

Public Policy
on
Carbon Dioxide and Pollution
with respect to
Climate Change

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Executive Summary

Carbon Dioxide (CO₂) is not the primary cause or driver of Climate Change. When all the greenhouse gases are properly considered, CO₂ represents only 3% of the warming potential gases. ***Signing a CO₂ reduction treaty is not the solution to global warming*** as CO₂ (even if double the current level) will contribute a ***negligible amount*** to global warming. Instead, ***curbing pollution in all forms should be a policy priority.*** Smog and poor air quality in large cities is literally shortening life expectancies and correcting this should be a top priority. Clean generation of electrical power is essential to raise the standard of living for those both with and without access to electricity.

Main Points

This document is aimed at political policy decision-makers and reflects the current global warming/climate change debate that is ongoing in the scientific arena, essentially between those who consider CO₂ the cause of global warming and those who argue that variations in solar radiation and energy stored in the oceans to be the primary factors. It is envisaged that readers will view the charts and explanations, which back up the points made below.

1. Carbon Dioxide (CO₂) is a clear, naturally occurring gas that is essential to the growth of all vegetation. CO₂ is part of the photosynthesis used to capture sunlight and release oxygen. CO₂ is odorless and is not a pollutant, unlike the particles/ash, and chemicals emitted by volcanoes and some coal fired power plants. CO₂ has been demonized by the media, but is vital to life.
2. Data from ice core samples taken from multiple sites near both poles now traces what was going on over the last million years and more. The main data from ice cores is temperature; CO₂ concentration and dust and have varied greatly. This data is considered robust as it comes from several far apart sites and was collected and analyzed by different scientific organizations.
3. While the data is consistent, the interpretation of the charts is the source of much debate – especially with respect to cause and future global temperature projections.
4. The global temperature has varied greatly over the period where data is available. Some ten ice ages are documented as are several warming periods - the interglacial periods (typically about 100 thousand years each). During our current interglacial period there were further warming periods when the Minoan and Roman empires flourished, and the Renaissance occurred.
5. The period from 1850 to 1910 was relatively cool, but there were warming periods between 1910 and 1940 and again from 1975 to 1995 and this is evident in the charts. However, there are discrepancies in the temperature charts, when compared to satellite recordings.
6. The majority of climate scientists and their computer models have difficulty in explaining the last 18 years when there has been a “warming pause” or stall in the warming trend.
7. A 15-year pause in warming is rare in any model prediction, while a 20-year pause is very rare. Two more years of this stall are needed for a very rare event to be noted.
8. The IPCC – International Panel on Climate Change was formed by the UN in 1988 and

produced its first Assessment Report - AR1 in 1990. AR1 includes a projected rise of 0.3°C per decade with a very wide error margin (0.2 to 0.5/decade). For instance, they estimate that over 20 years there would be a temperature increase of 0.6°C, with a possible range from 0.2°C to 1.6°C. The reality, because of the warming pause/stall, has been close to no increase at all.

9. The IPCC has, over the last 25 years, convinced the media, policy makers and governments that CO₂ is the cause of global warming and that CO₂ must be reduced.
10. Reasons that demonstrate that CO₂ is not a driver of the temperature increase are
 - The 18 year “warming pause” - a major *disconnect* between the IPCC projections & reality
 - The continued rise of CO₂ over the last 18 years, while the temperature has flat-lined
 - The fact that in all previous ice ages the CO₂ increase has lagged behind the temperature rise and thus cannot be a cause of global warming.
11. IPCC has excluded water vapour, the most important greenhouse gas (GHG), from the majority of its recent charts and tables. The relative concentration of these GHGs are
 - Water Vapour (H₂O) 95%
 - Carbon Dioxide (CO₂) 3%
 - Methane (CH₄), CFC, NO₂ etc. 2%
12. Computer-based models used by IPCC to predict the future are inaccurate and do not explain the complex interaction of the incoming solar and cosmic radiation, the cloud and atmosphere interaction and the air/ice/ocean interaction. Fluctuations in solar output and sunspot cycles need further research, as they most likely have more impact on global temperatures, than CO₂.
13. The continued rise in CO₂, while not the primary cause of global warming, is strongly correlated with the rise in human population from 1 to 7 billion people over the last century along with the associated increase in complex human activities, such as farming and industry.

