

**Cool It**  
**What it Will Take to Reverse Global Warming**  
**By**  
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In a 2002 *Nature* article, environmentalist Russ George says, “Listen, it’s so easy to save the planet. We just have to restore the ocean to its historical level of health and productivity. The Ocean will easily manage the lion’s share of CO<sub>2</sub>, as it always has in the past.”<sup>1</sup> It’s true, not only is the ocean by far the largest carbon sequester on the planet, it’s also the largest producer of oxygen in the process. But, like the rest of our planet—the soil, the air, the trees and forests, the glaciers and icesheets, and all the other life-sustaining systems on our pale blue dot—the ocean is in deep trouble. I don’t consider it extreme to say we are at the beginning of a global environmental apocalypse. I consider it the beginning only because we have not yet experienced the hell that is coming if we don’t take drastic action now.

As I see it, there are four major obstructions in our way of effectively addressing Climate Change: denial, scale, knowhow, and hopelessness. The first of these, denial, is largely driven by politics. It is unfortunate that in the U.S., one of the two largest carbon polluters on the planet, along with China, has an entire political party that has historically called the inconvenient truth that’s right before their eyes a hoax, cast doubt on its causes, and supported Presidents who delight in thwarting any progress from being made to combat it: even though the “climate is actually now considered one of our biggest enemies. The US Department of Defense even lists it as a top threat.”<sup>2</sup> As difficult as it to imagine a nation’s Commander and Chief failing to act on the concerns of our top military advisors, this has too often been the case in our country. And even those who want to do something about it must endure years of political gridlock just to make minor advances that will be too little, too late.

Regarding scale, the Earth is enormous, relative to us, and repairing the problems human waste has caused appear to be overwhelming. Even if we we’re able to achieve net-zero carbon emissions today, how could we possibly stop the chain of events that have already been set in motion? In his book, *Hacking Planet Earth*, environmental journalist and author Thomas Kostigen says, “The chance of reducing global temperatures by cutting back on carbon emissions is just 5 percent, according to analysis published in *Nature Climate Change*.”<sup>3</sup> Just this week, it was a big deal for President Biden to commit to a 52 percent reduction by 2030. That’s huge, but not enough.

The matter of scale combined with our lack of knowhow leads to the fourth major obstacle in our way—hopelessness. If the problem seem too big to tackle, and we don’t know where or even how to begin, then we feel powerless to do anything about it. “What’s the point of doing anything,” we think. “Game over.” Yet I will argue, to the contrary, there is one approach to solving climate change and global warming that can help us overcome all of these obstructions—technology.

Technological advances often occur outside government intrusion or influence, especially from Republicans who have a zealous hatred of regulations, so we don't have to worry as much about government apathy or gridlock when it comes to tech. And, once adopted, technology can be scaled up and become cheaper, more efficient, and almost ubiquitously adopted within just a few short years—think automobiles, computers, and smartphones. It is also through the invention of technologies that climate scientists and geoengineers, who do have knowhow, are able to make a practical difference. Finally, as I will argue today, many of today's technical realities, as well as those on the way, are reasons for genuine hope that we not only stop climate change but also turn back the clock on global warming and repair much of the harm we have inadvertently caused to our suffering planet.

Some will feel naturally resistant to this line of reasoning, believing our use of technology is what has gotten us into such hot water. How can the source of the problem be its solution? Yet, as obscure as my opinion might be, I believe the activities of all creatures alter their environments, often in detrimental ways. Our species is nature's toolmaker and the use of our tools has long altered our environments to meet our needs. But this is not the Earth's first such precipice, nor have other periods of apocalypse been the fault of technology. About 2.5 billion years ago, only a billion years after life on Earth began, a population explosion of oxygen excreting single cells, the only kind of life on the planet, had fundamentally changed the chemistry of its atmosphere. Today, most life forms need oxygen to survive, and we forget how dangerous a compound it is. Not only is it a corrosive strong enough to destroy iron and other metals, in large amounts it is highly explosive. During the first known mass extinction, the Earth was also on the brink of becoming but another cosmic fireball.

That apocalypse was averted at almost the last minute as some mutated cells evolved to consume the oxygen and excrete it as life-saving carbon dioxide instead, which eventually became food for Earth's vegetation. So today we are facing a mirror image of the first major die-off. Oxygen breathing organisms putting too much carbon in the air, mostly because our overpopulated species has depended upon the burning of fossil fuels (stored carbon) to energize our technologies. Still, unlike many, I don't consider this unnatural but perfectly natural. Humans, toolmaking, and technology are part of nature. Again, the first mass extinction and near apocalypse was caused by mindless cells that dramatically altered the environment with nothing more than their presence and no technologies whatsoever.

