Global Warming

At what point does atmospheric greenhouse gas release become unethical?

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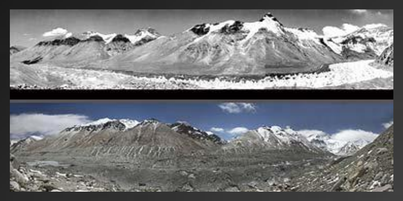

Fig. 1 Mount Everest 1968 VS. 2007

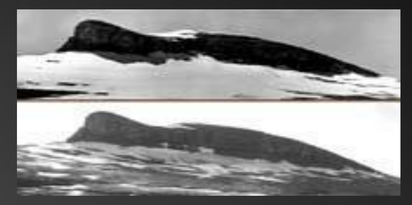

Fig. 2 Glacier Nacional Park

Abstract

In recent decades, the concept of global warming has developed increasing concern among the scientific community and general public alike. What was initially dismissed as little more than unlikely has now become a severe warning for global climate crisis threatening not only our way of life but ultimate future existence on this planet. Global warming is defined as the steady mean increase in atmospheric temperature, the primary asserted cause thereof being increased emissions and inherent atmospheric concentrations of "greenhouse gases" – carbon dioxide in particular. These gases contribute to the greenhouse effect by trapping radiation (from the sun) in the atmosphere. The largest contributor of man-made carbon dioxide is the burning of fossil fuels, especially in regards to energy production and transportation vehicles. As a result, the manufacture and utilization of cars in today's society is not only perhaps the greatest contributor to human induced global warming but also the single major aspect that everyone can do something about. With present knowledge and considering the potential environmental influence of our collective actions, it's the obligation of human society to restrict its climate change inducing actions if it wishes to persist and thrive as a species.

Purpose

The purpose of this research project is to increase awareness and understanding of global warming. With an emphasis on human contribution, the idea is to reflect upon our potential global environmental impact and our ability to prevent catastrophic climate change if we are indeed the underlying cause of recent temperature increases. Through clarification of global warming concepts and interpretation of statistically significant information, a greater understanding thereof is achieved. This translates to an increased ability to make informed decisions and understand what can be done to help lesson our collective impact.

Mechanism

On the molecular level, how does the greenhouse effect occur? Since Earth is surrounded by the vacuum of space, the only way energy is going to enter and/or leave the Earth's atmosphere is via radiation. When electromagnetic radiation from the sun (or any other source of emission, for that matter) interacts with a molecule, it absorbed and thereby temporarily increases that molecule's kinetic energy until it is transmitted via conduction, convection, or radiation thereof. The wavelength of electromagnetic radiation that will interact with any particular molecule is dependent on the properties thereof, which dictate its specific absorption signature. While some of the suns energy (in all wavelengths of visible and infrared light) is reflected by the Earth's surface, much of it is absorbed and results in an inherent warming of the surface that is re-radiated as infrared (long wave) energy. The primary greenhouse gas culprits (water, carbon dioxide, methane, etc.) are transparent to visible light in their chemical properties yet absorb mainly infrared (thermal) radiation, enabling them to effectively retain and re-radiate energy in the form of heat. The greater the atmospheric concentration of these thermal radiation absorbing gases, the more difficult it becomes for this energy to ultimately escape the atmosphere and radiate back out into space. Much like an actual greenhouse, the heat is effectively trapped; consequentially, we observe an increase in Earth's surface temperatures. Over time, these rising surface temperatures have been demonstrated to correlate with increased greenhouse gas concentrations in the atmosphere.

