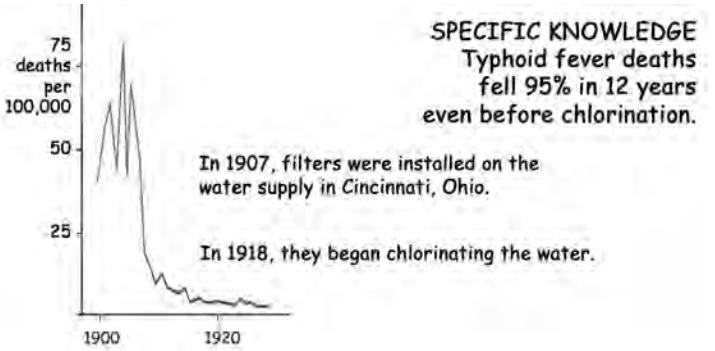
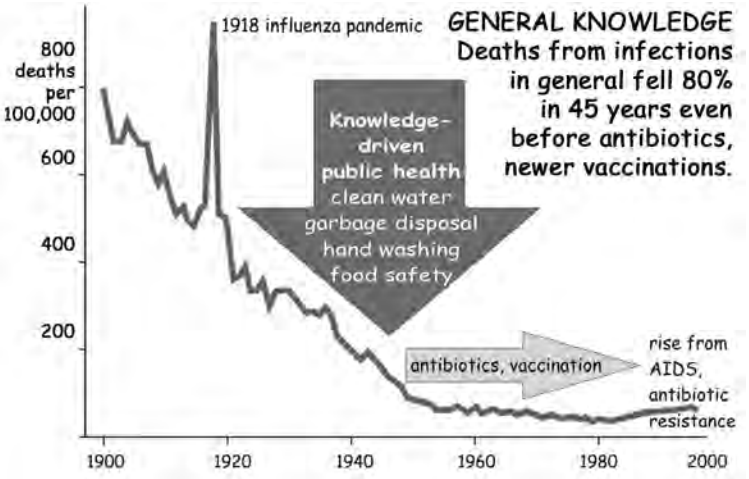


Since there is a lot of climate science left to be discovered, one source for optimism comes from the analogy to how things went in medical science when it was in a comparable stage of development. A lot can be done with inexpensive technology once you understand how things work.



William H. Calvin, GLOBAL FEVER (University of Chicago Press, 2008)

18

The Climate Optimist

Mention global warming at a social gathering and see what happens, now that skepticism and glib comebacks have turned into concern and sorrow. People will, of course, assume that you're a pessimist about our prospects.

"Not really," I protest. That earns me a quizzical look.

"Wait a minute," she says. "If you're an optimist, why do you look so worried?"

Dramatic pause.

"So you think it's easy, being an optimist?"

Indeed, many scientists look worried these days. We've had a steady diet of bad news coming from climate scientists and biologists.

But I think that, with notable exceptions, we scientists are more hopeful about weathering this crisis than are people who only recently have become aware of how serious the situation has become—but cannot yet imagine

a way out. To become even a guarded optimist, you have to think hard about both a technofix and some social engineering.

First, I reflected, the history of science and medicine shows that, once you mechanistically understand what's what, you can approach all sorts of seemingly unsolvable problems. I'm optimistic that we will learn how to stabilize climate.

When pessimism tempts me, I usually remember the progress that I've seen. When I was born in 1939, antibiotics were just a rumor, there were few vaccines, and one's chances of dying from an infection were three times greater than they are now.

I've seen an enormous increase in our knowledge about how bodies work, from molecules to mind (what I'd still be working on, were it not for the climate crisis). The average lifespan has been extended by decades in many countries, just in the time that I've been personally observing the scene as a medical school professor. And in the first half of the twentieth century (graph, page 226), deaths from infections dropped by an order of magnitude even before antibiotics and vaccinations came to dominate the scene.

