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Grassroot Institute of Hawaii Discusses Local and National Policy

policybrief

Global Warming: Rethinking the CO₂ and Temperature Relationship

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April 2009

In this GreenPaper:

- 1] Non-CO₂ greenhouse gases such as water vapor and methane have a much greater impact on temperature than CO₂.
- 2] Cloud cover, radiation, and temperature, all key agents of climate change, have interactions that remain poorly understood.
- 3] Earth's 4 billion year history shows climate fluctuations are the norm while climatic stability is unusual.
- 4] Ice core data confirms CO₂ increases do not cause warming.

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The presumption of anthropogenic (human-caused) global warming is a prevailing concern among academics, politicians, and environmentalists. On a daily basis, the media report that human-caused elevated levels of carbon dioxide in the Earth's atmosphere are responsible for increasing temperatures that will contribute to a rise in sea levels, tsunamis, food shortages, starvation, and spread of disease. Hollywood celebrities such as Leonardo DiCaprio and Gwyneth Paltrow have joined Al Gore in perpetuating these predictions, convincing average citizens that the apocalypse is fast approaching.

The idea that anthropogenic accumulation of carbon dioxide will cause unprecedented warming has gained popularity. In 2007, the Hawaii state legislature passed a law making Hawaii the second state in the nation to establish an enforceable limit on its greenhouse gas emissions. The cap requires a reduction in emissions to 1990 levels by 2020, which is approximately a 20 percent decrease from current emissions⁵.

Proponents of such legislation claim that rising temperatures are unequivocally destructive and that the only way to stop further warming is to drastically cut, or even eliminate, carbon dioxide emissions. These proposals are all based on a foregone conclusion attained by popular opinion instead of balanced scientific discussion.

This brief will be the first in a continuing series that seeks to enrich a heavily biased debate in which some have gone so far as to declare that a "consensus" on global warming has been reached, just as there once was a consensus that the Earth was flat, and that the sun revolved around the Earth. A consensus does not make an assertion true, and genuine scientists reach conclusions via facts, not popular opinion. The following provides factual background on greenhouse gases and the greenhouse effect, the Earth's temperature record, and the relationship between carbon dioxide and warming, and answers questions concerning effects of potential future warming and mitigation policies.

1

Greenhouse Gases and the Greenhouse Effect

First, it is crucial to understand the greenhouse effect,

the mechanism by which life on Earth is possible. According to the United Nations' Intergovernmental Panel on Climate Change (IPCC)'s definition of the greenhouse effect, greenhouse gases absorb thermal infrared radiation, trapping heat within the surface troposphere system⁶. Greenhouse gases (in order of contribution to the greenhouse effect) such as water vapor, carbon dioxide (CO₂), methane, nitrous oxide, ozone, and chlorofluorocarbons (CFCs) absorb this reflected radiation, in turn warming the atmosphere⁷.

Without the greenhouse effect, Earth would be uninhabitable with an average temperature of -04 degrees Fahrenheit (average temperature is 57 degrees Fahrenheit)⁸.

Global warming alarmists rebuff CO₂'s essential role in maintaining a habitable environment, viewing CO₂ as a destructive greenhouse gas responsible for increased absorption of radiation and subsequent alleged warming. Alarmists push programs targeting elimination of CO₂ emissions, conveniently ignoring the role of water vapor, methane, and other gases that collectively have a greater impact on temperature.

As previously mentioned, water vapor, not CO₂, is the most abundant and significant greenhouse gas contributing

to the greenhouse effect. Water vapor's contribution to the greenhouse effect may be as high as 70 percent⁹. In November 2005, National Geographic reported that water vapor, not carbon dioxide, was the culprit behind rapidly rising temperatures in Europe¹⁰. Rolf Philipona, lead researcher of the World Radiation Center in Switzerland, found that "the strong water vapor impact" was "driving the higher temperatures"¹¹. According to the Center's team of scientists, 70 percent of the recent increase in temperatures in central Europe was due to water vapor, and 30 percent was due to other greenhouse gases¹².

