Presentation to the Republican Study Committee of Colorado

On Global Warming and Climate Policy

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April 27, 2007

Chairman Lambert, Vice Chairman Lundberg, and Committee members: Thank you for inviting me to discuss global warming and climate change policy. On personal a note, I am honored to share the podium with Dr. Gray, one of the world's leading hurricane experts.

My testimony develops the following points:

- Global warming is real and much of the warming since the mid-1970s is likely due to rising greenhouse gas levels from fossil energy use and other human activities.
- However, the rate of warming has been modest and constant. Both data and theory suggest that future warming in the 21st century will be at low end of the UN climate panel's projected range—2ºC or less.
- Accordingly, the impacts of warming on human civilization and eco-systems are likely to be manageable and have benefits as well as costs.
- Vice President Gore's influential film, *An Inconvenient Truth*, warns that, in the 21st century, global warming may shut down the Gulf Stream, plunging Europe into a mini-ice age; gin up ever-more powerful and deadly storms; and break apart the great ice sheets, inundating the world's coastal cities. Gore hypes the possible link between global warming and hurricanes. The ice sheet doomsday scenario is science fiction.
- The Kyoto Protocol, even if implemented by all industrial countries, would avert an un-detectably small amount of global warming. Yet Kyoto would cost the U.S. economy tens to hundreds of billions of dollars in lost jobs, higher energy prices, and reduced GDP. Kyoto is all economic pain for no environmental gain.
- Per ton of emissions reduced, State-level greenhouse gas regulation is potentially far more costly than Kyoto.
- The real inconvenient truth is that we do not know how to meet current, much less future anticipated, global energy needs with low- and non-emitting technologies. Carbon constraints tough enough to detectably cool the planet would be economically ruinous—a "cure" worse than the alleged disease.
- Corporate lobbying for carbon regulation does not mean that Kyoto-style policy is

good for the economy. All it shows is that some companies seek to establish a Carbon Cartel—a system of OPEC-like quotas (emission permits) for restricting the supply and raising the price of all carbon-based energy, not just oil.

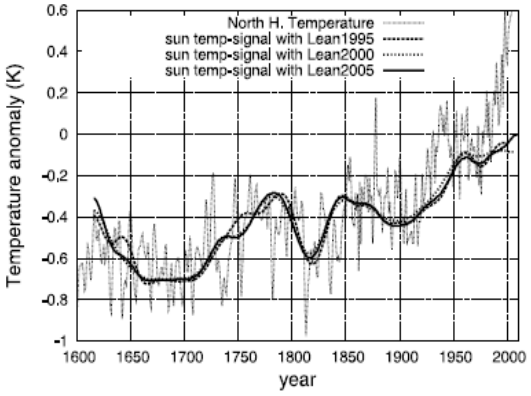
- Putting an energy-starved world on an energy diet is not moral. Diverting major quantities of grain stocks to "feed" cars is not ethical.
- Policymakers concerned about global warming should: (1) Support basic research to develop affordable, emission-free energy technologies, and (2) target scarce international assistance efforts where they can do the most good for each dollar invested.

I. Global warming is real and much of the observed warming since the mid-1970s is likely due to rising greenhouse gas (GHG) levels.

"Warming of the climate system is unequivocal," declares the UN Intergovernmental Panel on Climate Change (IPCC), in the Summary for Policymakers (SPM) of its forthcoming *Fourth Assessment Report*. The SPM also states that, "Most of the observed increase in average global temperatures since the mid-20th century is very likely due to the observed increase in greenhouse gas concentrations."[1] Most climate scientists accept those conclusions, and I know of no compelling reason to dispute them.

However, the SPM makes other claims that do not jibe with my reading of the scientific literature. For example, the SPM estimates that the Sun caused less than one-tenth of all global warming to date, contributing only 0.12 Watts per square meter (WM^{-2}) of "radiative forcing"[2] since 1750 compared to 1.6WM^{-2} for all "net anthropogenic" influences.[3]

Not all scientists agree. Scafetta and West (2006) found a strong correlation between Northern Hemisphere temperature over the past 400 years and three reconstructions of total solar irradiance (TSI) during the same period.[4] See the Figure below.



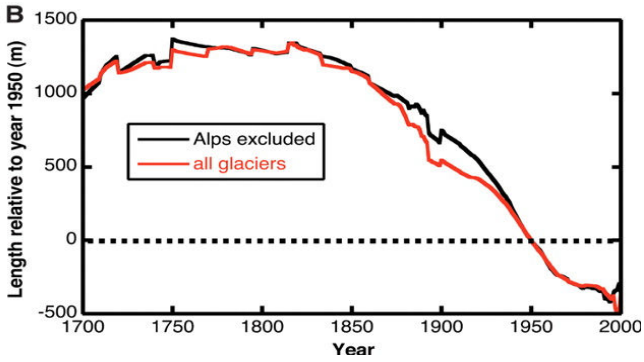
Parallel trends in solar irradiance and Northern Hemisphere temperatures. Source: Scafetta and West (2006)

The researchers note that there is "good agreement between the patterns [of temperature

and solar irradiance] for the three pre-industrial era centuries," and that during the 20th century "one continues to observe a significant correlation between the solar and temperature patterns: both records show an increase from 1900 to 1950, a decrease from 1950 to 1970, and again an increase from 1970 to 2000." Although Scafetta and West find that global warming since 1975 has occurred too quickly to be explained by solar variability, they conclude that "the sun might have contributed approximately 50 percent of the total global surface warming since 1900."

Even in recent decades, the Sun may be a factor in global warming. Mishchenko et al. (2007), using remote-sensing satellites, found that "aerosol optical thickness" (the reflectivity of atmospheric haze) decreased steadily during the 14-year period from 1991 to 2005.[5] In other words, more sunlight is reaching the Earth. If this finding is valid, comments *Science* magazine reporter Richard Kerr, "it might explain the unexpectedly strong global warming of late, the accelerating loss of glacial ice, and much of rising sea levels."[6]

Mountain glaciers are sensitive to small changes in ambient temperature. Consequently, scientists study changes in glacier size and mass as indicators of climate change. The Figure below comes from a study of 169 glacier records.[7] It clearly shows that substantial glacier retreat occurred during the period from 1850 to 1900 and that the lion's share occurred before 1940. This is significant, because about 70 percent of the rise in GHG concentrations above pre-industrial levels occurred after 1940. What's more, there was hardly any change in GHG levels until 1900. Atmospheric carbon dioxide (CO_2) levels were about 280 parts per million (ppm) in A.D. 1000 and were still below 300 ppm at the turn of the last century.[8]



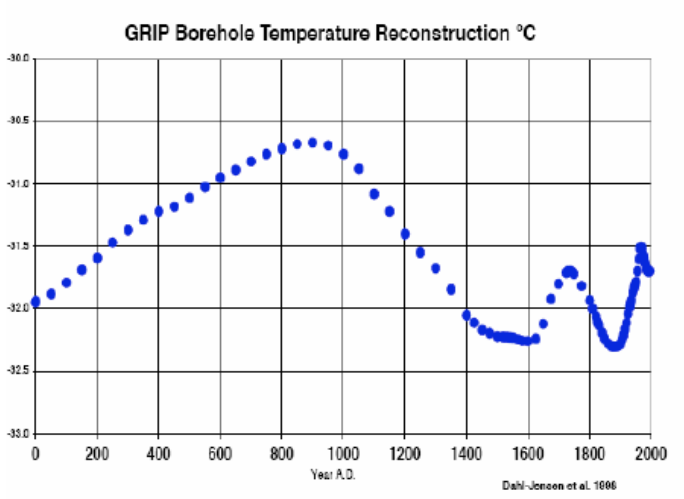
Changing length of mountain glaciers, 1700-2000. Source: Oelermans (2005)

To its credit, the IPCC does not place high confidence in its estimate of solar radiative forcing, describing as "low" the current level of scientific understanding of the Sun's role in climate change.

Another questionable assertion is the IPCC's claim that, "Paleoclimate information supports the interpretation that the warmth of the last half century is unusual in at least the past 1,300 years." Each week the Center for the Study of Carbon Dioxide and Global Change reviews another paleoclimate study finding that the air or water of a particular

area was warmer than the present during the Medieval Warm Period.[9]

For example, temperature measurements inferred from oxygen-isotope ratios in air bubbles trapped in northern Greenland ice cores show a warmer-than-present Medieval Warm Period.[10]



Reconstructed temperatures from the Greenland Ice Core Project (GRIP) borehole, at the summit of the Greenland Ice Sheet. Source: Dahl-Jensen et al. (1998)

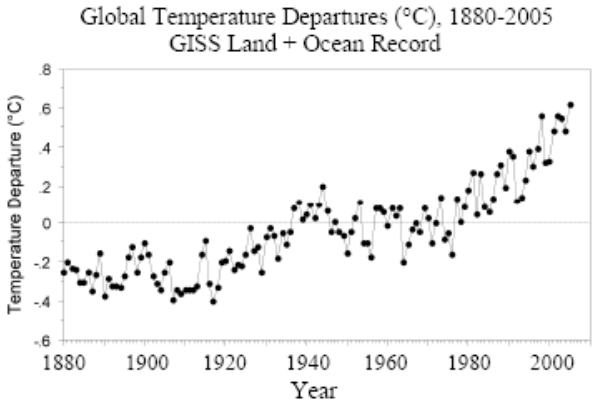
Finally, the IPCC says that "last time" the "polar regions" were "significantly warmer than the present for an extended period" was "about 125,000 years ago," i.e., during the last interglacial period.[11] This is accurate but misleading, because one polar region—the Arctic—was substantially warmer than the present during the Holocene Climate Optimum, a period from about 5,000 to 9,000 years ago.[12]

Briner et al. (2006) found that, 10,000 to 8,500 years ago, Canada's Baffin Bay was ~ 5°C warmer than it is today.[13] Kaufman et al. (2004) found that, 9,000-7,000 years ago, northern Russia (including Siberia) was 2-7.5°C warmer than it is today.[14] McDonald et al. (2000) found 120 sites out of 140 in the Arctic Western hemisphere where proxy data indicate warmer-than-present conditions during the early Holocene.[15] Darby et al. (2001), reviewed by the Center for the Study of Carbon Dioxide and Global Change, found that during the middle Holocene (about 5,000 years ago), Western Arctic sea surface temperature in August was 3-7°C warmer than it is today.[16] A forthcoming study by Caseldine et al. finds that from roughly 8,000 to 6,700 years ago, July surface air temperatures in northern Iceland were at least 1.5°C warmer than the 1961-1990 average and possibly 2-3°C warmer.[17]

I cite these studies not to deny that rising greenhouse gas levels are warming the planet but to challenge the alarmist spin that the recent warming is unprecedented or outside the range of natural variability.

II. The rate of recent warming has been modest and constant.

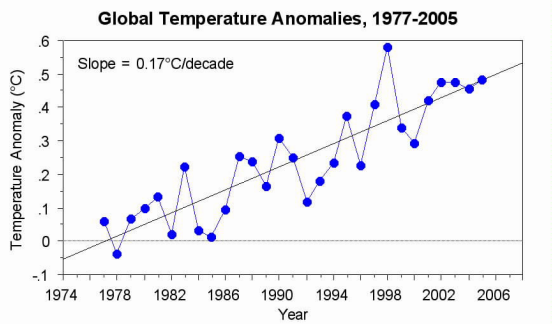
There were two distinct warming periods during the past century, separated by a slight cooling trend. The first warming, from 1916 to 1945, occurred before the major buildup in greenhouse gas levels, and, contrary to the IPCC, may in large part be a natural recovery from a multi-century cold spell known as the Little Ice Age.