Address Pollution – Instead!

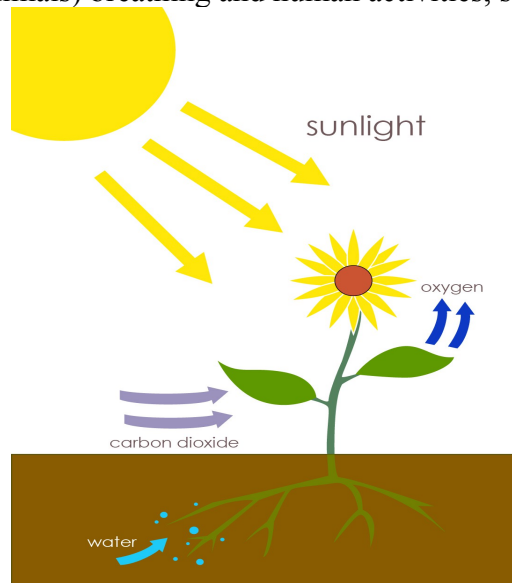
14. The increased population would all like to enjoy the same quality of life as found in western nations, and this causes a corresponding demand in energy and other resources.
15. China has pulled some 400 million people out of poverty over the last 40 years, but this has meant adding coal fired power plants at the rate of 50 per year or about one a week. Most of these power plants do not have scrubbers to remove polluting chemicals and particulate matter.
16. The air quality in major cities (mainly in Asia – Beijing, Shanghai, New Delhi, Mumbai, etc.) is atrocious and dense smog is a regular occurrence. Pollution from both power plants and vehicles is a huge health issue, which must be addressed.
17. These countries and their cities should install scrubbers on current coal-fired power plants to remove pollutants; and convert existing plants to natural gas, where and when possible. New power plants should be non-polluting nuclear reactors and ideally fast breeder nuclear reactors to burn the current large global stockpile of partially spent nuclear fuel.
18. Curbing pollution in all forms should be a policy priority. CO₂ is not a pollutant and not the root cause of global warming. Instead, addressing the airborne chemicals and particulate pollution problem will reap great rewards in public health for billions of people, and is much more important than curbing CO₂.

Charts and Explanations

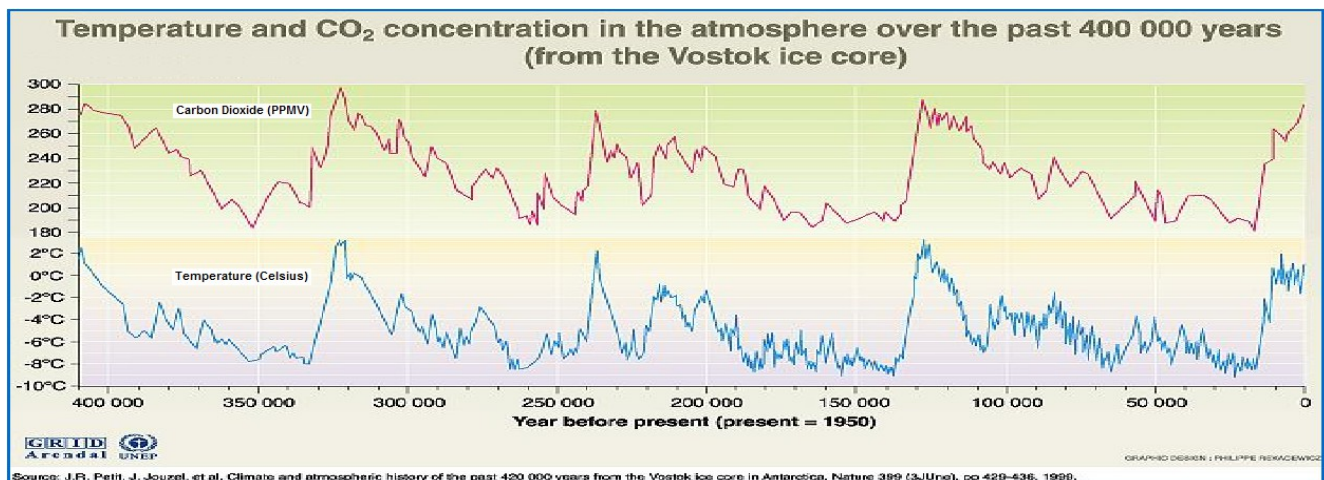
1. Carbon Dioxide (CO₂) and Photosynthesis

Carbon Dioxide (CO₂) is a naturally occurring, invisible gas that is essential to the growth of all vegetation. CO₂ is part of the photosynthesis used to capture sunlight and release oxygen, as the

graphic below shows. CO₂ is also produced by the decomposition of dead plant material, bacteria, algae, humans (and all other animals) breathing and human activities, such as farming and industry.



