the weekly anthropocene

Dispatches From The Wild, Weird World Of Humanity And Its Biosphere

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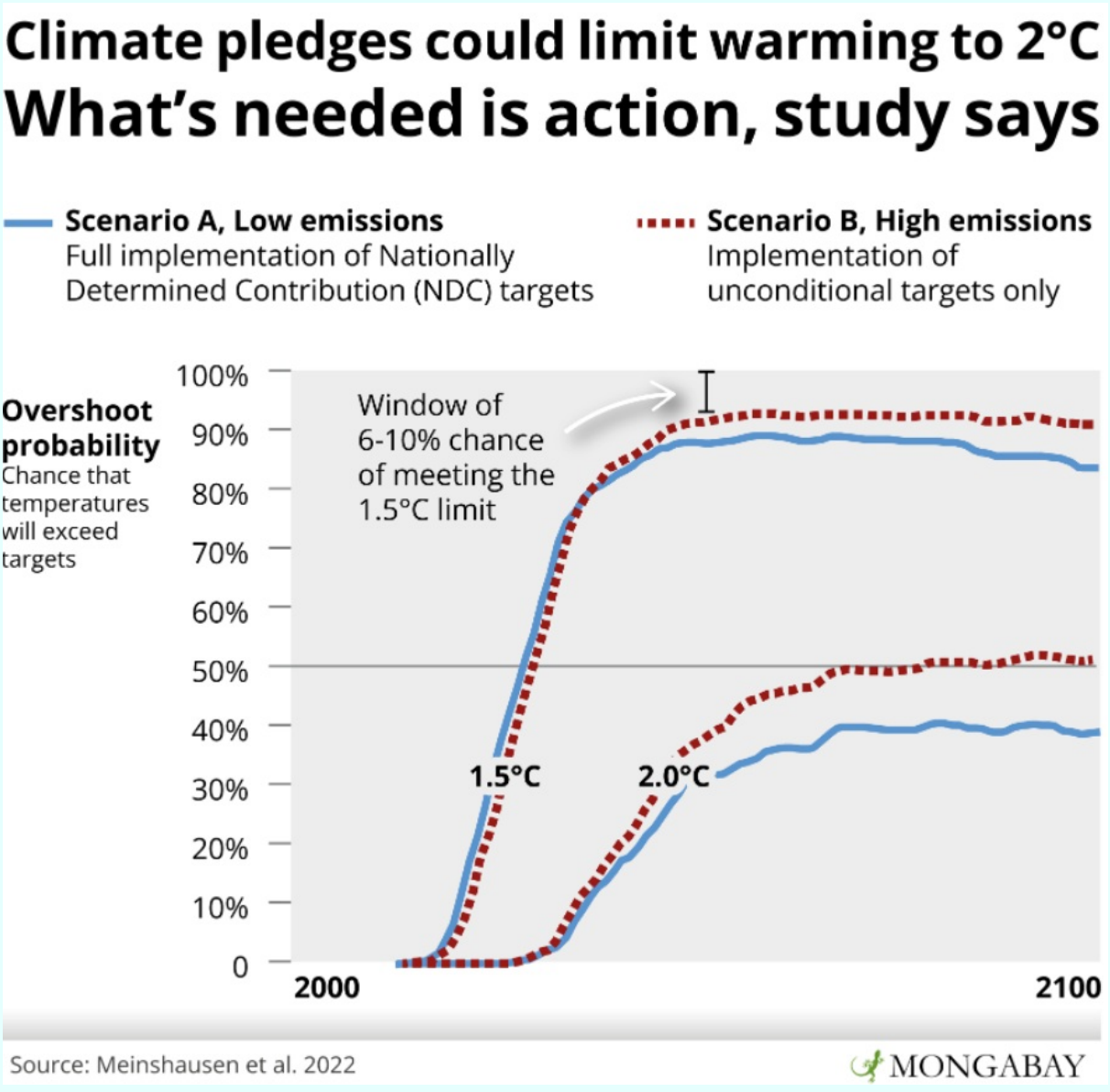
Climate Futures