Source: Baliunas et al. (2007),[18] adapted from Goddard Institute for Space Studies data, http://data.giss.nasa.gov./gistemp/graphs/Fig.A2.txt

Much of the second warming—from 1976 to the present—is likely due to rising levels of greenhouse gases, chiefly CO_2 and methane (CH_4).[19] As greenhouse physics predicts, most of the warming has occurred in regions (the Sahara Desert; Northwest North America and Siberia in the winter) that have the lowest concentrations of water vapor, the atmosphere's main greenhouse gas. In addition, the upper atmosphere (stratosphere) has cooled, which is to be expected as greenhouse gas concentrations increase and absorb more outgoing long-wave radiation in the middle atmosphere (troposphere).

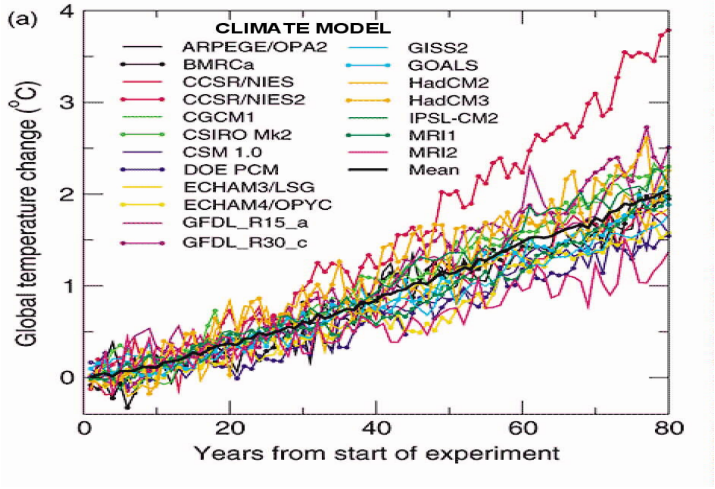
However, the rate of warming at the Earth's surface is modest and remarkably constant—about 0.17ºC or 0.3ºF per decade since 1976.[20] If we consider the satellite temperature record, which measures the middle atmosphere and is therefore not biased by the urban heat island affect, the warming trend is lower—about 0.12ºC per decade.[21]



Data Source: Climate Research Unit.[22] Figure Source: World Climate

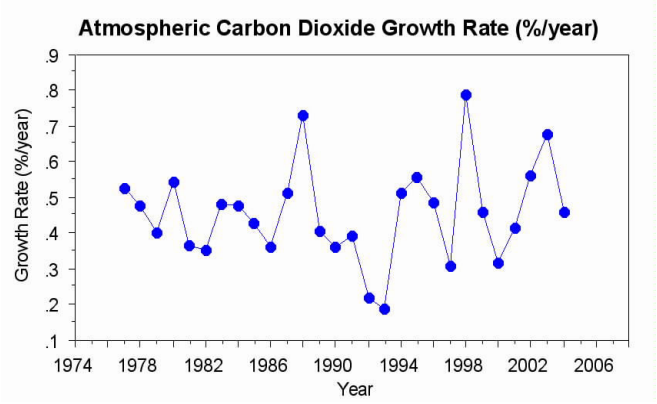
Report[23]

Significantly, most climate models predict that, once global warming from rising greenhouse gas levels starts, it continues at a constant rather than an accelerating rate. The Figure below, presented in the IPCC's 2001 report, shows that all but one of 19 climate models forecast a constant rather than accelerating rate of warming.



Temperature projections from 19 climate models all run under a scenario of atmospheric carbon dioxide concentrations increasing at a rate of 1%/year. All but one project constant warming rates. Source: IPCC 2001, p. 537

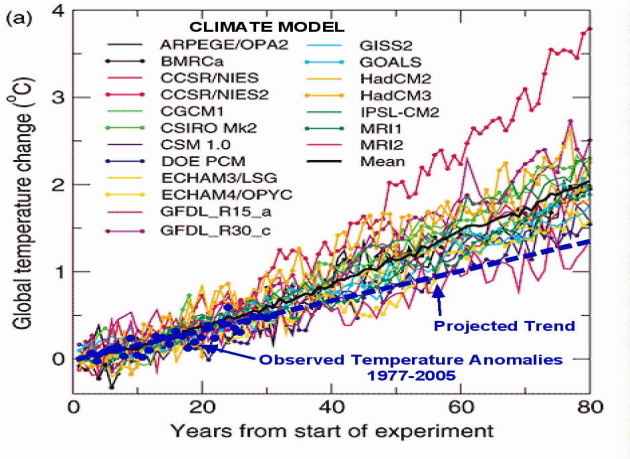
Interestingly, all of these models assume that atmospheric CO_2 levels will increase at a rate of 1 percent per year. The observed rate of CO_2 buildup is less than half that amount—about 0.45 percent per year.



Atmospheric CO_2 levels have increased, on average, by about 0.45%/year. Data source: Carbon Dioxide Information Analysis Center.[24] **Figure source: *World Climate Report***[25]

The "best estimate" of 21st century global warming is 1.8°C in the IPCC low-end

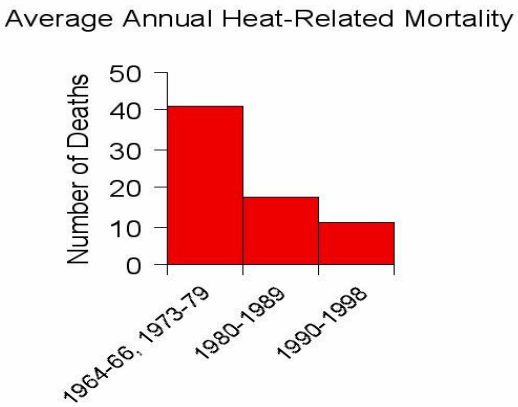
emission scenario and 4°C in the IPCC high-end scenario.[26] Because both data and theory suggest that warming will proceed at a constant rate, and because most models assume unrealistically high rates of CO_2 buildup, it is reasonable to expect a 21st century warming at the low end of the IPCC projected range—2ºC or less. The Figure below shows the observed warming trend, reflecting the actual rate of CO_2 increase and the non-accelerating form of most model forecasts, extended into the future.



Reasonable forecast of global warming based on 30 years of data and the linear form of most model projections. Source: World Climate Report[27]

III. The impacts of warming are likely to be manageable and have benefits as well as costs.

We often hear that global warming will increase the frequency and severity of heat waves. Heat waves can kill, but where hot summer weather occurs frequently, people adapt, and heat-related mortality falls. In the United States, summer urban air temperatures have steadily increased, whether due to global warming, the urban heat island effect, or both, yet heat-related mortality has declined. This is not surprising, because electricity is generally affordable and access to air conditioning is widespread. See the Figure below:



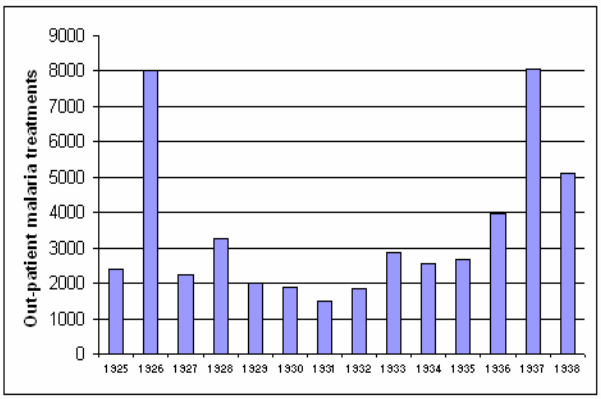
Annual population-adjusted heat-related mortality averaged across 28 major U.S. cities. Heat-related mortality has been steadily declining. Source: *World*

***Climate Report*, adapted from Davis et al. (2003)**[28]

Bjørn Lomborg, in recent testimony before Congress, notes that many more people die from excess cold than from excess heat. For example, the record-breaking summer heat wave of 2003 killed an estimated 2,000 people in the UK, but more than 25,000 people die in the UK each year due to excessive cold. Lomborg cites studies showing that, even if we make the unrealistic assumption that people will not adapt as the climate warms, a future warming of up to 2°C will be a net life-saver. Specifically, for Britain, a 2°C warming "will mean 2,000 more heat deaths but 20,000 fewer cold deaths." In the United States, "the net *lower* death count from global warming in 2050 is estimated at 174,000 per year."[29]

Of course, people will adapt but government should not get in their way. Air conditioning is a life-saving technology whose value will increase in a warming world. To the extent that carbon caps or tougher efficiency standards increase the operating cost or purchase price of air conditioners, those policies could make it harder for low-income households to beat the heat.

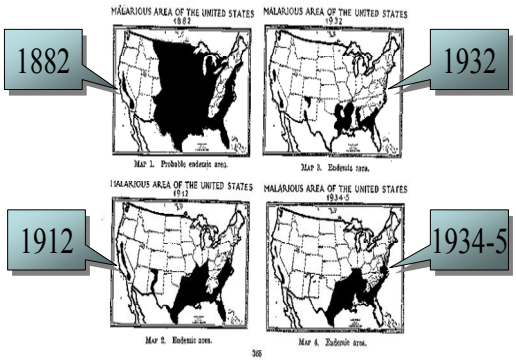
Alarmists warn that global warming will increase our risk of exposure to "tropical diseases" like malaria. Such anxiety is based on historical ignorance. In *An Inconvenient Truth* (*AIT*, p. 141), Vice President Gore asserts that Nairobi, Kenya used to be "above the mosquito line" and hence was too cold for mosquitoes to inhabit. He concludes that global warming must be responsible for malaria outbreaks in Nairobi in recent decades. In reality, as a World Health Organization report shows, malaria was a common scourge in Nairobi during the 1920s and 1930s, with major epidemics occurring in 1926 and 1938.[30]



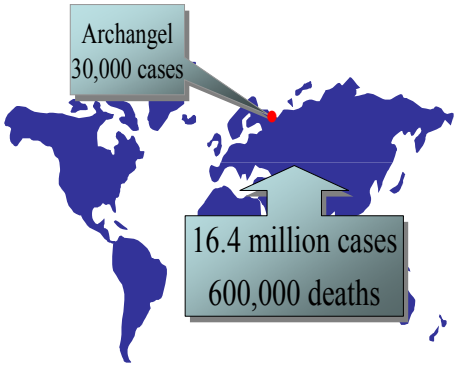
Outpatient treatments for malaria as recorded at the General and Railways dispensary in Nairobi between 1925 and 1938. Source: Snow et al. (1999)

Malaria is primarily a disease of poverty and technological backwardness, not of climate. Malaria outbreaks were common in such northerly climes as Minnesota, Canada, Britain, Scandinavia, and Russia during the 19th and early 20th centuries, when average global temperatures were cooler than today.[31] See the Figures below.

