



POLICY REPORT

A North Carolina Citizen's Guide to Global Warming

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JULY 2007

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INTRODUCTION

The state of North Carolina is headed toward imposing major new regulations and taxes on the consumption and production of energy. These restrictions include higher gasoline taxes; restrictions on the use of coal, oil and natural gas in electricity generation and mandatory use of wind and solar power; new land-use regulations that would restrict people's lifestyle choices and use of their property; tax penalties for roomier and more powerful cars; and the diversion of state funds from road construction to mass transit. All of this is being considered in the name of fighting global warming.

But how much have human activities affected the Earth's climate up to now? How much will human activities change the climate in the future? What fraction of human-caused climate change is

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the result of greenhouse gas emissions such as carbon dioxide (CO₂) and methane, and how much is from other factors, such as turning wilderness into cities and farmland? How harmful will climate change be, and what should policymakers in Raleigh, N.C., or Washington, D.C., do about it?

Climate change has dominated public attention during the last few years as environmentalists, along with many climate scientists, journalists and public figures, most notably Al Gore, have driven climate change to the top of the world's political agenda. The result has been a steady stream of scary headlines about hurricanes, floods, crop failures, and other disasters of biblical proportions that humankind's greenhouse gas emissions will ostensibly bring down upon us during the 21st century.

Gore warns that "We have just ten years to avert a major catastrophe that could send our

entire planet into a tail-spin of epic destruction involving extreme weather, floods, droughts, epidemics and killer heat waves beyond anything we have ever experienced."¹ According to Gore, the only way to avert these disasters is through a "wrenching transformation" of our way of life that involves drastic reductions in the amount of energy we use and large increases in the price we pay for the energy that remains.

As this guide will show, Gore's brand of over-the-top climate hysteria has nothing to do with reality. Whatever the risks of future climate change, they pale in comparison to the risks of the "wrenching transformation" sought by Gore and his environmentalist allies.

The restrictions they seek to force on the world would require us to relinquish the energy consumption that undergirds the extraordinary prosperity, health, and comfort of life in the U.S., the nations of Europe, and other wealthy countries. At the same time, those restrictions would prevent individuals in the world's poorest nations from aspiring to the rich world's quality of life, consigning them instead to continued poverty and hardship.

Environmentalists claim that their alarming view of the Earth's climate represents the "consensus" of climate scientists, and that the scientific literature provides no room for a more benign assessment of the causes and nature of climate risks. In reality, papers that contradict this ostensible consensus are published in the major scientific journals nearly every week, and we discuss some of their results in the pages that follow.

Claim: *The greenhouse effect is caused by human activities.*

Reality: The greenhouse effect refers to the fact that some gases—for example, water vapor, carbon dioxide, and methane—let in visible light from the sun, but absorb outgoing infrared light emitted by the Earth. All else equal, the result is warming of the atmosphere. Most of the greenhouse effect is natural and is due to water vapor naturally in the

atmosphere, as well as natural levels of carbon dioxide (CO₂), methane, and a few other greenhouse gases.² Without this natural greenhouse effect, the Earth's average temperature would be well below freezing and would be inhospitable to human life.³ Key questions for climate science and policy include the extent to which human greenhouse gas emissions are *adding* an additional increment to this natural greenhouse effect and what risks that might pose to human health and welfare.

Claim: *Greenhouse gas emissions and levels in the atmosphere are increasing.*

Reality: It depends on the gas. CO₂ levels in the atmosphere are increasing at an average rate of about half a percent per year, though this rate can vary a few tenths of percent in either direction from year to year.⁴ The atmospheric concentration of CO₂ is now about 385 parts per million (ppm), or 43 percent above the estimated pre-industrial level of 270 ppm.⁵

The increasing atmospheric CO₂ concentration is due to human CO₂ emissions, which come mainly from the burning of fossil fuels like coal, oil, and natural gas. Total human CO₂ emissions have been increasing at an average rate of about 2 percent per year during the last decade, though year-to-year changes can vary by a few percent in either direction.⁶

CO₂ is the most important greenhouse gas. However, the United Nations Intergovernmental Panel on Climate Change (IPCC) estimates that methane (natural gas) is also important, contributing about one-third of the warming effect of CO₂.⁷ Other estimates place the warming effect of methane as high as half the effect of CO₂.⁸ In contrast to rising CO₂, the atmospheric concentration of methane has virtually leveled off since 1999.⁹

Claim: *Carbon dioxide is air pollution.*

Reality: Carbon dioxide (CO₂) is a natural component of the atmosphere that is perfectly safe

to breathe. Even before humans started using fossil-fuel energy, carbon dioxide was present in the atmosphere at a concentration of about 270 ppm. You breathe out CO₂ whenever you exhale. Plants take in CO₂ and use sunlight to turn it into sugars, wood, and other carbon compounds through the process known as photosynthesis. Whenever you pop open a soda you're getting a whiff of concentrated CO₂, which is the chemical that gives sodas their fizz.

Environmentalists often claim that carbon dioxide is an air pollutant, presumably to create the impression that CO₂ is dangerous to breathe. By creating this confusion, environmentalists hope to generate support for CO₂ regulation on the coattails of existing public support for regulating real air pollutants, such as carbon monoxide, ozone, or particulates.

Although environmentalists claim their alarming view of the climate represents the scientific "consensus," papers that contradict it are published in the major scientific journals nearly every week.

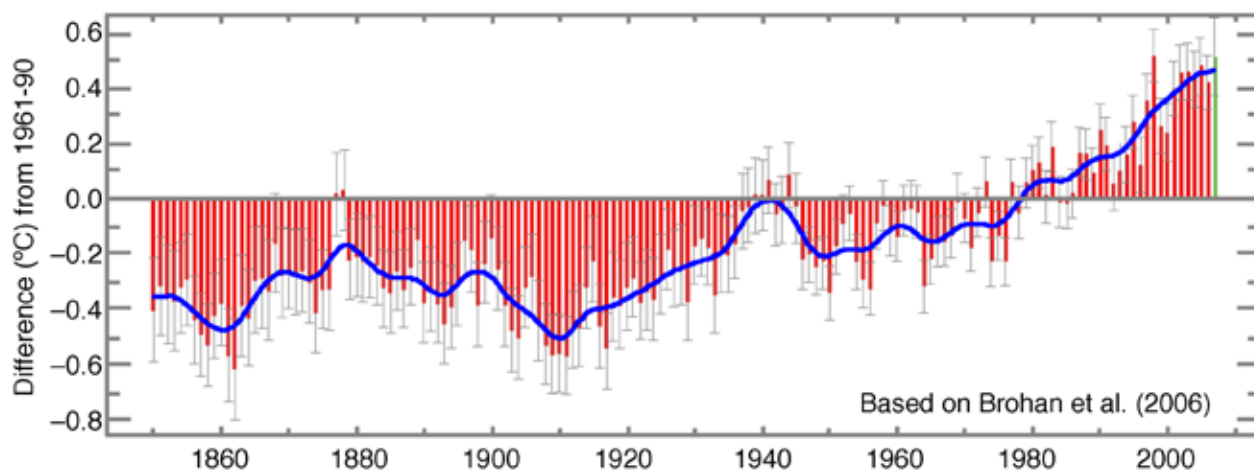
Claim: *The Earth has been getting warmer and current warming is unprecedented in recorded history.*

Reality: The Earth has been warming since the early 1800s, which marked the end of a roughly four-century period known as the Little Ice Age. Figure 1 shows an estimate of the average trend in global temperature since 1850.¹⁰

A key question in the climate change debate is whether recent warming is unprecedented during the last few thousand years. A wide range of studies of the Earth's past climate show that the globe likely has gone through a number of periods that were as warm as or warmer than the present, most recently during the so-called Medieval Warm Period.¹¹

If current warming is unprecedented during the last few thousand years or more, then the case for human activities as the cause of recent warming

Figure 1. World near-surface temperature trend, 1850-2006



Notes: Red bars give the difference between the estimated temperature in a given year and the average temperature during 1961 to 1990.

