

Techno-Optimism and Bad Science in Paris: The Problem With Carbon Capture and Storage

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UN climate conferences provide a platform for advocating real solutions to the climate crisis – but also for selling and promoting false ones. At the climate conference this and next week in Paris, many civil society groups and social movements are advocating genuinely meaningful responses to the climate crisis: keeping fossil fuels in the ground, ending perverse subsidies, shifting from industrial agriculture to agroecology controlled by small farmers, protecting forests and other ecosystems through community forestry and territories, guaranteeing areas conserved by Indigenous peoples and local communities, and building a new economic system that does not dictate endless growth. However, many activist voices and demands are being silenced inside and outside the conference, in part due to the French government's decision to ban climate protest marches and put at least 24 climate activists under house arrest, using emergency powers acquired in response to the recent terrorist attacks.

Meanwhile, the organizers of the climate conference have welcomed in fossil fuel firms and other corporate interests, which are represented by lobby groups such as the World Business Council for Sustainable Development, We Mean Business and the International Chamber of Commerce. Participants in the conference have been using this opportunity to launch private-public partnerships that are little more than new corporate lobby groups operated under the auspices of the United Nations, and include groups such as the Global Compact and the Sustainable Energy for All Initiative.

Some businesses have teamed up with think tanks and sympathetic nongovernmental organizations to form new lobby groups just in time for the Paris conference. Shell and the mining corporation BHP Billiton, for example, have founded the Energy Transitions Commission, which offers “independent advice for a sustainable future” to those in charge of energy policy decisions and investments. Their website is short on details about just what they would advise, but one of Shell and BHP Billiton's favorite “solutions” is carbon capture and storage (CCS). Their professed enthusiasm hasn't translated into any serious financial commitments: BHP Billiton has so far invested precisely nothing into that technology, while Shell has so far invested in just one commercial-scale project – capturing a proportion of carbon dioxide from a tar sands refinery in Alberta. Out of a total project cost of C\$1.35 billion, Shell committed a mere C\$485 million; all the rest was paid out of public funds.

The Allure of False Technological Solutions

This week's climate conference also has its share of techno-optimists peddling often absurd science-fiction “solutions.” One of the most widely cited media commentators on the Paris climate conference has been Tim Flannery. He has been cited by press agencies and leading news outlets around the world in the run-up to the conference.

Flannery is an Australian academic, former government adviser and chief councilor of the Australian Climate Council. He recently launched his latest book *Atmosphere of Hope: Searching for Solutions to the Climate Crisis*. It has won widespread media acclaim, and even the reputable science blog Yale Environment 360 has granted Flannery an uncritical interview about his proposed “solutions.” Some of Flannery's “third-way solutions” are proposals that have been widely cited in spite of a lack of scientific backing. He remains an outspoken proponent of biochar (i.e. fine-grained charcoal added to soils), a concept based on the assumption that biomass is essentially carbon neutral. Biochar advocates argue that adding biochar to soils is a reliable way of sequestering carbon and that this process will thus gradually draw down carbon dioxide from the atmosphere.

Flannery is either unaware of or unperturbed by peer-reviewed studies highlighting that there is still no credible data from long-term field experiments to show whether adding biochar to soils can actually sequester carbon in the long-term, nor whether or not, or under what circumstances, it will lead to the loss of existing soil carbon. Nor does Flannery note a study concluding that biochar may have positive, negative or no impacts on emissions of carbon dioxide, methane and the powerful greenhouse gas nitrous oxide from soils and that impacts are highly case-specific and cannot be credibly predicted without more long-term trials. Other “solutions” propagated by Flannery are truly bizarre. He is particularly enthusiastic about creating vast oceanic farms of seaweed, which he believes

would draw down large quantities of carbon, thus mitigating climate change and ocean acidification. The seaweed, he suggests, can then be turned into fuel and eaten. The fact that both eating the seaweed and burning fuels made from the seaweed would return all the “sequestered” carbon to the atmosphere seems to have escaped him.

Another idea that excites him is storing “carbon dioxide snow” in Antarctica. He has read a peer-reviewed study that convinced him that carbon dioxide snow is falling in Antarctica, which could be stored in large “chiller boxes” powered by wind turbines. Unfortunately, the lead author of the study that had so excited Flannery urged him to read the study more carefully before referring to it. He clarified that temperatures in Antarctica are too high and pressures too low for carbon dioxide to fall as snow.

Flannery’s background reading about “carbon negative cement,” another of his favorite “solutions,” seems to also have been rather cursory. This, he writes, is already on the market and has been well tested, with its use merely held back by engineers who are reluctant to use any product without a track record. Yet the company that manufactures it, Solidia, merely claims that their way of producing cement reduces carbon dioxide emissions by 30 percent – not that it is carbon neutral, let alone carbon negative.

An “even more amazing innovation,” according to Flannery, is a new method for modifying coffee grounds to store atmospheric methane. He forgets to mention that, to “modify” the coffee grounds, researchers mixed it with potassium hydroxide (which takes a great deal of energy to produce), kept it at an elevated temperature for 24 hours and then heated it to 700 to 900 degrees Celsius. The whole process hasn’t gone beyond a single laboratory experiment so far.

One could fill many pages with similar nonexistent or unproven “solutions” to the climate crisis that are being hyped up. There will always be individuals and enterprises peddling false claims and wishful thinking. Seeing influential scientists and scientific institutions embrace such unscientific false claims turns them from ridiculous and amusing eccentricities into something more sinister. Flannery himself is a widely published scientist and his Climate Council was set up to “provide independent, authoritative climate change information to the Australian public ... based on the best science available.”

