





The Catastrophe is coming

No matter what happens with the climate now, we're headed for a world of change. If it's really bad, our descendants will know which generation to blame: ours.

by [Chris Taylor](#)

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*NOTE FOR 2019 READERS: This is the sixth in a series of [open letters to the next century](#). The series marks a little-known chronological milestone. According to [UN data](#), life expectancy at birth in 27 countries now exceeds 81 years — meaning babies born in 2019 are more likely than not to see the year 2100.*

*What will the world be like at the other end of our kids' lives? Today's scientific discoveries, Silicon Valley visions, and science fiction can give us glimpses. But in this series of digital time capsules, we also recognize that our hopes and fears can shape what the future will become.*

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Dear 22nd century,

Do you still use that quaint phrase ‘the elephant in the room’? Does the family Elephantidae, [currently at risk](#), still exist, or is its extinction such a horrific elephant in the room that no one dares speak that name?

Either way, you’ve probably noticed the metaphorical elephant in my letters so far. This is one large and increasingly sweaty pachyderm. It’s the one aspect of your world our current U.S. president, Donald Trump, [has affected the most](#); the one that the [rise of fake meat](#) could mitigate; the planetary project you’ll likely be focusing on [instead of interstellar travel](#); the thing I keep apologizing for on behalf of several billion friends, many of whom have barely begun to realize they’re staring it in the face.

In my era, we usually call the elephant “climate change.” Millions still use the outmoded term “global warming.” My preferred coinage is “[global weirding](#),” which is more precise: Earth’s climate is now weird, it’s getting weirder, and that process has no known end.

I don’t need to tell you that. For you, climate change is decades-old history and an ever-present headache, even if we stop burning fossil fuels now. I expect you’ll use a more somber term to convey its historic magnitude. It will become a capital-T word in the style of The Bomb and The Holocaust. Let us simply call it The Catastrophe.



Many of my contemporaries found such comparisons overblown. In which case, I advised they read [The Uninhabitable Earth](#) by David Wallace-Wells, a round-up of the latest climate science currently giving a lot of readers nightmares. Often, scientists of our era mince their words and make conservative projections. Wallace-Wells, in stitching their research together, is unafraid to describe the interconnecting calamities of a relentlessly warming world. And it's hard to gainsay any of it. More droughts, more storms, rising seas, rising disease: all are coming, all will make each other worse.

To take one minor aspect of The Catastrophe: air pollution, which climate change is [already making worse](#), will [kill an estimated 150 million more people worldwide](#) for every single degree celsius of warming, researchers estimate. This, the author points out, is the death toll of 25 Holocausts or two World War IIs. Human activity has already locked in one degree of warming compared to pre-industrial levels. Two, three, or four more may come along before you do.

If anything, a name like "The Catastrophe" undersells what may be about to happen — just as "four degrees of warming" sounds like a fight over the thermostat instead of the end of our entire way of life.

Who to blame for this murderous mess? Not the 19th century with its Industrial Revolution smokestacks. Not the 20th century with its gas guzzlers. Not the latter 21st century, by which time we will have likely sobered up from our oil binge and [passed peak population growth](#). The numbers finger an obvious culprit: the early 21st century. A time when, despite the decline of coal, [carbon emissions are still rising](#).







Climate change is making wildfires worse. Here, a man stands on a rooftop as a 2013 wildfire takes hold in Camarillo, California.

David McNew / Getty

“The majority of the burning [of fossil fuels] has come since the [premiere of \*Seinfeld\*](#),” Wallace-Wells writes. “The story of the industrial world’s kamikaze mission is the story of a single lifetime.”

Still, an optimistic version of your world still exists. Not quite as optimistic as the headline of a recent NPR story, “[It’s 2050 and here’s how we stopped climate change](#)” — even if we stopped all emissions tomorrow, 2050 will still see a lot of grim weather effects thanks to that degree or two of warming. Still, we have the opportunity to be heroes as well as villains. Thanks to organizations like Project [Drawdown](#), which lists which action will reduce CO2 emissions by how much ([reduce food waste 50 percent](#) by 2050, for example, and we effectively take 70 gigatons of carbon out of the atmosphere), we know precisely what we have to do.

