Averting Our Eyes

E-mails received regarding the letter from the National Mining Association CEO and my letter to him (http://www.columbia.edu/~jeh1/NMAletters_20071121.pdf) suggest a need for an apology on my part and a clarification of the bottom line. Some context is required.

Generational knowledge and responsibility. The threat of global warming did not become clear until the present generation. Empirical evidence of warming was masked by weather fluctuations, and warming was kept small, temporarily, by the inertia of deep oceans.

We cannot blame our ancestors for burning fossil fuels in an uncontrolled way. They worked hard to bring themselves and their children a better life. Their greenhouse emissions are small in comparison to ours. Any effect of their emissions on our climate is truly inadvertent.

Ignorance is no excuse for us. There is overwhelming scientific evidence of global warming, its causes, and many of its implications. Today's generations will be accountable, and how tall we stand remains to be determined. There is still time, but just barely.

Status of the planet. Human-made greenhouse gas emissions today are enormous, especially carbon dioxide (CO_2), with annual emissions of over 8 Gigatons of carbon and average annual increases of about 2 ppm (parts per million) of CO_2 in the air. For the past 30 years the planet has been warming at a rate of about 0.2°C per decade. And the planet is out of energy balance by between ½ and 1 W/m^2 (more energy coming in than going out), so additional warming of about 0.5°C is "in the pipeline".

These facts are no cause for despair. There are enough health-damaging pollutants in the air today such that, if they (tropospheric ozone, its principal precursor methane, black soot, and some other trace gases that contribute to the global warming) were reduced by feasible amounts, the planet's energy balance could be restored, or nearly so. That is a doable task, and it would have many side benefits.

The primary challenge is the need to limit future emissions of carbon dioxide (CO_2). A substantial fraction, about one-fifth, of our fossil fuel CO_2 emissions stays in the air for more than 1000 years. Thus whether we burn a fuel and release the CO_2 today or next year does not matter all that much with respect to the end result. Conservation of precious fossil fuels is important – it is needed to give us time to develop energy sources and life styles to fit the era "beyond fossil fuels" – but we must realize that there is a limit on the total fossil fuel CO_2 that we inject into the atmosphere. We cannot burn all of the fossil fuels (oil, gas, coal and unconventional fossil fuels such as tar shale and tar sands) and release the CO_2 into the air without creating a different planet.

Burning all fossil fuels, if the CO_2 is released into the air, would destroy creation, the planet with its animal and plant life as it has existed for the past several thousand years, the time of civilization, the Holocene, the period of relative climate stability, warm enough to keep ice sheets off North America and Eurasia, but cool enough to maintain Antarctic and Greenland ice, and thus a stable sea level. We cannot pretend that we do not know the consequences of burning all fossil fuels.

Basic fossil fuel facts. Most of the increase of CO_2 in the air today, relative to pre-industrial times, is due to burning of fossil fuels. The fossil fuel contribution to CO_2 in the air today is due about 50% to coal, 35% to oil and 15% to gas. The annual increments for the past few decades have been slightly larger for oil than for coal, but coal use has accelerated in the

past few years and in the long run coal will be the greatest source because of its larger reserves (discovered deposits) and estimated resources (deposits still to be discovered).

There is a raging battle today about the size of fossil fuel reserves and resources, with "peakists" claiming that we are already at or near peak production of both oil and coal because the amounts of economically recoverable fuels in the ground are more limited than the fossil fuel industry has admitted. Evidence that reserves and resources have been overstated is strong. But it is also clear that, absent a price on carbon emissions, as the price of energy rises, the amount of economically extractable fossil fuels increases, including unconventional fossil fuels.

Regardless of reserve and resource uncertainties, we know there are enough fossil fuels to destroy the planet as we know it, if their CO_2 is released into the atmosphere. But the potential contributions of oil and gas to future CO_2 are limited even if we accept industry estimates (http://pubs.giss.nasa.gov/docs/notyet/submitted_Kharecha_Hansen.pdf). CO_2 from oil can be further limited via a gradually increasing price on carbon emissions that discourages industry from going to the most extreme environments in the world (such as the Arctic National Wildlife Refuge and Antarctica) to extract every last drop of oil.

Actions needed to stabilize climate. Two fossil fuel facts define the basic actions that are required to preserve our planet's climate: (1) it is impractical to capture CO_2 as it is emitted by vehicles (the mass of emitted CO_2 is about three times larger than the mass of fuel in the tank), and (2) there is much more CO_2 contained in coal and unconventional fossil fuels than in oil and gas. As a consequence, the strategy for saving creation must have two basic elements.

First, and this is 80% of the solution, coal use must be phased out except where the CO_2 is captured and sequestered. Thus there should be a moratorium on construction of new coal-fired power plants until the technology for CO_2 capture and sequestration is ready.

Second, there must be a moderate price on carbon emissions, and both businesses and consumers must recognize that this carbon price will continue to increase in the future. This price, and realization of further increases, will drive innovations for energy efficiency, renewable energies, and other forms of energy that do not produce CO_2. There are a variety of ways to impose this price, including, industry cap-and-trade, individual carbon allowances, and fuel taxes that can be designed to be fair. The need to restructure taxes to encourage development of clean energies does not need to imply a large increase of the net tax load, nor does it imply destruction of the economy. On the contrary, common sense suggests that many good jobs will be created in industries focused on energy efficiency, renewable energies, and other clean energy sources. A carbon price alone is not enough, because it must start at a moderate level to avoid economic disruption. Thus governments must take other actions such as changing rules so that utilities make money by encouraging conservation, increasing efficiency standards for vehicles, appliances, electronic goods, etc., and investing much more in energy research and development.