Source: Hadley Centre for Climate Change (2007).

would be more plausible, as would the claim that this warming might pose grave dangers. However,

A wide range of studies shows that the Earth has gone through a number of periods that were as warm as or warmer than the present, most recently during the so-called Medieval Warm Period.

if the climate was as warm or warmer in the past, then: (1) current warming would be within the range of natural climate variability, meaning that human greenhouse gas emissions are not essential for producing current warming; (2) since past warming was not accompanied by disastrous consequences for humanity or other life—polar bears clearly survived the Medieval Warm Period, which occurred between the 10th and 14th centuries—there would be less reason to assume that current warming will necessarily have grave consequences.

Claim: *Human greenhouse gas emissions are the only viable explanation for recent climate trends.*

Reality: The scientific literature suggests that a number of other factors may be significant contributors, including: human activities other than greenhouse gas emissions; changes in the sun's brightness over time that are not adequately accounted for in climate models; and changes in the number of cosmic rays hitting the Earth, which affects cloudiness.

Human factors other than greenhouse gas emissions can account for much of the warming observed over the last few decades, but are not accounted for in current climate models. One such factor is changes in land use. Data collected from 1979-2001 show that the greater the degree of industrialization over a given area of land, the greater the warming trend in that area. Greenhouse warming models fail to reproduce this regional variation of temperature trends with land use.¹² Some warming can probably also be explained by progressive conversion of desert areas to irrigated farmland, such as in California's Central Valley.¹³

Soot is produced by human burning of wood

and coal for energy, from human clearing of forests by burning, and from natural forest fires. Small amounts of black soot mixed in snow increase sunlight absorption, resulting in warming. A new study in the *Journal of Geophysical Research* concludes that this could account for 20 percent of global warming since the 1800s and between 31 and 94 percent of warming in the Arctic specifically. These effects are much larger than assumed by climate models.¹⁴

The sun's brightness varies over time and this naturally affects temperatures around the world. A recent study of the trend in solar energy reaching the earth during the 20th century concluded that 45 to 50 percent of all 20th century warming was due to changes in solar brightness, as was 25 to 35 percent of warming from 1980 to 2000.¹⁵ The authors concluded that "the solar impact on climate change ... is significantly stronger than what some theoretical models have predicted."

A relatively new theory is that average temperatures are affected by the amount of cosmic rays hitting the Earth. Cosmic rays affect cloudiness, which of course affects temperature. The amount of cosmic rays hitting the Earth depends on where the solar system is in its orbit around the galaxy and on variation in the strength of the sun's magnetic field. Recent research reports that trends in cosmic rays over time track changes in the Earth's temperature, so there could be a causal connection.¹⁶

Taken together, the results above have enormous implications for climate policy. If most warming is caused by human activities but not by greenhouse gas emissions specifically, and/or by natural factors, then reducing greenhouse gas emissions will not stop the warming, or will at least reduce the warming much less than expected.

Claim: *The pattern of the Earth's climate changes is consistent with human greenhouse gas emissions being the main cause.*

Reality: Climate models predict greenhouse warming should cause the lower troposphere (the

lowest portion of the atmosphere) to warm more rapidly than the Earth's surface.¹⁷ But just the opposite is occurring. Data from satellites and weather balloons show that the surface is warming more quickly than the lower troposphere.¹⁸

Climate models predict greenhouse warming should be most pronounced toward the poles. However, temperature trends in many polar regions are inconsistent with this expectation. Greenland warmed rapidly in the 1920s, when humans had emitted few greenhouse gases, then cooled from about 1930 to the early 1990s, despite rapidly increasing greenhouse gas emissions.¹⁹ Greenland warmed 50 percent faster from 1920 to 30 than it did from 1995 to 2005.

Alaska experienced net warming from 1949 to 2001. However, most of the warming occurred in one jump in 1976—an event now known as

Almost all of Antarctica has been cooling during the last two decades and snowfall has been increasing. Indeed, a range of climate trends are moving in exactly the opposite direction than predicted.

the Pacific Climate Shift. Alaska actually cooled for decades, both before and after this one-time temperature jump.²⁰

The Arctic was warmer during the 1930s than during the late 1990s and cooled about 2°F between 1935 to 1965, before temperatures began rising again. Almost all of Antarctica has been cooling during the last two decades and snowfall has been decreasing.²¹ Both trends are just the opposite of what climate models predict for the effects of greenhouse warming.

Claim: *The Earth is likely to undergo catastrophic warming during the 21st century.*

Reality: In its 2007 assessment, the IPCC predicts, based on climate models, that the Earth will warm anywhere from about 1.8°C to 4°C (3.2°F to 7.2°F) between the late 20th and late 21st

centuries.²² As noted above, the overall pattern of climate trends is not consistent with predictions based on greenhouse warming, suggesting that these climate-model results should be taken with a large chunk of salt. However, even if we assume the models are accurate, we still should expect warming to be at the low end of the IPCC's range.

First, the highest amounts of model-predicted warming require greenhouse gas levels to increase much faster than what is actually observed in the atmosphere. For example, in the real atmosphere, the concentration of methane has barely budged since 1999 and a recent study concluded "it is questionable whether human activities can cause methane concentrations to increase greatly in the future."²³ Yet the IPCC's predictions of substantial greenhouse warming depend in part on large increases in methane during the 21st century. The

A group of scientists recently reanalyzed worldwide hurricane data and found no trend in hurricane frequency or intensity during the last two decades.

IPCC's warmest scenario assumes atmospheric methane nearly doubles between 2000 and 2100. Even the IPCC's lowest warming scenario assumes methane increases nearly 25 percent between 2000 and 2030.²⁴

Second, climate models predict a linear (straight line) warming trend if atmospheric CO₂ increases by a constant percentage each year.²⁵ Since CO₂ has been rising at about 0.5 percent per year, we should therefore get a pretty good idea of the amount of warming during the 21st century by just extrapolating the current trend.²⁶ When we go through this exercise, we end up with at most about 1.8°C (3.2°F) of warming, which is at the bottom of the IPCC's range.²⁷

POTENTIAL IMPACTS OF CLIMATE CHANGE

Claim: *Climate change has caused an increase in the number and intensity of hurricanes during the last few decades.*

Reality: Research published in the journals *Science* and *Nature* in 2005 concluded that there had been an increase during the last few decades in the number and intensity of hurricanes around the world, and that this was likely due to human-caused greenhouse warming.²⁸ Climate activists and the popular press took these papers to be smoking guns that humans were changing the climate in dangerous ways. However, more recent research contradicts these conclusions.