If we stay focused on The Catastrophe already unfolding all around us, we will have the impetus to get it done. Wallace-Wells himself remains an optimist — and indeed had a baby while writing the book, a daughter who may live into the 22nd century herself — on the principle of “if we broke it, we can fix it.”

The truly nasty 22nd century comes into being only if we keep procrastinating — which is more of a danger than we think.

It’s easy to keep scary thoughts at bay by looking out the window — “eh, it’s basically fine, right?” and, over the years, adapt to slowly worsening weather like the proverbial frog in boiling water. That’s another animal metaphor you may no longer use, this time because it’s not true ([a frog would hop out of a slowly boiling pot](#)).

Still, the point stands: In our case, there’s nowhere to hop to. And we’ve already shown our capacity to adjust to worse news over time.

The full nightmare scenario is one in which we don’t even have the mental capacity to see how bad it’s getting. Warmer temperatures and more carbon in the atmosphere both have [negative effects on the brain](#), which may make the denial problem worse — [smart drugs and headbands notwithstanding](#). “With CO2 at 930 parts per million (more than double where we are today), cognitive ability declines by 21 percent,” Wallace-Wells writes.

That in turn raises the specter of even more climate-denying leaders trying to rewrite their past and present in ever more outrageous ways, even into your century, even in the midst of The Catastrophe. *Americans live exclusively in enclaves in Alaska and have always done so, right? What do you mean, there weren’t always Mad Max-style resource wars in the disease-ravaged wastes further south? Fake news!*

## Catastrophe Now

If you were able to revive every adult alive on the planet right now and made them stand trial for The Catastrophe, how would we plead? Could any of us claim ignorance? Not really. The [man-made greenhouse effect](#) was known scientific fact before I was born. President Johnson [described it in a 1965 address to Congress](#), even if some subsequent presidents denied it. I’m old enough to remember the panic years around 1989, when even hard-right leaders like [Margaret Thatcher called for a “vast international co-operative effort”](#) to fight warming. We knew.

What we can claim, weakly, is that we were confused and distracted. Never before in history had humans faced an enemy like this: carbon dioxide is odorless, colorless, ubiquitous, necessary for life, and it takes a fair amount of scientific literacy to understand why too much of it is bad news. Heck, even when our poisons were odorful and yellow-stained, as in the case of cigarettes, it took us decades of denial — from the first lung cancer links published in the early 1950s — before the numbers of U.S. smokers began to decline.

The news business wasn’t built to handle an invisible, slow-building multi-decade threat either. The Catastrophe should be the top story in every publication and on every nightly TV report, but it isn’t. We already know the details. News, by definition, is that which is new. Reporters on the scene get excited about weather. They are mute on climate.

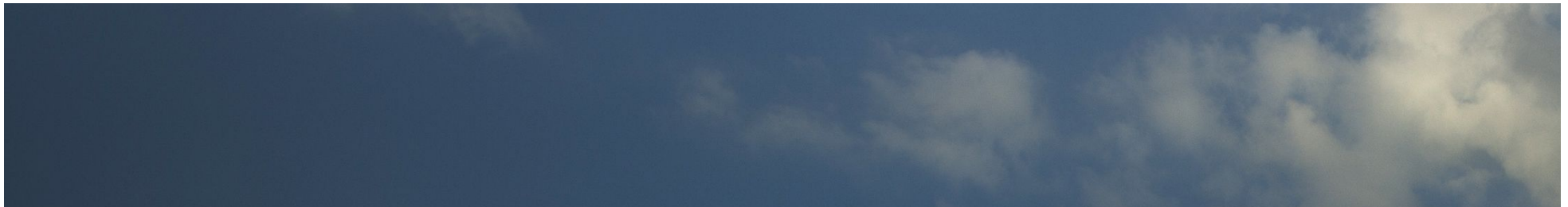
In the early years of climate change stories, there was a fair amount of crying wolf. (Do you still have wolves?) Estimates of effects were all over the map, especially in the years before the Intergovernmental Panel on Climate Change and supercomputer-enabled climate modeling. Climate denialists loved to point to articles from the 1990s that predicted doom. Since it hadn’t materialized yet, they reasoned, it never would, and thus the instinct inside us all — “everything is fine and if it isn’t we can adapt” — was basically correct.