Malaria in the United States



Malaria, Soviet Union, 1923-1925



The resurgence of malaria in some developing countries is chiefly due to decreased spraying of homes with DDT, anti-malarial drug resistance,[32] and incompetent public health programs, not to any ascertainable changes in climate.[33]

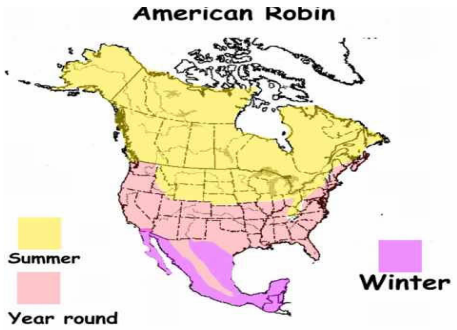
In any case, carbon regulation is bad malaria policy. As economist Indur Goklany explains, a global carbon stabilization program might reduce the total population at risk for malaria by 2.8% in 2080 at a cost of $250 billion per year. In contrast, malaria's current yearly death toll of about 1 million could be cut in half at an annual cost of about $1.25 billion through a combination of proven measures including spraying with insecticides, window screens, bed nets, better case management, and more comprehensive medical care.[34] In the long-run, the best anti-malaria program for developing countries is economic growth.

What about the impacts of warming on non-managed species and ecosystems? Claims that global warming is causing, or is likely to cause, mass extinctions are not credible. Consider the much-touted study in *Nature* by Thomas et al. (2004), who predicted that climate change could wipe out up to a quarter of all terrestrial plant and animals species by 2054.[35] As Virginia State climatologist Patrick Michaels points out, if the relationship that Thomas et al. posit between species extinction and global temperature increases were valid, then the roughly 0.8°C temperature increase that occurred since the late 19th century would already have wiped out hundreds of thousands of species. "Yet nowhere is there evidence for such occurrences."[36]

Several studies appear to show that global warming has turned some plant and animal species into "environmental refugees" fleeing to higher elevations or latitudes to escape the heat. However, in their review of this literature, Sherwood, Keith, and Craig Idso found that in case after case, the effect of global warming was to expand the species' range by making it possible for the plant or animal to survive in areas that were previously too cold.[37]

For example, robins today thrive in areas of Alaska and Canada where no robins were seen only a few decades ago.[38] Robins still winter in southern Mexico, but they can now

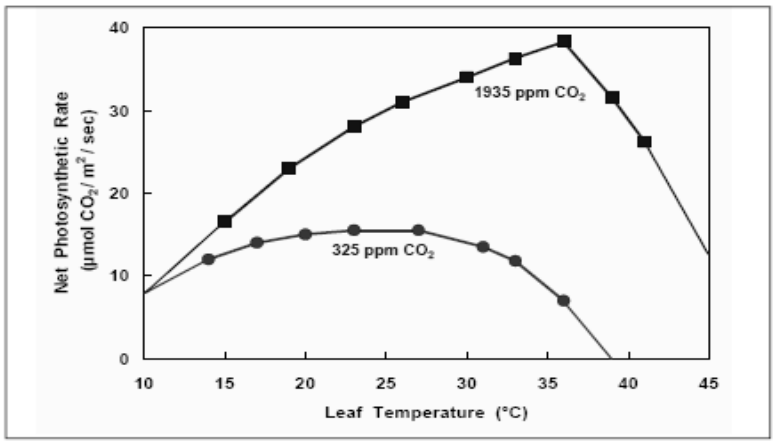
summer in the Alaskan and Canadian Arctic. In the case of robins, global warming is for the birds!



Global warming has expanded the Robins' habitat[39]

Literally hundreds of scientific studies show that rising CO_2 levels help trees, crops, and most other plants grow faster and larger, produce more fruit, utilize water more efficiently, and resist pollution stress. Based on experimental data, the Center for the Study of Carbon Dioxide and Global Change estimates that the 100-ppm increase in CO_2 levels since pre-industrial times has increased average crop yields by 60% for wheat, 33 percent for fruits and melons, 62 percent for legumes, 67 percent for root and tuber crops, and 51 percent for vegetables.[40] That is an extraordinary positive externality, courtesy of the Industrial Revolution!

Elevated CO_2 levels not only boost plant productivity but also raise the optimum temperature of plant productivity.[41] See the Figure below.



Warmth boosts plant productivity in CO_2-enriched environments. Source: Center for the Study of Carbon Dioxide and Global Change

Since all animals depend on plants, directly or indirectly, as a food source, rising CO_2 levels nourish the entire biosphere.

IV. Will global warming cause a mini-ice age in Europe?

In *AIT* (p. 149), Gore describes the functioning of Atlantic branch of the thermohaline circulation (THC). The sinking of dense (cold and salty) water in the North Atlantic pulls warm surface water up towards Europe from the equator. It is often said that this oceanic "conveyor belt" is responsible for the fact that London and Paris are 15-20°F warmer than New York City during the winter. Gore warns that "the rapid melting of Greenland ice" might decrease the density of North Atlantic surface water to the point where it sinks too slowly to drive the conveyor. According to Gore, such an event happened "10,000 years ago," and "The Gulf Stream virtually stopped … Consequently, Europe went back into an ice age for another 900 to 1,000 years." He worries that it could happen again.

This gloomy scenario is doubtful on several counts. First, oceanic heat transport via the THC may not be the main source of Europe's winter warmth. Richard Seager of Columbia University's Lamont-Doherty Earth Observatory argues that the key factor is a difference in the warmth of the prevailing winds that blow across northeastern North America and Western Europe. During the winter, "South-westerlies bring warm maritime air into Europe and north-westerlies bring frigid continental air into north-eastern North America."[42] If this finding is correct, then Europe should continue to enjoy mild winters even if global warming weakens the THC.[43]

Gore appears to refer to the Younger Dryas when he says a shutdown of the THC plunged Europe back into an ice age. But this is unclear, because Gore speaks of an event "10,000 years ago," whereas the Younger Dryas occurred 12,800 years ago. Some scientists speculate that a weakening or shutdown of the THC caused a mini-ice age in Europe approximately 8,200 years ago. So Gore may have the latter event in mind.

Be that as it may, Seager questions the THC-shutdown explanation of the Younger Dryas on two counts. First, "the Younger Dryas was not a purely North Atlantic phenomenon: Manifestations of it also appeared in the tropical and southern Atlantic, in South America, and in Asia." Second, "evidence has emerged that the Younger Dryas began long before the breach [in a giant ice barrier] that allowed freshwater to flood the North Atlantic."[44]

But even if a THC-shutdown did put Europe in a deep freeze in the remote past, there is little likelihood of this happening in the foreseeable future. In the case of the Younger Dryas, "A volume of 9,500 cubic kilometers of water was suddenly released to the northern Atlantic through the St. Lawrence Valley."[45] Similarly, in the case of the mini-ice age of 8,200 years ago, the rupture of a giant ice dam allowed more than 100,000 cubic kilometers of fresh water to pour into the North Atlantic.[46] In contrast, the rate of fresh water infusion from Greenland today is a comparative trickle—an estimated 224±41 cubic kilometers per year.[47]

Consider also that Northern Hemisphere climate during the last interglacial period (roughly 130,000 to 118,000 years ago) was relatively stable, even though Greenland experienced summertime temperatures 4°C-5°C warmer than the present for several

millennia, and even though sea levels rose to several meters higher than present.[48] These conditions may eventually have produced a "deep-water reorganization" that began the transition to the next ice age—but only after 8,000 years of comparative climate stability.[49]

Is the THC slowing down? Bryden et al. (2005)[50] found that it is, but Meinen et al. (2006)[51] and Schott et al. (2006)[52] found that it isn't. Latif et al. (2006)[53] observed a "strengthening" of the THC since 1980. There certainly is no indication that Europe is cooling due to any modification of the THC.

A quibble perhaps, but Gore erroneously conflates the THC with the Gulf Stream. The THC is a convective system driven chiefly by the sinking of dense (cold and salty) surface water in the high northern latitudes. The Gulf Stream, on the other hand, is a wind-driven system, energized primarily by the Earth's spin. As one scientist put it, the Gulf Stream is safe as long as the Earth turns and the wind blows.[54]

V. Is Global Warming Making Hurricanes Stronger?

Gore claims there is a "strong, new emerging consensus that global warming is indeed linked to a significant increase in both the duration and intensity of hurricanes" (*AIT*, p. 81). Based on this alleged consensus, Gore blames global warming for the devastation wrought by Hurricane Katrina (*AIT*, pp. 94-95).

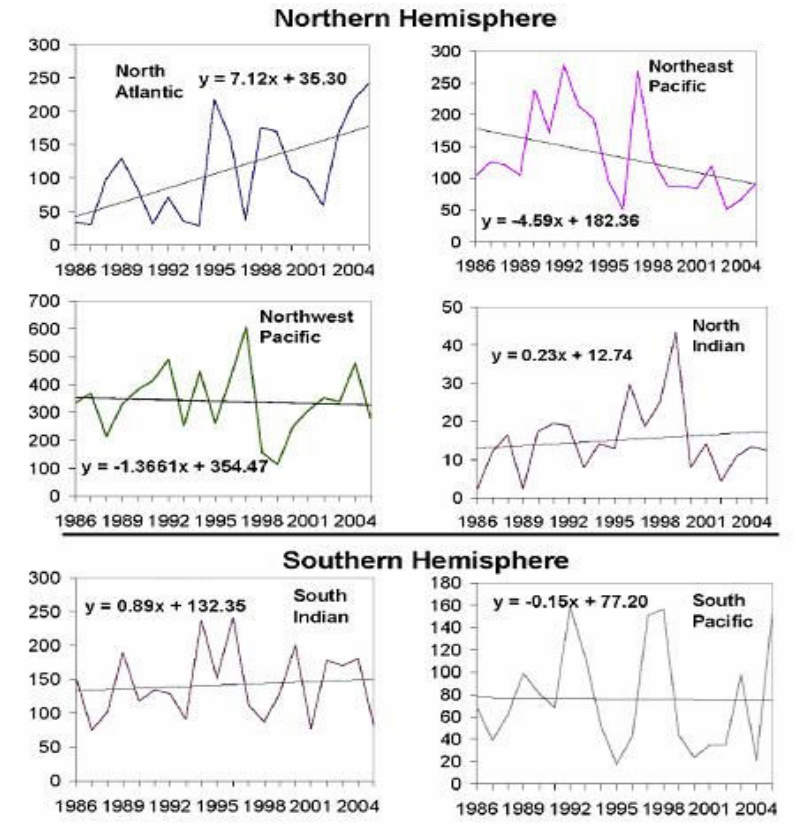
This is demagoguery. Kerry Emanuel of MIT, a leading proponent of the view that global warming is making hurricane stronger (see below), cautioned against attempts to link Katrina and other recent Atlantic storms to global warming.[55] Similarly, in November 2006, the World Meteorological Organization stated: "No individual tropical storm can be directly attributed to climate change."[56] Katrina was the worst natural disaster in U.S. history not because of any extra oomph it supposedly received from global warming—it was a category 3 storm by the time it made landfall—but because the federal government had failed to build adequate flood defenses for New Orleans.[57]

There is a robust debate on a possible link between global warming and hurricane strength, but the scientific jury is still out. Kerry Emanuel found that hurricane strength, a combination of wind speed and storm duration, which he calls the "power dissipation index" (PDI), increased by 50 percent since the mid-1970s, and that the increase is highly correlated with rising sea surface temperatures.[58] However, other experts question these results.