The *Science* paper started its hurricane trend analysis in 1970, the year that adequate global satellite coverage of hurricanes became available. But as it happens, data for the North Atlantic region go back to the mid 1940s.²⁹ These data show hurricane activity was about the same from 1945 to 65 as during 1995-2005.

More recent analysis shows that the ostensible worldwide rise in hurricanes since 1970 now appears to be an artifact resulting from inconsistencies in how data from different regions and time periods were analyzed. A group of scientists recently reanalyzed worldwide hurricane data and found no trend in hurricane frequency or intensity during the last two decades.³⁰ And just as this paper was going to press, the journal *Nature* published a 250-year record of Atlantic hurricanes showing that it was the 1970s and '80s that were atypical for their low hurricane activity, while the active hurricane seasons of the last decade reflect the long-term norm.³¹

Claim: *Global warming will increase the number and intensity of hurricanes in the future.*

Reality: Climate models predict that greenhouse warming should affect hurricanes in some ways that would increase hurricane intensity and in other ways that would decrease hurricane intensity.

For example, higher sea-surface temperatures provide more of the energy that fuels hurricane winds. Sea-surface temperatures have indeed been increasing as the Earth has warmed, exactly as would be expected.³²

On the other hand, vertical wind shear and vertical stability also affect hurricane intensity. Vertical wind shear is the variation of wind speed with altitude. Vertical stability is the propensity of air masses to mix vertically (lower vertical stability means more mixing). Climate models predict that greenhouse warming would act to increase both vertical wind shear and vertical stability.³³ Both of these changes would *decrease* hurricane intensity.

Observations in the tropical Atlantic show that the real atmosphere is behaving just the opposite of greenhouse warming predictions. Since the 1970s, vertical wind shear and vertical stability have been decreasing.³⁴ Both of these trends would tend to increase the number and intensity of hurricanes—exactly what has been observed in the Atlantic.³⁵ We are thus in the ironic situation where the reason for the increase in Atlantic hurricanes during the last decade may be that the atmosphere is behaving *opposite* to what would be expected under greenhouse warming.

Claim: *Climate change is the cause of the increasing financial losses from hurricanes.*

Reality: Most of the people who live along the coast in hurricane-prone areas of the U.S. have moved there since 1960.³⁶ The rapid increase in the number of people—and their buildings and property—in hurricane-prone coastal areas guarantees that hurricane losses will increase over time, even if there is no change, or even a decrease, in the number or destructiveness of hurricanes.³⁷ If you estimate the financial losses that would have occurred if past hurricanes had hit today's coastal infrastructure, you find that there has been no trend from 1900 to 2005 in hurricane destructiveness, and six of the ten most destructive hurricanes, including the most destructive one, hit before 1950.³⁸

Scary claims of increasing hurricane devastation are one of the main weapons in climate alarmists' arsenal. Activists were quick to blame Hurricane Katrina on global warming. As Al Gore puts it in *An Inconvenient Truth*, "And then came Katrina ... the consequences were horrendous. There are no words to describe them."³⁹ Ironically, Katrina was only a Category 3 hurricane (where 1 is weakest and 5 is strongest) by the time it hit New Orleans.

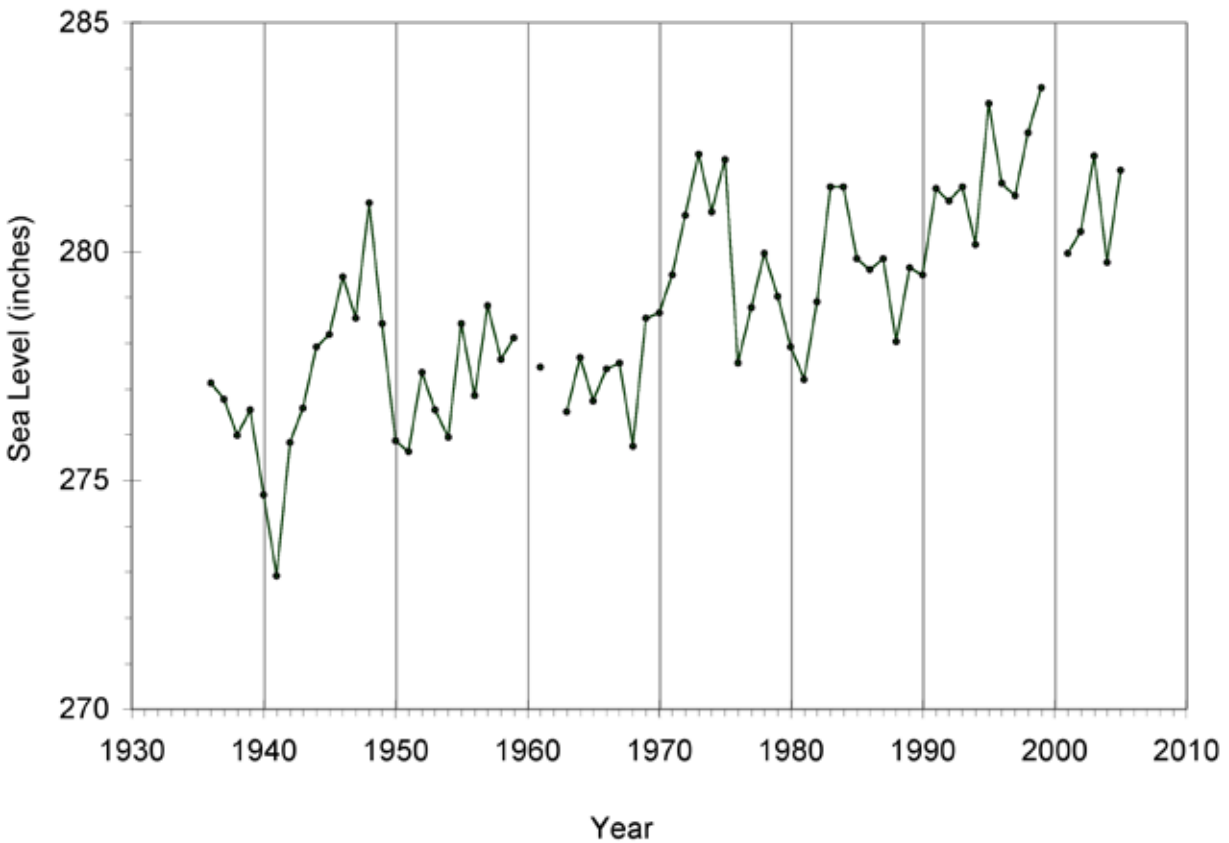
Hurricane Katrina's devastation is a tale of human-caused damage. But it doesn't have anything to do with climate change. Rather, Katrina is a story about government subsidizing people to live in risky areas and failing to build adequate defenses against storms that were guaranteed to arrive eventually, with or without human-caused warming.⁴⁰

Data for N.C.'s coast show that average sea level has dropped a few inches below peak levels achieved during the 1990s and is now about the same as peak levels during the 1940s and 1970s.