By 2019, it was getting harder to cling to that concept. Individually, each weather event could be written off as not conclusively a result of climate change. But the ever-faster pile-up of events (the latest, as I write this: historic flooding in Iowa and Nebraska) became harder to ignore. Americans are, I hope, finally waking up to the fact that we’re not just talking about monsoons in Bangladesh and crop failures in Syria and the [disappearance of Pacific islands](#).

Tornadoes in the midwest, hurricanes in the gulf states, flooding in Florida, summer heatwaves and winter polar vortexes on the East Coast: All of this is accelerating now and is not going to stop for decades, if at all.

Here in California, where we try to be woke eco-citizens but think nothing of hopping on planes and into SUVs, most imagined ourselves immune from the horrors out there. A [7-year-long drought](#) didn’t do much to change that blithe state of mind, especially since the 2019 rains replenished all our reservoirs. (Most barely noticed the [mudslides](#) and topsoil damage that came with the deluge.)

But the state’s largest wildfires, all happening within a few years of each other, changed that. A choking haze from California’s worst ever fire so far sat atop San Francisco for several weeks last November, making our Pacific-conditioned [air quality suddenly worse than Delhi’s](#). That got our attention.



















Sea water engulfs the church of Pariahan village in the Philippines. Once a bustling village known for flamboyant parties and serene vistas, Pariahan is slowly being washed away by rising sea levels.

Jes Aznar / Getty

Already, The Catastrophe has overshot our worst predictions. The Arctic permafrost, with its locked stores of carbon, methane, and ancient viruses, wasn't supposed to melt as fast as it currently is. (It could release a [hundred billion tons of carbon by your century](#), or as much as we've released in the last 25 years, all on its own.) The eastern Antarctic ice shelf didn't get the memo that it was supposed to be stable and has started [jumping into the sea to join the iceberg party](#).

How bad could it get by your century? *The Uninhabitable Earth* is a litany of how bad, depending on how many more degrees we add to the thermostat. Four degrees — which, thanks to the melting permafrost, we may hit even if we stop all emissions — leads to an estimated \$550 trillion in damages, twice the value of our entire global economy.

High-tide flooding will batter the East Coast of the U.S. [literally every other day](#). Florida will probably have to be abandoned altogether. I'd smirk and say you're not missing much, but of course that's not true. As Joni Mitchell sang in words that will still hold true for the 22nd century, [you don't know what you've got till it's gone](#). A constant state of global famine is a real possibility. As topsoil gets washed away, dried out or otherwise damaged, we will have less space to grow crops, and the [crops we can grow will provide more sugars and fewer vitamins](#) — all while population trends give us three billion more mouths to feed. The UN says we may see as many as a [billion climate refugees just by 2050](#), or a thousand times the number of people who fled Syria's civil war. It has no estimate for 2100.

It won't be that much better for those of us who retain our homes. A third of the world's population now lives with deadly heatwaves for at least 20 days of the year; by 2100, that could be true for three-quarters of us. We're not just talking about more days inside with the AC cranked up, we're talking [temperatures so hot that they cause organ failure](#). Like an immune system shaking off a virus, the planet may literally cook us to death.

