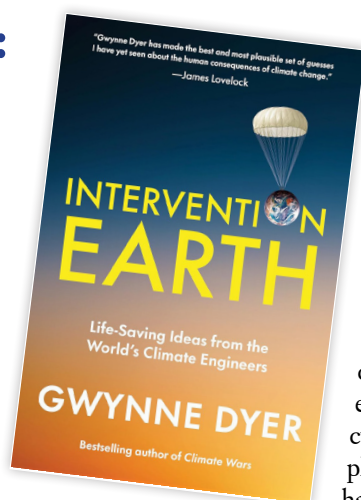


Climate Intervention for Human Survival

Intervention Earth: Life-Saving Ideas from the World's Climate Engineers

By Gwynne Dyer,
Random House Canada, 2024
Hardcover: 340 pages



If you think the climate situation is noticeably worse than five years ago, you are not imagining it. The two books under review here agree and focus on why “net zero” and an energy transition away from fossil fuels are insufficient solutions to the crisis.

Gwynne Dyer and Wake Smith cover similar territory. Dyer is a storyteller with an emphasis on quoting from the 100 climate experts he consulted (including Wake Smith) about climate interventions, and in particular Solar Radiation Modification (SRM) and carbon dioxide removal (CDR). Both authors lead us ultimately, convincingly, even reluctantly towards SRM advocacy: The reflection of the sun’s heat back out into space. If you are inclined to be skeptical of human-engineered solutions, their arguments should challenge.

Smith and Dyer both support the adage that only loss instructs, and they see resistance by many environmentalists and activists, not to mention governments, to embrace climate engineering. This will soon change, they hope, as the challenges of wildfires, extreme weather events,

crop failures, migrations and killing summer heat all mount.

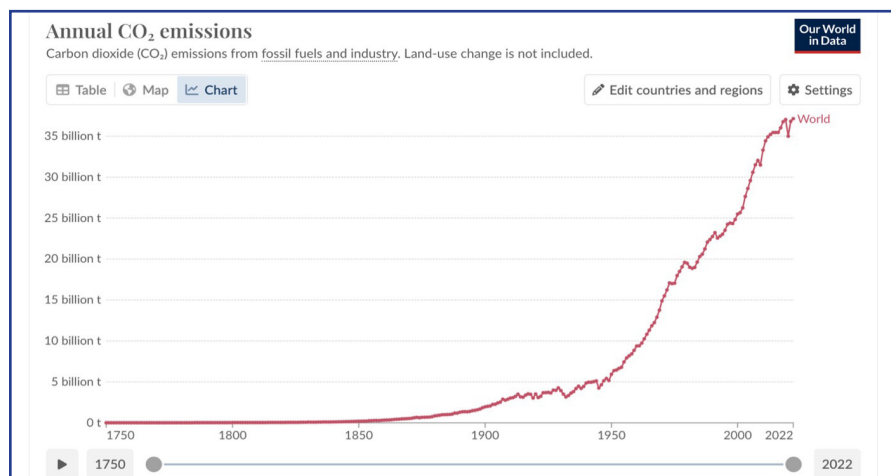
We expected linear impacts of a gradual CO₂ rise, Dyer argues, but the tipping points and feedback loops will cause an accelerated effect. Therefore, just cutting emissions and planting trees might have been sufficient in the year 2000, but

no longer. Substituting solar energy for fossil fuels, installing heat pumps are now cheaper than before and meat substitutes are more feasible – but at scale, and in time? We are heading for 450 ppm of CO₂ by 2032 at current emission rates, which so far show little sign of dropping. They rose in 2022 over pre-COVID 2019. Because there was no global uptake, therefore we will see no avoidance of wild weather. This means two degrees Celsius above pre-industrial rates, on average.

The hope is that SRM might win us decades while we cut fossil fuel emissions and remove excess carbon. Otherwise, the warming will “topple global civilization into famine, mass migration and war.”

