Young People's Burden

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Young People's Burden: Requirement of Negative CO_2 Emissions, by twelve of us[1], is being made available as a "Discussion" paper in ***Earth System Dynamics Discussion*** on 4 October, as it is undergoing peer review. We try to make the science transparent to non-scientists. A video discussion by my granddaughter Sophie and me is available. Here I first note a couple of our technical conclusions (but you can skip straight to "**Principal Implications**" on page 2):

1) Global temperature: the 12-month running-mean temperature is now +1.3°C relative to the 1880-1920 average in the GISTEMP analysis (Fig. 2 in above paper or alternative Fig. 1 below). We suggest that 1880-1920 is a good choice for "preindustrial" base period; alternative choices would differ by only about ±0.1°C, and 1880-1920 has the advantage of being the earliest time with reasonably global coverage and reasonably well-documented measurement technology.

Present 12-month running-mean global temperature jumps about as far above the linear trend line (Fig. 2b in the paper) as it did during the 1997-98 El Nino. The linear trend line is now at +1.06°C, which is perhaps the best temperature to compare to paleoclimate temperatures, because the latter are "centennially-smoothed," i.e., the proxy measures of ancient temperature typically have a resolution not better than 100 years. The present linear trend (or 11-year mean) temperature is appropriate for comparison to centennially smoothed paleo temperature, because we have knowledge that decadal temperature will not be declining in the next several decades.

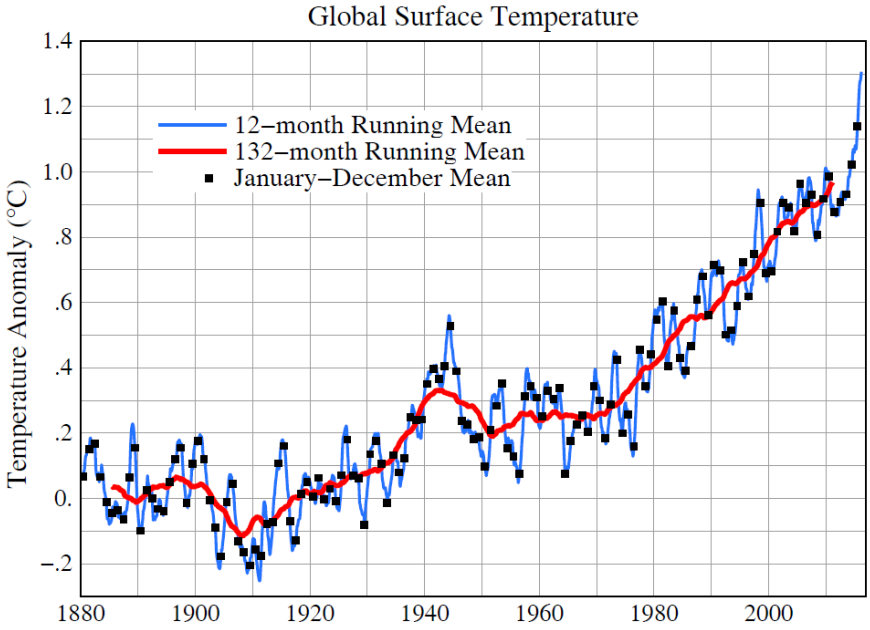

Fig. 1. Global surface temperature relative to 1880-1920 based on GISTEMP analysis (mostly NOAA data, cf. Hansen, J, R Ruedy, M Sato, and K Lo, 2010: Global surface temperature change. *Rev. Geophys.*, **48**, RG4004.