Even Wallace-Wells barely bothers considering warming of [six degrees or more](#), though some scientists give it an 11 percent chance of happening by your century. But as someone with a professional interest in all possible futures, I see that one, too. I see it mostly at night when sleep fails to come: a world where we cannot grow crops and cling to the margins of a mass extinction, where the cooler heads are fewer and cannot pull us out of the tailspin, where the survivors cannot stop their tears.

Another recent book, *Light of the Stars* by astrophysicist Alan Frank, suggests that climate change is the real answer to the famous [Fermi paradox](#), which asks why we haven't received any messages from other worlds given how many trillions of star systems are out there. Every civilization would likely build itself atop combustible fuel, meaning every civilization would go through its own Catastrophe — if not to the point of annihilation, then to the point where it is so hobbled that it cannot expand into space, ever.

## A better place

Despite the bleakness of the outlook, I am still at root an optimist. For years I've been writing about, and collecting stories about, technology that could mitigate The Catastrophe in unusual ways.

Take fake beef, which I've written about in the form of the [Impossible Burger](#). Having tasted the more delicious [Impossible Burger 2.0](#), the first of many upgrades, I predict this stuff will soon be indistinguishable from the real thing, even for regular meat eaters like me. Since it is way more economical to grow food than to keep cattle, fake meat will be cheaper, sooner than we think. One of the planet's [most destructive industries](#) may die a deserved death at the hands of market forces — no Green New Deal required.

Speaking of which, I predict we'll eventually get some form of [Green New Deal](#) in the U.S. and beyond. (As I wrote this, Britain's Labour party announced its version of the plan, which [calls for complete decarbonization of the UK economy in 10 years](#)). It will probably take a decade or two more of calamity to convince a majority of the U.S. Congress — the 2020s and 2030s are likely to be very grim decades — and [like the original New Deal](#), it will probably work more within the capitalist system than without.

Much of the good news on climate change is frustratingly small beer compared to the scale of the problem. Costa Rica just committed to [banning fossil fuels](#) by 2050. California is now powered by [one-third renewable energy](#). That's great; now where's everyone else? A [Brazilian photographer plants 3 million trees](#); what does that matter if [Brazil's new president wants to tear down the Amazon rainforest](#)?

I believe big, bold change is coming. The Alexandria Ocasio-Cortezes of the world will have their day. The 21st century may be a kind of mirror image of the 20th in this regard. If the 2030s unleash economic and ecological nightmares on the scale of the Dust Bowl and Depression a hundred years prior, then AOC may be the FDR that rises to meet the challenge. (She'll be 44 in 2033, on the 100th anniversary of FDR's inauguration.)











Wind power and the bright, but uncertain future.

Florian Gaertner / Photothek via Getty Images

The 2040s may see a global mobilization on the scale of World War II a century earlier. With the pro-environment millennial generation now firmly in control of governments around the world, it could be a decade of decisive moves that will finally, definitively decarbonize the global economy — perhaps with international systems of subsidies and fines to help fossil fuel-dependent countries switch to cleaner sources of energy. Meanwhile, liability lawsuits will nip at the heels of energy giants foolish enough to delay the inevitable switch.

By this point, even a conservative rate of technology advancement should have gifted us everything we need to survive in a post-carbon world. Autonomous electric vehicles should be ubiquitous. Solar panels will be cheap and light and transparent enough to place on every window. Green roofs will be all the rage. [High-altitude blimps, tethered with giant power cables](#), will pick up enough wind energy from the jet stream to make our turbines look like pinwheels. [Vertical farms](#) will grow food for cities, allowing regular farmland to go wild — [which in turn will soak up CO<sub>2</sub>](#) by creating billions of new plants.

Will this all arrive too late to prevent some form of Catastrophe? If it has to wait until the 2030s or 40s, probably. But given the broken political system the millennials and Generation Z will inherit when they step into the corridors of power, and the fact that fossil fuel companies are [still spreading disinformation](#), I don't see it happening much sooner. Earth may give us something of a reprieve on one hand — scientists are currently pleased by [how much CO<sub>2</sub> the oceans continue to absorb](#) — even as it takes away with the other (that pesky permafrost).

