**Catastrophic Carbon Removal**

**(why the ‘BIG SOLUTION’ is failing badly)**

The citation is:

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**If you’ve been tuning into my little weekly ramblings since I started this channel five years ago, you’ll know that I’ve regularly talked about the widening chasm between what we need to do to fix climate change and what we’re actually doing to fix climate change.**

**15:00 Here’s a chart I’ve used on several occasions over the years. It comes from a special report called SR15 published in 2018 by the Intergovernmental Panel on Climate Change.**

**25:00 It shows how, rather than continuing to run our societies in the way we have been for the last century or so, 31:00 we all apparently need to experience a collective epiphany around about 2023 36:00 and realise, ‘en- masse’, that allowing average global temperatures to stray more than one-point-five degrees Celsius above pre-industrial levels would actually be an extremely bad idea indeed. 46:00 Having made that discovery we will then essentially need to switch off everything we do that emits carbon dioxide 52:03 which, in case you’re wondering, is pretty much everything we do. Even that won’t quite cut it though. 58:16 We’ll also have to start sucking carbon dioxide back out of the atmosphere so that 1:02:13 atmospheric CO2 levels start to fall, and we get ourselves back to a nice safe place 1:08 by the end of the century, 1:09 with global temperatures stabilised. 1:12**

**Just as a quick reality check…1:13 here’s how that plan is going so far. 1:16 Not ideal, is it? 1:19**

**So, has the so-called Carbon Dioxide Removal strategy got any chance of making a difference? Well, that really is a very good question indeed, and it’s one that has now been answered in a comprehensive new study by a team of eminent scientists from Europe and America.**

**So, let’s have a look at what they uncovered.**

**Hello and welcome to Just Have a Think.**

**First things first. Carbon Dioxide Removal is not the same as Carbon Capture. You probably already know that, but it’s worth just quickly clarifying it again for anyone who’s not sure. 2:01 Here’s a nice neat definition from the American University in Washington DC. 2:05 Carbon Capture and Storage, or CCS, captures carbon dioxide from a smokestack or flue 2:11 at somewhere like a coal-fired power plant or a cement factory, and then, in theory, sequesters (or permanently stores) that carbon dioxide underground. 2:20**

**Carbon Dioxide Removal, or CDR, 2:23 is the process of drawing CO2 gas directly out of the atmosphere 2:27 by removing it from ambient air, anywhere on the planet, 2:30 either via mechanical technology or by using nature’s own processes, 2:35 and then storing the carbon durably in soil, or in the oceans, or in geological formations, 2:40 or even in products like furniture and buildings that are likely to be around for a long time. 2:46**

**This latest research paper, 2:47 very appropriately titled “The State of Carbon Dioxide Removal”, assesses how much CDR is already happening around the world, how quickly the technology is moving and whether the world is on track to delivery what’s required. 3:00**

**3:01 This graphic shows the total amount of CO2 that is currently being sucked out of our atmosphere per year at the moment. 3:06 It’s about two billion tonnes, which is a lot of CO2, 3:10 but bear in mind that we humans spew out about thirty seven billion tonnes of carbon dioxide into the atmosphere each year, so you know, there’s a slight disparity there.**

**3:18 This grey section represents 3:20 ninety-nine-point-nine percent of all CDR taking place around the world today, 3:25 and it may surprise you to learn that it’s actually coming from 3:27 conventional methods including the creation of new forests, the restoration of previously deforested areas, 3:33 increases in soil carbon and 3:36 the use of durable wood products like panels and sawn wood used in construction. 3:41**

**3:42 To properly show you how much CDR is being achieved by new technologies like Bioenergy with Carbon Capture and Storage and Direct Air Capture, 3:52 we have to do some serious zooming in on this tiny little orangey bit here. 3:57**