Further research is needed to fully comprehend the feedback loop in which water vapor is involved. The National Oceanic and Atmospheric Administration (NOAA), an agency within the US Department of Commerce, reports that changes in water vapor concentration are a result of climate feedbacks. NOAA acknowledges that the feedback loop involving water vapor "is critically important to projecting future climate change," but remains "fairly poorly measured and understood"¹³. For now, NOAA concludes that inferior measurements of global water vapor render any measurement of growth in atmospheric concentrations uncertain¹⁴. Without understanding the full extent to

5] Greenland was much warmer between 8,000 and 5,000 years ago¹. During the Medieval Warm Period, many parts of the world were much warmer than today^{2,3,4}.

6] Significantly warmer temperatures would not cause complete melting of glaciers in the Arctic.

7] NASA data indicate no warming occurred from 1940-1975, despite increasing CO₂ emissions.

8] Again in the 21st century, no further warming is occurring despite rising CO₂ emissions.

9] Since the turn of the century, 2008 has been the coolest year.

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which the most significant greenhouse gas, water vapor, (among at least a dozen other factors) affects temperature, it is presumptuous to believe that CO₂ alone drives temperature changes.

Methane is another overlooked greenhouse gas that NOAA states is an “extremely effective absorber” of radiation¹⁵. Methane traps heat about 20 times more effectively in the atmosphere than carbon dioxide and is generated by natural and human activities¹⁶. Not all environmentalists have ignored the role that methane plays in enhancing the greenhouse effect. Dr. James Hansen, director of NASA’s Goddard Institute for Space Studies and a well-known figure in climate change awareness, has said, “non- CO₂ greenhouse gases are probably the main cause of observed global warming, with methane causing the largest net climate forcing”¹⁷.

Despite significant contributions by water vapor and methane to temperature change, global warming alarmists continue to focus exclusively on cutting CO₂ emissions. Disregarding all other greenhouse gases except for CO₂ undermines the very science and authenticity on which their arguments for complete elimination of CO₂ emissions rest.

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Earth's Temperature Record in a Meaningful Context

Seemingly every year, newspaper headlines declare that the current

year is the warmest year on record. However, the timeline and context in which these temperatures are viewed is more important than the temperatures themselves. If a company that has consistently posted revenues over a twenty-year period saw its revenues decline in the past week, it would be a gross mischaracterization to label the company a failure based on those seven days' performance versus its twenty years of profit. It would be similarly misleading to say that the Earth is experiencing unmatched temperatures when looking at a record that extends only a hundred years.

Ice cores provide a glimpse into the climatic past as far back as 100,000 years. Studies of two-mile long ice cores taken from Greenland show a widely varied climate pattern record¹⁸. While the media frequently report on current temperature fluctuations and melting ice sheets, all apparently the result of human activity, geoscientist and past chair of the National Research Council, Dr. Richard B. Alley, notes that climatic stability is the exception rather than the rule. He observes that the warm, stable climate of past millennia in which humans have inhabited the Earth is an anomaly instead of the norm¹⁹.

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Temperatures were warmer than present during the Climatic Optimum lasting from 8,000 to 5,000 years ago²⁶. After the Little Ice Age (approximately lasting from the 16th to the mid-19th century²⁷), temperatures spiked around 1930 and have since decreased in the last decades²⁸.



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On the grounds of temperature records, global warming alarmists say that current high temperatures are unparalleled, citing that the global surface temperature has increased about one degree Fahrenheit (1.33 ± 0.32 °F) from 1905-2005 without providing a thorough context or background²¹.

While a hundred-year period may appear to be a long stretch of time, in the Earth's timeline, a century barely registers. Most scientists agree that the Earth is over four and a half billion years old and that life has existed on Earth for about one billion years²². In this massive interval, the Earth has experienced warming periods much warmer than today (think dinosaurs) and cooling periods of at least four major ice ages. Earth's prehistory is marked by a wildly fluctuating climate.

The methodology behind Michael Mann's hockey stick graph of Northern Hemisphere temperatures over the past millenium, which has been used to precipitate popular belief in climate change, has been largely discredited due to the fact that the latter portion starting at the end of the nineteenth century is based on temperature records whereas the remainder of the graph was reconstructed using proxy data, mainly those of tree rings²³.