But the constant flooding, wildfires and other out-of-control weather patterns will accelerate regardless. There is no Hollywood ending to climate change. Life will feel like a slow-motion disaster movie even if we meet our [Paris Agreement goals](#) and limit warming to 2 degrees. (Do you remember the Paris Agreement that the entire world joined and the U.S. left?) We are going to have to get very good at [building affordable housing in the wake of natural disasters](#).

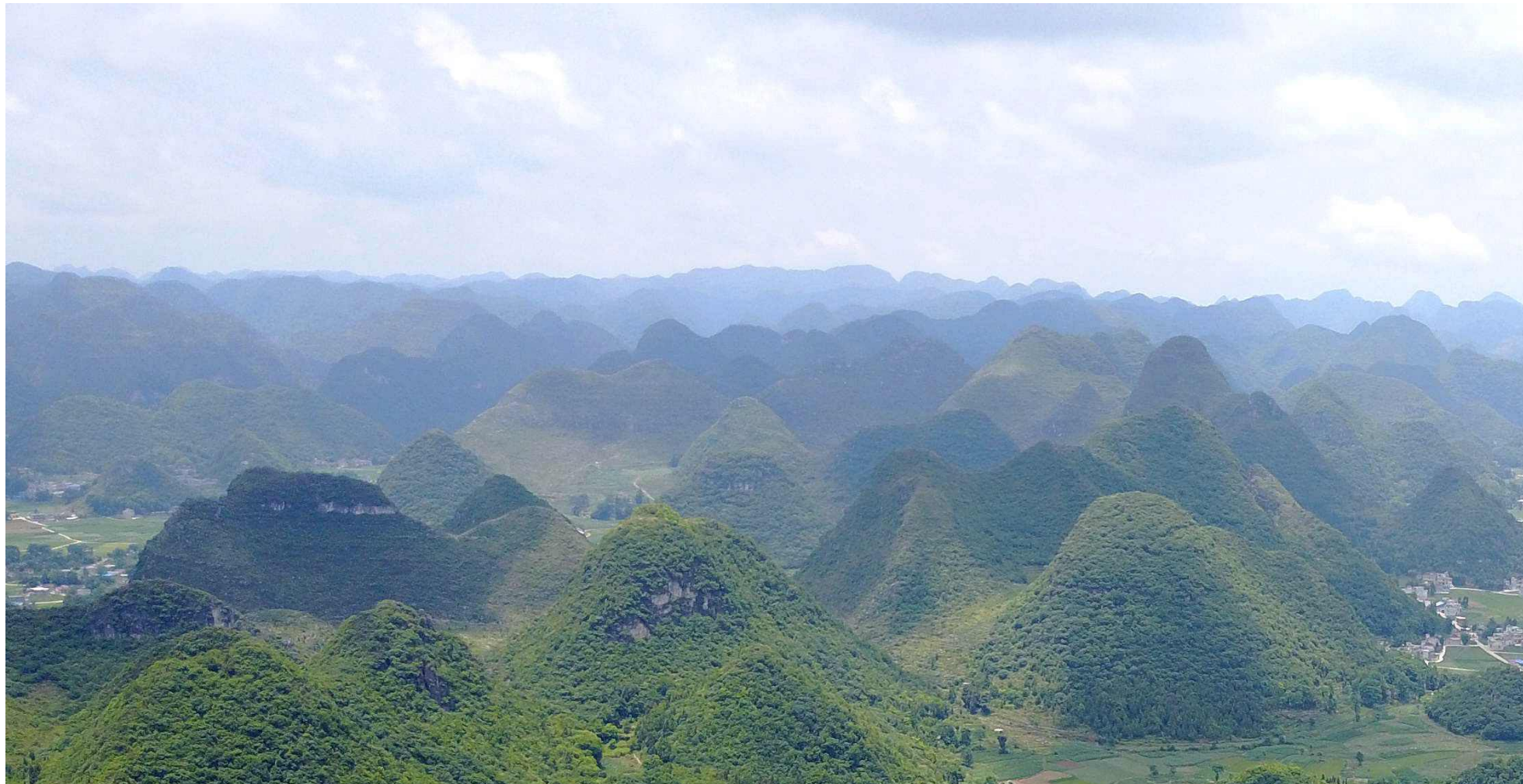
There is no Hollywood ending to climate change.