I would further argue that if we are going to stop the warming of our planet and avoid the worst related disasters, part of the solution must include what our toolmaking species does best. It must include technologies designed to save our planet. Prior to writing his latest book, Thomas Kostigen had penned several others, mostly about the small changes each of us can make to decrease our carbon footprints, beginning with *The Green Book: The Everyday Guide to Saving the Planet One Simple Step at a Time*, written in 2007. But, in 2016

Kostigen reached a turning point, realizing, “this movement won’t work at the grassroots level, it is time to turn our collective attention toward supporting industry and encouraging the business community, scientists, and technologists—innovators!—to step up and do what they do best: invent, pioneer, disrupt the same old ways of doing things. Yes, industry, the sector of society responsible for much of human-caused global warming to begin with, has to turn things around and lead the charge to help mend our climate.”<sup>4</sup>

One of those innovators, Bill Gates concurs in his new book, *How to Avoid Climate Disaster: The Solutions We Have and the Breakthroughs We Need*. “When it comes to climate change,” he says, “I know innovation isn’t the only thing we need. But we cannot keep the earth livable without it. Techno-fixes are not sufficient, but they are necessary.”<sup>5</sup>

The argument that technology got us into this mess, therefore it can’t get us out of it, is logically unsound. A key that locks a door can also unlock it, just as the same door that opens can be closed. Nor is all technology the same. A nuclear bomb can destroy a city, a butter knife cannot. To assume that all technology is fundamentally destructive and, thus, part of the problem, is nonsense. We have reached a point, furthermore, where we must address many of the causes and repercussions of global warming on a global scale, and that can best be done with innovative technologies. I say this, not as a technophile or technoutopian, but as a logical thinker.

What I’m talking about is using technology to alter our climate, to make our planet a bit cooler again, to revitalize the dying soil so it can sequester carbon again and better sustain plant life, to heal and cool the ocean by restoring its dead zones, to refreeze and rebuild our glaciers and icesheets, to get our energy from completely renewable sources starting yesterday, and to reduce our dependences on billions of methane and carbon producing livestock animals for food. And I know this is possible because something like it has already been done. We have already successfully used technology to reengineer our entire planet in about a hundred years, changing its chemical composition in short order, we just didn’t intend to do so. Now imagine what we can do in another century if we use our technological wits to intentionally geoengineer our planet.

Already, in just a few short years, renewable energy has become the cheapest in history, thanks to solar and wind power, both of which are technologies. Almost every month it seems we hear about a major car company’s decision to go entirely electric, thanks to improved battery storage, thanks, that is, to technology. And the great advantage of technology is that its use and improvements grow exponentially, so that it achieves scale in short order, just as computers, smartphones, and the Internet have done in only the past three decades.

In 2017, Dutch inventor and entrepreneur, Boyan Slat said, “Technology is the most potent agent of change. It is an amplifier of our human capabilities.”<sup>6</sup> Unlike the plastic pollution

he's taking on, Slat's is hardly a household name. If you remember it all its because he made big headlines in 2018 after launching Ocean System 001 in the San Francisco Bay, a 2000-foot-long contraption he'd invented to remove plastic from the ocean. Slat came up with the idea in 2012, when he was only 18 years old. Two years earlier, while diving, the concerned teenager noticed more plastic in the sea than fish and became passionate about cleaning it up. He was only 19 when he founded The Ocean Cleanup, a non-profit with a mission to develop technologies to rid the oceans of plastic.

System 001 was an experimental learning experience that ended up breaking in half. But a year later, an advanced system allowed The Ocean Cleanup to successfully bring its first load of plastic back to shore, about 60 large bags worth, including small millimeter-seized pieces. Then, just last month, on October 20<sup>th</sup>, The Ocean Cleanup removed nearly ten tons of plastic waste from the Great Pacific Garbage Patch, using Ocean System 002. The patch of floating garbage is almost twice the size of Texas and is kept in place due to ocean currents. In October, Slat told reporters that "If we just collect this amount of garbage 3,000 more times, then the garbage patch will be gone and will just exist in the history books."<sup>7</sup> And now that proof of concept has been achieved, it time to scale up. Slat and The Ocean Cleanup intends to do by deploying fleets of the plastic collecting technology, that will include ten new systems every five years.

