

Dr. James E. Hansen, Director
Climate Science, Awareness and Solutions
Earth Institute, Columbia University
475 Riverside Drive, Suite 401-O
New York, NY 10115

To the General Public of the United Kingdom Including, Especially, British Young People (in care of Plan B Earth, 62 Sutherland Square, London SE17 3EL, UK)

I write to you, citizens of Britain, after Plan B Earth's valiant effort in law was thoughtlessly turned back by your courts. Plan B asked merely – reasonably and moderately -- that your great nation update its carbon emissions reduction target to keep pace with the very moderate goals adopted in the 2015 Paris Agreement by the international community.

I write too in recognition that citizens throughout the U.K., led increasingly by the young – those who stand to lose most, now are rising to demand that national leaders develop and adhere to a viable path away from calamitous global warming, including all the disruption to civilization and nature that is, of necessity, at issue.

For over four decades I have sought, in several ways, to call attention to the enveloping crisis, and to suggest straightforward solutions. Those ways range from scientific research to public writing and speaking, from testimony before Congress and in front of numerous courts of law, and to public protest including, at times, highly respectful acts of non-violent civil disobedience – on occasion leading even to my arrest.

It is not for me to determine what is the best course of action for any one of you. I point out here only that every major personal choice of necessity must, or at least should, be preceded by a personal assessment of available resources, opportunities, tradeoffs, and risk. In particular I urge every young person to consider the full range of likely consequences

before undertaking any major act of civil protest. And if you elect to proceed, I urge you to carry yourself always with dignity – that by your example you should serve as a light in this dark time.

That said, I wish also to counsel every parent, and every grandparent. I urge you in particular to take a stand, so as to not let the full burden of responsibility befall our children. Arm yourself with information of the highest quality, think for yourself, and then exercise your full intellectual and moral capacity to help your nation and our planet survive.

I have no doubt that the era of fossil fuels is drawing to a close. But questions remain as to the speed of the common transition and, in direct consequence of that speed, the nature of what will be left in its wake. I cannot answer, in particular, whether our civilization will survive in any recognizable form the assault on nature and the human dislocation attending loss of our planet's great coastal cities that we confront with unarrested climate change. Towards that end, then, I offer the following specific points, indicating source material that is readily available for readers wishing to pursue a deeper understanding:

1. The international scientific consensus acknowledges that global climate change from persistent high fossil fuel emissions is now well into the danger zone.¹ Direct corollaries of that observation, in my view, include most importantly that CO₂ emissions from all major sources must be reduced with all deliberate speed, and

¹ See, e.g., IPCC (Intergovernmental Panel on Climate Change), 2014: *Synthesis Report, Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. See also IPCC, 2018: Summary for Policymakers. In: *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* [Masson-Delmotte, V., P. Zhai, et al. (eds.)]. World Meteorological Organization, Geneva, Switzerland, at <https://www.ipcc.ch/sr15/chapter/summary-for-policy-makers/>.
https://www.ipcc.ch/site/assets/uploads/2018/02/AR5_SYR_FINAL_SPM.pdf.

also that excess atmospheric CO₂ must be drawn-down to the extent feasible so as restore a relatively stable climate system.²

2. Our collective failure to timely secure those corollaries may soon press the climate system past tipping points from which there may be no reasonable prospect of return. Absent strong, binding, transparent, sustainable and replicable incentives and rules that ensure such phasedown and drawdown, every expansion of infrastructure geared to the production or utilization of additional fossil fuel renders our present climate crisis even less tractable. Major new fossil fuel commitments function also to transform our inadequate-to-date GHG reduction aspirations -- including those that obtain now in the UK -- into a mere mirage.
3. I incorporate by reference into this statement three peer-reviewed studies of which I am the principal co-author. They are *Assessing “Dangerous Climate Change”: Required Reduction of Carbon Emissions to Protect Young People, Future Generations and Nature*. PLOS ONE (2013); *Ice melt, sea level rise and superstorms: evidence from paleoclimate data, climate modeling, and modern observations that 2°C global warming could be dangerous*, Atmos. Chem. Phys. (2016); and Exhibit 4, *Young people’s burden: requirement of negative CO₂ emissions*, Earth Syst. Dynam. (2017). These studies – all freely available on the internet³ – support and elaborate on my opinions here.

² The harsh reality, however, is that there are significant physical and practical limits to the employment and financing of so-called negative emissions options (including, afforestation, agricultural and soil improvements, and technological air capture of CO₂, so that while drawdown of atmospheric CO₂ may play a useful role, it most assuredly cannot fully compensate for continued inadequate GHG emissions mitigation. See, e.g., Nature, *Why current negative-emissions strategies remain ‘magical thinking’* (February 2018) at <https://www.nature.com/articles/d41586-018-02184-x>.