One of the most little-known and yet most important facts about climate change is that in the last decade, the range of likely temperature outcomes for Earth this century has narrowed substantially. Part of that is bad: we haven't cut emissions fast enough, so it looks overwhelmingly likely that we will not meet the target of

keeping warming below 1.5 degrees Celsius. (We're currently at 1.1 to 1.2°C above preindustrial levels). But part of that is really, *really* good: due to rapid growth in renewable energy, it no longer looks likely at all that humans will keep burning coal for the next hundred years, so it looks much less likely that we'll reach worst case scenarios of 4°C or higher. In 2010, before the clean energy boom and massive price drops of the last decade, it looked very possible that we'd burn coal straight into truly apocalyptic 4-5°C scenarios. But as it turned out, global coal use peaked in 2013, and is set to decline still further.

A landmark new study in *Nature,* "Realization of Paris Agreement pledges may limit warming just below 2 °C," (here's the PDF) put some numbers on this. The researchers analyzed every formal national-level climate pledge made between December 2015, when the Paris Agreement established the format of national emissions reduction pledges, and November 2021, when a bunch of new pledges were made and previous ones strengthened at the UN climate talks in Glasgow. Plugging those into Intergovernmental Panel on Climate Change (IPCC) models, they found that if all current pledges are met on time, we have only a 6-10% chance of keeping warming below 1.5 °C by 2100 (indeed, we'll probably pass 1.5 °C in the next decade or two) but a 50% or higher chance of keeping warming below 2°C by 2100. (See chart above from Mongabay for a graphical representation of this).
“What our paper shows is that the combined effect of achieving all of these net-zero pledges would lead to a temperature rise of around 1.8° [3.2°F] to 2° by the end of the century,” said coauthor Dr. Christopher McGlade. “This is big news, because it’s the first time that governments have come forward with specific targets that can hold global warming to below the symbolic 2° level.”

The obvious question becomes: what are the odds of governments actually reaching these targets? Potentially quite high, in spite of themselves! Keep in mind, we've actually been *meeting* the (admittedly not that ambitious) national climate targets that have been previously set. In 2009, President Obama pledged that US carbon emissions would be 17% below 2005 levels by 2020, and come 2020 they were actually 21.5% lower, only some of which was due to the COVID drop. And this study only looked at *national*-level emissions-reduction targets announced by governments under the Paris Agreement framework: it didn't take into account at all the plethora of US states like California, Maryland, New York, Illinois, Maine, and even Nebraska with their own plans to reach 100% clean energy by 2050 or earlier, or the boatload of car companies that have pledged to sell only electric vehicles by 2040 or earlier, or the overwhelming economic incentives accelerating a move towards renewable energy, or the new emissions-reducing industries like coal-free "green steel" that are popping up without much government support at all. Even if a bunch of national governments fall short, again, at passing climate action legislation to meet their pledges, there are a lot of positive forces pushing for emissions reduction.

So, to sum up: we've essentially missed our shot at 1.5°C, and that's going to really suck, with more souped-up tropical storms, droughts, wildfires, heatwaves, water stresses, food insecurity, ice sheets melting, coral reefs dying, small island nations overwhelmed by rising seas, and so on. We're already seeing that kind of world taking shape today; just in the last few weeks, the Great Barrier Reef was hit by another mass coral bleaching event and South Africa declared a national emergency as record-breaking rainfall killed hundreds and displaced tens of thousands. But 2°C or a little lower is definitely doable-maybe even likely! If you sent that message back in time to the climate scientists of 2010, it might well be greeted with wild cheers. (For more on this, check out this thread and this truly excellent YouTube video, also available above. Note that the video is referencing earlier studies which discussed the likelihood of staying under 3°C, so the news has gotten better since then).