Christopher Landsea of NOAA, finding no trend in the PDI for land-falling U.S. hurricanes, suggests that Emanuel's finding may be an "artifact of the data"—a consequence of advances in satellite technology, which have improved detection and analysis of non-land-falling hurricanes.[59]

Philip Klotzbach of Colorado State University found "a large increasing trend in tropical cyclone intensity and longevity for the North Atlantic basin and a considerable

decreasing trend for the North Pacific," but essentially no trend in other tropical cyclone-producing ocean basins.[60]



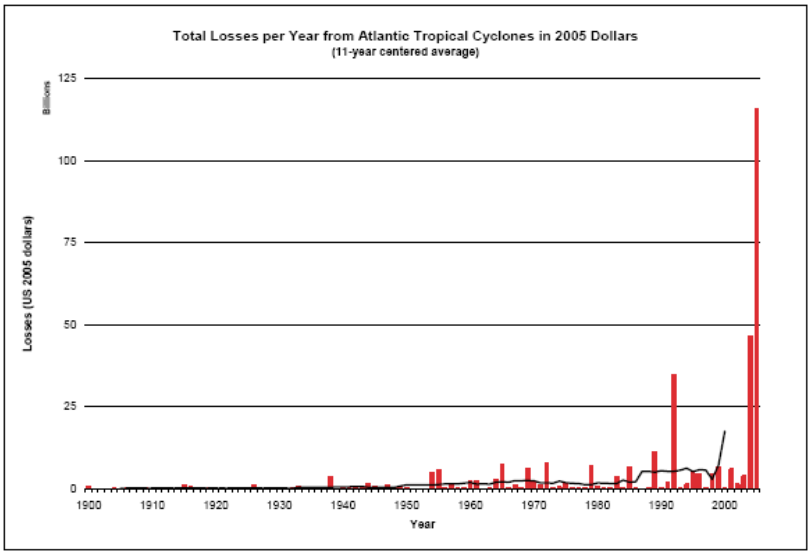
Accumulated Cyclone Energy (ACE) index values for six ocean basins. The ACE index is a measure of the energy contained in the tropical cyclone over its lifetime. There has been an increase in the North Atlantic, a decrease in the Northeast Pacific, and not much long-term change anywhere else. Source: Klotzbach (2006)

Similarly, Kossin et al. (2007) found an upward trend in hurricane intensity in the Atlantic basin during the past 23 years but not in any of the world's other five hurricane basins.[61] Since the Atlantic basin accounts for only 15 percent of total hurricane activity, it seems a stretch to link changes observable only in the Atlantic to *global* warming.

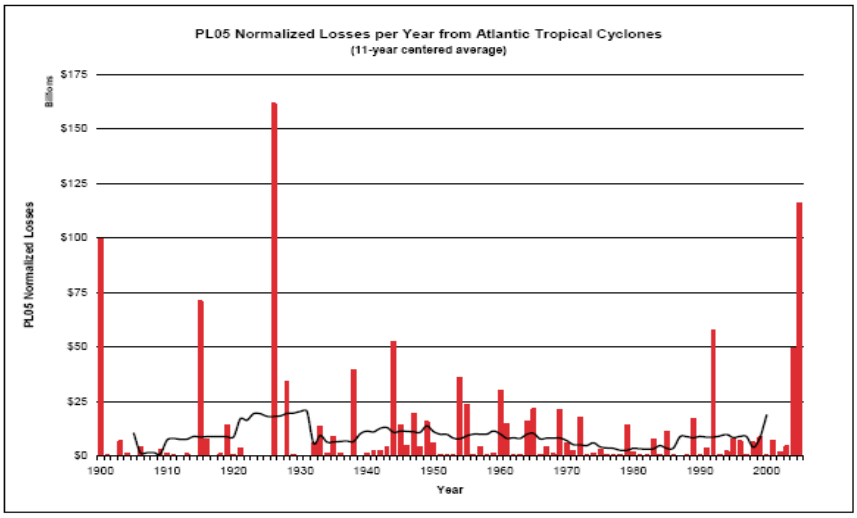
Gore (*AIT*, p. 101) presents a chart showing a 15-fold increase in economic losses in recent decades related to hurricanes and other extreme weather events. From this trend he infers that global warming must be intensifying hurricanes and other forms of extreme weather.

However, Roger Pielke, Jr. of the University of Colorado found that once the economic losses are adjusted for changes in population, wealth, and the consumer price index, there is no long-term change in hurricane damage—evidence against the hypothesis that hurricanes are becoming more destructive.[62] The Figure immediately below shows total

non-adjusted losses from Atlantic hurricanes. There appears to be a trend reflecting an increase in hurricane strength.



The next Figure shows the same damages after adjusting for changes in population, wealth, and inflation. The apparent trend disappears.



When it comes to hurricane damage, the socio-economic factors simply overwhelm the climatic factors. Consider that just two Florida counties, Broward and Dade, are home to more people today than all the coastal counties stretching from Texas to Virginia in 1930.[63] Florida's coastal population increased by 75 percent just since 1980.[64] There are vastly more people and property in harm's way today than in earlier decades. Changes in socio-economic variables, rather than any measurable increase in hurricane intensity, explain the big increase in hurricane-related losses.

Here is some good news you won't find in *AIT*. Despite the increase of population in high-risk areas, both aggregate mortality and mortality rates due to extreme weather events—hurricanes, droughts, floods, wildfires—declined dramatically since the 1920s.[65]

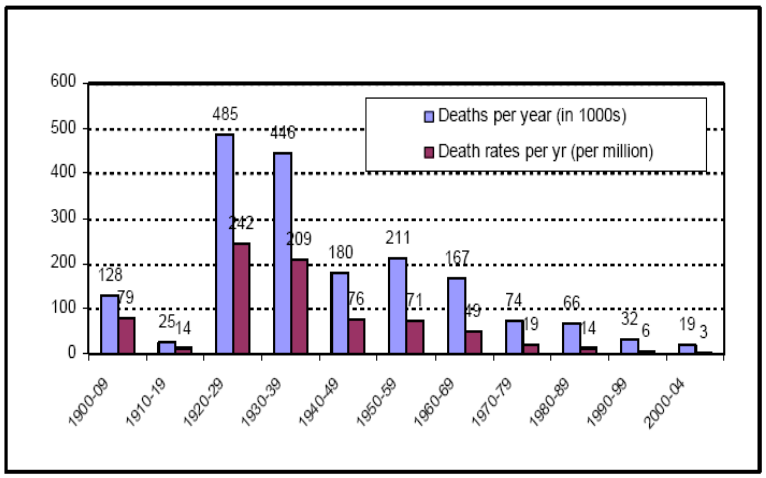


Figure 1: Global Death and Death Rates Due to Extreme Events, 1900-2004. Note that data for the last period are averaged over five years worth of data. Sources; EM-DAT (2005); McEvedy and Jones (1978); WRI (2005).

Weather-related deaths and death rates declined dramatically even as the climate warmed and as coastal populations grew. Source: Goklany

According to Gore, "The emerging consensus linking global warming to the increasingly destructive power of hurricanes has been based in part on research showing a significant increase in the number of category 4 and 5 hurricanes." (*AIT*, p. 89)

Peter Webster and colleagues found a significant increase in the number of major hurricanes during the period 1970-2004.[66] In contrast, Klotzbach found only a "small increase in global Category 4-5 hurricanes from the period 1986-1995 to the period 1996-2005," and considers it likely that "improved observational technology" accounts for the small increase he observed.

Klotzbach, Webster, and Kossin all found an increase in Atlantic hurricane intensity in recent decades. But the study periods in Klotzbach, Webster, and Kossin are of fairly short duration. Is the increase in Atlantic hurricane intensity a long-term trend or just the upswing of a natural oscillation?

Patrick Michaels investigated Atlantic storm intensity using pre-1970 data from the National Hurricane Center.[67] He found that the "trend" observed by Webster disappears once data going back to 1940 are included. The number and percentage of intense Atlantic storms from 1940 to 1970 were about equal to the number and percentage of intense storms from 1970 to 2004.[68]

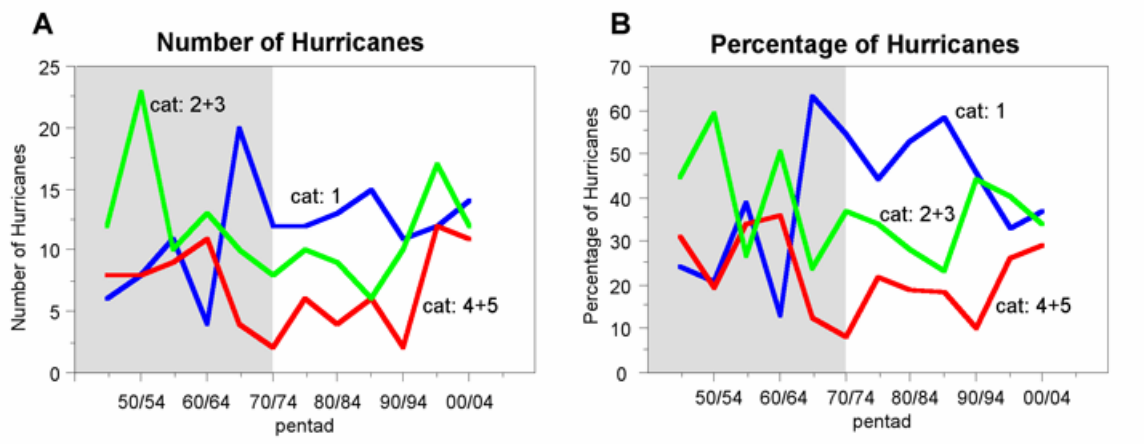


Figure derived from National Hurricane Center data. Gray shaded area illustrates data from the pre-1970 period. Source: Patrick Michaels

To summarize the discussion to this point, there is no scientific consensus linking global warming to recent hurricane behavior. Consider this excerpt from the "Statement on Tropical Cyclones and Global Warming" adopted by 120 hurricane experts at a recent meeting of the World Meteorological Organization:

> The possibility that greenhouse gas induced global warming may have already caused a substantial increase in some tropical cyclone indices has been raised (e.g. Mann and Emanuel, 2006), but no consensus has been reached on this issue.[69]

What then do climate models tell us about how global warming may affect hurricanes in the future?

Since hurricanes are heat engines, it is likely that global warming will increase the number, strength, and/or formation area of hurricanes *to some extent*. But by how much is unclear. Thomas Knutson of NOAA and Robert Tuleya of Old Dominion University estimated in a 2004 study that a 2.0°C rise in maximum SSTs would increase hurricane wind speed by about 6 percent over 80 years.[70] "That means," Patrick Michaels comments, "global warming is likely to be responsible, right now, for at best, an increase of about 0.6% in hurricane wind speeds—raising a decent hurricane of 120 mph to 120.7 mph, a change too small to measure."[71]

Knutson and Tuleya came to pretty much the same conclusion: "From our standpoint, the small 0.9 degree Fahrenheit warming observed in the Atlantic since 1900 implies only a 2-3 miles per hour intensity increase to date. Such a small increase is hard to detect. It is difficult to attribute the upswing in strong hurricane activity this past season to global warming. Season-to-season variability is very large."[72]

Another modeling study, Bengtsson et al. (2006),[73] projects no increase in tropical storm severity from global warming:

- "There are no changes in the extremes of tropical storms [in our model projection] in spite of increased tropical SST by 2°–3°C."
- "The Atlantic [tropical] storms are reduced in number, in particular the stronger ones, while the storms in the eastern Pacific are virtually unchanged though there is some indication of fewer extreme storms. In the western Pacific there is little change. It is interesting to note that the change in SST by between 2° and 3°C *has not had any influence on the numbers and intensities of the more powerful tropical storms*."