Claim: *Human-caused global warming is causing dangerous increases in sea levels and may wipe out North Carolina's coastal areas.*

Reality: Climate activists in North Carolina have been claiming that greenhouse warming will flood the Outer Banks and wipe out the state's coastal areas.⁴¹ But data for North Carolina's coast show little sea-level rise during the last few decades. Wilmington has the longest-running series of sea-level measurements for North Carolina, covering the years from 1936 to 2005 (see Figure 2). Average sea level has risen only about 5 or 6 inches during this 70-year period. Furthermore, for the last five years, average sea level has actually dropped a few inches below peak levels achieved during the 1990s and is now about the same as peak levels during the 1940s and 1970s. There doesn't seem to be much of a global warming signal in the North

Figure 2. Sea level trend in Wilmington, North Carolina, 1936-2005



Notes: Breaks in the curve signify years without valid sea-level data.

Source: Proudman Oceanographic Laboratory, Permanent Service for Mean Sea Level, www.pol.ac.uk/psmsl/datainfo.

Carolina sea-level trend data.

In fact, seen in context, there is little reason to attribute recent sea-level rise to greenhouse warming. Data from around the world show that average sea levels have been rising for at least the last hundred years (see Figure 3).⁴² Furthermore, the rate of sea-level rise slowed down during the 20th century.

According to the Carbon Dioxide Information and Analysis Center, 94 percent of all human CO₂ emissions occurred after 1910 and 90 percent after 1920.⁴³ Furthermore, because of their much greater mass, the world's oceans take decades to “catch up” with changes in the atmosphere. If human greenhouse gas emissions are the main driver of sea-level change, we would have expected sea level to have been roughly constant back in the

early 20th century. Instead, as Figure 3 shows, sea level was already rising back in 1904, when humans had emitted hardly any greenhouse gases. And regardless of the “background” rate of sea-level rise, greenhouse warming would be expected to speed up sea-level rise. Instead, the rate of sea level has been slowing down.

Claim: *Global warming will cause the Greenland and Antarctic ice sheets to melt, raising sea levels by many feet and causing worldwide flood disasters.*

Reality: Greenland and Antarctica contain enough land-bound ice to raise global sea level by more than 200 feet.⁴⁴ Al Gore likes to show footage of large chunks of ice along the Antarctic

Peninsula falling into the sea, followed by computer-generated pictures of inundated coastal cities. What Gore doesn't mention is that the Antarctic Peninsula represents only about 2 percent of the continent's land area and is the only part of Antarctica that has been warming. As noted earlier, the rest of Antarctica has been cooling for the last few decades. Furthermore, as discussed below, much of the continent has been gaining ice.

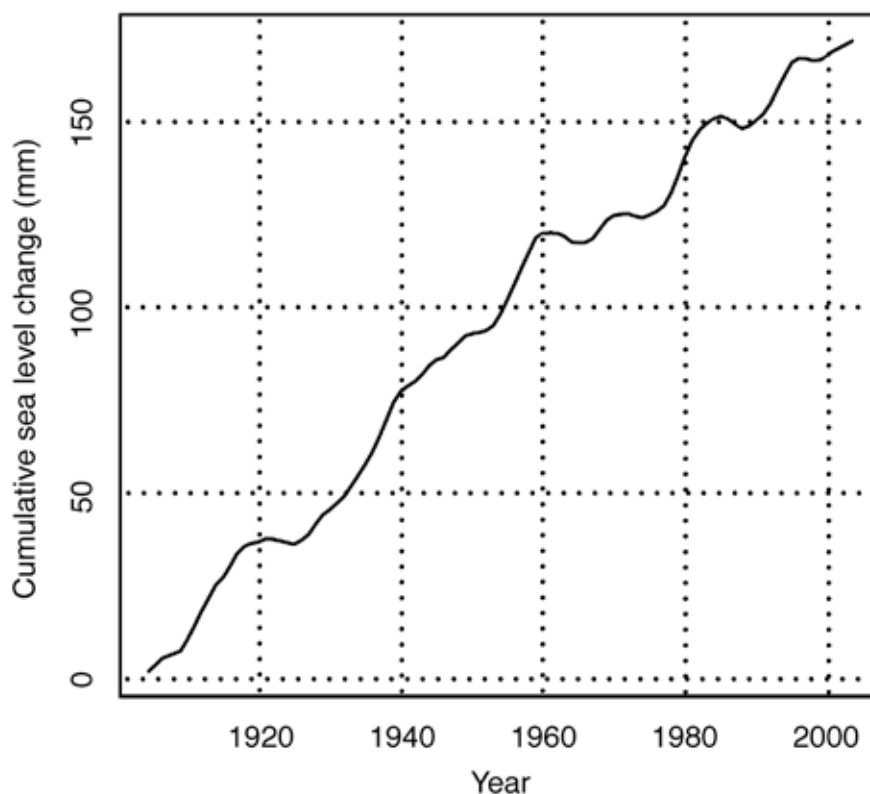
Studies of Greenland and Antarctica keep seeing back and forth over whether these areas are losing or gaining ice on net. A recent review of more than a dozen studies concluded that the net effect on world sea level from Greenland and Antarctica

is currently somewhere between a 0.15 millimeter per year (mm/yr) decrease to a 1.0 mm/yr increase, with a best estimate of an 0.35 mm/yr increase (less than 1/70th of an inch per year, or 1.4 inches per century).

The key question is whether human-caused warming will accelerate ice loss in coming decades. It is worth noting up front that higher temperatures in the past, for example, during the Medieval Warm Period, did not cause catastrophic loss of Greenland or Antarctic ice. Greenland also spent about half the 20th century with summer temperatures as warm or warmer than today, but without any massive loss of ice.⁴⁵ In fact, as shown in Figure 3, the rate of sea-level rise slowed down during the 20th century.

The most up-to-date research suggests that Antarctica's and Greenland's ice caps are not in danger of disappearing any time soon. A recent

Figure 3. Trend in world average sea level from 1904-2003



Notes: The vertical axis gives sea-level change in millimeters. 100 millimeters is about 4 inches.

Source: Figure 4 in Holgate (2007).

study of Greenland showed that organic matter from dead organisms has been preserved deep in Greenland's ice for hundreds of thousands of years.⁴⁶ This material wouldn't be there if the ice periodically melted away, suggesting that Greenland's ice cap is stable over long periods of time—including times such as the last "interglacial" period about 120,000 years ago, when temperatures were several degrees warmer than they are now. Another study found evidence for glacial ice on Greenland between 30 and 38 million years ago, "at a time when temperatures and atmospheric carbon dioxide concentrations were substantially higher" than the present.⁴⁷

Likewise, the East Antarctic Ice Sheet (EAIS) has also been stable over long periods of time and is not in danger of significant ice loss.⁴⁸ In fact, the EAIS appears to have been gaining ice on net recently.⁴⁹

Concern about Antarctic ice has largely focused on the stability of the West Antarctic Ice Sheet (WAIS). The base of the WAIS is mostly below sea level and part of the ice sheet floats on the ocean. Rising seas could conceivably cause more of the ice sheet to come off its “mooring” along the coastal areas of Antarctica, raising sea level still further. However, a recent set of studies suggests that the WAIS is in fact stabilized by “wedges” of sediment along the coast of Antarctica and would not be destabilized even if sea level rose by tens of feet.⁵⁰

Climate alarmists create the impression that global warming will flood the world’s coastal cities in the next few decades. In fact, even if warming were causing the demise of the ice caps, this would play out over hundreds of years rather than decades, giving the increasingly wealthy and technologically advanced people of the future plenty of time to respond. In any case, the latest research suggests that the ice caps are stable and contributing little to changes in sea level.

