

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

An open letter to the Dutch public (in care of Donald Pols, Director, Mileudefensie, postbus 19199, 1000 GD Amsterdam, The Netherlands):

I write on the eve of Mileudefensie's filing of a formal legal complaint against Royal Dutch Shell, plc (hereinafter, "Shell"). That citizen's group will file its lawsuit on behalf of all Dutch citizens, but the action has broader ramifications.

The lawsuit, as I understand it from the Mileudefensie notice letter of April 4, 2018, will allege that Shell has breached its duty of due diligence with respect to ensuing CO₂ emissions when, over decades, Shell pursued the exploitation, production, and sale of oil and gas despite knowing that its activities risked dangerous climate change.¹

Mileudefensie's theory is moderate. In my view, Shell's large-scale investment, since 2007, in especially CO₂-intensive fossil fuels – including tar sand oil, shale oil, and shale gas² – is better characterized as activity undertaken in *reckless disregard* for the fundamental rights of Dutch citizens (and others), rather than as negligence merely.

Citing to internal Shell documents, Mileudefensie establishes that Shell continues to operate on the assumption that fossil fuels will meet more than 50% of global energy demand in the year 2050. That is a recipe for global disaster, pure and simple, and it eviscerates, again

¹ That is, at least since 1986, according to the Mileudefensie Notice Letter (hereinafter, MNL) sent to Shell April 4, 2018. MNL at p. 5. See <https://en.mileudefensie.nl/news/noticeletter-shell.pdf>.

² *Id.* at p. 9.

in my view, Shell's assertion that it "welcomes and strongly supports the goals of the Paris Agreement."³ Recall that pursuant to the Paris Agreement nearly 200 nations committed to action holding the average global temperature to "well below 2°C, and to pursue efforts to limit the temperature increase to 1.5°C." Those temperature targets, in my professional opinion, were still insufficiently ambitious; nevertheless, they will not be achieved unless Shell and other energy producers are induced or required to phase-out such emissions nearly to zero by mid-century.

Milieudefensie's legal action comes none too soon. As I will here attempt briefly to explain, we confront a planetary emergency with respect to the climate crisis. I therefore offer the following specific points, indicating source material that is readily available for readers wishing to pursue a deeper understanding. I hope that on its basis more Dutch citizens will support the Milieudefensie lawsuit, or else undertake other compatible, pointed action to address the problem.

1. The international scientific consensus acknowledges that global climate change from persistent high fossil fuel emissions is now well into the danger zone.⁴ 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

³ Shell response to Milieudefensie of May 28, 2018.

⁴ 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.⁵

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 national GHG reduction aspirations -- including those that obtain now under the Paris Agreement -- 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 internet⁶ – support and elaborate on my opinions here.

⁵ 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., *Why current negative-emissions strategies remain ‘magical thinking,’* Nature (February 2018) at <https://www.nature.com/articles/d41586-018-02184-x>.

⁶ See “Dangerous Climate Change” at <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3849278>;

4. Atmospheric CO₂ has now reached 409 ppm,⁷ 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. 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.
7. Rapid shifting of climate zones, already well underway, will be a major contributor to species extinction if global warming continues. Coral reefs, the

"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>.

⁷ 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>.

“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.⁸

8. 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.
9. 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

⁸ 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=IwAR2BLVnOrUpIN20TMO_Z7ALUYSFNPXCNW9-3kSPZoziBQ59RZleGOuMJVzY.

that solidify our dependence on fossil fuels make it ever more likely that emission cessation goals will not be met.

10. 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.
11. 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.
12. 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.
13. 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.

14. 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.
15. 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.
16. Achieving those goals now requires not only the phasing out of emissions—including abandoning new major fossil fuel investment—but also “negative

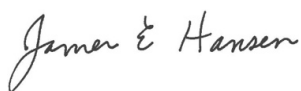
emissions,” i.e., extraction of CO₂ from the air, to the extent feasible and practicable.

17. 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.
18. 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.
19. 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.

20. 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. Holding the major fossil fuel companies to account, starting with Shell, is critical.



James E. Hansen
New York, New York
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