

**Fig. 1. Left: monthly global temperature anomalies. Right: Nino 3.4 temperature anomaly for past six years and 8 months, and NCEP forecast (green line).**

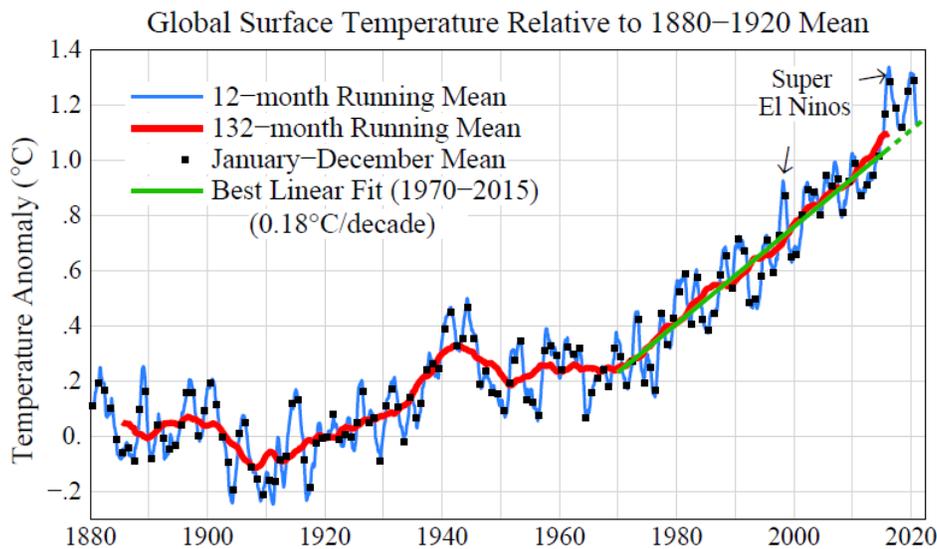
## August Temperature Update & Gas Bag Season Approaches

14 September 2021

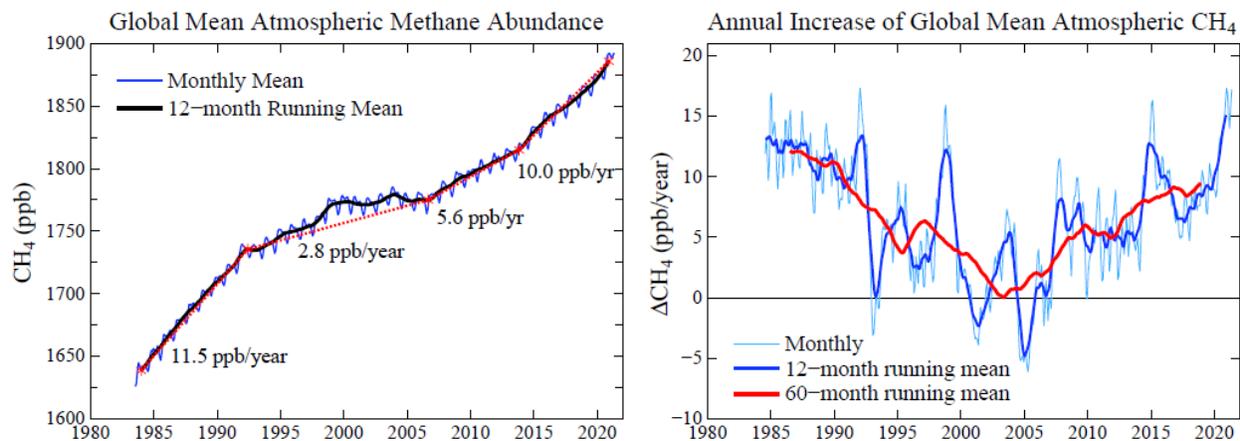
James Hansen and Makiko Sato

First the good news: NOAA’s newest prediction for the tropics has a deeper La Nina (Fig. 1, Right), which should keep global temperature near the 1970-2015 trend line (Fig. 2) for at least several months. That’s not entirely good news – the trend line is not a target to aim for, and a continuing La Nina keeps the tropics ripe for tropical storms. At the next El Nino, global temperature will be far above the trend line and may approach +1.5°C relative to 1880-1920.

The bad news: we approach the gas bag season – the next Conference of the Parties (COP26) is scheduled for November 1-12. Gas bag politicians won’t show you the data that matter because that would reveal their miserable performances. Instead, they set climate goals for their children while adopting no polices that would give such goals a chance. Some of them may have been honestly duped about the science and engineering, but many must be blatant hypocrites.