³ See “Dangerous Climate Change” at <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3849278>;

4. Atmospheric CO₂ has now reached 409 ppm,⁴ over 40 percent more than pre-industrial levels, and the resulting planetary energy imbalance has raised the global surface temperature > 1°C above the preindustrial period. Additional warming is certain in the short-term, even if fossil fuel emissions decline, but the period of continued warming will depend on additional fossil fuel exploitation.
5. Fossil fuel emissions are responsible for most of the increase in atmospheric CO₂, and increasing CO₂, in turn, is the main cause of Earth's energy imbalance and planetary warming. Accordingly, human decision-making and action are now in control of our planet's thermostat.
6. The U.K. government has long permitted, subsidized, allowed, and otherwise encouraged fossil fuel exploitation, processing, transport, and consumption – with little or no control on ensuing emissions of CO₂ and other GHG emissions.
7. My own government, major components of which are now in thrall to climate denialism and associated pseudo-scientific canards, is doubling down on that pattern and acting to increase fossil fuel exploitation and associated emissions.
8. But is also true that fossil fuel projects and associated emissions were at a grossly unsustainable level during previous U.S. Administrations – even those that recognized the reality of global warming. This means that recognizing the truth of the matter is but step one. In my view, it is critically important – in part to set a good example for the time when Washington D.C. will recognize reality -- that

“Ice melt, sea level rise and superstorms” at <https://www.atmos-chem-phys.net/16/3761/2016/acp-16-3761-2016.pdf> and *Young people's burden* at <https://www.earth-syst-dynam.net/8/577/2017/esd-8-577-2017.pdf>.

⁴ Based on Mauna Loa CO₂ annual mean data reported by the National Oceanic and Atmospheric Administration. See <https://www.esrl.noaa.gov/gmd/ccgg/trends/data.html>.

traditionally-allied nations do more than talk a good game. Your government should take action to rapidly move Britain off its present dependency on fossil fuels and towards increasing, then increasingly complete, utilization of non-carbon sources of energy.

9. In *Assessing "Dangerous Climate Change,"* my co-authors and I described the practical impacts of continued global warming. If ice sheets are allowed to become unstable, shorelines will be in perpetual retreat for centuries, a consequence of the slow response time of ocean temperature and ice sheet dynamics. Economic and social implications will be devastating. Because more than half of the largest cities in the world are located on coastlines and the population of coastal regions continues to grow rapidly, the number of refugees likely would eclipse anything experienced in history, with associated impacts on human health and the environment.
10. Rapid shifting of climate zones, already well underway, will be a major contributor to species extinction if global warming continues. Coral reefs, the "rainforests of the ocean," harboring millions of species, are threatened by the combination of a warming ocean, ocean acidification, rising sea level, and other human-caused stresses. The subtropics in summer, and the tropics in all seasons, will become dangerously hot. Species across the globe will face habitat loss and increased disease, starvation and drought. The patent risk to emblematic species increasingly is widely reported.⁵

⁵ See, e.g., David Dobbs, *Climate Change Enters Its Blood-Sucking*, The Atlantic (Feb. 19, 2019) at https://www.theatlantic.com/science/archive/2019/02/ticks-can-take-down-800-pound-moose/583189/?fbclid=IwAR2BLVnOrUplN20TMO_Z7ALUYSFNPXCNW9-3kSPZoziBQ59RZleGOuMJVzY.

11. In *Assessing “Dangerous Climate Change,”* we urged rapid emissions reductions (annual exponential reduction of 6% commencing in 2013) with drawdown of excess atmospheric CO₂ of approximately 100 GtC (the maximum thought achievable through improvements in forestry and agriculture) leading to a reduction in atmospheric CO₂ to < 350 ppm by the year 2100.
12. The actions described (rapid phasedown of CO₂ emissions and increased carbon storage in the soil and biosphere) were deemed minimally necessary to restore Earth’s energy balance, preserve the planet’s climate system, and avert irretrievable damage to human and natural systems – including agriculture, ocean fisheries, and fresh water supply – on which human civilization depends. However, if rapid emissions reductions are delayed until 2030, then the global temperature will remain more than 1°C higher than preindustrial levels for about 400 years. Were the emissions cessation only to commence after 40 years, then the atmosphere would not return to 350 ppm CO₂ for nearly 1,000 years. Projects that solidify our dependence on fossil fuels make it ever more likely that emission cessation goals will not be met.
13. Antarctic ice sheet mass loss is the potential source of large sea level rise. In our *Ice Melt* paper, we presented evidence, from modern observations, modeling, and paleoclimate analyses that the Atlantic Meridional Overturning Circulation (AMOC) is slowing as a result of freshening of the ocean mixed layer in the North Atlantic. Resulting reduced northward heat transport in the ocean will tend to warm the Southern Ocean, increasing the threat of Antarctic ice mass loss. We

concluded that continued high fossil fuel emissions this century would produce non-linearly growing sea level rise reaching multi-meter levels within a time scale of 50-150 years.