Just the basic knowledge about how diseases spread was what did most of the job, not a needle. Once this new knowledge was incorporated into everyday hygiene practices, eight out of ten fatal infections were prevented. We're used to thinking of science discoveries leading to

technological innovation. But here you see how knowledge, pure knowledge, pays off all by itself.

The reason I'm not so pessimistic about climate is that, once you understand what's what, progress speeds up. It is reasonable to hope that we will learn how to intervene and restore the climate in the decades ahead, much as we earlier did as basic knowledge transformed the practice of medicine.

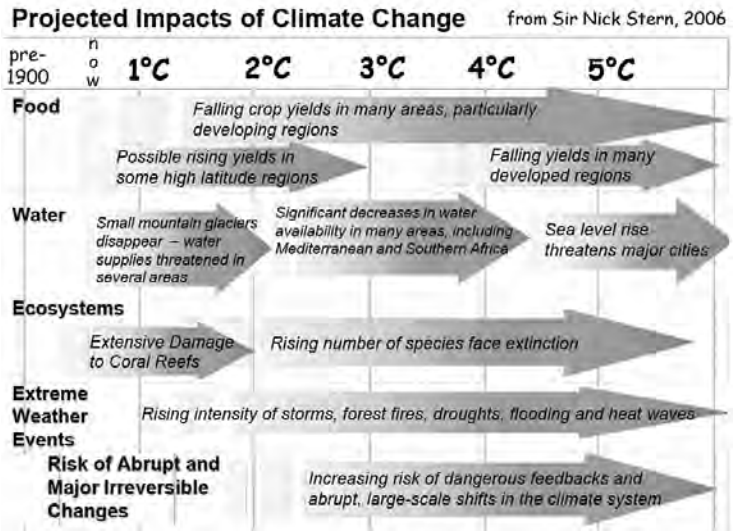
But the problem is clearly broader than scientists delivering new knowledge. Unless we redesign our civilization in numerous ways, all of the science in the world won't save us. Politicians and citizens alike have been deaf to scientific warnings over the last half century, reluctant to spend on infrastructure and education, and more concerned with present profits than with their responsibility to future generations.

Unfortunately the window of opportunity, to act on such knowledge, is closing. Fifty years have now passed since the first unequivocal scientific warnings of an insulating blanket of CO_2 forming around the planet. We have already entered the period of consequences. Climate scientists have long been worried about their children's future. Now they are also worried about their own.

Our Faustian bargain over fossil fuels has come due. Goethe's Dr. Faustus had twenty-four years of party now, pay later—and indeed, it's been longer than that since President Ronald Reagan axed the U.S. budget for exploring alternative fuels. This led to doubling our use of cheap coal, the worst of the fossil fuels. The energy

companies are planning, under business-as-usual, to redouble coal burning by 2030—even though we can now see the high cost of low price.

The devil's helpers may not have come to take us away, but killer heat waves have started, along with extreme weather that keeps trashing the place. We're already seeing droughts that just won't quit. Deserts keep expanding. Oceans keep acidifying. Greenland keeps melting. Dwindling resources are triggering terrible genocidal wars with neighbors. All of them will get worse before they get better.



Worse, a tipping point can lead to an irreversible demolition derby. Should another big El Niño occur and last twice as long as in 1983 or 1998, the profound drought could burn down the rain forests in Southeast Asia and the

Amazon—and half of all species could go extinct as a result.

Carbon-free energy is something that we simply have to do. The time for talk is past. If we turn around net carbon emissions by 2020 rather than 2040, we get another 2° of fever rather than 3°—and that's a big difference.

Remember, I tell her, that another 2°C is already going to mean substantial sea-level rise from melting Greenland—and even 1°C in the tropics will reduce crop yields for the cereal grains.

"I see why you're worried," she says, getting a word in edgewise. "But what's your optimistic scenario for dealing with this fossil-fuel fiasco?"

For starters, I think it likely that the leaders of the major religious groups will soon come to see climate change as a serious failure of stewardship.