Following disputes over the hockey stick diagram's accuracy, Congress called

for an investigation by the National Research Council of the US National Academy of Sciences. The ad hoc panel, assembled by the chair of the National Research Council, found that "Dr. Mann's assessments that the decade of the 1990s was the hottest decade of the millennium and that 1998 was the hottest year of the millennium cannot be supported by his analysis," and that "the paucity of data in the more remote past makes the hottest-in-a-millennium claims essentially unverifiable"²⁴.

Temperature values gleaned from the Greenland Ice Core Project (GRIP) borehole over longer periods reflect major natural temperature changes that occurred in the past including the Last Glacial Maximum, the Climatic Optimum, the Medieval Warm Period, the Little Ice Age, and another warm period around 1930 A.D.²⁵. Dahl-Jensen et al. found that temperatures were warmer than present during the Climatic Optimum lasting from 8,000 to 5,000 years ago²⁶. After the Little Ice Age (approximately lasting from the 16th to the mid-19th century²⁷), temperatures spiked around 1930 and have since decreased in the last decades²⁸. The following graphs (Figure 1) display temperature records of the past 8,000 years and the past 2,000 years from the GRIP borehole and the Dye 3 borehole located 865 km farther south:

"The paucity of data in the more remote past makes the hottest-in-a-millennium claims essentially unverifiable"

5

The Relationship Between CO₂ and Temperature

The Medieval Warm Period is considered an anomaly by global warming alarmists, chiefly because they blame manmade CO₂ emissions as the trigger for warming, and there was no increase in manmade CO₂ emissions to account for about five hundred years of warmth at the time. Additionally, when observing temperature records between 1880 and the present, no warming occurred between 1940 and 1975, a time of rapidly increasing CO₂ in the atmosphere³¹. To ignore this period is cherry picking, and to claim that CO₂ emissions are responsible for warming after 1975 without accounting for the cooling prior to 1975 weakens the alleged link.

Borehole readings show that temperatures have been much higher years before industrial activity.

Despite the fact that the boreholes were taken from locations 865 kilometers apart, the temperature histories are consistent and nearly identical.

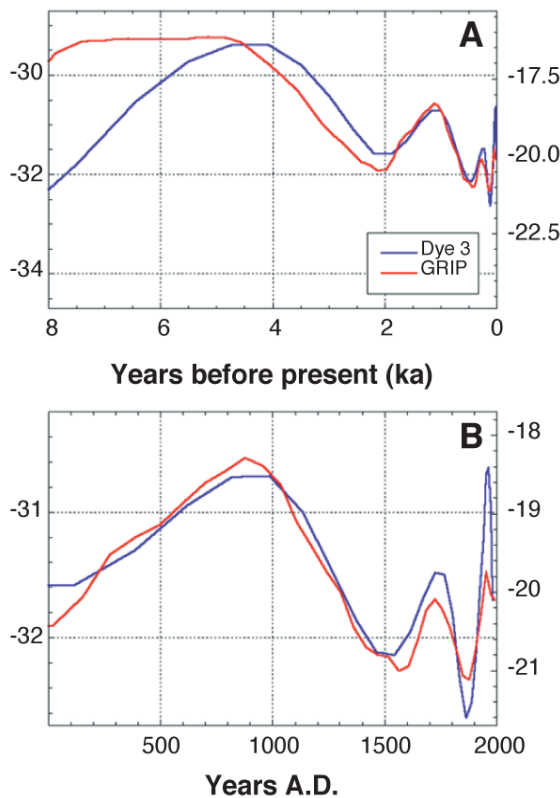


Figure 1: Fig. 4A, Fig. 4B. GRIP past surface temp²⁹

Plotting temperatures and CO₂ levels using ice core data reveal the reverse actually takes place— increases in CO₂ levels lag temperature increases instead of leading temperature increases. When snow compacts into ice layers, air bubbles from the atmosphere become entrapped in the ice. Scientists observe the history of atmospheric CO₂ concentrations from these air bubbles. Studies confirm the aforementioned pattern, which has been reported by Science and other peer-reviewed journals³². Using Antarctic ice cores, Indermuhle et al. found that CO₂