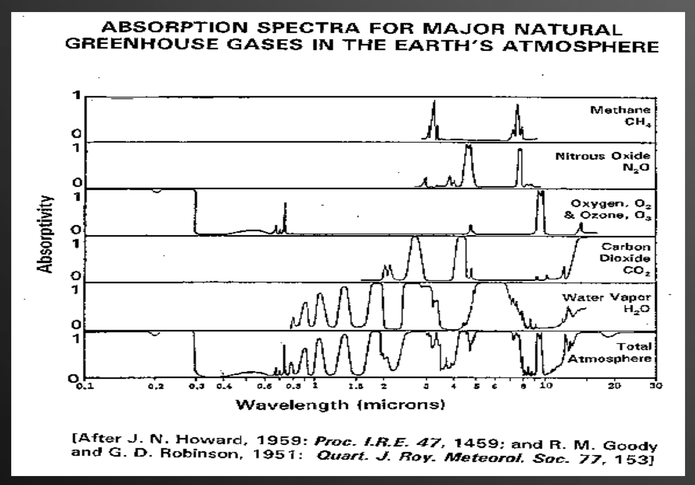

Fig. 3 Absorption Spectra of Greenhouse Gases

Atmospheric Carbon Dioxide

While carbon dioxide isn't the only culprit responsible for global warming, it is one of the primary greenhouse gases we are responsible for emitting and second greatest (water vapor being the first) contributor to the effect. These greenhouse gases are typically measured and numerically represented in parts per million (PPM) scales, meaning the number of molecules comprising one million molecules of the solution. (The values are derived using morality and dimensional analysis.) By taking ice core samples from isolated regions, scientists are able to look back thousands to millions of years into atmospheric conditions via particles trapped and preserved in the depths of the ice. From this, we are able to determine concentrations prior to the advent of direct atmospheric measurement. The data indicates that upwards of 1,000,000 years ago, carbon dioxide concentrations remained between 190ppm-300ppm; however, around the time of the industrial revolution these values began to rapidly spike into the 300+ppm range and is fast approaching 400ppm present day.

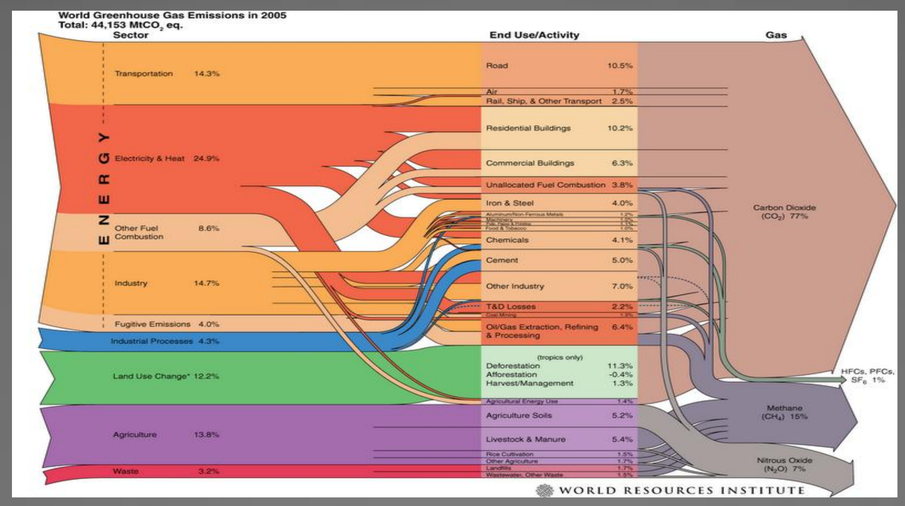

Fig.4 2006 Fossil Fuel Emissions

The single largest human contribution to artificial carbon dioxide emissions is from the generation of electricity both in the world and the United States, which in the U.S. alone accounts for 42% of total CO2 emission release. This includes natural gas, petroleum, and predominately coal burning. The second largest source of CO2 emissions comes from the category of transportation, which is inclusive of planes, boats, cars, etc. In the United States, cars and trucks are responsible for up to 2/3 of the total emissions in this category with mostly petroleum fuel being burned in the form of octane. Utilizing the molecular weight of carbon dioxide in combination with that of the carbon (present in the hydrocarbon molecules being combusted), it can be calculated that 19.4 pounds of carbon dioxide is produced from the combustion of a single gallon of gasoline and 22.2 pounds per gallon of diesel. The burning of natural gas and various industry related production processes also result in a notable amount of CO2 omissions.