2. Ice core data



This is one example of the ice core data, covering 400,000 years and four ice ages. Hundreds of charts from around the north and south poles are available, some going back over 1.5 million years.

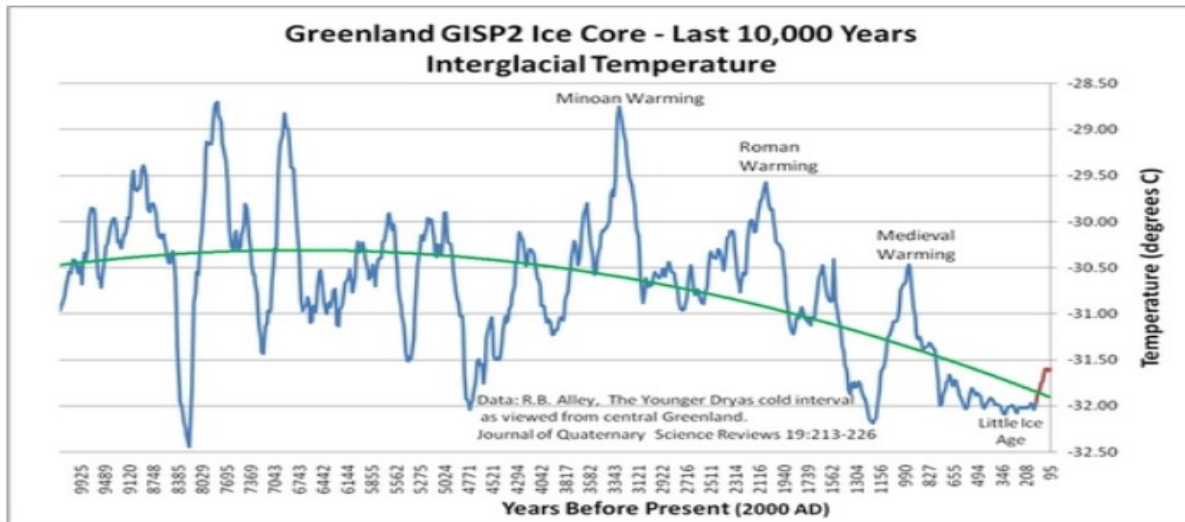
3. Interpretation of the charts

Interpretation of the charts has led to strongly held views and much discussion. For instance, is the rise of CO₂ the cause of the temperature rise or is the temperature rise causing more vegetation growth and more CO₂ to be created from different processes? In the ice age data, above, the rise of CO₂ has followed the increase in temperature in all documented ice ages (by a few hundred years (~800 years)) where data is available. Most climate scientists do not dispute this. On the other hand the rise of CO₂ in the 20th century started well before the temperature rise, which was between 1910 and 1940 and again from 1975 to 1995. Which is the driving force and which is the response variable? The data from many ice ages appears to be **more consistent with the temperature being the driving force** and the CO₂ responding some time later. The ice core data is considered to be accurate as it comes from

different sources close to both poles. The ice core temperature record of the last 4,000 years is also replicated by the record of the advance and retreat of the glaciers in Europe, tree ring studies, seabed core samples, and sea level measurements in the Mediterranean.