[1] J. Hansen, M. Sato, P. Kharecha, K. von Schuckmann, D.J. Beerling, J. Cao, S. Marcott, V. Masson-Delmotte, M.J. Prather, E.J. Rohling, J. Shakun and P. Smith

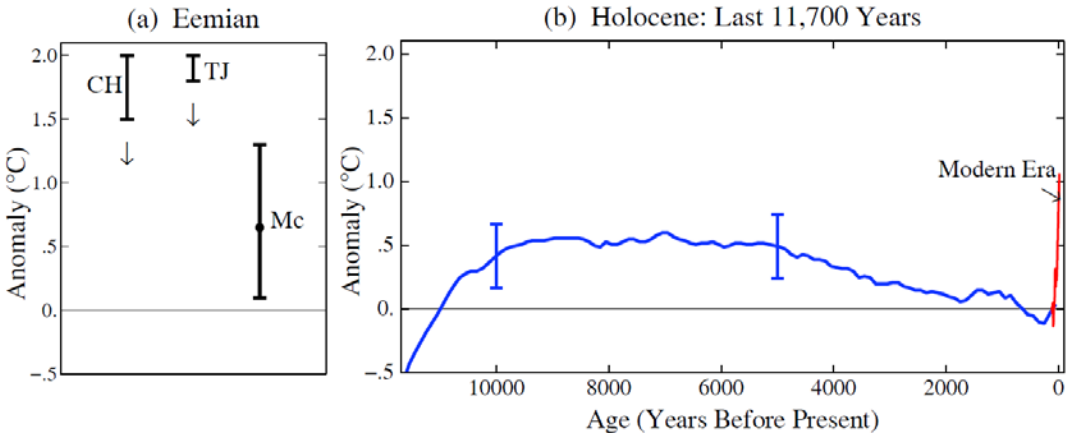

Fig. 2. Estimated average global temperature for the last interglacial (Eemian) period (McKay et al 2011; Clark and Huybers 2009; Turney and Jones 2010), the centennially-smoothed Holocene (Marcott et al 2013) temperature as a function of time, and the 11-year mean of modern data (Fig. 2). Vertical downward arrows indicate likely overestimates (see text in "Young People's Burden" paper).

2) The growth of the three principal human-caused greenhouse gases (GHGs: CO_2, CH_4, N_2O) are all accelerating. Contrary to the impression favored by governments, the corner has not been turned toward declining emissions and GHG amounts. The world is not effectively addressing the climate matter, nor does it have any plans to do so, regardless of how much government bureaucrats clap each other on the back.

On the other hand, accelerating GHG growth rates do not imply that the problem is unsolvable or that amplifying climate feedbacks are now the main source of the acceleration. Despite much (valid) concern about amplifying climate-methane feedbacks and leaks from "fracking" activity, the isotopic data suggest that the increase of CH_4 emissions is more a result of agricultural emissions. Not to say that it will be easy, but it is still possible to get future CH_4 amount to decline moderately, as we phase off fossil fuels as the principal energy source.

Principal Implications

A. Global temperature is already at the level of the Eemian period (130,000 to 115,000 years ago), when sea level was 6-9 meters (20-30 feet) higher than today (Fig. 2). Considering the additional warming "in the pipeline," due to delayed response of the climate system and the impossibility of instant replacement of fossil fuels, additional temperature rise is inevitable.

Earth's history shows that the lag of sea level change behind global temperature change is 1-4 centuries for natural climate change (Grant et al 2012, 2014)[2]. It is unlikely that response would be slower to a stronger, more rapid human-made climate forcing; indeed, Hansen et al (2016) infer that continued high fossil fuel emissions could lead to multi-meter sea level rise in 50-150 years. The desire to avoid large ice sheet shrinkage and sea level rise implies a need to get global temperature back into or close to the Holocene range on the time scale of a century or less.

B. "Negative CO_2 emissions," i.e., extraction of CO_2 from the air is now required, if climate is to be stabilized on the century time scale, as a result of past failure to reduce emissions. If rapid phasedown of fossil fuel emissions begins soon, most of the necessary CO_2 extraction can

take place via improved agricultural and forestry practices, including reforestation and steps to improve soil fertility and increase its carbon content. In this case, the magnitude and duration of global temperature excursion above the natural range of the current interglacial (Holocene) could be limited and irreversible climate impacts could be minimized.