Of course, every fraction of a degree matters, and we need to fight as hard as we can on every front from renewable grid buildout to forest conservation to slow down and eventually stop global warming. But it now looks like we actually have a decent shot, as a species, at industrializing and raising all of humanity's living standards immensely without *completely* destroying the biosphere or crippling civilization. Overall, this is really great news!

Investment in Carbon Removal

On April 12th, an alliance of major tech companies including Stripe, Shopify, Meta, and Alphabet (Google's parent company) announced that they would together buy $925 million in carbon removal by 2030, through a joint fund called Frontier Climate. This builds on previous much smaller investments by Stripe in small companies pioneering new carbon sequestration techniques, from Project Vesta's work using olivine to react with carbon in ocean water to companies working on "direct air capture," removing carbon directly from the atmosphere. These kind of "advanced market commitments," promising to pay for stuff that doesn't exist yet, have previously been highly successful in spurring the development of fields from semiconductors to vaccines. The companies' promising to pay for carbon reduction efforts will likely incentivize a lot more innovation in this space.

However, when discussing carbon capture efforts, it's important to note some really big caveats: namely that the field has historically been a haven of corruption and "snake oil salesmen." There was a massive scandal in Brazil where it turned

out that carbon credits had been sold by entities promising not to cut down large swathes of forest land...and then they sold the land to be clear-cut anyway, so the buyers' carbon emissions occurred, and then the "offset" forest got cut down, with the owners paid twice. Studies have found that the entire California carbon offset market likely had a net result of increasing carbon emissions, as it provided a legal/societal loophole for companies to keep polluting when they would likely have shut down those operations otherwise. And apart from the problems that have arisen to monetize forest carbon capture as in the cases above, a lot of climate activists and scientists have dismissed technology-based (as opposed to ecosystem-based) direct air capture of carbon dioxide as worse than useless, and a distraction from more important emissions-reduction efforts. At the moment, that's hard to argue with: all current direct air capture plants (mostly associated with Climeworks in Iceland) capture 13,000 metric tons of carbon per year, or less than 1% of the emissions of one coal plant, compared to about 31.5 billion metric tons of carbon emitted globally in 2021.

So, even with this new near-billion-dollar investment, direct air capture and carbon capture generally is not anywhere close to making a difference in the effects climate change will have in the near-term. But the good news is that it's *building the field*, investing in the development, iteration, and mass-production of technologies that might start making a difference by the 2050s if they scale up massively. Major tech companies' leadership on this will also likely result in tougher enforcement and monitoring than previous nation-state led carbon offset efforts which were often subject to political maneuvering and "creative accounting." (See the case of Bolsonaro's Brazil). And longer-term, good carbon removal tech would just be a really nice thing for humanity to have around. Being able to fine-tune a major regulating component of our atmosphere by, say, the 2100s would be incredible. As the near future is being decided by renewables progress and ecosystem protection, it's great to see major companies investing in long-term technological development.

Brazil

Like its brethren around the world, the tiny coral reef off the coast of the Brazilian town of Porto de Galinhas has been battered and bruised by heat waves and bleaching events in recent years. In response, a local research group called Biofábrica de Corais has developed 3D-printed "coral cribs" to help nurse dying coral fragments back to health. They're very low-cost, less than 28 US cents per crib, and come in customized shapes to provide the optimal growing surface for each species. (Pictured above, *Millepora alcicornis* "sea ginger" fragments in their cribs). The researchers work with local

fishers and scuba divers to retrieve damaged yet still-alive coral fragments from the seafloor and place them in an appropriate crib, later transferring racks of them to a protected "farm" patch of ocean where they can grow for a few months in peace until they're healthy enough to be retransplanted to the reef. The challenges are dire-in 2020, the team lost entire nurseries to a bleaching event before they could be retransplanted-but the low-cost community-rooted model is highly effective, potentially replicable in coral reef towns around the world.

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