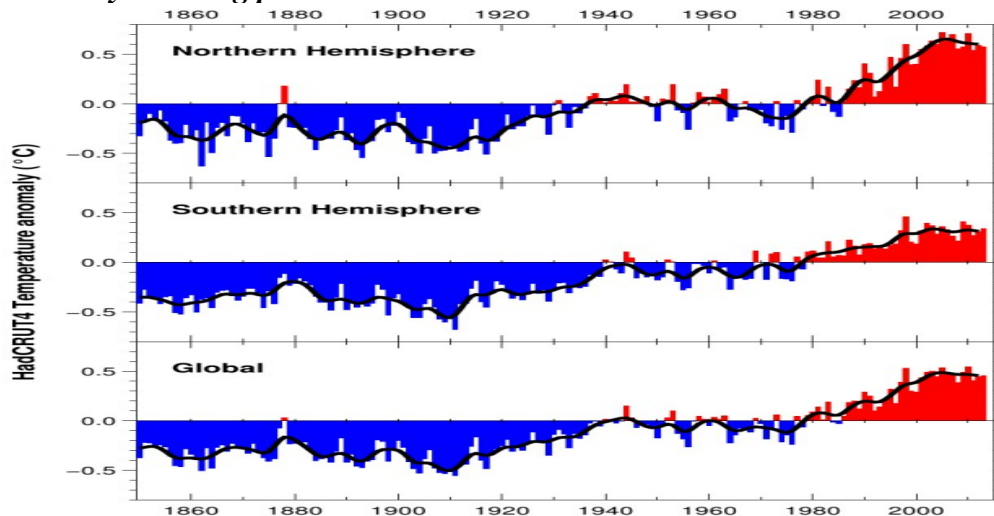
4. Ice ages

Typical interglacial periods are about 100,000 years and have further warm and cool periods between the ice ages.