**It works out to a grand total of 3:59 zero-point-zero-zero-two-three gigatons per year. Otherwise known as two-point-three-million tonnes. 4:05 It’s not just BECCS and DACCS to be fair. 4:08 section also covers biochar, which is essentially 4:12 charcoal produced from plant matter and stored in soil, and something called Enhanced Rock Weathering, which is the process of spreading finely ground silicate rock like basalt onto surfaces to speed up the chemical reactions that happen naturally between rocks, water, and air.  I’ll leave links in the description section to articles about both those techniques in case you want to learn more about them.**

**These novel CDR methods are clearly all at a very early stage in their development and right now there’s quite a bit of uncertainty about how much they would really cost if we scaled them all up by several orders of magnitude, and whether that scaling would genuinely bring the hoped for benefits or whether it would cause unexpected hazards further down the line. 4:54 But the paper also points out that while the more conventional methods are already well established and can, if done properly, result in positive side effects like improved biodiversity, 5:04 they do by definition need a lot of land, 5:07 and that’s a real limitation to how widely they can be implemented 5:11. Plus, the carbon removal achieved by trees and soils can be very easily reversed by unwanted events like forest fires and by extreme weather events brought on, ironically, by climate change itself. 5:22 So, the papers authors conclude that while novel methods have big hurdles to overcome, they may represent a more durable form of carbon storage in the long run. 5:32**

**But, could we perhaps just do without CDR and simply focus more on the most important priority of burning less fossil fuel in the first place? Well, that question takes us back to that chart I showed you right at the start, 5:44 which tells us that every pathway keeping us below one-point-five degrees of warming relies on carbon dioxide removal. 5:51 The research paper offers a similar but more concise version of the chart 5:55 onto which they’ve applied three different scenarios. 5:57 The first scenario is what would be needed if we really focussed on reducing demand for fossil fuels so that we actually achieved the 6:04 forty-eight percent reduction in greenhouse gas emissions by twenty-thirty that our global leaders all proclaimed as essential 6:12 during COP 26 in Glasgow in 2021. If we followed that ambitious path, 6:17 then carbon dioxide removal would have to increase from 6:20 two billion tonnes a year to something like 6:22 four and a half billion tonnes a year by twenty-fifty. 6:25**

**6:26 Scenario two is based on focussing predominantly on renewable technology to get us out of jail, 6:31 with a resultant 6:32 thirty-one percent reduction in emissions by twenty-thirty. 6:35 Making that work would require an increase in CDR up to almost 6:39 eight billion tonnes a year by mid-century. 6:41 And then there’s the third scenario which considers what we’d need to achieve if we didn’t bother change much at all in the way we live our lives, 6:48 but really went all in on carbon dioxide removal, 6:51 with a thirty three percent reduction of atmospheric greenhouse gases by twenty thirty. 6:56 In that case we’d be looking at almost 6:58 ten billion tonnes of carbon dioxide removal per year with a margin of error that could take us up to more 7:04 than fourteen billion tonnes a year. 7:08**

**If you add all that up, which the authors of this paper kindly did for us, then the news is that all pathways limiting warming to one-point-five or two degrees will involve carbon dioxide removal during the eighty years 7:19 between twenty-twenty and twenty-one hundred, that range from 7:23 four hundred and fifty billion tonnes to as much as 7:25 one thousand-one hundred billion tonnes. 7:30**

**So, the next question might reasonably be, what’s the plan? 7:33 Well, it’ll probably come as absolutely no surprise at all to hear that the authors found there was a major gap between how much 7:39 CDR is actually being planned by nations around the world, and how much will 7:44 actually be needed to stay within the crucial warming limits. 7:48 The sum total of the Nationally Determined Contributions, or 7:51 NDCs pledged by every one of the one-hundred and ninety six nations 7:55 that signed up to the 2015 Paris Climate Agreement, 7:58 is an additional 8:00 zero-point one to 8:01 zero-point six-five billion tonnes per year of carbon dioxide removal by the end of this decade. 8:06 That’s shown by the two grey sections in this next chart, 8:10 one representing total CO2 that current policies would remove by 8:13 twenty-thirty and the other showing the total removed 8:16 by mid-century.**