In a just-published modeling study, Gabriel Vecchi of Princeton's Geophysical Fluid Dynamics Laboratory and Brian Soden of the University of Miami forecast that global warming will lead to a "robust increase" in Atlantic basin wind-shear strength during hurricane season (defined as June – November).[74] Pat Michaels explains why this finding is significant:

> A "robust increase" in vertical wind shear acts to *inhibit* tropical cyclone formation and intensification. The authors do not claim that in the future overall hurricane intensity or frequency will decline in the Atlantic, because along with the increases in vertical wind shear, there will also be increases in sea surface temperatures (SST)—which lead to stronger storms. However, the increases in vertical wind shear are found to lessen, to a substantial degree, the impacts of rising SST.[75]

Although there is no consensus among the experts about the possible influence of global warming on hurricanes, there is a strong consensus—ignored by Gore—that policymakers' first order of business should be to revise "building practices, and insurance, land use, and disaster relief policies that currently serve to promote an ever-increasing vulnerability to hurricanes."[76]

VI. Will Sea Levels Rise by 20 Feet?

Gore warns: "If Greenland melted or broke up and slipped into the sea—or if half of Greenland and half of Antarctica melted or broke up and slipped into the sea, sea levels worldwide would increase by between 18 and 20 feet" (*AIT*, p. 196). He estimates that more than 100 million people living in Beijing, Shanghai, Calcutta, and Bangladesh would be "displaced, "forced to move," or "have to be evacuated" (*AIT*, pp. 204-206). The World Trade Center Memorial would be "under water." He approvingly quotes UK science advisor Sir David King: "The maps of the world will have to be redrawn."

Now, it is certainly correct that if half the West Antarctic Ice Sheet (WAIS) and half the Greenland Ice Sheet (GIS) melted or slid into the ocean, sea levels would rise by 18-20 feet. But when Gore counts up all the people who would be "displaced," "forced to move," or "have to be evacuated," he implies that such catastrophic events could take place in our lifetimes or those of our children. There is simply no science to support such fears.

Gore hints that we may be witnessing the beginning of the end when he reports that a "new study" for the first time shows an overall decline in Antarctic ice mass (*AIT*, p. 190). Isabella Velicogna and John Wahr of the University of Colorado used satellite measurements of gravity fluctuations to infer ice-mass changes in Antarctica.[77] Gore gives the impression that all of Antarctica, including the East Antarctic Ice Sheet (EAIS), is losing ice mass. In fact, almost all the ice loss observed by Velicogna and Wahr comes from the smaller WAIS.[78] Gore neglects to mention that the study looked at only three years of data—from mid-2002 to mid-2005. That is simply too short a time-span to infer any trend in a system as vast and complex as Antarctica.

Davis et al. (2005) examined Antarctic ice mass balance changes over a somewhat longer period, from May 1992 to May 2003.[79] The Davis team also found that the WAIS was losing mass. However, the larger EAIS was gaining mass (from snow accumulation) at a faster rate, yielding a net increase in Antarctic ice. The overall effect was to *reduce* sea-level rise by 0.09 mm/year.

Two other studies also indicate a positive mass balance in Antarctica. Chen et al. (2006) found that, during April 2002 to November 2005, ice mass gains in the EAIS exceeded ice mass losses in the WAIS.[80] Wingham et al. (2006) found that, during 1992-2003, mass gains from accumulating snow on the Antarctic Peninsula and within East Antarctica exceeded ice mass loss in West Antarctica.[81]

Van den Broeke et al. (2006) found no net change in the size of Antarctica's ablation zones (areas where ice mass losses in the summer exceed winter snow accumulations), and no change in loss rates in those areas, during the 25-year period from 1980 to 2004.[82] In other words, global warming appears to have had no impact on overall Antarctic ice mass balance during the past quarter century.

Gore, however, warns that the WAIS could slip off its "moorings" and slide into the sea. He says we should worry about this, because "the ocean flows underneath large sections of this ice shelf, and as the ocean has warmed, scientists have documented significant and alarming structural changes on the underside of the ice shelf" (*AIT*, p. 190).

Gore provides no information allowing the reader to assess whether the "structural changes on the underside of the ice sheet" are "significant" or "alarming." He probably refers to research by NASA's Robert Bindschadler showing that water from the intermediate depths—the warmest water in polar oceans—is melting the submarine base of the glaciers, accelerating the flow of some outlet glaciers towards the sea.[83]

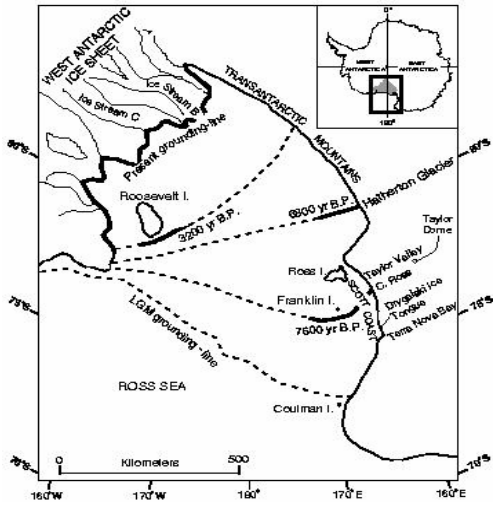
Bindschadler is careful to point out "the absence of any indication of increasing sea surface temperature" in the polar oceans, and he notes that "warmth in the ocean arriving from lower latitudes would raise the temperature of this intermediate water a fraction of a degree, hardly enough to initiate a sudden glacier acceleration." So what causes the acceleration?

According to Bindschadler, once the intermediate layer penetrates the moraine, or sill

(the barrier-like accumulation of boulders, gravel, and other debris deposited by the glacier as it retreats from its maximum extent), the water reaches the "grounding line," the boundary of the ice sheet's base on the sea floor. "Increased pressure at these greater depths lowers the melting point of this ice, increasing the melting efficiency of the warmer water. Rapid melting results." This explanation suggests a process that would occur with or without global warming. It also suggests a process that cannot be stopped. And that is what Bindschadler concludes:

> Retreating glaciers lengthen the distance warmer water must travel from any sill to the grounding line, and eventually tidewater glaciers retreat to beds above sea level. This might limit the retreat in Greenland but will save neither West Antarctica, nor the equally large subglacial basin in East Antarctica where submarine beds extend to the center of the ice sheet.

How long has this process been going on? For many thousands of years. Conway et al. (1999) mapped the retreat of the Ross Ice Shelf grounding line—the southernmost boundary of the WAIS—since the last glacial maximum. They found that "most recession occurred in the middle to late Holocene in the absence of substantial sea level or climate forcing."[84]



Holocene grounding-line recession in the Ross Sea Embayment; Source: Conway et al. (1999)

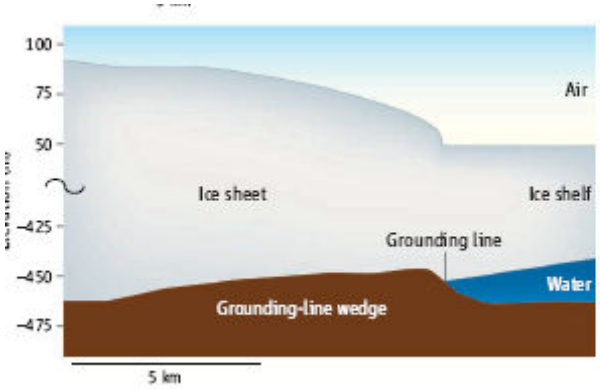
The Ross Ice Shelf today is approximately one-third its original size. Conway et al. concluded that current grounding line retreat is natural and will continue even in the absence of greenhouse forcing:

> We suggest that modern grounding-line retreat is part of ongoing recession that has been under way since the early to mid-Holocene time. It is not a consequence of anthropogenic warming or recent sea level rise. In other words, the future of the WAIS may have been predetermined when grounding-line retreat was triggered in early Holocene time. Continued recession and perhaps even complete

> disintegration of the WAIS within the present interglacial period could well be inevitable.

When might the "inevitable" occur? The Conway team state that, "if the grounding line continues to pull back at the present [i.e. 1990s] rate, complete deglaciation will take about 7,000 years."

Such estimates are uncertain, because ice sheets are dynamic systems that can change in unpredictable ways. However, as John Anderson of Rice University's Earth Science Department explains in a recent review article in *Science* magazine,[85] two just-published studies "show that at least one threat to the [West Antarctic] ice sheet's stability—sea-level rise—may not be as serious as has been feared." The studies[86] found that ice streams deposit material as they flow towards the sea. The debris forms wedges that prop up the ice sheet and stabilize the grounding line despite increases in sea level. In Anderson's words, the studies "provide evidence that the grounding line of the Whillans Ice Stream, one of the major drainage outlets of the West Antarctic Ice Sheet, rests on a wedge of sediments that will stabilize the ice stream during a sea-level rise of several meters. Thus, in the foreseeable future, sea-level rise should not threaten the ice sheet's stability." Indeed, observes Anderson, "At the current rate of sea-level rise, it would take several thousand years to float the ice sheet off the bed."



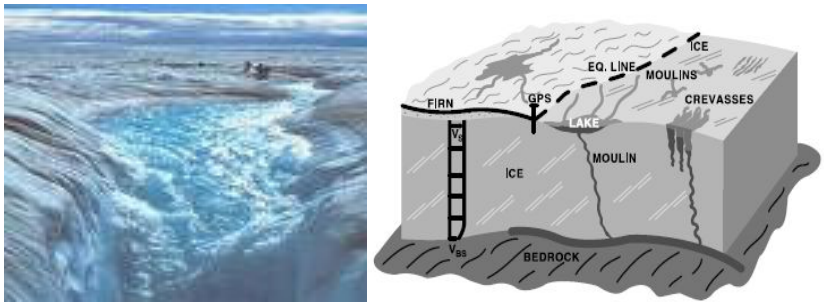
Flowing ice streams pile up a sedimentary wedge that "stabilizes the grounding line as the sea level rises." Source: Anderson (2007)

Gore also warns that half the GIS could melt or break up and slide into the sea. How likely is that?

Gore reports that vertical water tunnels known as "moulins," formed from melt-water pools on the surface of the ice sheet during the summer, penetrate down to the base of the ice mass. "When the water reaches the bottom of the ice, it lubricates the surface of the bedrock and destabilizes the ice mass, raising fears that the ice mass will slide more quickly toward the ocean" (*AIT*, p. 192).

To illustrate the supposed danger, Gore presents a photograph and a diagram from a study of "moulins" by Zwally et al. (2002), published in *Science*.[87] The film version of

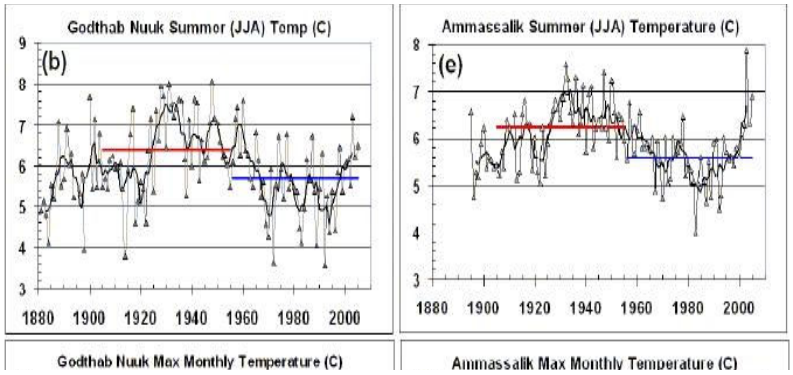
AIT animates the diagram so that the ice sheet begins to pull apart into two pieces.