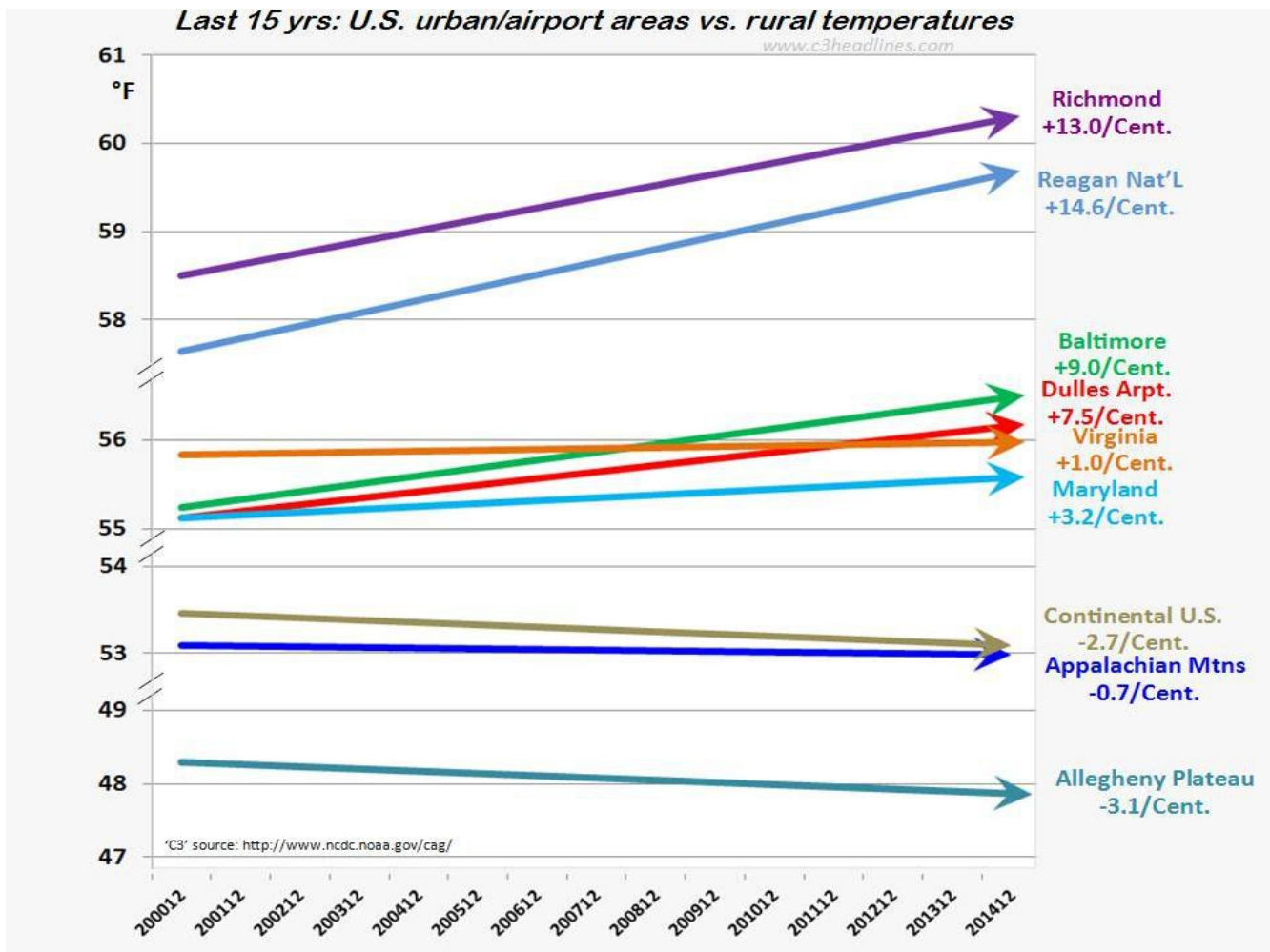


The next chart above is of the last 10,000 years showing the warming periods during the Minoan, Roman and Medieval Renaissance eras. This last warming period was followed by the “Little Ice Age”. Note that the 10,000 years is wholly contained in the last interglacial period. [David Lappi](#) who published the above chart, comments that all these 10,000 years were warmer than our current temperatures and modest warming trend. Many of the interglacial periods were several degrees warmer than now, and were times when different cultures progressed.

5. 20th century warming periods



The above charts are from the CRU (Climatic Research Unit, University of East Anglia, UK). It is



7. A 15-year pause - a rare event

Looking at more of the temperature anomaly graphs it is clear there are periods where the temperature has flat-lined – namely showed little or no increase or decrease. So while there are other pauses in the temperature in the past – computer climate models do not show a pause usually over 15 years, we now have 18 years of flat temperature data and a 20 year period is very rare. Two more years of similar data are needed for a very rare event to occur that most scientists and their models cannot explain away.

8. IPCC - Assessment Report projections

IPCC has produced five Assessment Reports numbered AR1 through AR5. AR1 came out in 1990 and started the assertion that CO₂ is the primary cause of the global warming. The first graph in section 12 below shows how the 44 computer models do in projecting the 18 year pause/stall in the temperature anomaly. AR5 was published in 2014 and is the source of some of the following charts.

9. CO₂ - the cause of global warming?

CO₂ has continued to rise from about 290 parts per million by volume in 1880 to the current time, where it is close to 400 ppmv. If CO₂ was the cause (“the driver”) of temperature rise then the temperature would continue to rise in parallel with the CO₂ rise. This has not happened. A couple of important points in viewing and interpreting these graphs is to check the end points and the

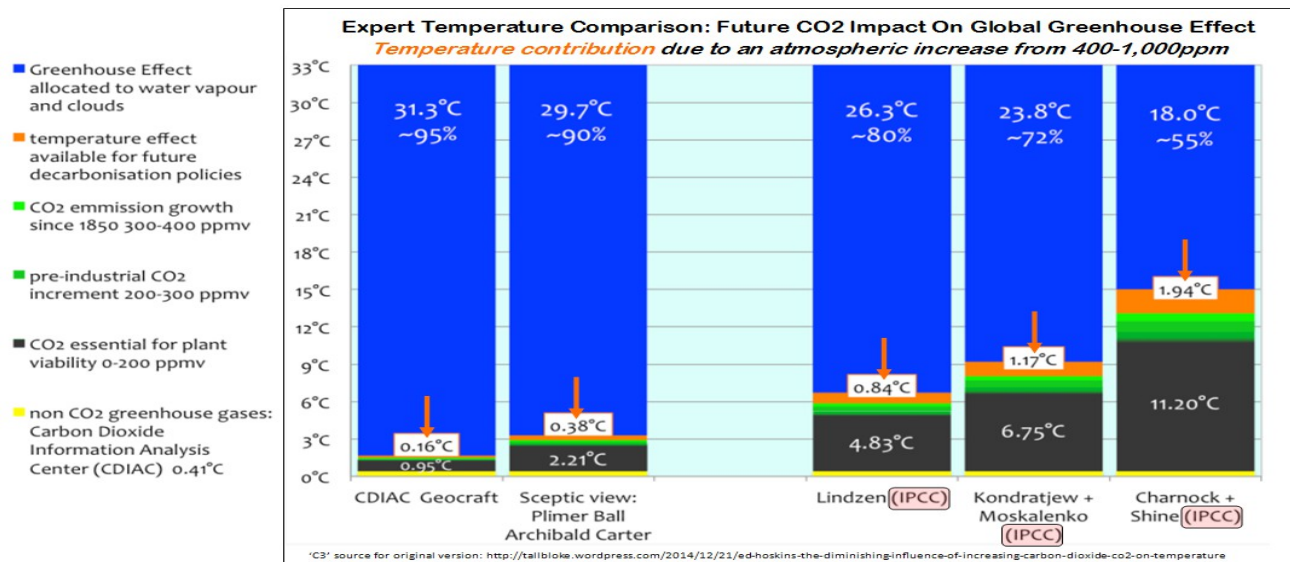
scale (is it a 100 year or a million year range?) that the creator of the graph has chosen. If you just look back over the last 20 years you can come up with a different average and a different insight into what is happening. Also the statement that “Correlation does not prove Causation” needs to be understood. Here again just because two time series have the same shape you cannot say which one is the driving force and which one is the response variable. The converse is also true that if two graphs do **not** have the same shape over the same time period, then you cannot say which one is the cause (the driver) and which one is the response. If the graphs diverge (as in the stall) it may be neither, in which case **other driving forces need to be found.** The temperature pause/stall does **not** match the continued increase in CO₂ so **this is a strong graphic argument that CO₂ is not driving the temperature response.**