Claim: *Climate change will increase deaths from heat waves.*

Reality: The risk of dying from heat waves dropped 75 percent in the United States from the 1960s to the 1990s, even as temperatures rose.⁵¹ The hottest areas of the U.S. have the lowest risk of heat-related deaths. Indeed, for several American cities with hot climates, higher temperatures are no longer associated with *any* increase in mortality.

These trends are due to the increasing use of air conditioning, improvements in health care and public education on the dangers of heat stress, and improvements in building and landscape design that factor in shade and other measures to reduce the effects of humidity and high temperatures.⁵² The United States isn’t unique in this respect, as other areas have reduced heat risks as well.⁵³ The steady reduction in heat risks over time ultimately results from increasing wealth and technological advancement.

Despite the evidence from past trends, many climate scientists continue to claim that greenhouse warming will increase future heat-related mortality. For example, a recent study published in the journal *Proceedings of the National Academy of Sciences* claimed that by 2100, heat-related mortality in Los Angeles would increase by a factor of 2 to 3 in a modest climate-change scenario, and by a factor of 5 to 7 in a high climate-change scenario.⁵⁴

How did these researchers manage to project an increase in heat risks, even though heat risks have actually been declining for decades in Los Angeles and everywhere else in the U.S.? Against all the evidence, they assumed people would simply stop taking steps to reduce their risk from extreme temperatures. Indeed, all claims of future increases in heat-related mortality depend on the ridiculous assumption that people will stop seeking better ways to protect themselves from the elements.

Climate activists have made much of the August 2003 European heat wave, which killed thousands of people, blaming the deaths on climate change. For example, in *An Inconvenient Truth*, Al Gore claims “We have already begun to see the kind of heat waves that scientists say will become much more common if global warming is not addressed. In the summer of 2003 Europe was hit by a massive heat wave that killed 35,000 people.”⁵⁵

In reality, the European heat wave was within the range of natural variability in the Earth’s climate: “Extreme warm anomalies equally, or more, unusual than the 2003 [European] heat wave occur regularly ... Extreme cold anomalies also occur regularly and occasionally exceed the magnitude of the 2003 warm anomaly ...”⁵⁶

The real reason for the high death toll was Europe’s poor preparedness for inevitable extreme weather events, rather than the high temperatures per se. Air conditioning is rare in Europe, which means people were often unable to protect themselves from the heat.⁵⁷ A comparison with the U.S. is illuminating. America’s southwest was hotter than Europe for most of the summer of 2003, yet there was no corresponding increase in mortality.⁵⁸

The focus solely on the heat side of the tem-

perature-mortality relationship is also misleading, because cold kills more people than heat.⁵⁹ Thus, even if we expected people not to take any steps to protect themselves from warmer temperatures, the overall effect of greenhouse warming would likely be a net *reduction* in total deaths from temperature extremes. Indeed, this is what a number of studies have concluded.⁶⁰

Ironically, one of environmentalists' main policy goals to address climate change is to make energy more expensive and less available. Whatever the cause of future weather extremes, following the environmentalists' prescription would make lifesaving winter heating and summer air conditioning less affordable, and thereby put more lives at risk.

Claim: *Global warming will spread malaria and other infectious diseases.*

Reality: The prevalence of infectious diseases is mainly a result of poverty and lack of technology, rather than of climate. Malaria used to be endemic in many areas with cold climates, including Russia, Scandinavia, Minnesota, Canada, and England.⁶¹ These areas wiped out malaria through economic growth and technological advancement. As Paul Reiter, an expert on mosquito-borne disease at the Institut Pasteur in Paris explains, “the histories of three such [insect-borne] diseases—malaria, yellow fever, and dengue—reveal that climate has rarely been the principal determinant of their prevalence or range.”⁶²

Claim: *The IPCC provides reliable estimates of future harm from greenhouse warming.*

Reality: The IPCC itself admits its harm projections “do not take into account any changes or developments in adaptive capacity.”⁶³ In other words, the IPCC assumes that as the climate changes, people will not take any new steps to protect themselves, and that new, safety-enhancing technologies will not be developed. This is like

predicting changes in human health and lifespans from 1900 to 2000 without including the benefits of antibiotics, air conditioning, and a thousand other 20th century advances.⁶⁴

Surely, during the 21st century existing technologies will continue to diffuse toward countries and people who don't already enjoy their benefits (as is already happening in China, India, and many other places); new marvels will continue to be developed that will improve our health and comfort; and the real incomes of the world's people will continue to increase (from 2000 to 2006, real GDP per person in China and India rose 59 and 29 percent, respectively).⁶⁵

The IPCC's assumption is unrealistic even on its own terms, because the IPCC does assume that people all over the world will get a lot wealthier in coming decades. For example, in its warmest

Following the environmentalists' prescription for climate change would make lifesaving winter heating and summer air conditioning less affordable, and thereby put more lives at risk.

scenario, the IPCC predicts world-average real GDP per person will increase by a factor of 18 between 2000 and 2100, while GDP per person in developing countries will be 62 times greater than it is now!⁶⁶

To put this in perspective, this would mean that by the year 2100, the average person in today's poor countries will have a real income nearly 3 times greater than the average income of Europeans and Americans today. Nevertheless, the IPCC assumes these fabulously rich people of the future will do no more to protect themselves from climate extremes—whether natural or human-caused—than today's poorest people.

MITIGATING CLIMATE CHANGE

Claim: *Reducing greenhouse gas (GHG) emissions enough to affect future greenhouse warming will be relatively inexpensive.*

Reality: Even if GHG emissions will cause substantial future warming, reducing those emissions enough to materially reduce that warming will require great sacrifices. Stabilizing CO₂ at the current atmospheric concentration would require reducing world CO₂ emissions to no more than the amount that oceans, forests, and other “carbon sinks” can absorb each year. In practice, that means CO₂ emissions must drop to about one-third the amount emitted in 2004.⁶⁷ Atmospheric CO₂ will continue to rise so long as emissions are greater than what the Earth can absorb.

To stabilize atmospheric CO₂, the nations of the world would have to restrict energy use to levels that are associated with extreme poverty.

Figures 4 and 5 show the stark realities of what this means in practice. Figure 4 displays CO₂ emissions per person in 2004 for various countries and regions, including the world average. Assuming each country is allowed a per-person emissions level consistent with CO₂ stabilization, emissions would have to drop to the level marked by the horizontal line in Figure 4. Developed countries would have to reduce CO₂ emissions by 80 to 93 percent. Even China would have to reduce per-person CO₂ emissions more than 60 percent, while Africa and India are already nearly at their CO₂ limit.