"Moulin" photograph and diagram; Source: Zwally et al. (2002)

The Zwally team did find that moulins accelerate glacial movement in Greenland in the summertime, but only by a few percent. For example, glacial flow in 1998 increased from 31.3 cm/day in winter to 40.1cm/day in July, falling back to 29.8 cm/day in August, increasing annual glacial movement by 4.7 meters. In other words, a glacier that travels about 108 meters per year instead travels 113 meters. The GIS is 2,530 kilometers in length and 1,094 kilometers across near its northern margin.[88] Only through the boldest leap of the imagination do an extra few meters of glacial flow presage a catastrophe in which half the GIS—a structure hundreds of thousands of times larger—slides into the sea.

Moulins in numbers equal to or surpassing those observed today probably occurred during the first half of the 20th century, because Greenland during almost all decades between 1915 and 1965 was as warm as or warmer than the decade from 1995 to 2005.[89] This means there should have been the same or greater acceleration in glacial flow. There was no catastrophic loss of grounded ice.



Greenland summers were warmer in the 1920s-1940s; moulins were probably more abundant; Source: Chylek et al. (2006)

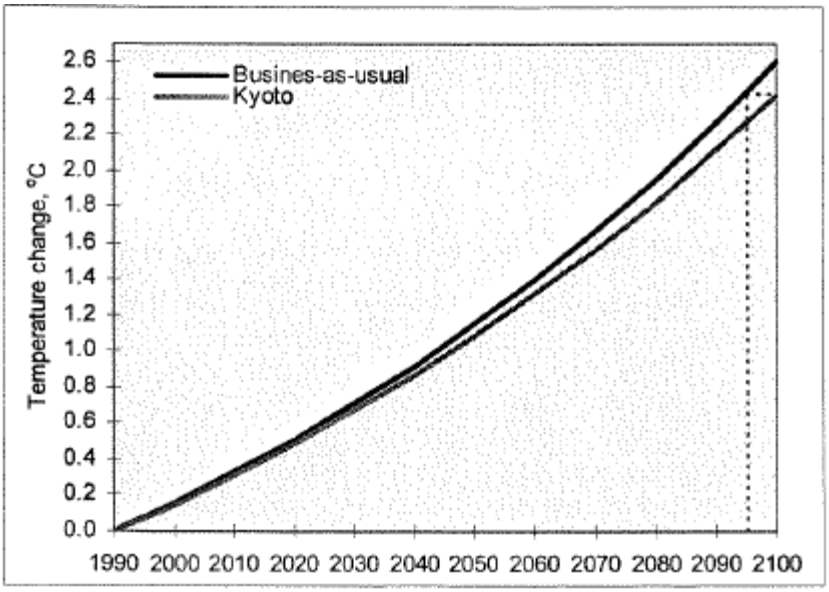
Gore also warns that half the ice sheet could melt. How long would that take? A modeling study reviewed by the IPCC in its 2001 *Third Assessment Report* found that a

sustained 5.5°C warming of Greenland would melt about half the glacier and increase sea level by 3 meters "over a thousand years."[90]

Nobody knows how warm Greenland is going to be over the next thousand years. We do have data on the net rate of ice mass loss in Greenland. Greenland's glaciers are thinning at the edges and thickening in the interior. If the gains are subtracted from the losses, the net volume of ice lost during 2003 to 2005 was ~101 gigatons a year.[91] At that rate, Greenland is contributing 0.28 mm of sea-level rise per year—less than one and a half inches per century.

VII. Kyoto: All pain for no gain

AIT never confronts the most obvious objection to regulatory climate policy. The main regulatory policies debated in Congress today—the Kyoto Protocol, McCain-Lieberman,[92] the Bingaman-Specter initiative[93]—would have no discernible impact on global temperatures. The Kyoto Protocol, for example, would avert only 0.07°C of global warming by 2050.[94] It would postpone the arrival of a 2.6°C warming by five years—from 2095 to 2100. See the Figure below.



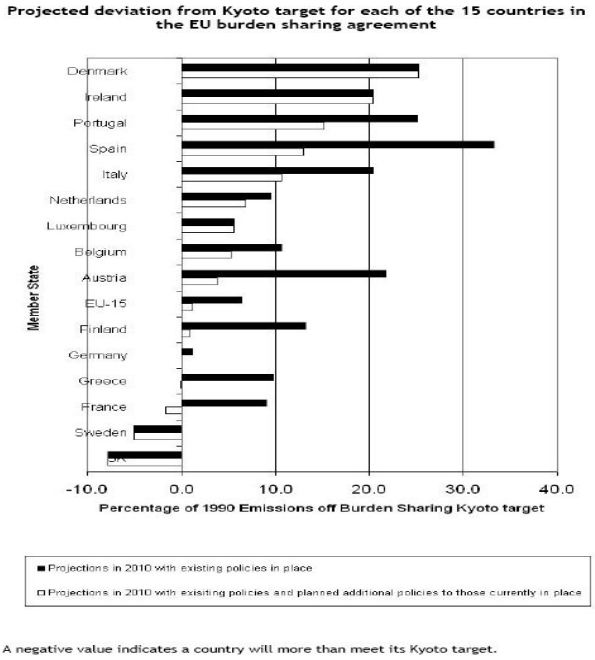
Kyoto postpones the arrival of a 2.6°C warming by five years; Source: Lomborg (2007)[95]

Similarly, Kyoto would avert only 1 cm of sea-level rise by 2050 and 2.5 cm by 2100.[96] It would have no measurable effect on hurricane strength, even if global warming is making hurricanes stronger, and none on malaria-related mortality, even if global warming is increasing the population at risk of exposure to malaria.

However, although Kyoto would provide no discernible climate protection, it would cost the U.S. economy tens to hundreds of billions of dollars in higher energy prices, lost jobs,

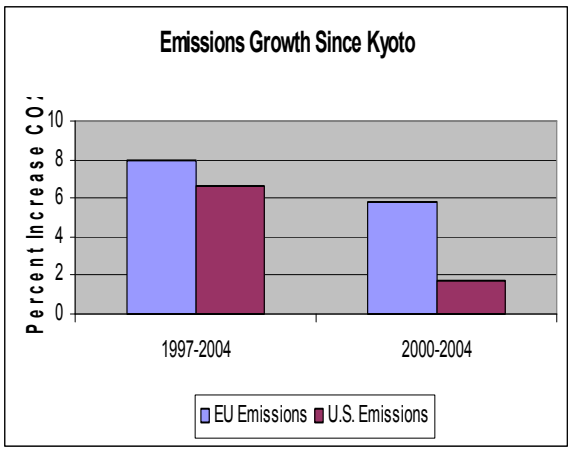
and lower GDP.[97]

Kyoto advocates might respond that the treaty is only a "first step." But even the first step is economically onerous. Most of the EU-15 countries are not on track to meet their Kyoto targets,[98] even though European compliance is facilitated by the dubious advantages of low economic growth and low population growth.



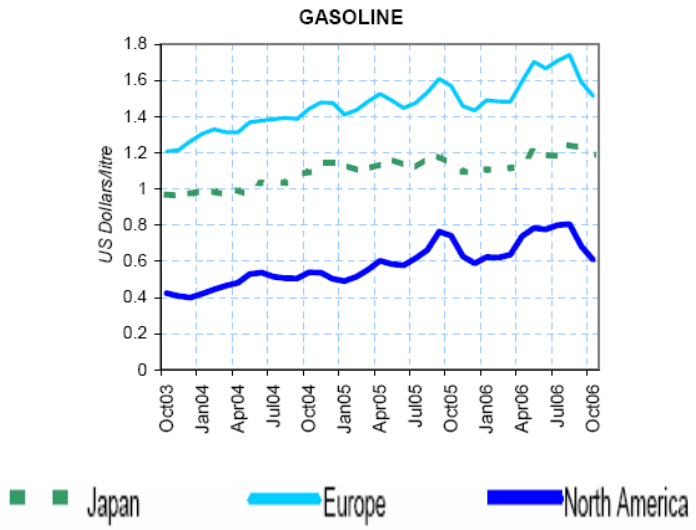
Source: Institute for Public Policy Research, Traffic Lights Report (Dec. 27, 2005)

Ironically, although the European Union ratified Kyoto and the United States did not, EU emissions have increased more rapidly than U.S. emissions since 1997, the year Kyoto was negotiated, and since 2000.



U.S. and EU emissions growth since Kyoto; Source: EIA data[99]

Many U.S. politicians professed to be outraged in late 2005 when gasoline prices spiked above $3.00 a gallon. Consumers pay twice as much for gasoline in some European countries, due to high motor fuel taxes.[100] See the Figure below.



End User Petroleum Product Prices, Oct. 2006; Source: IEA[101]

Yet from 1990 to 2004, EU transport sector CO_2 emissions increased almost 26 percent and are projected under current policies to be 35 percent above 1990 levels in 2010.[102] How much higher than European-level gasoline prices do politicians like Gore think Americans should have to pay to reduce emissions?

VIII. State-level greenhouse gas regulation is potentially far more costly than Kyoto.

In 2003, the Illinois-based Heartland Institute undertook an extensive analysis of state-level greenhouse gas regulatory initiatives. Heartland found that state efforts are likely to cost up to 10 times as much per ton of emissions reduced as a national program, for three reasons.[103]

First, states would not be able to meet their reduction targets by exploiting "lower marginal cost opportunities outside their borders." All emission reductions would have to be made in-state, even if cheaper reductions could be realized elsewhere. A multi-state compact like the Northeast Regional Greenhouse Gas Initiative (REGGI) would alleviate this problem somewhat. Nonetheless, an optimal program would encourage reductions wherever it is cheapest to make them "regardless of geographical location." State-wide or regional programs allow fewer economical reductions than national or international programs.

A second reason why state efforts would yield less bang for the buck than would a federal program is that states have a limited ability regulate energy "upstream"—at the wellhead or mine mouth. State efforts typically are industry-specific such as caps on utility

emissions or mandates requiring utilities to generate electricity from alternative fuels. This results in "high-marginal cost reduction efforts in some industries while low-cost opportunities remain unexploited in other industries."
The third reason state reductions cost more per ton is that firms can more easily avoid regulation by changing jurisdictions. Emissions "leak" from regulated to non-regulated states—as does capital, jobs, and tax revenues. The regulated state incurs significant economic losses with little net emissions reduction to show for it.

Heartland estimated, for each of 22 states, the economic and fiscal consequences of meeting Kyoto's emission reduction targets via state-level programs. Here are the results for Colorado.[104] The Colorado state government would spend an additional $61 million per year while losing $2.5 billion each year in tax revenues due to slower economic growth. Consumers and businesses would incur $2.5 billion in additional annual costs, which translates to about $1,500 of additional expense per household.

IX. The real inconvenient truth is that we do not know how to meet current, much less future anticipated, global energy needs with low- and non-emitting technologies.

Martin Hoffert and his colleagues, a team of 18 energy experts, assessed possible technology options that might be used in coming decades to stabilize atmospheric CO_2 concentrations.[105] They examined wind and solar energy, nuclear fission and fusion, biomass fuels, efficiency improvements, carbon sequestration, and hydrogen fuel cells. The Hoffert team found that, "All these approaches currently have severe deficiencies that limit their ability to stabilize global climate." They specifically took issue with the IPCC's claim that, "known technological options could achieve a broad range of atmospheric CO_2 stabilization levels, such as 550 ppm, 450 ppm or below over the next 100 years." World energy demand could triple by 2050. However, "Energy sources that can produce 100 to 300% of present world power consumption without greenhouse emissions do not exist operationally or as pilot plants."