C. Continued high fossil fuel emissions place a burden on young people to undertake massive technological CO_2 extraction. Quietly, with minimal objection from the scientific community (Anderson, 2015, is a courageous exception), the assumption that young people will somehow figure out a way to undo the deeds of their forebears, has crept into and spread like a cancer through UN climate scenarios. Proposed methods of extraction such as bioenergy with carbon capture and storage (BECCS) or air capture of CO_2 imply minimal estimated costs of 104-570 trillion dollars this century, with large risks and uncertain feasibility. Continued high fossil fuel emissions unarguably sentences young people to either a massive, possibly implausible cleanup or growing deleterious climate impacts or both, scenarios that should provide incentive and obligation for governments to alter energy policies without further delay.

Personal Opinions About the Relevance of this Paper

A. The Paris Climate Accord is a precatory agreement, wishful thinking that mainly reaffirms, 23 years later, the 1992 Rio Framework Convention on Climate Change. The developing world need for abundant, affordable, reliable energy is largely ignored, even though it is a basic requirement to eliminate global poverty and war. Instead the developed world pretends to offer reparations, a vaporous $100B/year, while allowing climate impacts to grow.

B. President Obama seems not to understand that as long as fossil fuels are allowed (to appear to the user) to be the cheapest reliable energy, they will continue to be the world's largest energy source and the likelihood of disastrous consequences for young people will grow to near certainty. Obama proudly states that his EPA regulations can actually produce a greater emissions reduction than would his initial nearly-worthless proposal of a cap-and-trade "scheme". Obama salves his conscience by noting his agreement to share information with China on carbon-capture-and-storage, which neither nation will ever employ at the scale needed to deal with the climate problem, and his plans to be a climate ambassador in his old age.

C. Technically, it is still possible to solve the climate problem, but there are two essential requirements: (1) a simple across-the-board (all fossil fuels) rising carbon fee[2] collected from fossil fuel companies at the domestic source (mine or port of entry), not a carbon price "scheme," and the money must go to the public, not to government coffers, otherwise the public will not allow the fee to rise as needed for phase-over to clean energy, (2) honest government support for, rather than strangulation of, RD&D (research, development and demonstration) of clean energy technologies, including advanced generation, safe nuclear power.

D. Courts are crucial to solution of the climate problem. The climate "problem" was and is an opportunity for transformation to a clean energy future, but for the worldwide lack of

[2] Do not be misled by politicians' use of the phrase "price on carbon" or "carbon price." This is almost always a code phrase indicating they have worked out a "scheme" with special interests, or plan to work out a "scheme."

executive leadership and well-paid subservience of legislatures to the fossil fuel industry. The heavy hand of the fossil fuel industry works mostly in legal ways such as the "I'm an Energy Voter" campaign in the U.S. Failure of executive and legislative branches to deal with climate change makes it essential for courts, less subject to pressure and bribery from special financial interests, to step in and protect young people, as they did minorities in the case of civil rights.

E. "Equal Rights" and "Trust" justifications are both needed. The first lawsuit filed by Our Children's Trust against the U.S. government (Alec L et al v. Jackson et al), with science based on our Plos One paper (Hansen et al, 2013)[2] lost in the United States DC District Court, on grounds that we had not made the Constitutional basis clear enough. Our new case in the U.S. District Court in Oregon (Juliana et al v. United States) puts comparable emphasis on the "Atmospheric Trust" concept developed by Mary Wood and "Equal Rights" concept in the "Equal Protection of the Laws" and "Due Process" clauses of the U.S. Constitution.

Julia Olson, founder and leader of Our Children's Trust, gave a brilliant, compelling presentation on 13 September. Principles for the trust concept, as discussed in John Davidson's declaration that I noted earlier extend back to Greek and Roman law articulated by Cicero, through intergenerational rights and justice articulated by English theorists such as John Locke, to a concern of American Founders for "unalienable rights" of future generations, expressed in their letters, the Virginia Bill of Rights, and in our Declaration of Independence and Constitution.