Those CO₂ emissions of course represent energy from fossil fuels. Hydropower and nuclear energy provide about 12 percent of the world's energy, while renewables add another 1 percent.⁶⁸ Using energy thus largely means burning fossil fuels, which provide about 87 percent of the world's energy. This is shown in Figure 5. The blue bars

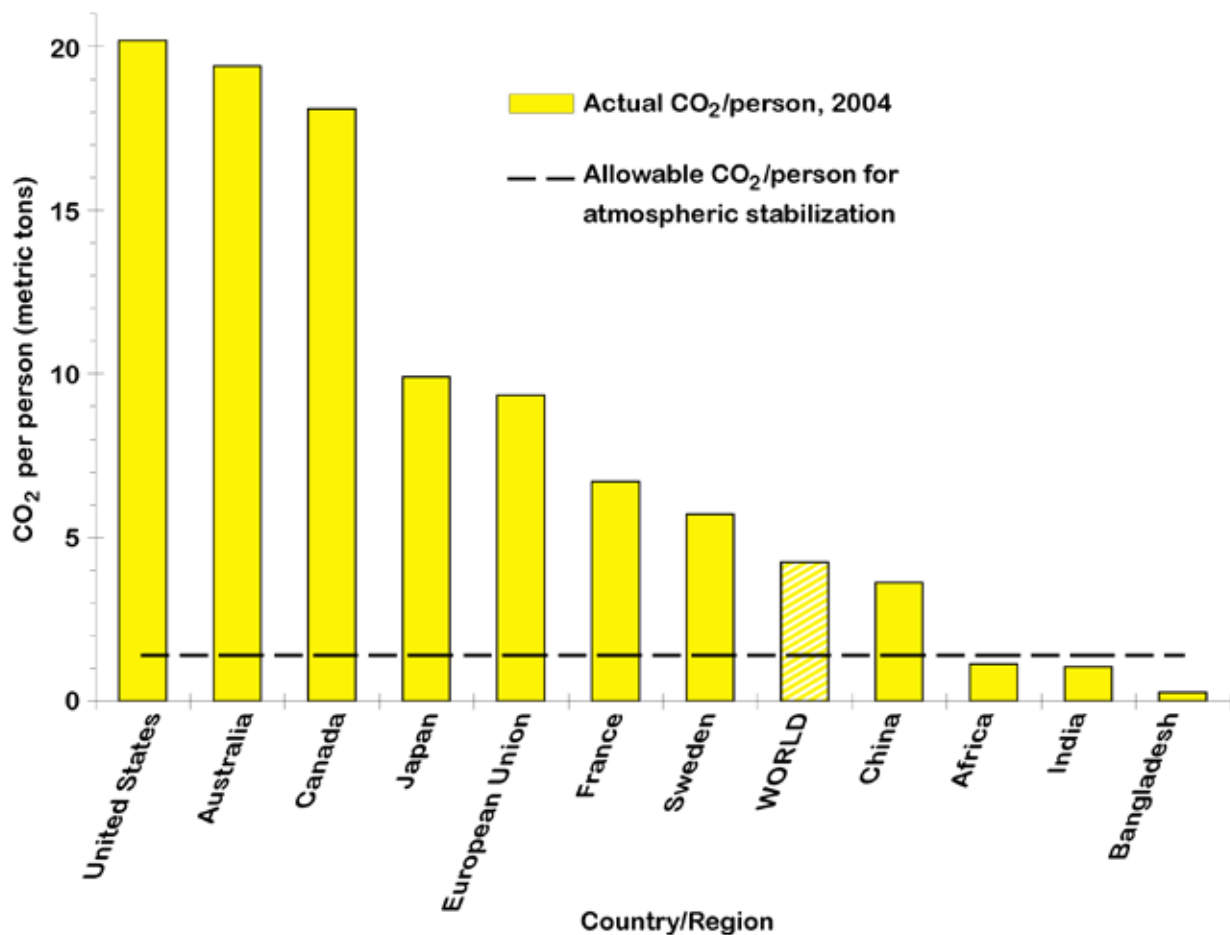
give actual energy use per person in 2004 for the same countries and regions displayed in the previous figure.

Now assume we wanted to reduce energy use to a level consistent with CO₂ stabilization. At the world's population in 2004, that would mean CO₂ emissions of about 1.4 metric tons per person each year. Given CO₂ emissions per unit of energy in each country, the yellow bars in Figure 5 show where energy use per person would have to be capped in order to achieve this level of CO₂ emissions. The U.S., Australia and Canada would have to reduce energy use by more than 90 percent. Even Europeans and the Japanese, who use half the energy per person of Americans, would have to reduce their already low energy use by about 85 percent. Even China would have to reduce energy use per person by more than 60 percent, while Africans and Indians would be allowed to use hardly any more energy than they do now.

Claim: *Global warming could be solved by simply increasing the amount of low-carbon fuels in our mix of energy sources.*

Reality: The analysis above is based on the *current* mix of energy sources around the world. But what if we moved away from fossil fuels and used energy more efficiently? Sweden provides a potential answer, and it's not encouraging. Nuclear provides 37 percent of the country's energy, while 17 percent comes from renewables, and 10 percent from hydro. As a result, Sweden has among the lowest CO₂ emissions per unit of energy in the world. Only 36 percent of Sweden's energy comes from fossil fuels.

What if every country reduced the fossil fuel portion of its energy use to Sweden's levels—a 57 percent reduction in CO₂ emissions per unit of energy for the U.S. and 58 percent for the world as a whole? Wouldn't that allow us to continue getting the benefits of abundant, inexpensive energy without increasing CO₂ levels? The dashed line in Figure 5 shows that the answer is no. Even after this enormous switch away from fossil fuels, Amer-

Figure 4. CO₂ emissions per person in various countries and regions, 2004

Notes: The European Union includes the 15 original member countries of the European Union (France, Germany, Italy, Spain, England, Netherlands, etc.).

Source: U.S. Energy Information Administration (2006).

icans would still have to use 84 percent less energy than we do now. Even Europeans and the Japanese would have to cut their already low energy use by 70 percent, while China would be stuck at about its current low level of energy use.

Figure 5 shows the stark difference between actual energy use per person in the world's wealthy and poor countries. To stabilize atmospheric CO₂, the nations of the world would have to restrict energy use to levels that are associated with extreme poverty. This is true even if we assume an extraordinary transformation of the world's energy supplies to focus on nuclear and renewables, instead of fossil fuels.