Bioenergy With Carbon Capture and Storage

The negotiating text in Paris contains proposed text about “zero net emission,” based on the assumption that actual emissions can be neutralized by future “negative” ones. This is based on conclusions in the 2014 report of the International Panel on Climate Change (IPCC). According to that report, most relevant models predict that “negative emissions” in the form of bioenergy with carbon capture and storage (BECCS) would be required later this century if we are to avoid more than 2 degrees Celsius of warming. BECCS would involve capturing carbon dioxide from biofuel refineries or biomass burning power stations and burying it underground. The idea that large-scale BECCS is feasible and can draw billions of tons of carbon from the atmosphere has risen to prominence since the 2014 IPCC report was published.

But just how did the IPCC come to effectively endorse the idea of BECCS (albeit with some mentions of “uncertainties”)? For this it is important to understand the setup of the IPCC. It consists of three different working groups: about climate science, climate change impacts and climate change mitigation. The first two have a consistent record of carefully reviewing and summarizing the peer-reviewed science. Their findings are highly regarded by virtually all except for climate change deniers. While those working groups are – quite appropriately – dominated by climate and earth systems scientists and ecologists, climate economists have risen to prominence in the IPCC working group on mitigation.

At the heart of this working group’s latest 2014 report is a review and summary of integrated-assessment models. An open call for such models was issued in 2007. Different technology options and emissions scenarios were to be entered into models to show how such different technology choices and socioeconomic pathways would translate into different concentrations of greenhouse gases and thus different risks of warming.

At an expert meeting convened by the IPCC in September 2007, modelers were told that to ensure the robustness of the modeling studies, “scientifically peer-reviewed publication is considered to be an implicit judgment of technical soundness.” Thus, if a company’s representatives manage to publish a peer-reviewed study in whichever journal, which “concludes” that the company’s technology is sound, modelers can assume the result to be fact. Peer-reviewed studies written by industry representatives are commonplace. Climate change deniers would have a field day if the IPCC working group on climate science set such a low standard for evidence!

As for the “GHG and carbon cycle accounting, land use implications, and economic considerations” of different technology choices used in models, those were to be assessed by a panel. Quite how wasn’t made clear, but the discussion of the life-cycle greenhouse gas impacts of different, supposedly low-carbon and carbon-negative technology choices in the latest IPCC report is woefully brief. At the 2007 expert meeting, some participants expressed concern that at least some models were expected to include “negative emissions” – namely through bioenergy with carbon capture and storage (BECCS). They pointed out that there were “technical concerns about the ... characterisation of the negative emissions technology” and about potential consequences, including on emissions of the powerful greenhouse gas nitrous oxide from greater fertilizer use.

Judging by the IPCC’s 2014 report, those concerns were brushed aside. The vast majority of models considered by the IPCC “find” that BECCS is needed if we want to have a greater than 50 percent chance of keeping global temperature rise within 2 degrees Celsius. Modelers had done as they had been requested: They had included “negative emissions” from BECCS into their models – often on a grand scale, without considering whether such a technology was viable, whether carbon pumped underground can be trusted to stay there forever, nor whether burning billions of tons of wood, crops and other biomass every year could possibly be “carbon neutral” (the prerequisite for it to become “carbon negative” with carbon storage).

BECCS could, according to the models summarized by the IPCC, sequester up to 10 billion tons of carbon dioxide every year. That figure was based on two sources: One was a [literature review](#) by a Ph.D. student. The other was a report published by the International Energy Agency (IEA), written by Ecofys.

Ecofys is a consultancy that is fully owned by a Dutch energy company ([Eneco Group](#)) that has built the first large biomass power station in the Netherlands, hence clearly not unbiased. Ecofys’ estimate of the maximum BECCS potential is derived from estimates of the global potential for “sustainable biomass,” made up of “residues” and “energy crops.” But how did they estimate that? For the “residues,” they lifted a figure from a preliminary report, which contained no details at all about what that figure was based on. For the “energy crops,” they used figures from one study that estimated how much could be produced by converting “abandoned cropland” and natural grasslands to bioenergy plantations.

Natural grasslands are home to a significant proportion of the world’s biodiversity and they store large amounts of carbon, most of it in soil – and much of that is emitted when grasslands are ploughed up and turned into monoculture plantations, as several peer-reviewed studies confirm. Yet in the Ecofys/IEA report and thus in the IPCC report, all this bioenergy is simply assumed to be carbon neutral (and thus carbon negative with carbon capture and storage). The fact that the IPCC report suggests a massive “negative emissions” potential from BECCS raises serious concerns that scientific standards have been abandoned in relation to climate change mitigation.

This is only one of the problems with BECCS, as a [new Biofuelwatch report](#) shows in detail: The technologies that would be required to sequester significant amounts of carbon dioxide from biomass burning power stations are beset with major problems and challenges. Overcoming those to render BECCS technically and economically viable seems unlikely. Carbon sequestration can be combined with additional oil extraction, but this would likely result in greater overall carbon emissions. Sequestering carbon without such oil recovery, on the other hand, is even less likely to become economically viable, and evidence shows that it is far from reliable.

In short, there is no credible scientific basis whatsoever for suggesting that BECCS could ever sequester up to 10 billion tons of carbon dioxide per year. Yet this very claim is the basis for the text proposal about “negative emissions” debated by governments in Paris right now.