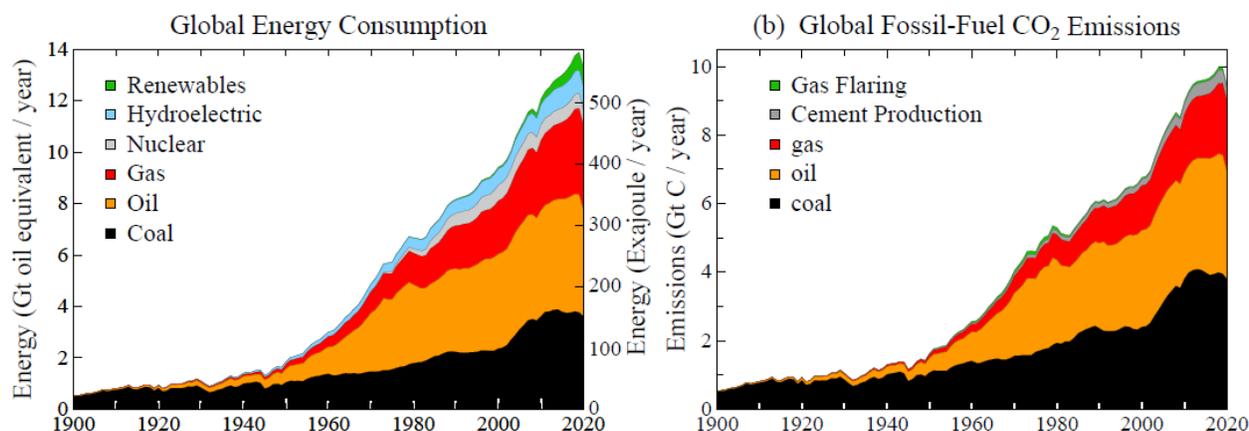
**Fig. 2. Global surface temperature relative to 1880-1920 average.**



**Fig. 3. Left: global CH<sub>4</sub> from Ed Dlugokencky, [NOAA/GML](#). End months for four slopes are January 1984, May 1992, August 2006, October 2013 and May 2021. Right: annual CH<sub>4</sub> increase.**

Data that matter are those for the real world. Methane (CH<sub>4</sub>) amount in the air (Fig. 3) is growing again, thanks to our politicians. At COP6 in Bonn in 2001, Germany used its host country status to lock out nuclear power as a clean development mechanism, thus locking in dependence on gas and assuring accelerated growth of atmospheric CH<sub>4</sub> and CO<sub>2</sub>. Stabilization of climate requires abundant carbon-free electricity. Instead, use of gas as the complement to intermittent renewables is almost as bad as coal because of the effect on both CH<sub>4</sub> and CO<sub>2</sub> amounts.

Actions by Germany favoring fossil fuels pale compared with political machinations in the U.S. President Bill Clinton, in his first State-of-the-Union address following his election in 1992, announced termination of research and development for advanced nuclear power. Clinton assumed, in accord with advice he received, that renewable energies could supplant fossil fuels, nuclear power and large hydro by 2025.<sup>1</sup> Almost unlimited, uncalculated, subsidies were provided to renewable energies, in part via requirement that utilities obtain a growing percentage of power from renewables – renewable portfolio standards, instead of clean energy portfolio standards. Three decades of heavy R&D subsidies drove down the price of renewables, but that is all. Thus, three decades after Clinton’s election, about 80 percent of energy in the United States and in the world (Fig. 4) continues to be provided by fossil fuels.<sup>2</sup>



**Fig. 4. Global energy consumption and fossil fuel emissions. BP data<sup>3</sup> are used from 1965. Gilfillan et al. data<sup>4</sup> for earlier years are adjusted by factors near unity to match BP in 1965.**

