ALL YOU EVER WANTED TO KNOW ABOUT CARBON OFFSETS

What exactly are carbon emissions?

Carbon emissions are a very natural phenomenon. You are releasing carbon into the atmosphere while you sit and read this text. Every time you exhale, you emit carbon into the air. When dead trees and fallen leaves decompose due to the action of insects, bacteria or fungi, they emit carbon into the air. Ever since there was oxygen-breathing life on the planet, living things have been emitting carbon into the air. Few aspects of life on earth are more ancient than carbon emitted into the atmosphere by living things.

Where does this carbon come from?

All animals (including insects and many bacteria) take in oxygen through their lungs, gills, even through their skin, or pores in some cases. Once inside their bodies, the oxygen is used to break down carbon-rich molecules (i.e. sugars / carbohydrates a.k.a. carbs) to release energy. That energy is critical for growth, staying warm, for muscle action, thinking or simply just to keep on living. During this process, oxygen atoms combine with the carbon atoms freed up by broken down sugars, creating carbon dioxide (CO_2) molecules. The CO_2 molecules are carried into the blood and are then released into the air through the lungs (for most land vertebrates, like humans).

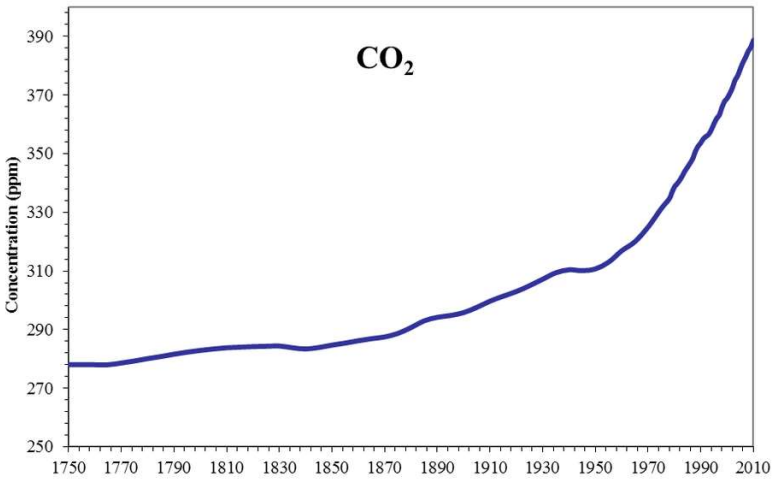
$$C_6H_{12}O_6 + 6O_2 \rightarrow 6H_20 + 6CO_2 + \textbf{energy}$$

(glucose + oxygen → water + carbon dioxide + energy)

If it's a natural process, then what's the problem?

The natural emission of CO_2 is actually a good thing. After all, plants, algae and phytoplankton in the sea need to consume vast amounts of CO_2 to survive. If all the CO_2 disappeared from the atmosphere, plants would die and in no time, so would just about all the rest of living things on Earth.

I clearly recall my high school biology textbook, back in the late 1970's, indicating that the concentration of CO_2 in the atmosphere was 340 parts per million (e.g. for every million molecules that made up air, 340 of them were CO_2). We are now hitting the 415ppm mark (see diagram below – the CO_2 concentration has been mostly flat for the past 10,000 years, but in the past 100 years, it has spiked dramatically). That's 22% rise in 40 years, and that's the problem.



Why is more CO_2 a bad thing?

CO_2 is an invisible gas – it lets visible sunlight pass through it undisturbed. The sunlight reaches the surface of the planet and warms it up. But CO_2 has the canny capacity of stopping infrared radiation (the kind of radiation that any warm object will emit – you can feel it if you place your hands near – not on - a hot iron). So, while the sun warms the surface of the planet in the daytime, at night, the heat absorbed by land, oceans and cities no longer dissipates back into space as readily as before (this explains why average night-time temperatures are going up faster than day time temperatures). Gases that prevent heat from escaping earth are collectively called greenhouse gases (GHGs) – because they work a bit like the glass walls of a greenhouse – letting in sunlight but trapping the heat within[1].

