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September Temperature Update & COP 26

14 October 2021

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The UN Conference of the Parties (COP26) for the Framework Convention on Climate Change will be in Glasgow 1-12 November. There is a chance that Boris Johnson, UK Prime Minister and meeting host, might make this COP more effective than prior COPs, as discussed below.

Prior COPs have been characterized by self-delusion so blatant that one of us (JEH) describes the backslapping congratulations at the end of the COPs as a fraud. We cannot blame it all on the political leaders, however. We scientists deserve a large part of the blame.

Scientists were slow to realize how low the targets must be for greenhouse gas (GHG) levels and for global warming to achieve a stable, healthy climate for young people and future generations. We also should have made clearer the effects of lags (delayed responses) in the climate system, as well as the time required to replace energy systems that are the largest source of GHGs.

Political leaders were slow to even set a meaningful goal. At last, with the Paris Agreement at COP21 in 2015, they set a goal to limit global warming to 1.5°C. Global warming had already reached about 1°C, so 1.5°C was believed to be the lowest feasible warming limit. However, the leaders did nothing to realize the two essential actions that the target implied (see below). Instead, they went home and took actions and allowed policies that made the goal unachievable.

In fairness to politicians, their actions are constrained by realpolitik and realpolitic (pronounced teak and tick, respectively; pronounce real as you please). Realpolitik refers to practical factors that limit the speed of change even with informed, committed, leaders. Realpolitic refers to additional politics – usually spurred by special interests – that further limits the rate of change.

Young people have the most at stake with climate change. As discussed in a [communication last week](#),¹ they provide reason for optimism. Potential leaders among young people are capable of seeing the forest for the trees and they have a desire to follow the data.

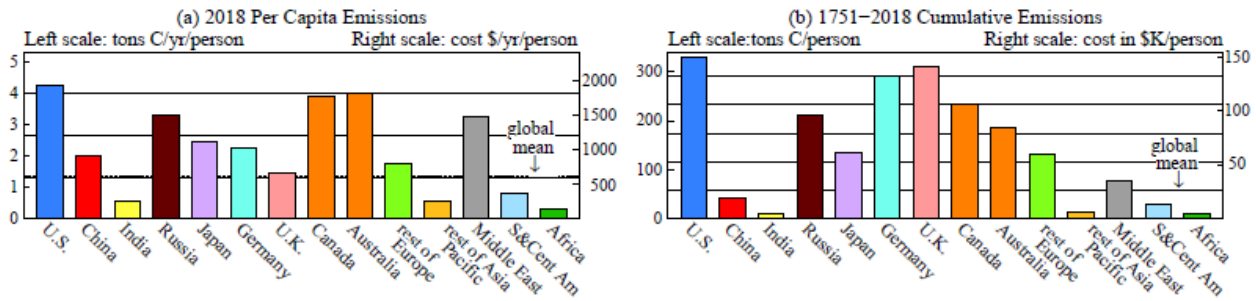


Fig. 2. Left: fossil fuel emissions in 2018. Right: cumulative 1751-2018 emissions.

The left pie chart in Fig. 1 shows the sources in 2018 of the main driver of global climate change – CO₂ from fossil fuels. (The charts with data through 2020 will be available on [one of our websites](#) within the next two weeks.) China is now the largest emitter of fossil fuel CO₂, with more than double the emissions of the United States (in 2020 their portions of global emissions were 29% and 13%). However, climate change is proportional to cumulative emissions^{2,3} -- the pie chart on the right. The United States is still most responsible for global warming.

Emissions per capita (Fig. 2) are also relevant. U.S., Canadian and Australian citizens are the highest per capita emitters today among the major emitting nations (Fig. 2a). United States, United Kingdom and German citizens are most responsible for climate change (cumulative per capita emissions, Fig. 2b, based on 2018 populations).