The bottom line: "CO_2 is a combustion product vital to how civilization is powered; it cannot be regulated away." Without "drastic technological breakthroughs," it is not possible to stabilize atmospheric CO_2 concentrations *and* meet current and projected global energy needs.

A report by the Pew Center on Global Climate Change, *U.S. Energy Scenarios for the 21st Century*, implicitly comes to the same conclusion.[106] The Pew report sketches out three scenarios—possible future development paths—of the U.S. energy supply system from 2000 through 2035, and the increase in carbon emissions under each scenario.

Pew's analysis of one scenario is an eye-opener. In "Technology Triumphs," state policy interventions, technology breakthroughs, and changing consumer preferences converge to accelerate commercialization of high-efficiency, low-emission, and zero-emission energy technologies. In this scenario, state governments:

- Set "rigorous" efficiency standards for appliances, enact caps on CO_2 emissions

from power plants, and introduce or expand renewable portfolio standards (policies requiring specified percentages of electricity to come from wind, solar, and biomass technologies).

- Enhance electric power generation and transmission efficiencies via tax preferences and other policies promoting investment in "combined heat and power" (on-site electric generating units that harness exhaust heat to support space and water heating, air conditioning, and various industrial processes) and "distributed generation" (small-scale units located at or near customer sites that avoid energy losses incident to long-range transmission).
- Subsidize fuel cell research and effectively raise federal fuel economy standards by requiring new cars, minivans, and light trucks to reduce emissions of CO_2 per mile traveled.

These actions, combined with breakthroughs in solar photovoltaic manufacturing and a shift in consumer preference from "sprawling" to compact residential development, slow the growth of vehicle miles traveled, expand markets for hybrid cars, accelerate power sector fuel switching from coal to natural gas, and lay the building blocks of a hydrogen economy.

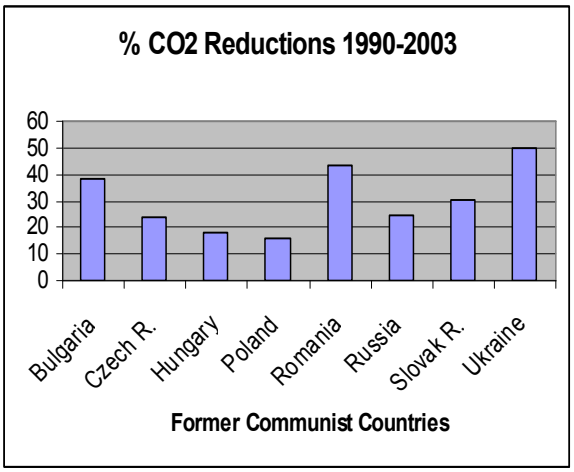
"Technology Triumphs" is really a "Politics Triumphs" scenario with state governments implementing a wide array of "technology forcing" schemes to "green" U.S. energy markets.

But the Pew report inadvertently pours cold water on the view that dramatic emission reductions and robust economic growth can go hand in hand. In the "Technology Triumphs" scenario, U.S. carbon emissions "rise 15 percent above the year 2000 levels by 2035"—about 35 percent above the U.S. Kyoto target—despite multi-state regulation of CO_2 emissions from vehicles and power plants, mature markets for hybrid cars, widespread efficiency upgrades in the power sector, a successful launch of the hydrogen economy, and the proliferation of "energy smart" communities and houses.

The Pew report concludes that, "In the absence of a mandatory [national] carbon cap, none of the base case scenarios examined in this study achieves a reduction in U.S. carbon dioxide emissions by 2035 relative to current levels." And it emphasizes, "This is true even in the scenario with the most optimistic assumptions about the future cost and performance of energy technologies." In other words, to reduce emissions, it is necessary to force people to use less energy than they need—a lot less.

What these studies reveal is that regulatory climate strategies put the policy cart before the technology horse. Only when the market is ready to supply vast quantities of affordable, emission-free energy, would it be prudent to consider taxing or capping emissions.

Here's another inconvenient truth. The only countries to have achieved deep emission cuts over several years are the former Soviet Union and Eastern Europe. Their "method" was economic collapse. See the Figure below.



Percent CO_2 emission reductions of seven former communist countries, 1990-2003 Source: International Energy Agency data[107]

IX. A cap-and-trade system would set up a Carbon Cartel.

Many prominent corporations—Duke Energy, Alcoa, and Goldman Sachs, to name a few—now support Kyoto-style regulation. This does not mean that regulatory climate policy is good for the economy. It means that some firms can profit—at least in the short-run—from economically harmful regulation.

It all started with Enron! Enron was one of the most influential corporate lobbyists for Kyoto. Enron was a natural gas distributor, and Kyoto would kill coal-fired electric generation, boosting demand for Enron's product. Enron also produced wind turbines—and other product whose market share would grow in a carbon-constrained world. And Enron's energy traders expected to make juicy commissions on the purchase and sale of carbon credits. An internal Enron memo enthused that Kyoto would "do more to promote Enron's business than almost any other regulatory initiative outside of restructuring the energy and natural gas industries in Europe and the United States."[108]

Enron may be defunct, but other energy-rationing profiteers carry on the great tradition. Consider Duke Energy, which merged with Cinergy in May 2005. An October 2006 study by the Pew Center on Global Climate Change includes a table on the per-ton cost of Cinergy's various greenhouse gas reduction projects in 2004.[109] The table shows that 97 percent of Cinergy's emission reductions came from efficiency improvements in its overwhelmingly coal-fired electric generating stations. Cinergy's investment of $1.94 million in efficiency upgrades reduced the company's CO_2 emissions by 349,882 tons. This works out to a cost of $1.11 per ton of CO_2 reduced.

Duke belongs to a coalition called the U.S. Climate Action Partnership, or CAP. One of CAP's "six principles" is to "reward early action."[110] What this "principle" means is that the government should award carbon credits, applicable to a future cap-and-trade

program, for emission reductions firms made "voluntarily" in the past. Now, suppose Duke is awarded early action credits for Cinergy's reductions, Congress enacts Phase I of the McCain-Lieberman Climate Stewardship Act, and CO_2-equivalent permits sell for $15 a ton in 2010 and $45 a ton in 2025, as estimated by the Energy Information Administration.[111] In that case, Duke would reap a windfall profit of between 1,263 percent and 3,990 percent.

What's wrong with making a profit, you might ask? What's wrong in this case is that Duke can cash in its early credits only to the extent that other firms are constrained by regulation buy to them. The costs those firms incur would then result in either higher prices for consumers or lower wages or fewer jobs for workers.

Cap-and-trade sets up a Carbon Cartel—an OPEC-like system of production quotas (in the form of emission permits), albeit for all carbon-based fuels, not just oil. As a result of cartelization, energy costs rise, consumer prices rise, real wages fall, and output and employment fall. We know these are the effects of cartels, which is why we used to put people who set up cartels in jail. Yet the Climate Action Partnership wants legal blessing for this new cartel. Any legislation enacting cap-and-trade would establish a new class of robber barons and provide legal protection for their profiteering activities.[112]

A brand-new report[113] by the Congressional Budget Office (CBO) confirms that cap-and-trade programs transfer wealth from consumers to energy producers. Moreover, the impacts are "regressive in that poorer households would bear a larger burden relative to their income than wealthier households would." For example, CBO "estimated that the price rises resulting from a 15 percent cut in CO_2 emissions would cost the average household in the lower one-fifth (quintile) of the income distribution about 3.3 percent of its average income. By comparison, a household in the top quintile would pay about 1.7 percent of its average income."

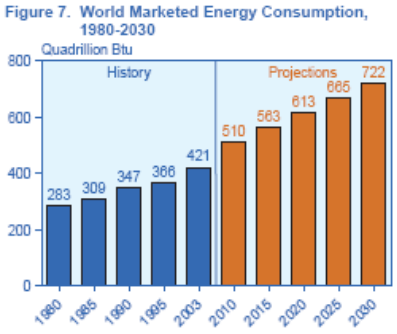
How much income might be transferred from consumers to producers? According to CBO, "A review of the existing literature and of the range of CO_2 policies now being debated suggests that the value of emission allowances might total between $50 billion and $300 billion per year (in 2007 dollars) by 2020."

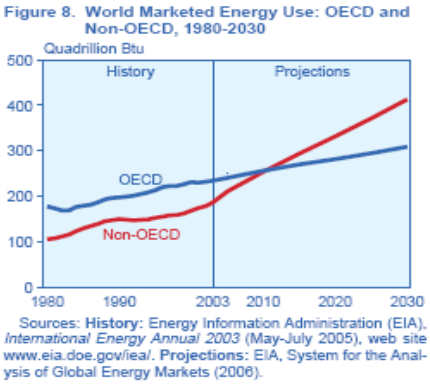
X. Putting an energy-starved world on an energy diet is not moral. Diverting major quantities of grain stocks to "feed" cars is not ethical.

In *AIT*, Gore never considers the obvious moral objection to his agenda—its potentially catastrophic impacts on the world's poor. Stabilizing atmospheric CO_2 levels is not even remotely possible unless China, India, and other developing countries restrict their use of carbon-based energy.[114] Consequently, Kyoto advocates view the treaty as just a "first step."[115] But the global economy is moving in exactly the opposite direction.

Demand for fossil energy is growing, especially in developing countries. The Energy Information Administration projects a 71 percent increase in global energy consumption

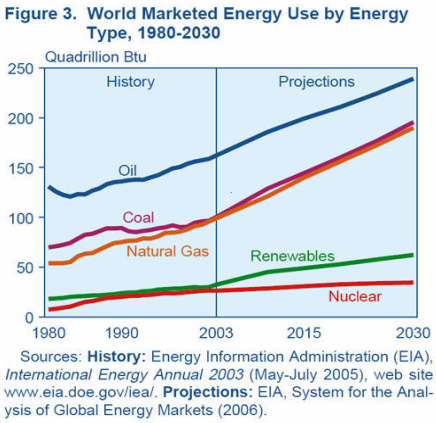
between 2003 and 2030, with three quarters of the increase occurring in developing countries.[116]

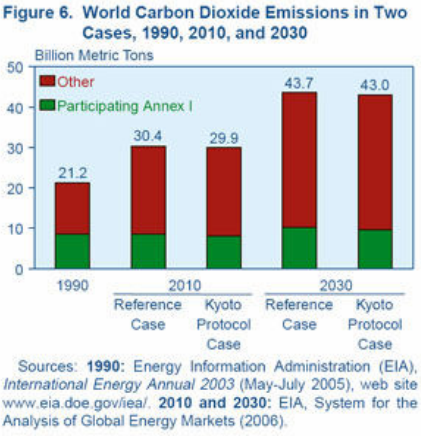




World energy consumption is projected to grow 71% from 2003 to 2030, with three-quarters of the growth in developing countries. Source: EIA

Most of the increase in demand will be met by fossil fuels, with the result that in 2030, fossil fuels are projected to supply about 86 percent of world energy consumption—roughly the same percentage as in 2003.[117] As a consequence, and notwithstanding Kyoto, CO_2 emissions worldwide are projected to rise from 21.2 billion metric tons in 1990 to 29.9 billion in 2010 and 43 billion in 2030.[118]