I hope you fully absorbed what I just said. We are going to clean up our oceans! If this monumental achievement weren't enough, The Ocean Cleanup has also figured out how to prevent plastics from getting into the ocean to begin with. Two years ago, in 2019, Slat unveiled The Ocean Cleanup's newest technology, the Inceptor, to be used, as he said, for "closing the tap." The Inceptor is a plastic gathering, fully autonomous, solar-powered vehicle that, as its name suggests, intercepts plastic garbage in rivers that would otherwise feed it into the oceans. There are about 100,000 rivers in the world, but The Ocean Cleanup has identified which of them are the main arteries sending plastic waste into the heart of the sea, which is only about 1 percent, that's 1,000 rivers, that are responsible for 80 percent of the waste.<sup>8</sup> The Intercept has already been deployed in some of the worst rivers in the world, which means the ocean will stay clean by also cleaning our rivers.

So, thanks to this single organization, and its innovative use of technology, we are going to rid our oceans of plastic pollution and protect them against it in the future. And, if you're wondering what happens to all that plastic once its removed, The Ocean Cleanup recycles it into pellets than can be reused for new plastic products, then recycled again when necessary. In fact, if you want to contribute to The Ocean Cleanup, you can contribute \$200 and receive a high-quality pair of designer sunglasses made out of plastic that's certified to have been removed from the Great Pacific Garbage Patch.

Unfortunately, in addition to those on the Right who are in denial, there are some environmental activists who are extremely resistant to any kinds of technological responses

to climate change. In my opinion, such extremism is dangerous because we don't have time to waste, nature needs our help, and technology has to be part of the solution. Take, for example, the Ocean's dead zones, vast regions that have become oxygen deprived because of polluted runoff, also fed by rivers. As their name implies, these dead zones are uninhabitable for marine life. The closest dead zone to the U.S., in the Gulf of Mexico, fed by the Mississippi River, is nearly nine-thousand square miles and is continuing to expand. Even if the pollution stopped today, it would take thousands of years for nature to heal it on its own. It would do so by increasing ocean life, which produces the waste necessary for microorganisms like kelp, algae, and phytoplankton to eventually reoxygenize ocean habitats. Alas, overfishing, pollution, warmer waters, and dead zones have dramatically reduced life in the sea, including microbial life, as evidenced by the bleaching of its coral reefs, so there's not as much for nature to work with anymore.

Marine biologist John Martin tried to find a solution to this major problem as far back as the 1980s. Upon finding these dead zones are deprived of iron, he experimented but adding iron to a small area. The result was an increase of phytoplankton, a microbic food source that absorbs carbon on the surface of the ocean then sinks to the bottom of the sea where it is safely stored. Despite his success, he was rebuffed, asked to stop, and accused of littering the ocean with iron pollution by others in his scientific community. Martin, nevertheless, persisted with his experiments, this time near the Galápagos Islands, where phytoplankton levels again soared.

After Martin's premature death in 1993, others were inspired by his findings. In 2012, environmental entrepreneur Russ George poured hundreds of tons of iron dust into the Pacific Ocean a couple hundred miles offshore of British Columbia. Kostigen says, "They accused George of illegal dumping, violating United Nations covenants on geoengineering, and other international protocols. But guess what? What he did worked. The oceans came to life with schools of fish and marine life."<sup>9</sup> Yet the marine science community was again furious, the Canadian authorities raided his office, held George at gunpoint, and destroyed all of his research and data, data George says indicated "exactly how much carbon was removed from the air by iron dusting the ocean."<sup>10</sup> Of course, iron dusting needs further research and should be closely monitored so it doesn't overproduce unwanted menaces, like red tides, but it could also be a magic bullet for healing our oceans that is abundant, cheap, and can be ordered off Amazon or picked up at your local hardware store. Kostigen reminds us, "Iron fertilization would be ten to one-hundred times cheaper than forestation."<sup>11</sup> So we can't let our fear of technology prevent us from solving problems that can't otherwise be solved.

Other hopeful technologies include physicist Jean-Pierre Wolf's laser device that could fairly be described as a remote control for rain. By pointing it at the sky, "It can manufacture lightning in a cloud, break through air molecules and make rain, or, conversely, blast through water molecules and dissipate precipitation."<sup>12</sup> Imagine what this can do for

parched areas of the planet, like California, devastated by global warming, and how it might restore them and protect them from forest fires.

Thanks to an XPRIZE competition, we also now have affordable technology that can remove thousands of liters of water from the air in a day, running on completely renewable energy. This technology is already being used in some of the most parched places in the world and just this past week there was an article in our local paper about a company in our own community that's been selling them to California.