The most extraordinary fact revealed in Fig. 2 is probably current emissions by the U.K. The industrial revolution began in the U.K. and for a long period the U.K. had the highest emissions per capita. Yet U.K. per capita emissions today are about one-third of those in the United States, and U.K. emissions are declining rapidly.⁴

However, global GHG emissions remain high and are even increasing (Fig. 3). The covid pandemic has temporarily reduced emissions, but partial data for 2021 reveal a resumption of emission growth. The data for the real world make a mockery of emission scenarios that are designed to meet COP goals to limit global warming. An IPCC (Intergovernmental Panel on Climate Change) climate forcing scenario defined several years ago to hold global warming to about 1.5°C now has a yawning, growing, gap with reality (Fig. 4).

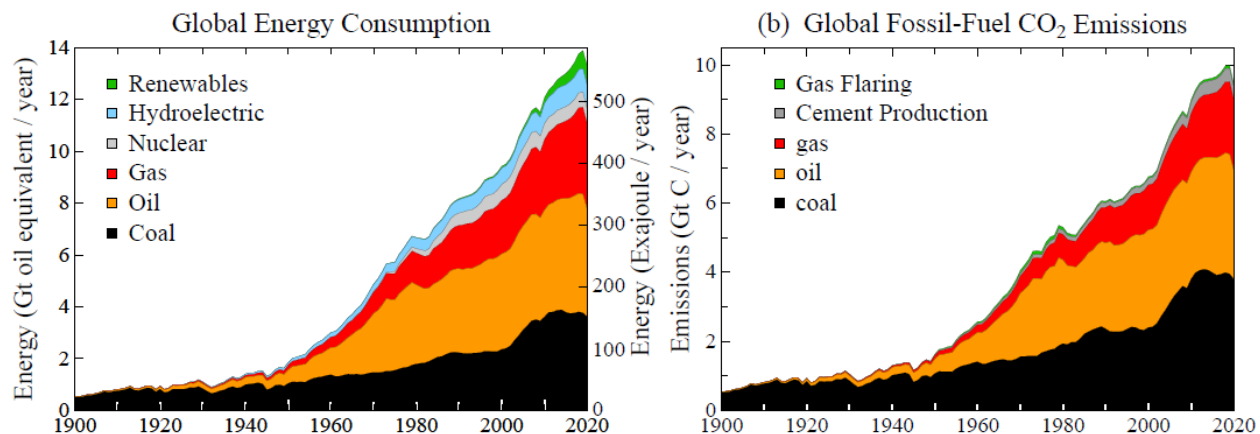


Fig. 3. Global energy consumption and fossil fuel emissions. BP data⁵ are used from 1965. Giffellan et al. data⁶ of earlier date are adjusted by factors near unity to match BP in 1965.

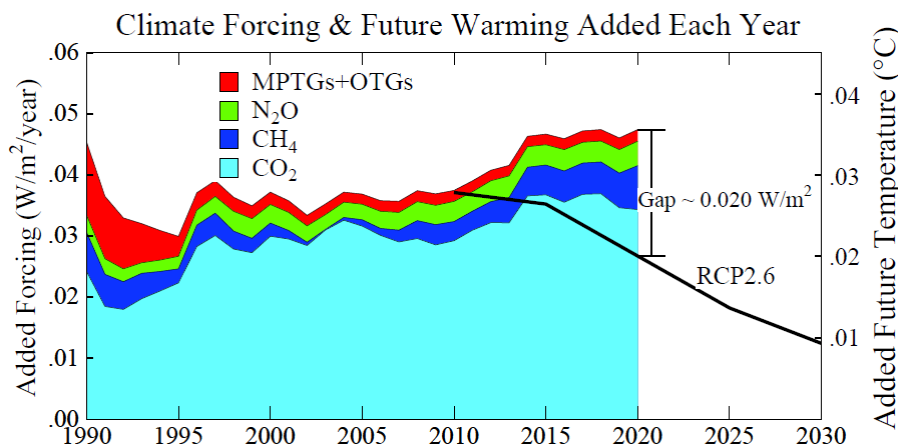


Fig. 4. Annual growth of GHG climate forcing (red is trace gases, mainly CFCs). Graph shows 5-year means, except 2019 is the 3-year mean and 2020 is 1-year mean.

How could global political leaders be allowed to live in Fantasyland? Did scientists not understand fundamental requirements for phasing down GHG emissions? It's not rocket science. Several disciplines are involved – Earth science, energy science, economics – but surely these areas are well represented on the Intergovernmental Panel on Climate Change.