10. IPCC - Explanations needed for current data inconsistencies

The ice core samples going back over a million years show that CO₂ increased after the temperature increase that marked the end of an ice age. These data are not in dispute. Now the CO₂ levels from the last 20 years do not match the temperature anomaly data. IPCC has to explain these discrepancies.

11. IPCC focuses on CO₂ – excludes H₂O from many charts and tables

Many of the IPCC tables in AR1 through AR5 only talk about the “man-made” greenhouse gases (CO₂ occurs naturally and is also produced by humans and human activity), and normalize all their data values with CO₂ having a value of 1. This is deceptive as the **primary greenhouse gas is water vapor**, which represent 95% of the GHGs, CO₂ is 3% and others (CH₄ (methane), CFC, etc.) about 2%. This ratio is well documented in some of the early reports (AR1), but is ignored in later reports. [Lightfoot](#) and [Mamer](#) have a paper, which uses two different means to establish the 95% value. While this ratio varies considerably from the cold north to ocean cities near the equator, the average is a good estimate on a global basis. This means that all the data normalized with CO₂ (at 1) should be divided by about 32 (95% divided by 3%) and compared against water vapor. Also water vapor is a more important greenhouse gas and absorbs heat energy more effectively than CO₂ and therefore the 32 suggested above is a lower limit. The chart below shows the 95% and other possible water vapor concentrations.

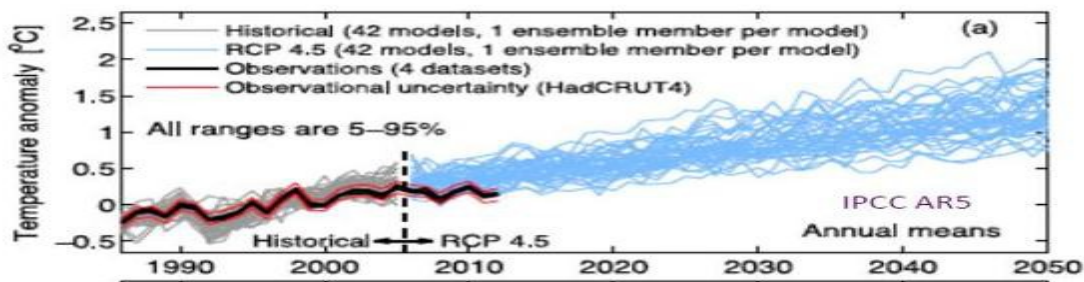


12. Computer-based models inadequately simulate the complexity of the environment

Computer models are good at predicting tomorrow's weather. And for a week into the future they give a reasonable estimate. Further out along the time axis the projections get poorer. Computer climate