TRAJECTORY

Dyer highlights an influential 2018 survey paper by Will Steffen et al. “Trajectories of the Earth System in the Anthropocene.” It summarized much of the research and confirmed worst fears, concluding that to avoid Hothouse Earth we must make “deliberate decisions” and this will entail “stewardship of the entire Earth System—biosphere, climate, and societies—and could include decarbonization of the global economy, enhancement of biosphere carbon sinks, behavioral changes, technological innovations, new governance arrangements, and transformed social values.” Warming will continue even as emissions are reduced and reach net zero. Critical now is avoidance of the possible tipping points in the next 20 years. This, the Trajectory authors made clear, will require possible “solar



radiation management [SRM], and adaptation to unavoidable impacts of the warming already occurring.”

Hugh Hunt, at Cambridge University’s Centre for Climate Repair told Dyer that just a few years ago he was skeptical of “that geoengineering crap” but now he has shifted towards seeing its inevitability.

If we quickly shrank our emissions by half by 2030, then we would have had fifteen years to chase the other half. This would still require reliance on solar, wind, nuclear and geothermal energy sources, a switch to electric vehicles, biochar and passive housing. Many of these options are ready (as is noted also by Bob McDonald in his recent book *The Future is Now*.)

The Extinction Rebellion campaign, Dyer claims, did cause a measurable attitude spike, evidence that public protest does have an impact. But is it sustainable? Two-thirds of people polled worldwide in 2021 in a UNDP assessment said they thought we were in a global climate emergency. Most people also supported renewable energy. Fossil fuel companies now recognize there is a global warming problem and have shifted from denial to arguments for a “lower carbon” (not a no-carbon) future or green-washing.

But a sense of denial flows from this year’s COP28 climate and G7 conferences, where it was still claimed global temperatures could be prevented from rising above preindustrial levels (the 1.5 degrees C “limit”) into the mid-2030s. Now we face “multi-trillion dollar global investments in huge engineering projects of several kinds, and enormous changes to industry, business, consumption, employment, lifestyle, taxation.... All done in a tearing hurry” and with no guarantee that it will create the goal of a stabilized earth.

In late 2023 well-regarded Columbia

University climate scientist James Hansen argued in “Global Warming in the Pipeline” that the Equilibrium Climate Sensitivity (ECS) is far worse than thought. And there is an additional unreleased temperature warming already “in the pipeline”. Hansen is no alarmist. What this means is that with long- and short-term feedbacks calculated in, a plus ten degrees outcome is now possible, with sea levels 25 meters higher and mass death over centuries. Hansen argues that the climate’s temperature rise has already increased by half in the last decade. To prevent the likely 2 degrees over pre-industrial rise now expected in the mid-2030s, humans will have to intervene immediately. Hansen calls for deliberate cooling through SRM. Let’s face it: We are already geoengineering the climate, now we have to restore it – which is how he thinks we must look at it.

Hansen therefore proposes we embrace nuclear energy, incorporation of carbon taxes, SRM measures to hold the heat down while the transition takes place and increase aid to developing countries so they can switch to sustainable energy sources. Michael Mann (University of Philadelphia, of “climate hockey stick” fame) doubts all of this; meaning there is a faceoff between two significant climate science leaders. 2024 temperature levels may indicate whether Hansen or Mann is right. (My hope is for Mann but my money is on Hansen.)

EMISSIONS

Fossil fuels are still 80 percent of total greenhouse gas emissions (with inevitable economic demands rising significantly). Overall, renewables are hoped to increase their proportion of global energy sources to 50 percent of the total by 2035. If the green movement had not turned against nuclear power, Dyer argues, we’d have

about three times as many of these power plants as we do now, and a very different situation, temperature-wise. He mentions the effective anti-nuclear campaign launched in 1971 by Friends of the Earth, whose founding funder Robert Anderson was the owner of (what is now) ARCO oil, although Dyer is careful not to suggest a fossil fuel conspiracy was afoot.

OPTIONS

A survey of 233 authors of the October 2021 IPCC climate change report revealed that only 4 percent of them believed we can limit global warming to less than +1.5 degrees. Dyer believes that, based on his interviews, at least half of scientists would now be willing to consider SRM to buy time. The reason is that all other methods are insufficient or marginally effective.