And once they see our present fossil-fuel use as a deeply immoral imposition on other people and unborn generations, their arguments will trump the talk-endlessly-to-buy-time objections of the vested interests—just as such their moral arguments did when ending slavery in the nineteenth century, in spite of the perceived costs to the economy.

Second, the developed nations are fully capable of kick-starting our response to global fever with present technology—enough to achieve, within ten years, a substantial reduction in their own fossil fuel uses. How?

Wind farmers will prosper as pastures grow modern windmills to keep the cows company. Heat farmers will drill down deep. Giant parking lots, already denuded of trees, are perfect places for acres of solar paneling. Drivers will love the shaded parking spaces. Maybe they'll even recharge their cars.

The escalating Carbon Fee ("C-fee") with an elimination of payroll taxes will create a big wave of retrofitting homes and businesses. Value-added C-fees will give every stage in the supply chain an incentive to go C-free. Just call it "C-free or C-fee."

Big, brightly lit grocery stores with giant parking lots will compete poorly with efficient warehouses that deliver web and phone orders within the hour, like pizza. Smaller neighborhood grocery stores will once again do a big walk-in business and they will compete with the warehouses by offering "green bicycle" delivery powered by excess adolescent energy.

High-speed toll gates will become the norm on commuter highways. (Yes, I know, but remember that the paycheck was just enriched by eliminating payroll taxes.) Since 90 percent of U.S. commuters go by car, and only one of nine drivers has a passenger, splitting the cost will become attractive.

Speed limits will be lowered to 50 mph (80 km/h) for fuel efficiency and, as in 1973, drivers will marvel at how smoothly the traffic flows when everyone is going the

same speed. Double taxes will apply to vehicles with worse-than-average fossil-fuel consumption, steadily reducing the number of oversized vehicles with poor streamlining. Plug-in hybrids will begin to dominate new car sales. In an era of more power grid failures, hybrids will serve as emergency generators for the house. All-electric "clean cars," while they are parked for a charge, will help prevent grid failures by smoothing dips and spikes.

A firm, fast schedule will be established for retiring or retrofitting existing coal plants. My bet is that adding geothermal or nuclear power plants will prove safer, cheaper, and faster than fixing coal.

So which numbers are the most important to keep in mind? Emissions each year, emissions growth, CO_2 concentration, or temperature?

It depends. For ocean acidification, the CO_2 concentration in surface waters is the big player in the long-run. But the heat is the big short-term problem.

For climate change, temperature change per se is the driver that precipitates many other consequences. For producing temperature change, it's not only CO_2 that drives it but the other greenhouse gases, such as methane from pipeline leaks and nitrous oxide from fertilizers.

Remember that decreasing sinks via land clearing can be just as important as increasing sources. It acts like an increased carbon emission.

One of the first things that you notice from the emissions pie (back on page 158) is that land clearing accounts for 18 percent of the problem, even larger than the worldwide use of oil for transportation at 14 percent. And that agriculture adds 14 percent too, mostly via fertilizers, plowing practices that speed soil decomposition, and cows that burp. So shrinking this carbon pie down to half its present size depends heavily on agricultural innovations, as well as overhauling the present energy production portfolio. While two-thirds of the pie comes from the urban energy emissions that we usually talk about, a third of the possibilities for shrinkage come from the countryside's excesses.

So an optimist notes that fully a third of our possibilities for reversing the trends come from a sector that we don't usually talk about. And that reducing methane emissions, as we have already started doing, is a particularly fast way of reducing the fever.

Before 2020, let us assume that the transition to hybrid electric and compressed-air vehicles will shift transportation's energy demands to C-free but industrial-strength sources such as hot rock and nuclear. They will power much of the transportation sector, thus reducing oil use.

The low-loss DC transmission lines should allow, via cables under the Bering Strait, solar-generated electricity to flow from the bright side to the dark side of the earth,

around the clock. Superconducting wires will likely be running inside some retired pipelines.