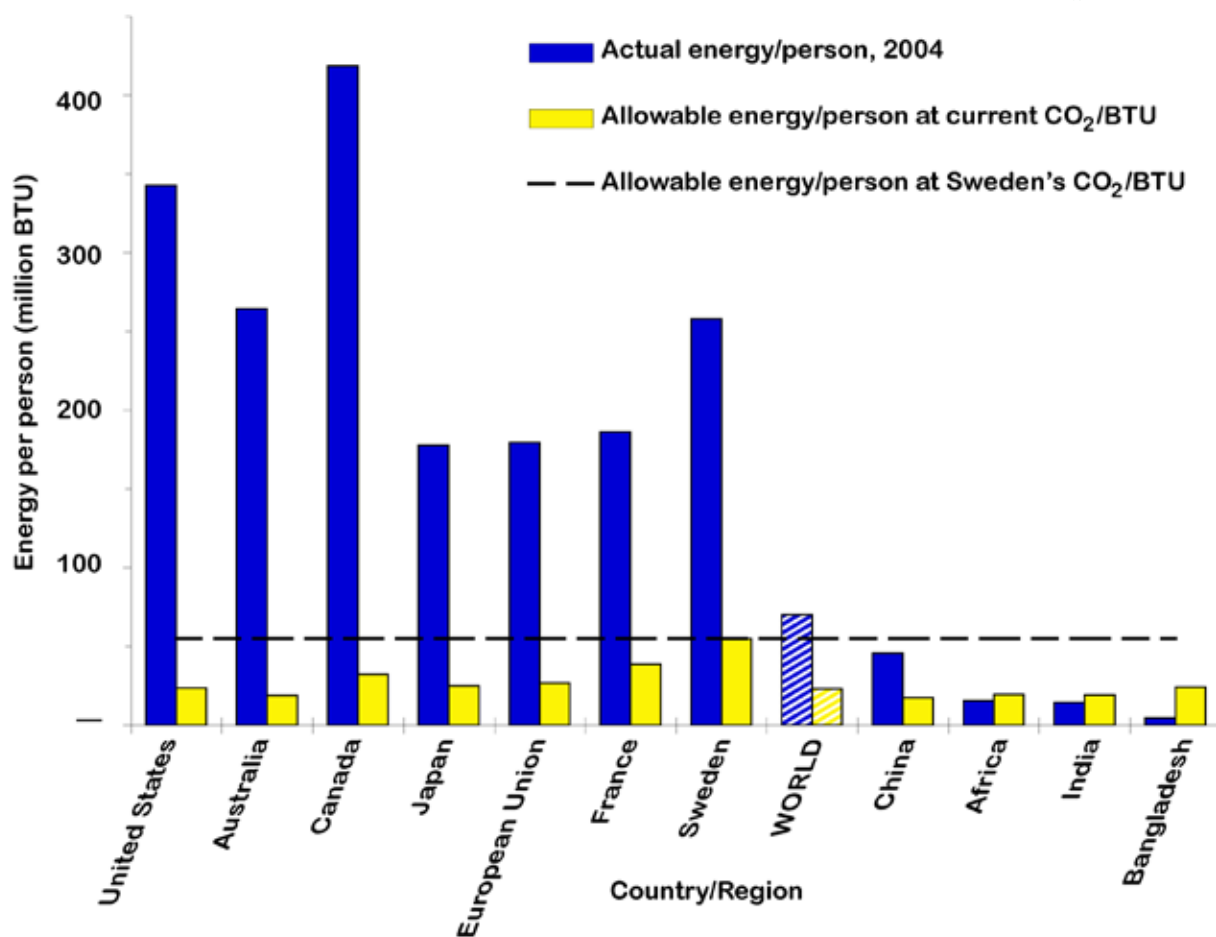
But even this understates the enormity of the task, because the world's population will continue

to increase, from about 6.5 billion today to a peak of about 8.7 billion in 2050, before population begins to decline.⁶⁹ This means that to achieve any given level of atmospheric CO₂, we would need to knock an additional 25 percent off the allowable energy use per person.

Claim: *We can stop global warming through energy efficiency and alternative fuels.*

Reality: Perhaps there are other large, untapped, inexpensive sources of alternative energy that could replace fossil fuels. Or perhaps it is possible to use far less energy than Japanese or Western Europeans and still enjoy the health, safety, and mate-

Figure 5. Actual energy consumption per person in various countries and regions, 2004, compared with energy consumption needed to stabilize atmospheric CO₂



Notes: The yellow bars are calculated based on CO₂ emissions per BTU (British Thermal Unit) specific to each country in 2004. The European Union includes the 15 original member countries (France, Germany, Italy, Spain, England, Netherlands, etc.).

Source: U.S. Energy Information Administration (2006).

rial comforts of developed nations. But if there were, presumably Europe's \$6-per-gallon motor fuel would already have stimulated Europeans to shift to these hypothetical non-fossil-fuel energy sources. But just as in the U.S., European cars run on petroleum.

Europeans pay much more for energy than Americans—not only for gasoline and diesel—but also electricity rates that are 1.5 to 3 times greater than the U.S. average.⁷⁰ Europe's high energy costs have helped push Europeans into tiny (by U.S. standards) cars, made them drive much less than Americans drive, and forced many of them to do without comforts like air conditioning. But even so, Europeans still use several times more energy

than could be allowed in a CO₂ constrained world.

Stupendous subsidies for alternative energy, such as wind, solar, and ethanol, have likewise failed to create either low-cost or abundant alternatives to traditional energy sources. And if there's a way to have an American or European lifestyle with Indian or Chinese levels of energy consumption, no developing nation has yet divined the secret either.

The results of the Kyoto Protocol demonstrate the difficulty of achieving even the most minimal reductions in GHG emissions. Signatories to the treaty agreed to cut their GHG emissions to 8 percent below their 1990 emissions level by 2012. But since the treaty was ratified a few years ago, both

CO₂ and total GHG emissions have been *rising* in the European Union, Japan, Canada, and other wealthy countries.⁷¹ Most participating countries are on track to exceed their Kyoto caps by a large margin.⁷²

The fact that developed countries can't even slow growth in CO₂ emissions, much less reduce emissions, suggests that the large CO₂ reductions necessary to stabilize atmospheric CO₂ levels will cause extreme hardship—much greater hardship than might occur from any warming due to GHGs. Even some climate alarmists realize this. In an interview on the radio program *Earth & Sky*, Jerry Mahlman, a climate scientist at the National Center for Atmospheric Research in Colorado, describes the situation with unusual candor:

I'll tell you one of the horrifying facts of global warming, and why it is so inexorable. Suppose that you and I wanted—along with all the rest of the people in the world—to cut down on CO₂ emissions so that they would be small enough to [stabilize] concentrations of carbon dioxide in the atmosphere. ... Well, it turns out that every person in the world would have to ... cut [carbon dioxide] by 75 percent.

That's a horrific number if you think about everything that you do: whether it's talking on the telephone, or driving our cars, or heating or cooling our homes. Think of everything that's manufactured, energy used to extract metals, for example. ... You would have to have a radical change in your lifestyle. ...

In fact, it's worse than I talk about, because suppose that we're able to produce the miracle—the absolute miracle—of reducing 75 percent in our emissions globally. Guess what? Over the next hundred years, the Earth would warm up another degree Fahrenheit, even though we produced that miraculous result. ...

It's really hard to do something about [global warming] in a relatively short period of time, say over the next three decades. It's really, really hard.⁷³

Another inconvenient fact is that achieving any less than these economically crippling reductions in CO₂ emissions would not prevent warming, but would merely delay it. For example, if all developed nations, including the U.S., fully complied with Kyoto, it would reduce the average temperature in 2050 by less than 0.12°F and would delay any given amount of temperature rise by no more than about seven years.⁷⁴

Climate activists create the impression that every little bit of CO₂ reduction will help prevent climate change. But even if most warming is caused by GHG emissions, this claim is false. There is no climate policy being considered or implemented by any state or nation that would do more than delay the warming for a few years.