For example, 60 percent of earth’s mammalian biomass is livestock, and replacement of this industry even by half could free up land for plant agriculture, and rewilding. Almost a fifth of GHG equivalent emissions are from ruminant methane. Beef alone accounts for 7 percent of the GHG problem. Assuming no immediate shift to veganism and vegetarianism, non-ruminant diets (chicken, pork and fish) could constitute a significant transition. There will however be pushback from the legacy agriculture sector, about 2 billion farmers worldwide, and what Dyer calls the “attack of the Sunset Industries”. An “epochal shift in the human diet is probably the only hope for preserving the world’s remaining biodiversity, [and] its best hope for reducing food-related emissions in good time...”

Atmospheric methane removal is also low hanging fruit, and its removal techniques, such as through deployment of iron salt aerosols (ISA) appear to be much simpler to do than CO2 removal.

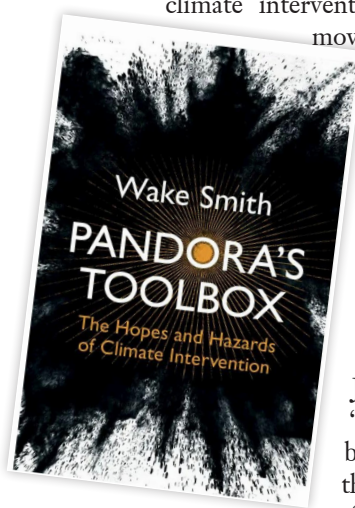
Climate Intervention for Human Survival

Dyer briefly surveys a variety of negative emissions projects (such as carbon capture, ocean iron fertilization, reforestation and afforestation, direct air capture, enhanced weathering.) CO2 removal (CDR) became acceptable to talk about at the 2015 IPCC meeting in Paris. But, put in perspective, currently we remove under a million tons of CO2 annually. We need to remove ten billion tons by 2050. Dyer concludes that all these combined techniques will take decades or centuries. None of them could cancel even 2 percent of emissions by 2030. At scale, therefore, we are very likely a long way off. This returns us to the necessity of also considering the “desperate ideas” and therefore particularly Solar Radiation Management (SRM).

Pandora’s Toolbox

By Wake Smith;
Cambridge University Press, 2022
Hardcover:402 pages

Wake Smith spends the first 130 pages of his book covering the science, economics, mitigation, energy transition, and agricultural, forestry and land use responses, as well as enormous and costly urban adaptation measures that many of us are familiar with.



His arguments reinforce that the energy transition is necessary. “Massive climate intervention is inevitable” but this is not the solution to climate change. For that we require sub-zero carbon. Good luck convincing the Gulf states, Russia and Venezuela to “wreck their economies and leave immense quantities of proven reserves in the ground”. Not to mention China’s plans to build hundreds of new coal-fired power plants. Better news, Smith points out, is that developing countries can leapfrog past some of the wealthier countries faster and cheaper, with less need for legacy fossil fuels because of modern technological advances. As well, certain plant species will benefit from moderate warming, which could reduce food prices. In any case people will have to adapt – just to eat!

Both Smith and Dyer see Paul Crutzen’s 2006 paper “Albedo Enhancement by Stratospheric Sulfur Injections” as the beginning of the climate intervention (geoengineering)

movement, and they chart a similar course through the science. Dyer’s is more recent (2023) and journalistic while Smith’s (2022) is somewhat more detailed. Pandora’s Toolbox was published before Jim Hansen’s 2023 “Pipeline” paper but both authors also agree that even if we turned off the carbon tap immediately (which is impossible), and “net zero” is achieved – planetary temperatures will continue to

rise to levels that will severely threaten global human quality of life. Known as “committed warming”, the only conceivable measures possible at that point involve reflecting solar radiation so less of it reaches Earth. This means whitening surfaces, brightening and multiplying clouds or floating mirrors in space.