Here I (JEH) summarize what I learned when I was dragged into the matter during the 4-year period between the 2004 and 2008 Presidential elections in the United States. I had avoided media and controversy for more than a decade, until 2004, when I spoke out publicly about the need to phase out fossil fuel emissions. Specifically, I said that I was voting for John Kerry over the incumbent, George W. Bush, because of Kerry's intent to address climate change.

My public talk was not appreciated by the White House, which provoked NASA to impose prior restraint on my presentations and interviews.⁷ When this unconstitutional action was exposed in the media, it led to interactions with students at universities, with environmental groups, and with business and utility executives. It was an intense 4-year education culminating in an energy workshop on the eve of the 2008 Presidential election, as described mainly in draft chapters 42 ([Old King Coal Lives](#))⁸ and 43 ([Energy for the World](#))⁹ for *Sophie's Planet*. It would take time to write and publish a paper on workshop conclusions, so, after Barack Obama was elected but before he took office, my wife Anniek and I wrote a letter to the Obamas describing the principal conclusions (see draft chapter 44 [Tell the President the Whole Truth](#)¹⁰ for *Sophie's Planet*).

Remarkable opportunities to learn continued after 2008. I was invited to give a talk on climate change at the *Symposium on a New Type of Major Power Relationship* in Beijing in February 2014, as described in draft chapter 47 ([China and the Global Solution](#)). My presentation in Beijing was blunt; the [charts](#)¹¹ are available. East-West cooperation will be essential to solve the climate problem; we will all suffer or enjoy the same planetary fate.

Future global fossil fuel emissions depend especially on developments in the East. With that in mind, Junji Cao and I organized a workshop and published a [paper](#)¹² discussing the potential for modern nuclear power to replace fossil fuels for electricity generation. China-U.S. cooperation has become more challenging since our workshop, but for the sake of young people our nations must work together. As scientists, we can facilitate cooperation by continuing to work with our friends, colleagues and former students in China.

Two actions are essential if we are to phase down GHG emissions rapidly. The first, as described many places, most recently at [Can Young People Save Democracy and the Planet?](#),¹ is the need for a rising carbon fee as a foundation that will make all other carbon-reduction policies work faster and more effectively. The funds (collected from fossil fuel companies) must be distributed uniformly to legal residents – otherwise the public will never allow the fee to rise to the levels needed to rapidly phase down carbon emissions.

The second essential action is whole-hearted support for development and deployment of modern nuclear power. Otherwise, gas will be the required complement to intermittent renewable energy for electricity generation. Gas implies pipelines, fracking, air and water pollution, and emission of CH₄ and CO₂ that would assure climate disaster. Modern nuclear power, in contrast, has the smallest environmental footprint of the potential energies because of its high energy density and the small volume of its waste, which is well-contained, unlike wastes of other energy sources.

Nuclear power is already the safest of all major energy sources,¹³ based on deaths per kilowatt hour, but modern nuclear power is now far superior, with the ability to shut down in case of an anomaly and not require external power to keep the nuclear fuel cool. Nuclear power has also been the fastest way to deploy power to scale,¹² which will be important for phasing out CO₂ emissions in places such as China.

The principal argument against nuclear power is cost, but, based on the amount of material (concrete, steel, etc.) required for a power plant, nuclear power has the potential to be the least expensive. In traveling with environmentalists, I learned that many of them believed it was good to make nuclear power expensive by taking action to slow power plant construction and install anti-nuclear people in the Nuclear Regulatory Commission. They reminded me of the boy who murdered his parents and then cried out to the judge: “have mercy, I am an orphan!”

Realpolitik and realpolitic. No time remains today to discuss them (but you can see numerous examples today). I must get in the car and drive to Washington, where my attorney Dan Galpern and I will be on a panel discussion¹⁴ on Climate Change and Executive Power at Georgetown University at 6 PM and deliver a letter to the EPA Administrator tomorrow, encouraging him to use his existing authority to collect a rising carbon fee. The Supreme Court, in *Massachusetts vs EPA*, ruled that CO₂ is a pollutant; EPA has the authority to collect a rising pollution fee.