Speaking of XPRIZE, earlier this year Elon Musk announced the largest incentive prize in history, a hundred million dollars to the person or team that comes up with a scalable carbon sequestration technology. To win the four-year competition, XPRIZE says, "teams must demonstrate a working solution at a scale of at least 1000 tonnes removed per year; model their costs at a scale of 1 million tonnes per year; and show a pathway to achieving a scale of gigatonnes per year in the future."<sup>13</sup> This amount is based on the International Panel on Climate Change's estimate that nearly 10 gigatonnes of net CO<sub>2</sub> need to be removed each year just to keep global temperatures from getting worse. Based on XPRIZE's incredible history of success, we can expect to have this technology by 2025, if not before.

The Gates foundation is working on technology that will pump cool water from the bottom of the ocean in front of hurricanes to keep them from becoming too powerful. And, recognizing that trees are the largest sequestration species on land, Salesforce, the largest employer on land, is working with the World Forum to plant a trillion more trees by 2030. They've already planted ten million since starting last year. This is being done to restore mangroves in Madagascar, reforest areas burned by fires, repair degraded farmlands, and watershed restoration in Latin American, as well as other places. Sometimes drones are used to blast seeds into the ground in remote, hard-to-reach areas. To top it off, environmental engineer Klaus Lackner has invented an artificial tree that captures a ton of carbon dioxide per day. A hundred million of these trees could capture all our carbon pollution, 36 gigatons a year.

Reflective particles in the atmosphere, reflectors on the desert sands, reflective roofs and asphalt, are all technologies that also now exist to help bounce carbon captured heat back into outer space. So are massive solar farms in the most energy deprived places on the planet, as well as bladeless windmills that are low to the ground, require less land, are more efficient than traditional windmills, and won't interfere with migratory birds. There are cloud brightening yachts that reflect hot sunlight back into the atmosphere instead of burning up our endangered coral reefs, along with the relocation of dying coral beds to cooler climates. There are vertical farms that use 40 to 95 percent less water to feed growing urban populations, and new technologies for preserving and restoring the soil on traditional farms. There are plans to build embankments and manufactured islands to prevent warm water from further interacting with glaciers and icesheets. Earlier this year,

the first companies were approved to sale lab grown meat to consumers, an industry that will dramatically reduce the carbon footprint of tens of billions of livestock animals and be far less cruel and healthier for us all. AI controlled autonomous green energy cars are also likely to be commonplace by 2030, if not having entirely supplanted driving as we know it.

The list of technologies, companies, and innovators coming up with solutions to global warming is a lot longer than what I've mentioned here and continues to mount. We don't usually hear about them because the national media get too focused on stories that are sensational but don't really make any difference in our lives, like obsessing over an accidental shooting on a Hollywood movie set, or on a pop star's private struggle with her father, and so forth. They don't give us daily reports on how much hotter it is around the world, or how many gallons of glaciers have melted, or how much the sea level has risen, you know, the things that should really matter to us.

Fortunately, there are lots of people paying attention to these matters and doing something about them. Knowing this should give up hope. Perhaps Thomas Kostigen gives the timeliest anecdote in the final sentences of *Hacking Planet Earth*: "Medical vaccines have saved humans from dying off in droves. Geoengineering and environmental technologies are the vaccines I believe we need to cure the planet's ills. It's time to take our shots."<sup>14</sup>

<sup>1</sup> Kostigen, Thomas M., *Hacking Planet Earth*, TarcherPerigee Books, New York, NY, 2020, p. 134.

<sup>2</sup> Kostigen, Thomas . *Hacking Planet Earth* (p. 161). Penguin Publishing Group. Kindle Edition

<sup>3</sup> Ibid., p. 177.

<sup>4</sup> Kostigen, Thomas M., *Hacking Planet Earth*, TarcherPerigee Books, ibid., p. 3.

<sup>5</sup> Gates, Bill. *How to Avoid a Climate Disaster* (p. 14). Knopf Doubleday Publishing Group. Kindle Edition. 2021

<sup>6</sup> *The Economist* (2017)

<sup>7</sup> <https://www.youtube.com/watch?v=tLcnJEMnITs>

<sup>8</sup> <https://www.youtube.com/watch?v=KyZArQMFhQ4>

<sup>9</sup> Kostigen, Thomas M., *Hacking Planet Earth*, TarcherPerigee Books, ibid., p. 132.

<sup>10</sup> Ibid., p. 133.

<sup>11</sup> Ibid., p. 134f.

<sup>12</sup> Ibid., p. 14.

<sup>13</sup> <https://www.xprize.org/prizes/elonmusk>

<sup>14</sup> Kostigen, ibid., p. 273.