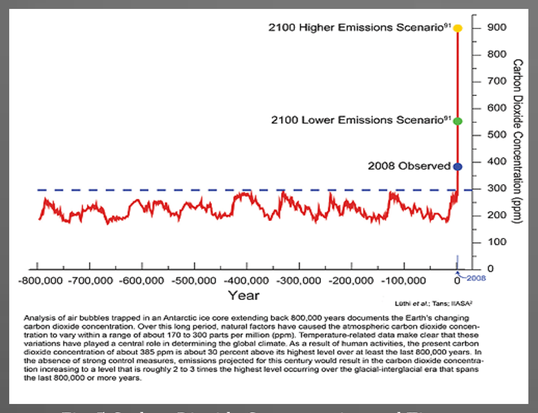

Fig. 5 Carbon Dioxide Concentration and Time

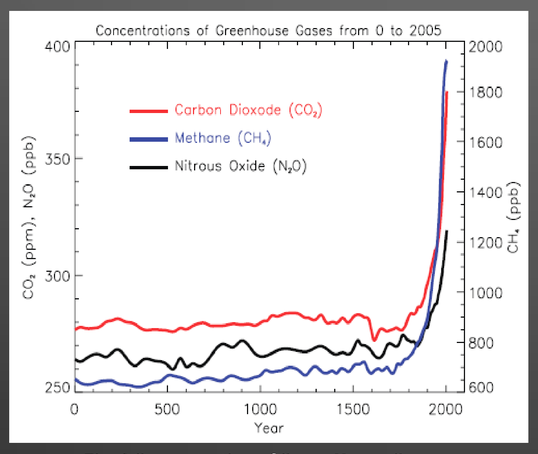

Fig. 6 Concentration of Green House Gasses

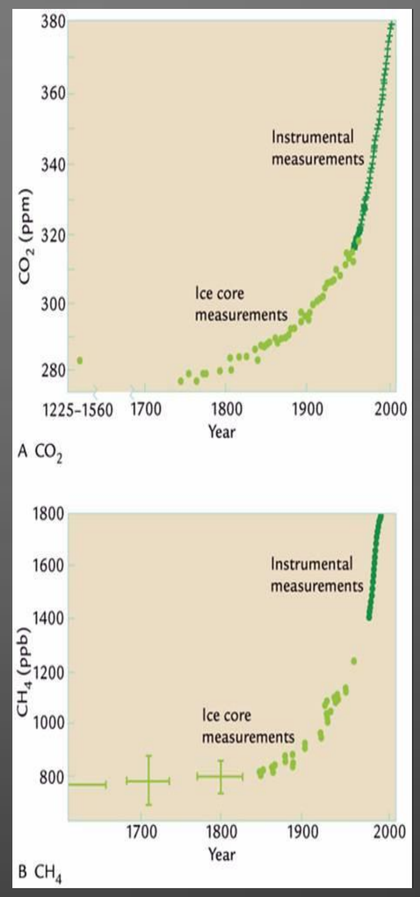

Fig. 7 Co^2 Concentration in Atmosphere

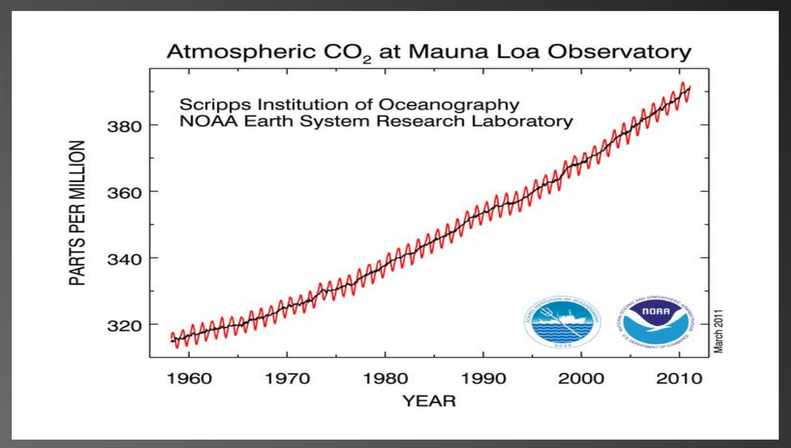

Fig. 8 Mauna Loa Observatory CO2 Measurements

Conclusion

The observations and research clearly implies a gradual increase in global temperature and the potential correlation with increased human emissions is difficult to ignore. With the advent of the industrial revolution, we have undeniably caused an excess spike of carbon dioxide (one of the major and most prevalent greenhouse gases second only to water) along with several other greenhouse gases to be emitted into the atmosphere. The increase in emissions still continues at an alarming rate, threatening catastrophic climate change and our inherent ability to comfortably thrive on the planet. Our influence on the planet resonates with every other living organism that inhabits it. To reduce our "carbon footprint," significant changes must be made: cutbacks in energy expenditure, increased production efficiency, the utilization of innovative alternate energy sources, and hybrid vehicles that are less reliant on fossil fuels. If we wish to sustain a stable environment, careful consideration must be given to our frivolous utilization of resources and the consequential impact on Earth's climate.

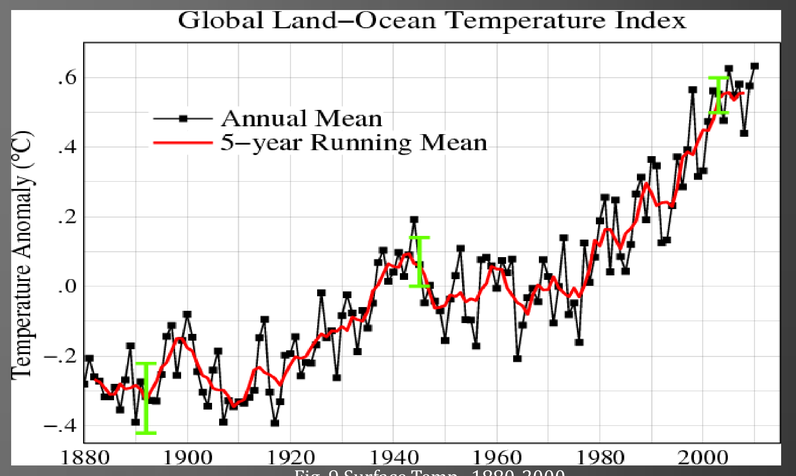

Fig. 9 Surface Temp. 1880-2000

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