Machinations in Washington today are fluid, so I won't prejudge the outcome, but some of the inklings are discouraging. Same old Democratic tricks to kill nuclear power. Wind and solar subsidies of \$25/MW-hr for 10 years; \$3/MW-hr for nuclear for 5 years. If that's what they are up to, they should scrap all subsidies and put a rising price on carbon. Maybe we could balance the budget and stop borrowing money from our grandchildren.

It also seems that they have removed funding for the Versatile Test Reactor (VTR), which is the basic building block for R&D on advanced nuclear reactors that can produce more energy with less waste, testing new fuels and materials needed to build the best reactors – that is, if the U.S. wanted to remain a leader in the technology.

With one party that calls climate change a hoax and another that doesn't understand what is needed to deal with it, it may be that the only fix is a third party. We probably need a third party

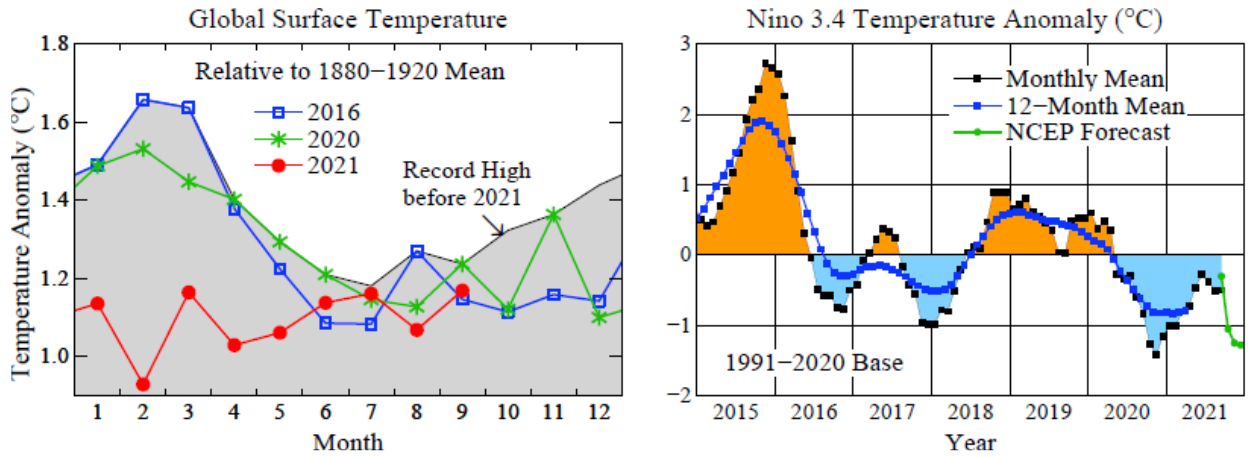


Fig. 5. Left: monthly global temperature anomalies. Right: Nino 3.4 temperature anomaly for past six years and 9 months, and NCEP forecast (green line).

anyhow, one that accepts no money from special interests, for the sake of saving democracy. It will be up to young people to evaluate the situation and choose a course.

But let's wait a little longer before passing judgment.

Regarding Boris Johnson: it's possible he will put the UK on a path to 100% clean electricity (renewables + nuclear, no gas or coal), in which case the UK, which led us into the fossil fuel era, could lead us out. That path requires a good design for a modular nuclear reactor that can be produced in volume. Ready soon? Renewables were given a few decades of heavy subsidies via renewable portfolio standards, which should have been clean energy portfolio standards. Despite the lack of support, modern nuclear has progressed. We will see how long it takes.

September 2021 is the second warmest September in the period of instrumental data (Fig. 5), despite the cooling effect of the recent and newly emerging La Nina. The 12-month running mean of global temperature (Fig. 6) is probably at or near its minimum, but it will not rise substantially until we move past the current La Nina.