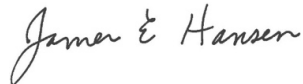
14. The climate system is now out of equilibrium. In such a system, in which the ocean and ice sheets have great inertia but are beginning to change, the existence of amplifying feedbacks presents a situation of great concern. There is a real, imminent danger that we will hand young people and future generations a climate system that is practically out of their control.
15. While *Assessing "Dangerous Climate Change"* concluded that the combination of rapid emissions reduction and storage of carbon in the soil and biosphere via reforestation and improved forestry and agricultural practices could keep global temperature close to the Holocene range, continued high emissions and continued global warming are altering that picture.
16. In *Young People's Burden*, we showed that the rapid warming of the past four decades has raised global temperature to a level matching best estimates for the level of warmth in the Eemian period. The Eemian period, the most recent interglacial period prior to the Holocene, lasted from about 130,000 to 116,000 years before present. Global temperature in the Eemian, at about +1°C relative to 1880-1920, was moderately warmer than the Holocene and sea level reached heights as great as 6-9 meters (20-30 feet) above present. Thus, this analysis provides some insight into what may occur along our coastlines as global temperatures increase.

17. During the past several hundred years, cities were built along coastlines at or just above sea level with enormous investment. This has been possible because of stable sea levels. Similarly, agricultural regions and other settlements relate to relatively stable Holocene climate patterns. The exploitation of fossil fuels, however, has upset that stability. Our coastal cities, agricultural food production upon which we depend, and other environment-dependent livelihoods are placed at risk if we allow warming to continue. Because of the inertia of ocean temperature, i.e., the long period required to cool once it has warmed, we stand to lock in highly undesirable consequences for young people and future generations.
18. It is, accordingly, critical that we strive to keep global warming from exceeding about 1°C relative to the pre-industrial level, consistent with our prior conclusion that we must aim to reduce CO₂ to less than 350 ppm. The appropriate limits for global temperature and atmospheric CO₂ may be lower, but they certainly are not higher.
19. Achieving those goals now requires not only the phasing out of emissions—including abandoning new major fossil fuel investment—but also “negative emissions,” i.e., extraction of CO₂ from the air, to the extent feasible and practicable.
20. If phasedown of fossil fuel emissions begins soon, most of this extraction can still be achieved via improved agricultural and forestry practices, including reforestation and steps to improve soil fertility and increase its carbon content. In that case, the magnitude and duration of global temperature excursion above the natural range of the current interglacial (Holocene) could be minimized.

21. But, in contrast, continued high fossil fuel emissions would place a burden on young people to undertake massive technological CO₂ extraction if they are to limit climate change and its consequences. Estimated costs of such extraction are in the range of tens to hundreds of trillion U.S. dollars this century, which raises severe questions about their feasibility. Continued high fossil fuel emissions unarguably sentences young people to a massive, implausible cleanup or growing deleterious climate impacts or both.
22. And yet we remain virtually locked in a worsening trajectory. *See*, in particular, Fig. 14 of *Young People's Burden* (showing recent growth of total GHG effective climate forcing). This is the consequence both of affirmative actions to permit continued high fossil fuel extraction, production and utilization, and our collective failure to take affirmative action to secure emissions reduction. Rather, we see situations, where the government ignores the crisis and permits projects that depend on increasing fossil fuel extraction, exacerbate dangerous climate change, and risk our children's rightful inheritance. We thus confront a planetary emergency: the harm to be prevented is imminent, further delay in confronting it serves to press that risk towards global catastrophe.
23. Particularly in light of approaching points of no return, it is, in my opinion, essential to commence serious and sustained action to return atmospheric CO₂ to < 350 ppm without further delay. Essential, that is, if our governments wish to preserve coastal cities from rising seas and floods (caused in part by melting of Antarctic and Greenland ice) and superstorms, and otherwise to restore a viable

climate system on which the life prospects of young persons and future generations so thoroughly depend.

The foregoing, accordingly, constitutes my best brief effort to explain our present, serious, global, climate crisis. I will have failed if, upon its review, the reader decides to shirk his or her fundamental responsibility. Now, more than before, we need to bring to bear our full acumen, time, and resources so as to demand and forge a viable future.



James E. Hansen
New York, New York
March 5, 2019