This fact was recently highlighted in a lawsuit working its way through the federal courts.

There is no climate policy being considered or implemented by any state or nation that would do more than delay the warming for a few years.

A few years ago, California adopted a law, known as AB 1493, that requires a 30 percent reduction in GHG emissions from new cars by 2015.⁷⁵ Ten other states, including New York and Vermont, have enacted the California requirement. In trial depositions and testimony under oath, environmental officials from these states, as well as James Hansen, a prominent climate scientist retained as an expert by California's air regulators, stated that there would be no detectable change in future temperatures even if the entire world implemented California's CO₂-reduction requirement for automobiles.⁷⁶

SCIENTIFIC CONSENSUS ON CLIMATE CHANGE

Claim: *Climate scientists have reached a widely shared consensus that human greenhouse gas emissions are the main cause of global warming and that warming will cause great harm.*

Reality: Surveys of climate scientists' views on climate change demonstrate that many, and in some cases most, climate scientists disagree with some or all aspects of this ostensible consensus.

In 1996 and 2003, climate scientists Dennis Bray and Hans von Storch surveyed hundreds of climate scientists on their views about climate change.⁷⁷ These surveys suggest that climate scientists as a group hold equivocal views about the extent of human influence on climate and the likely consequences of climate change. For example, in

The greatest threat we face from climate change is the danger of rushing into foolish and costly policies driven by ill-founded climate change hysteria.

the 2003 survey 56 percent of respondents agreed with the statement "Climate change is mostly the result of anthropogenic [human] causes." Only 24 percent agreed that "The current state of scientific knowledge is developed well enough to allow for a reasonable assessment of the effects of greenhouse gases."⁷⁸

There was little consensus on many aspects of climate science:

- 35 percent of scientists agreed that "Climate models can accurately predict climate conditions in the future." And among those who agreed, 80 percent chose the weakest level of agreement among the choices available.
- 46 percent of scientists agreed that "Natural scientists have established enough physical evidence to turn the issue of global climate change over to social scientists for matters of policy discussion."

- 49 percent of scientists believed that "The claims of skeptical scientists who dispute the IPCC consensus get too much [media] coverage."

Ultimately, the only important substantive test of a scientific theory is whether it makes accurate predictions about the behavior of the real world. Still, climate activists use the claim of "scientific consensus" as a fallacious means to shut down a debate they don't wish to have. This supposed consensus does not, in fact, exist.⁷⁹

CONCLUSION

The Earth has indeed warmed during the last few decades and may warm further in the future. But the pattern of climate change is not consistent with the greenhouse effect being the main cause. Some climate variables are trending in exactly the opposite direction of that predicted by greenhouse-driven climate models. To the extent recent warming is caused by humans, soot emissions and land-use change could be playing a role as great if not greater than greenhouse gases.

But even if the greenhouse effect is the main cause of recent warming, temperature and greenhouse gas emission trends suggest the amount of warming will be modest. Hurricanes are not increasing nor is sea-level rise speeding up. Heat-related mortality risks continue to decline.

This is all good news, because to really make a serious dent in greenhouse gas emissions, at least within the next few decades, would require a truly "wrenching transformation" of human societies. Such a transformation would impoverish the currently wealthy and deny the benefits of wealth to the currently impoverished.

Although it is important to keep monitoring the Earth's climate to avoid both natural and human-caused climate surprises, the greatest threat we face from climate change is the danger of rushing into foolish and costly policies driven by ill-founded climate change hysteria.

ADDITIONAL RESOURCES AND FURTHER READING

In addition to the studies cited in this report, there are a number of resources for skeptical discussions of climate change that are largely absent from popular accounts.

- Marlo Lewis, *A Skeptic's Guide to An Inconvenient Truth*, Competitive Enterprise Institute, 2007, www.cei.org/pages/ait_response-book.cfm#CHAPTERS. A point-by-point critique of Al Gore's errors, omissions, and misleading portrayals.
- World Climate Report, www.worldclimaterreport.com. Blog by climate scientist Pat Michaels discussing the latest research on climate.
- Center for the Study of Carbon Dioxide and Global Change, www.co2science.org. Includes summaries of thousands of individual journal articles, as well as topic summaries on many areas of climate research.
- Roger Pielke Sr. Research Group Weblog, climatesci.colorado.edu. Discussions of the latest climate research.
- R. M. Carter *et al.*, "The Stern Review: A Dual Critique," *World Economics* 7 (2006): 165-232, meteo.lcd.lu/globalwarming/Carter/WE-STERN.pdf. Detailed discussion of the economics of climate change and its mitigation in the context of the British Government's *Stern Review of the Economics of Climate Change*.
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76. Selections from various depositions in the case are collected in a Powerpoint presentation at vermontco2.com/wp-content/uploads/2007/06/presentation_waiver_may-30-07.ppt. Full transcripts of depositions and the trial itself are available at www.mobileco2.com.

77. All responses were anonymous in both surveys. The 2003 survey included 530 climate scientists from 27 different countries. Bray and von Storch submitted the survey results in a paper to the journal *Science*, which elected not to publish it. D. Bray and H. von Storch, *The Not So Clear Consensus on Climate Change* (Geesthacht, Germany: Institute for Coastal Research, 2003), w3g.gkss.de/G/Mitarbeiter/bray.html/BrayGKSSsite/BrayGKSS/WedPDFs/Science2.pdf. The detailed survey results are available online at w3g.gkss.de/G/Mitarbeiter/bray.html/BrayGKSSsite/BrayGKSS/2003stats. These results are summarized in J. L. Bast and J. M. Taylor, *Scientific Consensus on Global Warming: Results of an International Survey* (Chicago: Heartland Institute, April 2007), downloads.heartland.org/20861.pdf.

78. There is some concern that there might be a "response bias" in this survey. Perhaps the scientists who are most skeptical or most alarmed about human-caused greenhouse warming might have been more motivated to reply. The pattern of responses doesn't suggest an obvious bias of this sort. Scientists had to choose a response to each question on a scale of 1 (strongly agree) to 7 (strongly disagree). For many questions, half or more of the responses were in the "middle of the road" range of 3, 4, or 5.

Another way to look at potential bias is to look at the breakdown of responses only among those who agreed or disagreed. For example, among the scientists who agreed that "Climate change is mostly the result of anthropogenic [human] causes," 38 percent picked 3 (weakest agreement) and 45 percent picked 2 (medium agreement), while only 17 percent picked 1 (strongest agreement). Results were similar for the statement "The current state of scientific knowledge is developed well enough to allow for a reasonable assessment of the effects of greenhouse gases." Of scientists who agreed with this statement, only 11 percent signified the strongest agreement, while 53 percent chose the weakest level of agreement.

79. For profiles of more than 20 skeptical scientists, with a new one added weekly, see Lawrence Solomon's series "The Deniers" in Canada's *National Post*: www.urban-renaissance.org/urbanren/index.cfm?DSP=larry&SubID=163.

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*“To prejudge other men’s notions
before we have looked into them
is not to show their darkness
but to put out our own eyes.”*

JOHN LOCKE (1632–1704)

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