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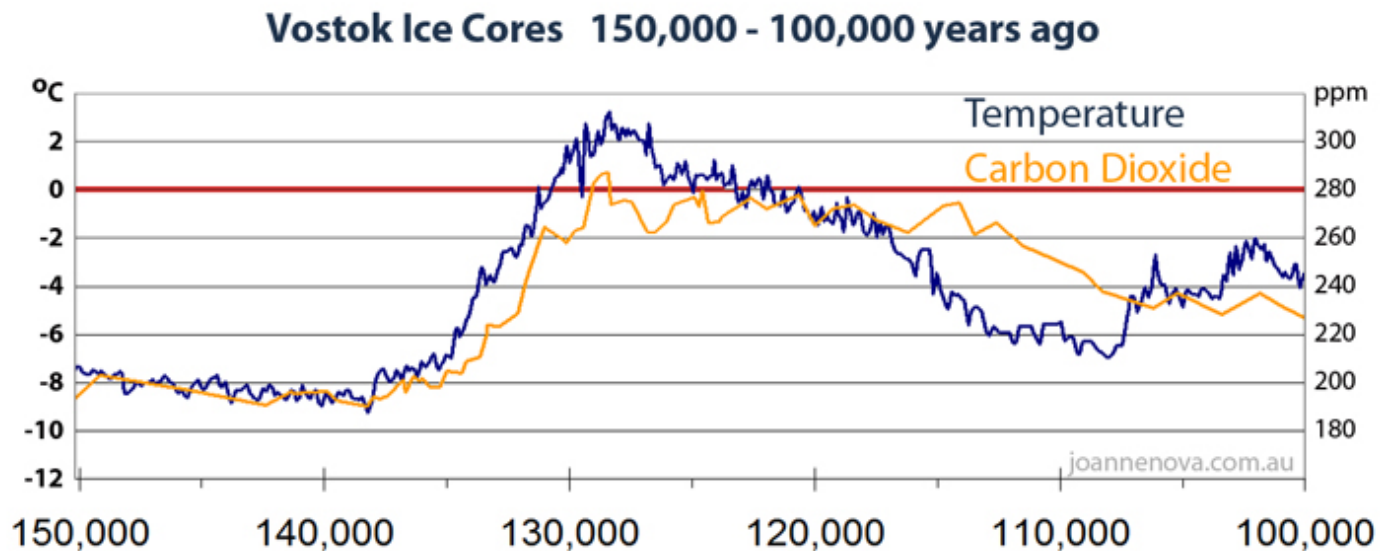
lags temperature by 1200 ± 3700 years³⁴.

Fischer et al. found a time lag of 600 ± 400 years in the last three glacial-interglacial transitions³⁵, while Siegenthaler et al. found a lag of 1900 years in Antarctic data³⁶. Ice core data consistently disprove that CO₂ increases lead temperature increases. If CO₂ increases occur after warming, then it cannot be true that CO₂ increases cause warming.

In December 2008, NASA's Goddard Institute for Space Studies reported that calendar year 2008 was the coolest year since the turn of the century despite increasing CO₂ emission levels during this eight-year period^{37, 38}. Instead of reexamining the hypothesis that CO₂ emissions lead to warming, some scientists alternatively concluded that La Nina conditions in the Pacific brought down temperatures³⁹.

After temperatures rise, on average it takes 800 years for carbon dioxide levels to follow.

Figure 2: Data from Historical Isotopic Temperature Record from the Vostok Ice Core and Historical CO₂ Record from the Vostok Ice Core, graphed by Joanne Nova³⁰.



Anticipated Effects of Potential Global Warming

Climate models and their projections are

not infallible. It is possible that in the future, the world will experience more cooling than has occurred since the turn of the century. Global warming alarmists are convinced that the opposite will occur despite the recent cooling trend. They are also only concerned with the cataclysmic consequences of further warming, neglecting to consider the advantages and disadvantages of either cooling or warming.

The most commonly mentioned impending disasters accompanying global warming are extreme weather events and melting ice sheets leading to a rise in sea levels. Global warming has been implicated as the cause of extreme weather events. Al Gore widely perpetuates this notion in *An Inconvenient Truth* and public speaking tours. However, in February 2009, the *New York Times* reported that Gore dropped a slide from his presentation that linked droughts, flooding, and other events with human-driven climate change following criticism by Roger Pielke, a scientist formerly of the National Center for Atmospheric Research⁴⁰. Gore's slide cited data from the Center for Research on the Epidemiology of Disasters (CRED)

in Brussels, which has stressed in its reports that several factors unrelated to climate, such as media development, increase numbers of reported disasters⁴¹. In a statement, CRED said, "We believe the increase (in disaster trends) is explained partly by better reporting of disasters in general . . . whether this is due to climate change or not, we are unable to say"⁴². The World Meteorological Organization has also weighed in on the extreme weather and climate change link, stating, "though there is evidence both for and against the existence of a detectable anthropogenic signal in the tropical cyclone climate record to date, no firm conclusion can be made on this point" and that "no individual tropical cyclone can be directly attributed to climate change"⁴³.