Which is why the most important debates of your century could revolve around geo-engineering — that is, trying to reverse the process of climate change by tweaking the planet's systems. This is where we could get ourselves into an even bigger mess if we're not careful, because every kind of geo-engineering proposed has its drawbacks.

Seeding the sky with sulfur dioxide particles at high altitude may reflect enough sunlight to [bring temperatures down safely](#), but it could also cause droughts and air pollution. As Wallace-Wells says, this approach would “turn our sunsets very red, bleach the sky, and make more acid rain.” If we do it too much, we could even tip the Earth into the opposite kind of Catastrophe, a new Ice Age. This is literally the plot of the movie [Snowpiercer](#), and I refuse to believe that you are the remnants of humanity criss-crossing the globe on a train that must keep moving or freeze.

I was excited when science fiction author Kim Stanley Robinson told me of a proposal by German scientists to pump sea water onto the east Antarctic ice shelf, where it would freeze — thereby averting sea level rise. It sounded too good to be true, and it in fact was. The problem is not that it would require massive amounts of energy to operate the pumps at any meaningful scale — it's only as much as the energy required to store the world's Bitcoin, as Robinson pointed out, and surely the survival of the human race is more important than cryptocurrency.

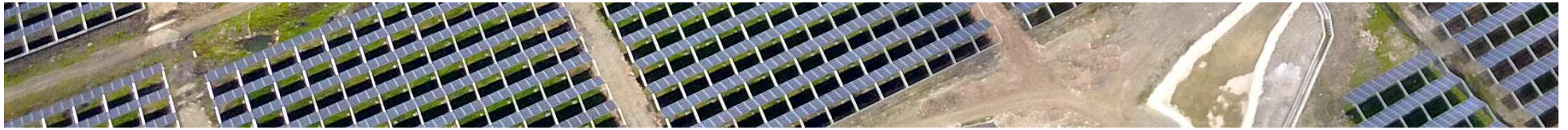
The problem is that the German scientists went back, did the math on where the water would go, and [found that the weight of that extra ice would actually accelerate Antarctica's melting](#). Whoops.











Greenhouses topped with solar panels dot the landscape of a village in China's Guizhou province. The combo is meant to deliver 150 megawatts of electricity and provide jobs for 2000 people.

STR / AFP / Getty Images

Finally, there's carbon capture technology, which promises to [suck CO2 out of the air using giant scrubbing machines](#). But the gas is so thinly dispersed that you'd need to build them everywhere around the planet — as many as 100 million machines just to match our current carbon output. Currently we have less than 20. Maybe we'll figure out how to do it more effectively and cheaply, or maybe this is a problem that has no solution in our physics.

This is why the two Catastrophe scenarios are so wildly divergent. If climate change is an out-of-control problem that defeats all human ingenuity, or if we fail to find the political will to fight it in time, our civilization will not only be disastrously diminished, we as a species will be permanently scarred. We fought nature, and nature won. Why bother expanding again?

But if we manage to head off the worst of it, or if you're the beneficiary of some new technology that has perfectly reversed climate change, we'll feel like superheroes. No challenge to the human race will ever be too mighty for us.

Either way, I hope you can forgive us for the century-long nightmare brought about by that big, sweaty elephant we allowed in the room. Here's hoping it's not the only elephant still around.

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- Written by  
Chris Taylor
- Top illustration by  
Bob Al-Greene
- Edited by  
Brittany Levine Beckman and Mark Kaufman