models are not the same as weather prediction models, but use some of the same concepts. When projecting over one or two decades the errors shown in almost all 44 models used by IPCC – exhibit a strong divergence from the reality of the last 20 years. Over 100 years these **projections are meaningless and are no good for making policy decisions**. The complexity of the environment covers many different scientific specialties, and few people are expert in all of them. There are 11 year sunspot cycles, multi-decadal cycles in the Atlantic and Pacific ocean warming, 200 ± 70 year cycles of warming and cooling as shows in section 4, and the 10,000 year cycles within the 100,000 year interglacial periods. All of these cycles are based on some [physical attribute of our planet and solar system](#) (e.g. the precession or wobble of the earth as it spins on its axis; where is the centre of gravity of the solar system relative to the sun?; the latent heat of water evaporating or condensing), and are poorly modeled by the 44 climate models used by IPCC. The chart below is initially from IPCC AR5, with comments from Dr. [Judith Curry](#), of Georgia Institute of Technology. Dr. Curry has suggested that these different cycles above may combine, with re-enforcement at one point and cancellation at another point in time and location. This may create an effect like a “stadium wave” when spectators, at a sporting event, get up and wave in turn, which concept might improve modeling of the warming hiatus.

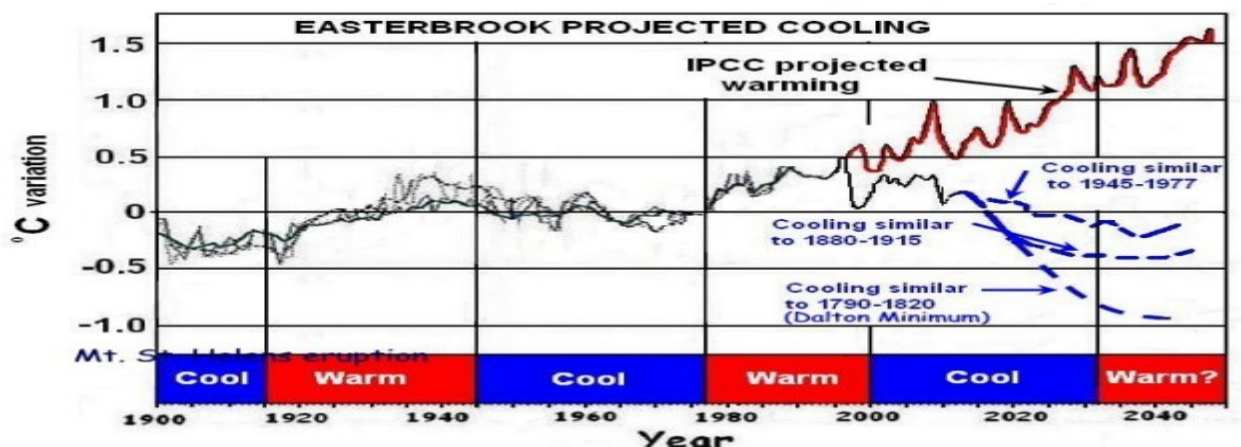
Significance of the 'pause' since 1998



Under conditions of anthropogenic greenhouse forcing:

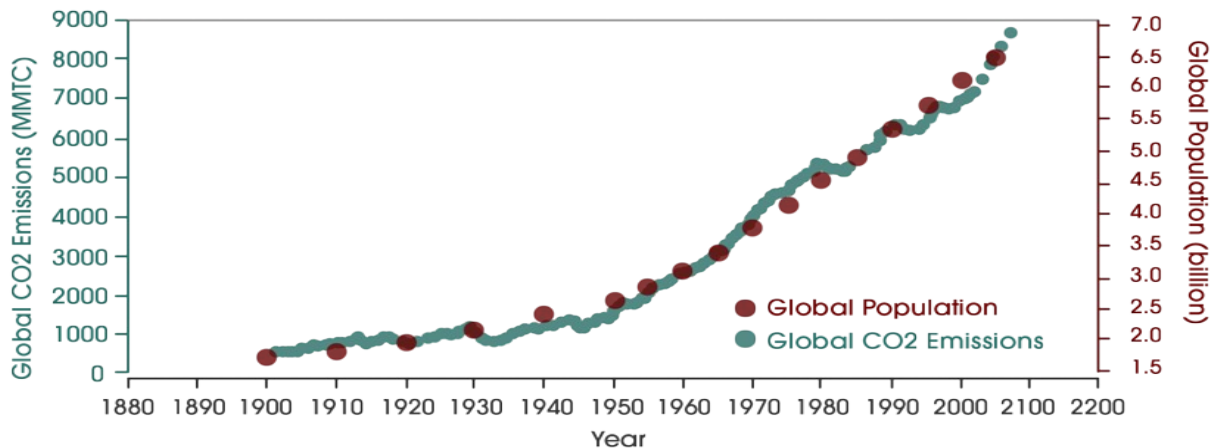
- Only 2% of climate model simulations produce trends within the observational uncertainty
- Modeled pauses longer than 15 years are rare; the probability of a modeled pause exceeding 20 yrs is vanishing small