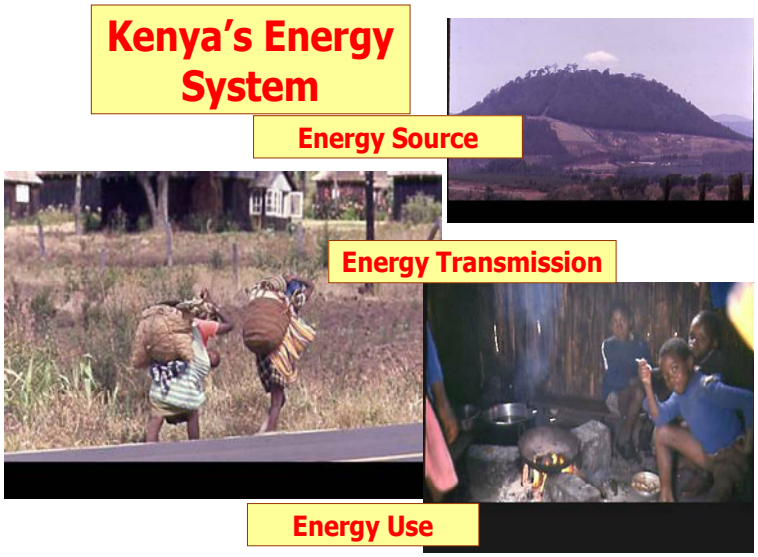
Kyoto notwithstanding, fossil energy consumption and CO2 emissions increase substantially. Source: EIA

The only way to reduce global emissions, therefore, is to limit developing countries' access to carbon-based energy. That would be a humanitarian and moral disaster.

Energy poverty is a scourge. An estimated 1.6 billion people lack access to electricity, and some 2.4 billion people still rely on traditional biomass—wood, crop waste, and

dung—for cooking and heating.[119] Daily indoor air pollution for these people is many times dirtier than outdoor air in the world's most polluted cities, and kills about 2.8 million people a year, most of them women and children.[120] Reliance on traditional biomass also takes a heavy toll on forests and wildlife habitat.

Kenya's "energy system," illustrated in the Figure below, typifies the plight of a large segment of humanity. Their energy source is the forest. Their energy transmission system is the backs of women and children. Their energy use consists of burning primitive biomass indoors. Energy poverty is a greater threat to their health and welfare than is climate change. Access to coal-fired electricity and gasoline-powered cars would benefit them more than would reductions in global CO_2 emissions.



Source: John Christy

One type of global warming policy—mandatory production of bio-fuels—poses a particularly sharp threat to poor countries by diverting major quantities of grain stocks to "feed" cars.

The 7.5 billion gallon bio-fuels mandate enacted by Congress in 2005 has increased U.S. corn prices by 50 percent. This caused a "tortilla crisis" in Mexico, as C. Ford Runge and Benjamin Senauer describe in the journal *Foreign Affairs*:

> In late 2006, the price of tortilla flour in Mexico, which gets 80 percent of its corn imports from the United States, doubled thanks partly to a rise in U.S. corn prices from $2.80 to $4.20 a bushel over the previous several months …The [tortilla] price surge was exacerbated by speculation and hoarding. With about half of Mexico's 107 million people living in poverty and relying on tortillas as a main

> source of calories, the public outcry was fierce. In January 2007, Mexico's new president, Felipe Calderón, was forced to cap the prices of corn products.[121]

Because the United States produces more than 40 percent of all corn worldwide and more than half of all corn exports, U.S. bio-fuel mandates affect corn prices everywhere. Further, because corn competes with other grains for land and customers, higher corn prices boost world grain prices generally.

This may benefit U.S. corn farmers (although at the expense of poultry, hog, beef, and dairy farmers, who use corn as animal feed) and large agri-business firms like Archer Daniels Midland. However, hungry people will suffer if Congress enacts President Bush's proposed 35-billion-gallon bio-fuels mandate and other industrial countries follow suit. Feeding cars requires vastly more grain than does feeding people, as Runge and Senauer explain:

> The World Bank has estimated that in 2001, 2.7 billion people in the world were living on the equivalent of less than $2 a day; to them, even marginal increases in the cost of staple grains could be devastating. Filling the 25-gallon tank of an SUV with pure ethanol requires over 450 pounds of corn—which contains enough calories to feed one person for a year. By putting pressure on global supplies of edible crops, the surge in ethanol production will translate into higher prices for both processed and staple foods around the world.

Runge and Senauer worry that surging demand for bio-fuels could increase the number of chronically-hungry people by 600 million in 2025:

> In a study of global food security we conducted in 2003, we projected that given the rates of economic and population growth, the number of hungry people throughout the world would decline by 23 percent, to about 625 million, by 2025, so long as agricultural productivity improved enough to keep the relative price of food constant. But if, all other things being equal, the prices of staple foods increased because of demand for bio-fuels, as the IFPRI [International Food Policy Research Institute] projections suggest they will, the number of food-insecure people in the world would rise by over 16 million for every percentage increase in the real prices of staple foods. That means that 1.2 billion people could be chronically hungry by 2025—600 million more than previously predicted.

Even if this forecast is alarmist, the ethics of bio-fuel mandates is appalling, as Dennis Avery of the Hudson Institute observes:

> We would effectively be burning food as auto fuel in a world that is not fully well fed now, and whose food demand will more than double in the next 40 years … Tightening the world's food supply by diverting major quantities of its grain stocks into fuels will drive up the prices of all food. This will inevitably hit hardest the poorest people in the world's food-shortage regions. This would not be ethical even if there were no other sources of energy.[122]

XI. Policymakers concerned about global warming should: (1) Support basic research to develop affordable, emission-free energy technologies, and (2) target scarce international assistance efforts to save the most lives for each dollar invested.

Greenhouse gas regulatory initiatives put the policy cart before the technology horse. Claims that carbon penalties can spur a technological transformation to an emission-free future are not credible. Consider a key finding of the EIA's analysis of Senator Bingaman (D-NM) and Senator Specter's (R-PA) draft legislation, one of the least onerous proposals being considered by Congress.

The Bingaman-Specter initiative features a "safety valve" capping the price of carbon-dioxide-equivalent emission allowances at $3.70 per ton in 2012 and $14.18 per ton in 2030. Even with these relatively modest carbon penalties, coal generation from 2004 to 2030 grows by only 51 gigawatts compared to 171 gigawatts in the "reference" (no policy change) projection. In other words, the projected growth in coal generation is cut by more than two-thirds. Nonetheless, the penalty is not high enough to make carbon capture and storage technology commercially viable.[123] One might suppose that more punitive carbon charges—the regulatory equivalent of a gun to the head—might do the trick. More likely, it would simply stop investment in coal-based generation.

Consider also the European experience with high motor fuel taxes, mentioned earlier. Taxes on gasoline are virtual carbon taxes, and in Europe they equate to carbon penalties of several hundred dollars per ton. Yet EU transport sector CO_2 emissions are soaring. Yes, small cars and diesel-powered cars occupy larger market shares in Europe than they do in the United States, but Europe is no closer than we are to achieving a "beyond petroleum" transport system.

Everyone agrees that the solution to global warming is technology. How then should government foster technology development? Government-funded R&D is often wasteful. Nonetheless, an R&D strategy has merit, especially compared to carbon regulation and bio-fuel mandates. Bjørn Lomborg recommends that all nations commit to spend 0.05 percent of GDP annually on R&D of non-carbon emitting energy technologies. A multi-lateral R&D program would have several advantages:

> This approach would cost about $25 billion a year, seven times cheaper than Kyoto and many more times cheaper than a Kyoto II. It would involve all nations, with richer nations naturally paying the larger share. It would let each country focus on its on future vision of energy needs, whether that means concentrating on renewable sources, nuclear energy, fusion, carbon storage, or searching for new and more exotic opportunities.[124]

Lomborg also advises that industrial countries concentrate their international assistance efforts in areas where they can save the most lives for each dollar invested. Today's best and brightest simply do not know how to reverse, halt, or even perceptibly slow climate change at reasonable cost. All regulatory approaches involve incurring relatively large

costs in the present for relatively small or speculative benefits in the future.

For a fraction of Kyoto's cost, says Lomborg, the industrial nations could dramatically reduce death and suffering from HIV/AIDS, malaria, water-borne disease, and malnutrition. Alleviating those problems have the added benefit of making poor countries wealthier and thus better able to manage the risks of climate change.

Lomborg, working with four Nobel economists, other experts, and college students (70 percent from developing countries), ranked alternative investments to solve global problems according to how many lives could be saved and at what cost. The ranking—known as the Copenhagen Consensus—lists Kyoto and other climate regulation among the "bad investments." The Figure below summarizes the Copenhagen Consensus:

		Challenge	Opportunity
Very Good Opportunities	1	Diseases	Control of HIV/AIDS
	2	Malnutrition	Providing micro nutrients
	3	Subsidies and Trade	Trade liberalisation
	4	Diseases	Control of malaria
Good Opportunities	5	Malnutrition	Development of new agricultural technologies
	6	Sanitation & Water	Small-scale water technology for livelihoods
	7	Sanitation & Water	Community-managed water supply and sanitation
	8	Sanitation & Water	Research on water productivity in food production
	9	Government	Lowering the cost of starting a new business
Fair Opportunities	10	Migration	Lowering barriers to migration for skilled workers
	11	Malnutrition	Improving infant and child nutrition
	12	Malnutrition	Reducing the prevalence of low birth weight
	13	Diseases	Scaled-up basic health services
Bad Opportunities	14	Migration	Guest worker programmes for the unskilled
	15	Climate	Optimal carbon tax ($25-300)
	16	Climate	The Kyoto Protocol
	17	Climate	Value-at-risk carbon tax ($100-450)

Table 1 Global priority list from Copenhagen Consensus, 2004.[77]

Conclusion

Global warming is real and much of the recent warming is likely man-made. However, the rate of warming is modest and constant, and we may reasonably expect future warming to be at the low-end of the IPCC's projected range.

Claims by Gore and others that global warming is a "planetary emergency" do not survive scrutiny.

Regulatory climate strategies impose relatively large costs in the short term for relatively small or speculative benefits many decades hence. Such policies have a high potential to exploit consumers, stifle economic growth, and undermine global food security.

Rather than put the policy cart before the technology horse, policymakers concerned about global warming should encourage worldwide R&D investment in non-carbon-emitting energy technologies. They should also target international assistance efforts where each dollar invested can do the most good, recognizing that carbon suppression

policies are a poor investment of inescapably limited resources.

Thank you again for opportunity to present my views. I would be happy to try and answer any questions you may have.

Bio

Marlo Lewis, Jr. is a Senior Fellow at the Competitive Enterprise Institute (CEI), where he writes on global warming, energy policy, regulatory process reform, and other public policy issues. Prior to joining CEI, Marlo served as director of external relations for the Reason Foundation and as staff director of the House Government Reform Subcommittee on Regulatory Affairs. He has published in National Review, the Washington Times, Investors Business Daily, the American Spectator, Tech Central Station, Energy, Pollution Liability Report, and The Hill. He has appeared on various TV and radio programs including Oprah Winfrey, C-SPAN, CNBC Capital Report, CBC-News Marketplace, and BBC TV. He holds a Ph.D. in Government from Harvard University and a B.A. in Political Science from Claremont McKenna College.

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