By 2020, we ought to see some important new technology coming on line, not just improvements in what we already use. The highly efficient binding energy extractors (BEEs, the fourth-generation nuclear power plants) could be running on the spent fuel of the earlier generations.

We need a way of pumping down the excess atmospheric CO_2 that is cooking the earth, in the manner that a kidney dialysis machine cleans the blood. Perhaps we will succeed in enhancing existing sinks. For example, we might encourage the whale's favorite food, the tiny plankton which provide half of the oxygen we breathe as they separate the C from the CO_2.

Sometime before 2040, I'd bet that we will be mining the air for CO_2, using it as fuel via some artificial process analogous to photosynthesis. But even if we invent and debug such schemes tomorrow, it can take several decades before an invention makes a dent in our increasingly urgent problem.

By 2040, let us suppose that we are busy extracting more CO_2 from the atmosphere than we add.

This will only happen if the technology of the developed world has become good enough to compensate for what's still going on in the overstressed nations that are too disorganized to get their energy act together.

When CO_2 levels fall enough to counter the delayed warming from past excesses, we will begin to see a rever-

sal of droughts and heavy weather, though the rise in sea level will likely continue, a reminder to future generations of our twentieth-century Faustian bargain. Even if Greenland and Antarctica stay frozen in the summertime, the distressed foundations of the sides of the Greenland ice sheet may allow the ice dome to spread sideways and push ice into the ocean, long before it might melt.

In 2006, climate scientist Jim Hansen said that "[W]e have at most ten years—not ten years to decide upon action, but ten years to alter fundamentally the trajectory of global greenhouse emissions . . . we are near a tipping point, a point of no return, beyond which the built in momentum and feedbacks will carry us to levels of climate change with staggering consequences for humanity and all of the residents of this planet."

We need to turn on a dime, close to what we saw in the United States in 1940 in response to the ominous Nazi takeover of Europe. President Franklin D. Roosevelt asked Congress to increase the construction of military aircraft by ten-fold and was wildly cheered. "The President's big round number was a psychological target to lift sights and accustom planners in military and industrial circles alike to thinking big," wrote a military historian. Roosevelt used the metaphor of a "four alarm fire up the street" that needed to be extinguished immediately, whatever the cost.

> From a standing start in late 1941, the automakers converted—in a matter of months, not years—more than 1,000 automobile plants across thirty-one states . . . In one year, General Motors developed,

> tooled, and completely built from scratch 1,000 Avenger and 1,000 Wildcat aircraft . . . GM also produced the amphibious 'duck'—a watertight steel hull enclosing a GM six-wheel, 2.5 ton truck that was adaptable to land or water. GM's duck `was designed, tested, built, and off the line in ninety days' . . . Ford turned out one B-24 [bomber] every 63 minutes.
>
> —author Jack Doyle, 2000

Now there's a source of optimism: we did it before. With great challenges come great opportunities and I'm an optimist about our ability to respond with innovation, much as various countries did during World War II.

> Most progress against air pollution has been cheaper than expected. Smog controls on automobiles, for example, were predicted to cost thousands of dollars for each vehicle. Today's new cars emit less than 2 percent as much smog-forming pollution as the cars of 1970, and the cars are still as affordable today as they were then. Acid-rain control has cost about 10 percent of what was predicted in 1990, when Congress enacted new rules. At that time, opponents said the regulations would cause a "clean-air recession"; instead, the economy boomed…
>
> Americans love challenges, and preventing artificial climate change is just the sort of technological and economic challenge at which this nation excels. It only remains for the right politician to recast the challenge in practical, optimistic tones … But cheap and fast improvement is not a pipe dream; it is the pattern of previous efforts against air pollution. The only reason runaway global warming seems unstoppable is that we have not yet tried to stop it.
>
> —commentator Gregg Easterbrook, 2006

GLOBAL FEVER

How to Treat Climate Change

WILLIAM H. CALVIN

THE UNIVERSITY OF CHICAGO PRESS
CHICAGO AND LONDON

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