hawaii 2015-2016

The rate of recovery of equilibrium conditions can be calculated from the slope of the curve between October and June, an eight-month period during which the $CO_2$ level increased from 397 to 408 ppm. This 11 ppm increase translates to a rate of 16.5 ppm per year or **33 gigatonnes** of contained carbon per year ("gtC/yr"). The current rate of man-made $CO_2$ emissions is **8 gtC per year**. Therefore, about 25 gtC is derived from natural sources such as the ocean out-gassing of $CO_2$.

Consequently, it can be concluded that the "equilibrium time" is no more than 4 months, not 5 or more years. This conclusion is supported by Tom Quirk[3]. The results of his investigation suggest "that the fossil fuel derived $CO_2$ is almost totally absorbed locally in the year that it is emitted."

## MISSING $CO_2$

The annual growth rate trend of $CO_2$ is about 2 ppm per year, which is equivalent to an increase of 4 gtC of $CO_2$ per year. If we wrongly assume that the increase in the $CO_2$ content of the atmosphere is due solely to man-made emissions, the increase should be 4 ppm per year; that is, 8 gtC per year.

However, the following figure reveals annual mean growth rates as low as 0.3 ppm, suggesting world-wide industrial collapses in such years with low growth rates. These collapses did not occur.

http://www.esrl.noaa.gov/gmd/ccgg/trends/gr.html

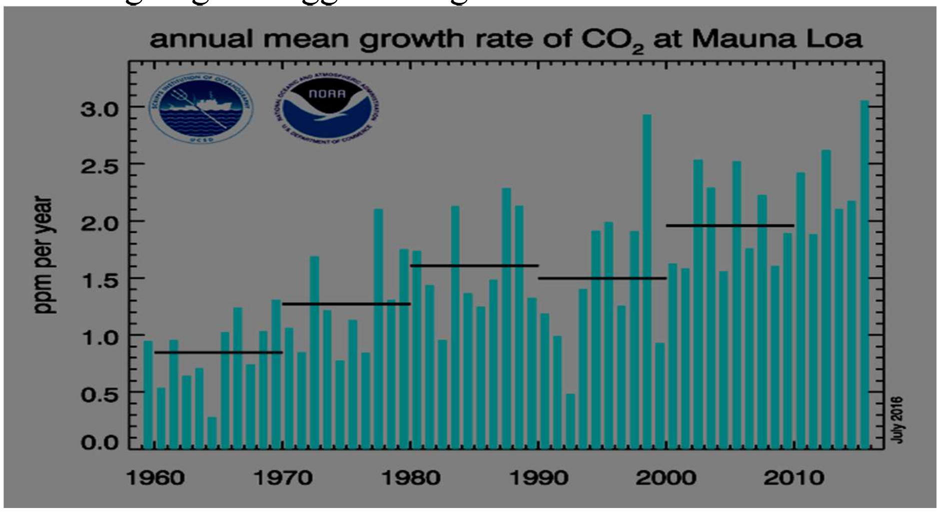


Figure 3 – Annual mean growth rate of $CO_2$ at Mauna Loa

Furthermore, the data in Figure 3 fails to show 'spikes' related to volcanic eruptions in 1991 (Mount Pinatubo) and 2010 (Iceland).

Obviously, the foregoing observations of missing $CO_2$ can only be explained if we recognize the operation of basic phase equilibrium principles, specifically Henry's Law. This approach is also consistent with Quirk's[3] suggestion of "a global or equatorial source of increasing $CO_2$." and "that natural variability of the climate is the prime cause of increasing $CO_2$, not the emissions of $CO_2$ from the use of fossil fuels."

**HENRY'S LAW**

Henry's Law is one of the gas laws. It was formulated by a British chemist, William Henry, in 1803. It states that the solubility of a gas in contact with a liquid surface is proportional to the partial pressure of the gas.

The practical consequences of Henry's Law is the maintenance of a constant ratio between the amount of $CO_2$ in the oceans to that in the atmosphere for a given temperature. This ratio is about 50/1.

Therefore, the consumption of all the planet's reserves of coal, oil, and gas (5,000 to 10,000 gtC[4]) will result in about 100 to 200 gtC of $CO_2$ being added to the atmosphere, an increase of 13% to 26%. The remainder will be absorbed by the oceans.

## CONCLUSION

The debate regarding the alleged heat-trapping properties of $CO_2$ is irrelevant because we cannot generate a significant quantity of this life-giving trace gas with our reserves of hydrocarbon fuels. Our atmosphere will continue to be $CO_2$ impoverished. It is certainly impossible to double the carbon dioxide content of the atmosphere.

## References:

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