The second half of Smith’s book delves into CO2 removal options, and the same carbon capture ideas explored by Dyer. These include “natural climate solutions” (NCS) such as reforestation (replacing forests that have been removed) and afforestation (adding new forests for the first time), neither of which is seen to be adequate. One study foresees “annual sequestration capacity dropping to zero by the end of the century, as the new forests [become] saturated”.

The two most prominent SRM proposals are marine cloud brightening (MCB) and stratospheric aerosol injection (SAI). MCB-generated spray, likely using ships equipped with aerosol dispersal nozzles, would reflect daytime solar radiation where low clouds in the troposphere sit over large water bodies. The challenge is to take advantage of what is called the Twomey effect (smaller water droplets make brighter clouds).

SAI however, Smith admits, is the “big, bad, scary idea of spraying chemicals into the sky to slightly reduce the incoming sunlight”, and the concept that “many of you may have expected this entire book to be about”, although it is covered in about fifty pages. He thinks things are bad enough that we must now consider SAI. The sulphur dioxide would be injected into the upper atmosphere (at 20 km) and convert to



Buur-Hakba Town | © AMISOM Public Information, Wikimedia

sulphuric acid. The particles will stretch towards the poles (by what is known as the Brewer-Dobson effect) after which they will eventually descend back to earth. This sequence is mimicked by volcanic eruptions, an unexceptional natural process, 50 to 70 times per year.

The goal, therefore, is to distribute aerosols in sufficient quantity to reflect solar radiation (albedo) by an added percent or two so that the temperature balance can be restored – at least until CO2 depletion is completed. Here author Smith’s aeronautics industry background comes in handy, and he explores several aircraft delivery options in some detail. The “fleet of high-payload, high-altitude crop duster aircraft”, the equivalent of a suite of aerial dump trucks, doesn’t yet exist and would take five to seven years to design and build and cost a few billion dollars. That’s peanuts compared to the cost of other needed mitigation and transition costs. As of 2022, he thinks we are decades away from actual SAI in practice. Worst case, if SAI fails, we can pull the plug on its deployment and the earth would return to its (hotter) status quo after a year or so, no further behind (or ahead).

One concern is that the project would cause less rain to fall, although no less than the pre-industrial cooler earth. Testing is needed to determine exactly how the hydrologic cycle will behave, and in different areas of the globe.

What about unintended consequences? Smith agrees it could turn out the prescription is worse than the disease, but if so, it should be research not emotion that determines what we do. The possibility exists that the evidence instructs: No, don’t do it. It is also possible that problem climatic effects are misattributed to SAI, so the monitoring of the effort will be complex. But Smith concludes that it looks like SAI can cool the planet quickly, and that it can be scaled up relatively cheaply. The key obstacles, he argues, are not technical but the politics of collective governance and related testing hesitancy.

GOVERNANCE

Any SRM governance mechanism must include “an awesome inspection regime [that] will burrow deeply into every economy of the world,” which implies there will be obstacles, spoilers and free riders. And who will pay? The

current or legacy polluters, the industrial North, the rich?

Some have called for a new World Commission to elaborate and assess regulations on SRM deployment, which might be more effective than current mechanisms like the IPCC or the UN Framework (UNFCCC). However, the recent United Nations Environment Assembly resolution in Nairobi that dumped on SRM technology even eschewed establishing an official expert research

group. This is evidence that many states – and publics – are not yet in the mood to even look into the feasibility of SRM options, let alone deployment.

Surely as the planet warms further – as it will do, whatever the energy transition – the tone of the naysayers will have to change. Facts, nationalisms, isolationists are all stubborn things. To Blake Smith “our sustaining environment hangs in the balance”. Will it be too late before a genuine common survival ethic settles in, so that the political change can happen?

Dyer and Smith cover very similar ground with these two excellent books. If forced to choose just one, I’d suggest Gwynne’s Dyer’s book has a slight edge. It is more up to date, less repetitive, and more accessible for a general reader.

.....

Reviewed by Robin Collins, who writes about peace and environmental issues from Ottawa.

Readers are welcome to discuss this review here: <https://tosavetheworld.ca/global-warming-2/#comments>