Sophie, my oldest grandchild and a fellow plaintiff in the federal lawsuit, and I are especially attracted by the simple concept of equal rights, with its preeminent position in the minds of our nation's founders, the Declaration of Independence beginning "… We hold these truths to be self-evident: That all men are created equal; that they are endowed by their Creator with certain unalienable rights; that among these are life, liberty, and the pursuit of happiness;" while the Constitution begins "We the People of the United States, in order to…secure the Blessings of Liberty to ourselves and our Posterity, do ordain and establish this Constitution…". The 5th and 14th Amendments together assure equal protection of the laws and due process, people should not be deprived of life, liberty or property without due process of law. While these are U.S. centric, the Universal Declaration of Human Rights, which is generally agreed to be the foundation of international human rights law, describes similar rights.

The trust and equal rights concepts are stronger together. In some countries one or the other may be more fitting, so it is worth developing both of them.

F. Assertions and insights at the hearing.

The transcript makes clear, I believe, that the defense is grasping at straws and will fail in their effort to get the case dismissed. As just noted, however, it is important to see on what basis the case is allowed to go forward. The presiding judge, the Honorable Ann Aiken, was prepared on all arguments from both sides and provided insights about some of their flaws.

The defense argued that young people do not have standing to sue, because the government has done nothing to make them a "suspect class" that can be discriminated against. Young people are created in the usual way, and the government need not do anything to make young people

and future generations different than the generation that is running the government and making decisions that can dramatically affect the former's life, liberty, property and pursuit of happiness. The older generation is now burning the fossil fuels, getting the benefits, and wittingly leaving a mess for young people to try to clean up. As Sophie says: "that's not fair." (see video)

The defense insists that the government could only be blamed for creating danger for young people if the government had taken "affirmative action" to create that danger, and, they say, the government took no affirmative action. Apparently, as Julia Olson points out, they do not want to count permits for extraction, drilling, exports and imports, transmission lines and pipelines, all to accommodate the fossil fuel energies, as part of the totality of national energy policies that the defendants are responsible for. And this is not to mention the military forces used to protect fossil fuel supply lines, most of which was never paid for, but was left as debt for young people to somehow pay for in the future, all for the benefit of the old and the problem of the young.

Judge Aiken noted the phrase "all deliberate speed," which played an important role in civil rights, a careful statement in the 1954 Brown v Board of Education decision. The Court could not meddle in the details of lawmaking and administration, but it could require that the other branches of government take actions that provide for civil rights with all deliberate speed, a phrase that was associated with the much-respected Oliver Wendell Holmes. However, after 10 years Justice Hugo Black declared in 1964 that "the time for mere 'deliberate speed' has run out," because the phrase was being used to delay compliance with the Court order.

"All deliberate speed" will be a dominant issue for climate. Our governments have not accepted the reality dictated by the laws of physics and climate science: we must phase out fossil fuel emissions rapidly. Mother Nature will not wait for bumbling half-baked government schemes for reducing emissions. It will be essential that the Court not only demand all deliberate speed, but continually examine the reality of what the government is accomplishing, and that the government have both short-term and long-term plans of action.

G. Funding for worldwide carbon sequestration and trace gas reductions.

Young People's Burden makes clear that rapid reduction of fossil fuel emissions is the most important requirement to assure prospects of young people, but it is not enough. It is also necessary to have a large drawdown of atmospheric CO_2 via improved agricultural and forestry practices, and to have multiple actions that limit the growth of or even achieve a reduction of other trace gases. These actions will need to occur nearly worldwide, especially in developing countries, and, even though there are some local benefits of many of these actions, substantial resources will be needed to see their realization.

Here is where legal action is almost surely required. Just as the tobacco industry was required to pay compensation to the public for health damage of smoking, so the fossil fuel industry should be required to pay, in view of the great largesse it has received from the public and the damage it is inflicting on young people and worldwide. Administration of these funds should be such as to continually evaluate and reward those countries that are most successful in taking the needed actions that store carbon and reduce trace gas abundances, thus avoiding graft and funds misuse.