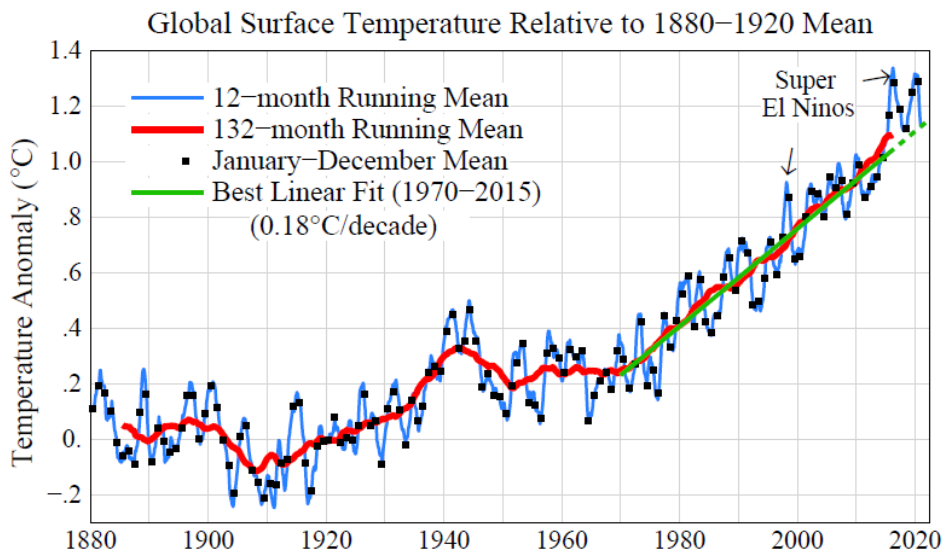


Fig. 6. Global surface temperature relative to 1880-1920 average.

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- ¹ Hansen, J., Can Young People Save Democracy and the Planet?, www.columbia.edu/~jeh1, 8 October 2021.
- ² Hansen, J., M. Sato, R. Ruedy, P. Kharecha, A. Lacis, R.L. Miller, L. Nazarenko, G.A. Schmidt, G. Russell, et al.: [Dangerous human-made interference with climate: A GISS modelE study](#). *Atmos. Chem. Phys.*, **7**, 2287-2312, 2007.
- ³ Matthews. H.D., N.P. Gillett, P.A. Stott and K. Zickfeld: [The proportionality of global warming to cumulative carbon emissions](#), *Nature* 459 829–32, 2009.
- ⁴ Hansen, J., [Letter to Prime Minister Boris Johnson](#), 4 February 2021.
- ⁵ BP (2021). Statistical Review of World Energy 2021, <http://www.bp.com/statisticalreview>.
- ⁶ Gilfillan D; Marland G; Boden T; Andres R (2020): Global, Regional, and National Fossil-Fuel CO2 Emissions: 1751-2017 CDIAC-FF, Research Institute for Environment, Energy, and Economics, Appalachian State University. DOI: 10.15485/1712447
- ⁷ Bowen, Mark, *Censoring Science: Inside the Political Attack on Dr. James Hansen and the Truth of Global Warming*. New York: Dutton, 2008.
- ⁸ Hansen, J.E., draft [Chapter 42: Old King Coal Lives](#) for *Sophie's Planet*, archived at www.columbia.edu/~jeh1.
- ⁹ Hansen, J.E., draft [Chapter 43: Energy for the World](#) for *Sophie's Planet*, archived at www.columbia.edu/~jeh1.
- ¹⁰ Hansen, J.E., draft [Chapter 44: Tell the President the Whole Truth](#) for *Sophie's Planet*, archived at www.columbia.edu/~jeh1.
- ¹¹ Hansen, J., [Symposium on a New Type of Major Power Relationship](#), Beijing, 24 February 2014.
- ¹² Cao, J, A. Cohen, J. Hansen, R. Lester, P. Peterson and H. Xu: [China-U.S. cooperation to advance nuclear power](#). *Science*, **353**, 547-548, 2016.
- ¹³ Markandya, A. and P. Wilkinson, [Electricity generation and health](#), *The Lancet*, **370**, 979-990, 2007.
- ¹⁴ Here's the event, in case you want to attend, in person or via video: <https://www.law.georgetown.edu/event/can-the-executive-branch-take-meaningful-action-to-arrest-the-climate-crisis-even-if-congress-fails-to-act/>