The carbon price will assure that we do not pursue absurd energy pathways, such as cooking the Rocky Mountains to drip oil out of tar shale. We must instead focus on the actions needed to achieve the clean environment of the future, with a stable climate that can continue to support all life, in the era beyond fossil fuels. As industry and the public realize where energy policies are headed, positive feedbacks and innovations are likely, so change will begin to happen rapidly. Indeed, much of the coal may be left in the ground. This is not a bad thing, halting mercury pollution of our oceans, mountain-top removal, and pollution of our streams.

One more point needs to be made. We are already near, and probably somewhat beyond, the maximum level of atmospheric CO_2 that we need to allow, if we wish to preserve a planet like the one we inherited. But this realization, too, is no cause for despair. Each year the earth

has been taking up, on average, 43% of our fossil fuel CO_2 emissions. There is a limit on the Earth's capacity to take up CO_2 on time scales less than millennia, but there are other actions that we can take in addition to the two major ones described above. Additional actions include improved agricultural practices that enhance carbon sequestration in the soil, and improved forestry practices that reduce emissions from deforestation.

The actions described are doable, and they make climate stabilization manageable. It should be noted that the resulting planet, with clean air and water, is also more attractive for humans and other species.

Coal trains and reactions. Recently a coal industry official tried to divert attention from the actions that are needed to solve the climate problem by criticizing a specific paragraph in my testimony opposing construction of a new coal-fired power plant that does not capture its CO_2 emissions (http://www.columbia.edu/~jeh1/NMAletters_20071121.pdf). The paragraph in my testimony mischaracterized was:

> Coal will determine whether we continue to increase climate change or slow the human impact. Increased fossil fuel CO_2 in the air today, compared to the pre-industrial atmosphere, is due 50% to coal, 35% to oil and 15% to gas. As oil resources peak, coal will determine future CO_2 levels. Recently, after giving a high school commencement talk in my hometown, Denison, Iowa, I drove from Denison to Dunlap, where my parents are buried. For most of 20 miles there were trains parked, engine to caboose, half of the cars being filled with coal. If we cannot stop the building of more coal-fired power plants, those coal trains will be death trains – no less gruesome than if they were boxcars headed to crematoria, loaded with uncountable irreplaceable species.

This paragraph described thoughts that went through my head as I observed a remarkable string, mile after mile, of coal trains. My words did not resemble their reconstruction by the coal executive and I certainly did not mean to trivialize suffering by the families who lost relatives in the Holocaust. Nevertheless, it is clear from reactions that several people were hurt by the words. Three scientific colleagues, including one who lost several relatives in the Holocaust, have expressed strong disappointment about the words. A much larger number of people expressed support for the statement, but I think that more weight must be given to those who objected, as their concerns were heartfelt and understandable.

My apology and discussion. I regret that my words caused pain to some readers. I hope that they will accept my apology for having caused discomfort, an apology that is heartfelt.

Here, not in defense of my words, rather to make two further points, I provide the comments of two other people:

Jim, I thought that your equating the coal trains in Iowa with holocaust death trains an apt and reasonable analogy. It does not at all trivialize the suffering and deaths of European Jews but rather is a tribute to them. They will not all have died in vain if the horror and inhumanity of the holocaust can be used to wake up the world to the catastrophic consequences of continued pollution of the earth's atmosphere with carbon dioxide. XXXXX

Jim: As a Jew, who is sensitive about misuse of references to the holocaust, I found no problem with your metaphor...nor to your response to the CEO...except for the reference to "creation"! YYYYY

My supposition was that most people would take the reference in the way indicated by the first of the last two comments. One merit of references and memorials to the Holocaust is as a reminder that we cannot allow such an event again, we cannot avert our eyes.

As for reference to "creation", my feeling about that topic developed during a meeting with evangelical leaders on a Georgia plantation. We found no reason for conflict between science and religion, but many reasons for working together. We all felt strongly about the need for stewardship, for passing on to our children and grandchildren the planet that we received, with its remarkable forms of life.

Summary and a possible alternative metaphor. My concern is with trying to close the gap between what is understood about global warming by the relevant scientific community, and what is known by those who need to know, the public and policy makers. I think that we still have a long way to go in making the danger clear, in part because of the inertia of the climate system and the danger of passing tipping points – points at which little or no additional forcing is needed to cause large, relatively rapid, undesirable effects.

Our fellow species feel the danger in climate change. Animals are not on the run (http://www.giss.nasa.gov/~jhansen/preprints/Wild.070410.pdf) for the sake of exercise. But they do not control what is happening. We do. We cannot avert our eyes and pretend that we do not understand the consequences of continued "business as usual".

A related alternative metaphor, perhaps less objectionable while still making the most basic point, comes to mind in connection with an image of crashing of massive ice sheets fronts into the sea -- an image of relevance to both climate tipping points and consequences (sea level rise). Can these crashing glaciers serve as a Krystal Nacht, and wake us up to the inhumane consequences of averting our eyes?

Alas, that metaphor probably would be greeted with the same reaction from the people who objected to the first. That reaction may have been spurred by the clever mischaracterization of the CEO, aiming to achieve just such a reaction. So far that seems to have been the story: the special interests have been cleverer than us, preventing the public from seeing the crisis that should be in view. It is hard for me to think of a different equally poignant example of the foreseeable consequence faced by fellow creatures on the planet. Suggestions are welcome.