Where is all this CO_2 coming from?

That rise is not because we're all just breathing harder. Most of us know that the rapid increase in CO_2 levels is directly linked to the rapid industrialization of our world. We generate electricity by burning coal, oil or natural gas. Transportation, either by plane, car or ship is mostly fueled by gasoline/oil, a lot of coal and wood has

[1] Methane is another important GHG. It is a lot more effective at trapping infrared radiation – but thankfully, it degrades naturally in the atmosphere. Methane released today will have largely degraded within 30-40 years, while CO2 is removed almost exclusively through photosynthesis, or through dissolution in ocean waters.

been burned for heating… These materials are very carbon rich. They were all originally made by plants through photosynthesis.

Over hundreds of millions of years, plants have been taking CO_2 from the atmosphere, and with the energy from sunlight, they transformed that CO_2 into sugars or other carbon rich materials such as wood and leaves. Throughout that time, all kinds of massive deposits of decaying plant material accumulated, either in expansive swamps, peatlands, or as muck deposited in river deltas. Over millions of years, geological processes took care of transforming those deposits into coal, oil or tar. In some cases, these deposits released natural gases that became trapped below rock formations (e.g. shale gas is one example).

So, every year, over hundreds of millions of years, these processes have constantly been vacuuming up vast amounts of carbon out of the atmosphere and a significant portion of that ended up being locked away, mostly deep underground. But all of a sudden, in a geological snap of a finger, what had been stored over all that time is rapidly being released by human activity. [2]

We're now hearing on almost a daily basis that if nothing is done, the increasing concentrations of CO_2 will cause global temperatures to rise, leading to all kinds of secondary disturbances such as sea level rise, floods from storms, droughts, wildly fluctuating local climates and more. We're warned that millions of people will be displaced, leading to widespread political upheaval and increased overall misery. Ecosystems, which typically develop gradually over thousands of years, will witness very rapid changes and their constituent species may be wiped out.

What can I do?

Beyond adopting a lifestyle that reduces your own CO_2, emissions and encouraging your government to develop climate friendly policies, you can support projects designed to reduce overall emissions or that actively remove CO_2 from the atmosphere. Examples range from low to high tech and include:

- Building a biogas plant that will transform garden and other organic waste into gas for cookstoves, reducing the need for dirty and high emission charcoal, or for extraction of underground gas;
- Reforestation of degraded lands;
- Contributing to the construction of wind or solar power stations to displace coal or oil burning generation plants in areas where financing for such activities is absent.

By calculating how much carbon you are emitting for different activities, and by supporting a project or activity that will remove that same amount of carbon from the atmosphere, or prevent that same amount of carbon from having otherwise been emitted, you can ensure that your activities are carbon

[2] It's important to note that cement production is also a very big emitter of CO2, responsible for about 3 times more CO2 emissions than air transportation. The next time you consider pouring cement, look at alternatives…

neutral. This process of removing CO_2 from the air through one initiative to compensate for CO_2 emissions created by other activities is called *carbon offsetting*.

What is a carbon offset?

Carbon offsets allow you to compensate for your own carbon emissions by supporting activities that will remove, or prevent the release of the equivalent amount of carbon from the atmosphere. Typically, these activities are rigorously monitored by organizations certified do ensure the system is working. A sophisticated industry has developed around offsets, comprised of standard- setting (usually not for profit) and certifying organizations (usually private sector) and project implementation organizations (a mix of not for profit and/or private sector).

How do carbon offsets work?

Organizations that carry out carbon offset projects complete very detailed studies of their proposed project, ensuring that the results will be *permanent*, *verifiable* (e.g. a third party will monitor the project to confirm it is working well), enforceable (there are penalties if targets are not met). Finally, they must ensure that their project will be *additional* - ensuring that the project in question, while reducing carbon emissions in one place will not inadvertently lead to the production of more emissions elsewhere (for example, if a forest is protected from planned logging, the project must ensure that the logging will just not shift to another forest that would otherwise not have been logged).