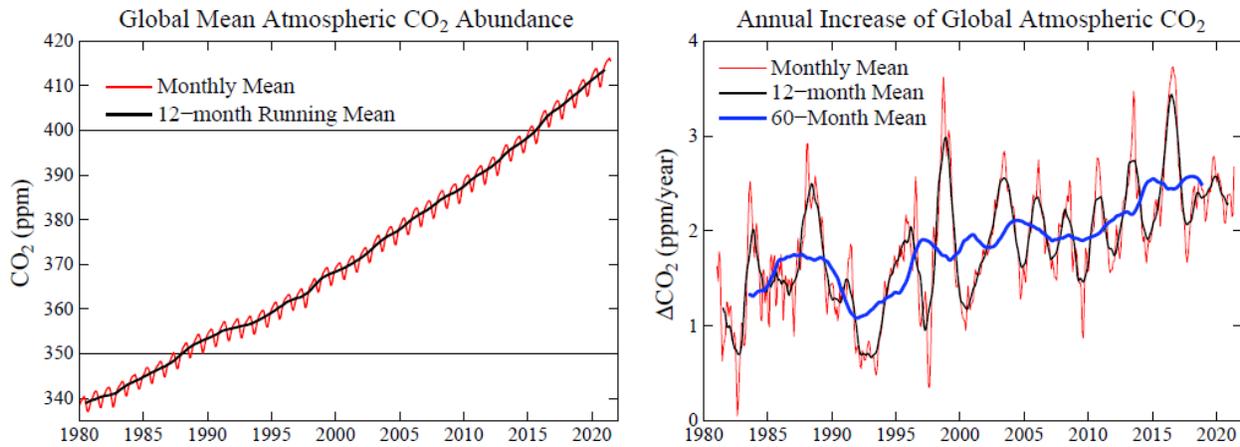


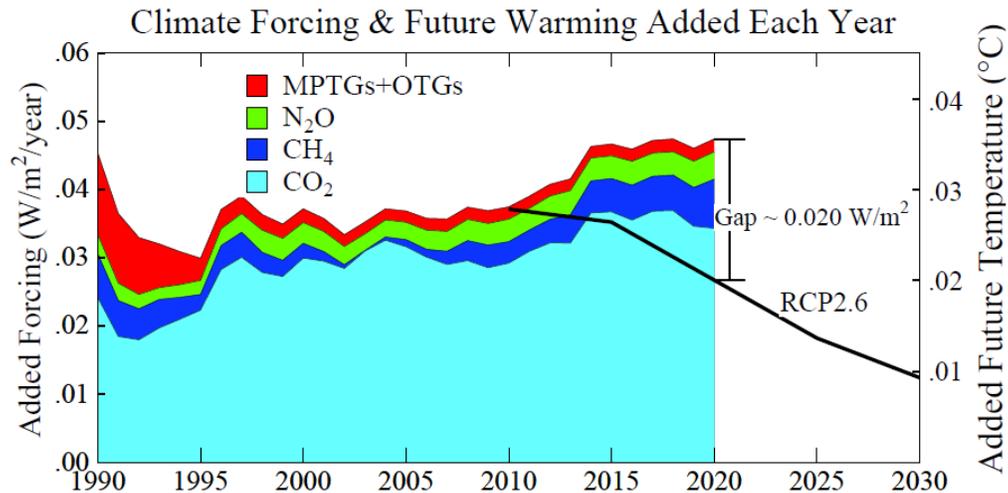
Fig. 5. Left: global CO<sub>2</sub> from [NOAA data](#). Right: annual CO<sub>2</sub> increase

Political leaders and the public need to be better informed about the potential of all alternative energies.<sup>5</sup> Raising living standards while phasing down fossil fuels requires a large amount of dispatchable electric power available 24/7. Historically the fastest growth of carbon-free electricity has been from installation of nuclear power,<sup>6</sup> but fast growth occurred only after acceptable reactor designs were fixed. Based on the materials required to construct modern nuclear power plants and the fuel cost, nuclear energy can be competitive in price with fossil fuels via mass manufacturing of modular reactors that are licensed as a product, but the potential for rapid deployment of modern nuclear will be achieved only if governments support the industry, as they supported renewable energies. There are reasons for optimism.<sup>7</sup>

Opposition to nuclear power appears to suffer from misconception that extermination of nuclear energy in the West would make the world a safer place. A more likely result would be to make Russia – which does not have an outstanding record in nuclear safety – the prime global supplier of nuclear power; Russia already has agreements to supply nuclear power stations to 27 nations.<sup>8</sup> The U.S. has been a leader in assuring international safeguards that discourage weapons proliferation, but it can continue in that role only if it is a leader in nuclear technology. Many, if not all, of the nations signed up to work with Russia likely would revert to using the U.S. as nuclear supplier, if the U.S. reassumed a responsible leadership role.

The United States has also been a leader in assuring safe operation of nuclear power plants; indeed, in the U.S., nuclear power has the lowest fatalities per unit energy of all major energy sources, even lower than solar power.<sup>9</sup> And emerging modern power plants have major safety advantages over the older technologies, including the ability to shut down in the case of an anomaly such as an earthquake and to keep the nuclear fuel cool without external power.