Dr. [Don Easterbrook](#) also has projections based on a similar ocean temperature analysis – see below. He has noted that 32,000 American scientists have signed a statement that there’s **NO correlation between climate change and carbon dioxide levels**.



13. Correlation of CO₂ rise and population rise

The way the population curve overlays the CO₂ curve does not prove that one or the other is the driving



(Source: World Climate Report, 2008)

force. However, the close correlation is suggestive that these two factors are strongly related. Based on the high correlation it is a reasonable statement that the increase in the population has had an input on CO₂ production. This statement is at the heart of the IPCC attribution of global warming to human activity. However, many scientists disagree that the resulting increase in CO₂ is the *cause* of the temperature increase. The ~800 years lag of CO₂ rise after ice core temperature increases, the 18-year warming pause, and the inability of over 40 computer climate models to match the actual temperature readings, shows that there is a major discrepancy that IPCC and the general climate science community have to explain. Many of the experts who disagree with IPCC say that variations in the sun output and ocean temperatures are much more important, and some are even calling for a 30+ year cooling period.

14. Raising standard of living needs energy and resources

In China some 400 million residents have been pulled out of poverty and enjoy a higher standard of living than 40 years ago. On the downside, people's standard of living is also strongly related to their energy consumption, and electricity in particular. The Chinese government has addressed this by adding about 50 power plants per year. Most of these power plants are coal fired and do not have scrubbers to remove the pollutants, soot and particulate material that come from the exhaust flues/chimneys. Some 1.5 billion people on a worldwide basis do not have access to electricity, and a huge number of power plants would be needed to address this deficiency, hopefully with non-polluting power generation. The increase in vehicles is also adding to particulate and chemical air pollution.

15. China coal power plants need upgrade to curb pollution

China and India are the primary burners of dirty coal and their cities should -

- Install scrubbers on current coal-fired power plants to remove pollutants
- Convert existing plants to natural gas, where and when possible
- New power plants should be non-polluting nuclear reactors. Eventually the optimum solution would be fast breeder nuclear reactors to burn the current large global stockpile of partially spent nuclear fuel

16. The air quality in major cities is a huge health issue

As I have seen from my visits to both China and India, the smog in the air is completely unacceptable and a huge health issue. China recognizes the problem and has the government structure and financial depth to address the problem, but the scale of the issue (with about 1.3 billion citizens) will take decades to resolve. Estimates are that the air quality is so poor as to reduce people's life expectancy by the order of five years.



17. Power plant changes to resolve health issues

The air in Beijing is so bad that the government took exceptional steps during the Olympics to try and improve the air quality. Even larger steps have to be taken to resolve the problem across the whole country. Link to [Smog in China](#) . The same applies to India and the other large Asian countries.

18. Curbing pollution in all forms

Addressing the ***particulate and chemical pollution problem*** (both power plants and vehicles) will reap great rewards in public health for billions of people. Link to [NEJM-Lung-Study](#) , [Fuel-costs](#) and [Under the Dome](#) Chinese video with sub-titles. This will allow billions of people to breathe more easily, and increase their life expectancy. They will also see blue skies, which is a rarity in many cities.

Conclusion

CO₂ is not a pollutant, does not cause smog and is not the root cause of global warming. CO₂ is vital to life – plants grow better in higher CO₂ levels. Policy makers at the national level should verify that the highest standards possible for clean energy production are regulated and enforced. ***Signing a CO₂ reduction treaty is not the solution*** as CO₂ (even if double the current level) will contribute a ***trivial*** amount to global warming. Instead, ***curbing pollution in all forms – and improving air quality in particular - should be a policy priority.***

Acknowledgments

The author would like to thank all those who contributed, including his McGill colleagues Douglas [Lightfoot](#) and Dr [John Felvinci](#). All charts are recognized as coming from the identified sources.