In preparing these projects, the proponents must also carefully calculate how many tons of CO_2 will be removed from the atmosphere, or how many tons will have been saved from being emitted. The overall cost of the project is divided by the number of tons of CO_2, and a final price per ton of CO_2 is obtained.

How do I know how much to contribute?

After having identified the price for a ton of carbon, the next step is to identify how many tons of CO_2 will be emitted by your activities. For example, using a readily available carbon emissions calculator for commercial aircraft, one comes up with a total of 0.55 tons of CO_2 emitted on a return flight from Toronto to Quito[3]. If a project has calculated that the price of capturing a ton of CO_2 is US$18, you can then contribute 0.55 tonnes x US$18/tonne = US$9.90 to the project and have a high degree of confidence that the carbon emissions from your flight have been offset.

Where does the money that CNH Tours assign go?

[3] https://www.icao.int/environmental-protection/CarbonOffset/Pages/default.aspx

All funds assigned by CNH Tours will be deposited semi-annually to carbon offset projects rigorously certified and monitored by the Gold Standard[4]. Based in Switzerland, Gold Standard…

> "…was established in 2003 by WWF and other international NGOs to ensure projects that reduced carbon emissions featured the highest levels of environmental integrity and also contributed to sustainable development."

Gold Standard®

Gold Standard is a not-for-profit organization and as of 2020, receives operational financial support from the United Nations and the World Bank, from the governments of Germany, Norway, Sweden, Switzerland and Luxembourg, from the World Wildlife Fund and from many other similarly reputable sources. According to its annual report, Gold Standard's work supported the reduction of 18.2 million tons of CO_2 and other greenhouse gases (e.g. methane) from being released into the atmosphere in 2019.

How did CNH Tours come up with $18/person for their Ecuadorian in-county emissions?

We had to calculate the amount of CO_2 emitted from the domestic flight and from the cruise separately, find the total and multiply by the cost to offset that amount.

FLIGHT: For the flight, there are a number of on-line calculators that make assumptions (typical commercial aircraft, average number of passengers) which we have no reason to dispute for the domestic flight to Galapagos. These calculators generally come up with similar figures. We provide the distance (round trip - 2,000 km in our case) flown and these calculators come to about 200 kg (about 440 pounds) of CO_2 emitted per passenger.

CRUISE: For the cruise, we spoke to ship owners who indicate that over the course of a multi-day itinerary, an average of about 375 litres of diesel fuel are consumed / cruise day. We divide by the number of passengers. We multiply that figure by the number of kilograms of CO_2 produced by burning 1 litre of diesel and come up with a total of 70kg (154 pounds) of CO_2 per passenger per day. We multiply that figure by the length of your cruise to obtain the final amount. For an 8 day cruise, that would be 560kg (1,232 pounds) of CO_2 .

FINAL PRICE OF YOUR OFFSET: We add the two sums (200kg + 560kg) and obtain the total amount of CO_2 metric tonnes (1,000kg – or 2,200 pounds). In our example, that comes to 760kg (1,672 pounds) and multiply that figure by the price/tonne for offsetting CO_2 as indicated by the Gold Standard website. While the cost of offsetting a tonne of CO_2 will vary significantly, depending on the type of project being financed, Gold Standard uses $18/tonne as an average.

The final figure obtained for our guest on an 8 day cruise would come to $13.68 for offsetting the carbon emissions for the domestic flight and cruise. To keep your invoices on the simpler side, we round that

[4] See: https://www.goldstandard.org/projects/climate-portfolio-variety-projects

up to US$14.00. This results in a contribution to the Gold Standard carbon offset fund of $14.00 per passenger on an 8 day cruise, including domestic flight emissions.

How do I know that CNH Tours is keeping its promise?

Annually, in early December (starting in 2022) CNH Tours will report in its blog the amounts we contributed, accompanied by a letter from our external accountant testifying to the full transfer of those funds to the accounts of Gold Standard.

Any further questions?

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