**Back to the COPs and the gas bags.** At the 2015 COP in Paris the politicians clapped each other on the back and agreed to lower the global warming target from 2°C to 1.5°C. This goal was entirely inconsistent with their policy actions. The organizers rejected at the outset the idea of a carbon fee or carbon tax, despite the certainty that fossil fuel emissions will remain high as long as the atmosphere is a free dumping ground for pollutants. A steadily rising carbon fee is the sine qua non for phasing down global fossil fuel emissions.



**Fig. 6. 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.**

Fortunately, a growing number of young people across the political spectrum<sup>10</sup> want to follow the science and adopt a rising carbon fee with 100 percent of the funds distributed uniformly to legal residents. They understand that 100 percent distribution of the collected fee to the public is needed to obtain broad public buy-in. Public buy-in is required, if the fee is to rise to the level needed to phase down fossil fuel use.<sup>11</sup>

Threats to this science-based foundation for effective climate policy come from special interests on both sides. On the one hand, there is the fossil fuel industry, which smells danger to its business model. On the other extreme are people who would grab the money for their favorite social programs,<sup>12</sup> which would kill the goose that could lay golden eggs. Carbon fee with 100 percent distribution to the public spurs innovation, the economy and government revenues.

However, a carbon fee is only an underlying requirement that is needed to make fossil fuel phaseout go rapidly. Countries such as China and India need an enormous amount of energy to raise living standards of large populations. More and more of that energy needs to be carbon-free electricity. The West knew that and China and India made known that they wanted modern, safe nuclear power as a major part of that energy, which would also help clean up air pollution. The West not only declined to help – it put up roadblocks.

The predictable result is immediate revelation that the real-world greenhouse gas growth is now entirely inconsistent with scenario (RCP2.6) designed to limit warming to 1.5°C (Fig.6). Well, technologies are being developed to extract CO<sub>2</sub> from the air, right? The estimated annual cost to remove the excess CO<sub>2</sub> emissions of a single year (to close the gap in Fig. 6) is now \$2-4 trillion – that’s a per year cost, and it’s growing.<sup>13</sup> That’s young people’s burden.<sup>14</sup>

<sup>1</sup> See Fig. 2 and discussion thereof in Chapter 2 of [Storms of My Grandchildren](#), Bloomsbury, 320 pp., 2009. An updated figure is [available](#).

<sup>2</sup> Hansen, J.E., draft [Chapter 43: Energy for the World](#) for *Sophie’s Planet*, archived at [www.columbia.edu/~jeh1](http://www.columbia.edu/~jeh1).

<sup>3</sup> BP (2021). Statistical Review of World Energy 2021, <http://www.bp.com/statisticalreview>.

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<sup>4</sup> 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

<sup>5</sup> Hansen, J.E., draft [Chapter 44: Tell the President the Whole Truth](#) for *Sophie's Planet*, archived at [www.columbia.edu/~jeh1](http://www.columbia.edu/~jeh1)

<sup>6</sup> 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.

<sup>7</sup> Hansen, J., [Why Are You Optimistic](#), 11 August 2020 communication, [www.columbia.edu/~jeh1](http://www.columbia.edu/~jeh1).

<sup>8</sup> World Nuclear Association, [Emerging Nuclear Energy Countries](#), accessed 3 September 2021.

<sup>9</sup> Markandya, A. and P. Wilkinson, [Electricity generation and health](#), *The Lancet*, **370**, 979-990, 2007.

<sup>10</sup> Hansen, J., [Student leadership on climate solutions](#), 31 July 2021

<sup>11</sup> Hansen, J., and J. Marshall, [A carbon tax is key to addressing the climate crisis – and carbon dividends could get Congress to support one](#), Op-ed in *Boston Globe*.

<sup>12</sup> There are urgent social needs in the U.S. that are required to assure equal rights and equal opportunity, as is crucial for a democracy to function well. These needs include universal pre-K education and affordable higher education, for example. These programs should be funded with government tax revenues, which will grow if a carbon fee with 100 percent dividend is adopted. However, if instead extremists favoring a green-new-cradle-to-grave-socialist-deal are allowed to grab all or part of the carbon (pollution) fee – rather than distributing the funds uniformly to all legal residents – that will assure only that we get neither a climate solution nor a fairer social democracy.

<sup>13</sup> Hansen, J., [Saving Earth](#), 27 June 2019 communication, [www.columbia.edu/~jeh1](http://www.columbia.edu/~jeh1).

<sup>14</sup> Hansen, J., 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, P. Smith, A. Lacis, G. Russell, and R. Ruedy: [Young people's burden: requirement of negative CO2 emissions](#). *Earth Syst. Dynam.*, **8**, 577-616, 2017.