Rising sea levels due to melting glaciers is also a commonly mentioned concern. According to the 2007 IPCC report, snow cover and mountain glaciers have declined in both hemispheres and losses from ice sheets in Greenland and Antarctica are very likely to contribute to sea level rise between 1993 and 2003⁴⁴. However, only six years earlier in 2001, the IPCC wrote "no significant acceleration in the rate of sea level rise during the 20th century has been detected".



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While concerns have focused on the warming of the Antarctic Peninsula, most of Antarctica is too cold for ice to melt. The southern part of the continent's icy mass, along with the eastern half which lies on solid rock, is so deep-frozen that it has not been at all affected by any warming⁴⁵. Due to icy winds, the compressed snow in the continent's deep interior is gaining volume⁴⁶. The Center for Polar Observation and Modelling, based in the UK, also found that mass gains from accumulating snow on the Antarctic Peninsula and within East Antarctica exceed the ice dynamic mass loss from West Antarctica⁴⁷. In Greenland, data collected over 11 years by satellite show that snowfalls from the North Atlantic oscillation are causing the interior to thicken by an average of six centimeters a year⁴⁸.

Some scientists are concerned over media outlets using short-term trends in sea ice to mislead the public about global warming. Earlier this year, the New York Times published meteorologist Dr. Vicky Pope's take on the melting hype and Arctic trends. Pope wrote "there is little evidence" to support the claim that

"Arctic summer sea ice has decreased so much in the past few years that it has reached a tipping point and will disappear very quickly"⁴⁹. She explained that losses in the past couple of years "could easily be explained by natural fluctuations in the weather, with summer sea ice increasing again over the next few years"⁵⁰.

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Presumably, the worst case scenario for global warming alarmists would be complete melting of glaciers in the Arctic. However, significantly warmer temperatures would not be able to bring

about complete melting. A recent study of ancient biomolecules from 1.2-mile deep ice cores from a Greenland glacier suggests that temperatures reached as high as 50 degrees Fahrenheit in the summer as recently as 450,000 years ago, while today, coastal regions average just above freezing (32 degrees Fahrenheit) in the summer⁵¹. DNA samples of trees, plants, and insects from the cores indicate that glaciers on Greenland did not completely melt away during this period of significant warmth⁵².



Policy Considerations

It is the individual responsibility of all citizens to be stewards of the environment and reduce pollution. The global warming movement has effectively distracted from this goal, pushing an agenda that calls for greenhouse gas emission caps and elaborate programs to fund renewable energy sources. Billions of dollars are being spent to reduce CO₂ emissions, all in the hopes of preventing any increase in global temperature and to maintain the current temperature, assuming that this is even within man's power.

No scientific study has been performed determining at what temperature humans and other species thrive the most, and at what temperature the human condition begins to decline.

As pointed out by former NASA chief Michael Griffin, taking drastic action to maintain the current temperature signifies that the current state of climate is the optimal climate, and that it must be maintained at all costs. Yet, no scientific study has been performed determining at what temperature humans and other species thrive the most, and at what temperature the human condition begins to decline.

Without knowing this optimal temperature, alarmists insist that the current state of climate is the most favorable for everyone and must remain unchanged. In effect, alarmists assume they are able to control the global climate at will. Their sweeping

emission-reducing proposals do not strike them as futile in terms of mitigating temperature changes.

Pumping more greenhouse gases into the atmosphere will not prevent future encroaching ice ages, just as switching entirely to renewable energy sources will not cool off the Sahara Desert. What is badly needed in the climate change debate is a heavy dose of realism and a return of attention to the more immediate needs of societies. Enacting any measure that professes to preserve an arbitrarily perfect global climate should be a collaborative process focusing on long-term rather than quick-fix solutions.



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