**8:18 If we then overlay the three scenarios from the last chart, 8:21 it’s pretty clear that things are going to go very pear shaped in the coming decades unless there’s a serious ramp up in government action on carbon dioxide removal. 8:30 Even in the best-case scenario where we all miraculously experience that epiphany I mentioned right at the start of the video, 8:36 we’d still be missing about two 8:39 billion tonnes of CDR by twenty-fifty. 8:43**

**To get a gauge of current thinking on the subject, the report’s authors went through what I imagine was an extremely painstaking process to identify where the balance of research has been progressing over the years. 8:54 When the IPCC published their very first climate assessment report back in nineteen ninety, 8:59 nobody was talking about removing carbon dioxide from the atmosphere. In fact, you’d have been considered a bit of a lunatic if you’d even suggested such an outlandish notion back then. 9:11 But as the years rolled on and we continued to completely ignore the warnings 9:14 and recommendations of subsequent, increasingly alarming climate assessments, 9:19 so the concept of CDR gained traction and the number of research publications started to follow what looks a bit like 9:25 an exponential curve. 9:28 Today, as our knowledge of the pros and cons of the various CDR techniques has improved significantly, 9:32 the most researched area is actually 9:35 biochar, represented by the big purple 9:37 section, followed closely by 9:39 soil carbon sequestration in general, again shown in 9:43 dark green. 9:45 By contrast, the report found that, of the roughly four-point one billion dollars of direct funding currently in place, the vast majority – about three-point five billion dollars - is being ploughed into proposed direct air capture demonstrators in America. What’s happening in the real-world is that innovation in CDR is morphing into intellectual property that can be used by existing big businesses, many of which are based in, or have close links with, the fossil fuel industry, to create profitable new enterprises. Purchases of carbon credits for removed Carbon Dioxide reached about two hundred million dollars between twenty-twenty and twenty-twenty-two, most of which came from DACCS. Two of the biggest DACCS companies operating today, Carbon Engineering and Global Thermostat, are not sequestering the CO2 they capture. Instead, they’re combining it with hydrogen to make hydrocarbons that they can then sell as so-called ‘net-zero-fuels’.**

**Meanwhile, the report highlights high profile press releases from various companies and industry groups announcing their intentions to scale up CDR activity in a way that implies we could actually achieve the mid-century targets we looked at just now, not just with DACCS, but also with biochar and BECCS. 11:00 The trouble, as the authors of this paper point out, in order to genuinely achieve those claims, 11:06 the carbon dioxide removal industry would have to scale up by 11:10 five orders of magnitude. 11:12 That means getting ten times bigger, 11:14 then ten times bigger again, 11:16 then ten times again, 11:17 ten times again 11:19 and ten times again I’ll let you draw your own conclusion from that statistic. 11:25**

**The conclusion that the research team draws from all this analysis is that the coming decade will be a crucial time for new CDR technologies. Essentially, say the authors, if we don’t get a move on now, and start hitting some serious targets in the next few years, then we really will have left ourselves with an impossible task during the second half of this century, which is of course when our kids and grandkids will be busy mopping up after us. 11:52**

**Now, this is perhaps one of the most contentious and emotive topics of conversation currently bubbling away as part of the overall climate debate. I’m quite sure a good many of you will have an opinion on the validity or otherwise of carbon dioxide removal techniques and how you think we should proceed in future. If you do, then I’ll be down in the comments section below here over the next couple of days, and I’ll be very interested to read your thoughts there.**

**That’s it for this week though. A huge thank you, as always to the channel’s Patreon supporters who keep me on the straight and narrow and allow me to keep ads and sponsorship message out of these videos. If you feel like joining them, then you’ll get exclusive early access to every new video that I produce, plus regular exclusive extra content from me, AND the chance to influence the video topics we chose via monthly content polls. And you can do all that by visiting patreon dot com forward slash just have a think.**

**And of course, if you found this video useful and informative, then you can help the channel absolutely for free by clicking the ‘subscribe all’ option in YouTube’s drop down menu so that you get notified whenever a new video comes out.**

**As always, thanks very much for watching, have a great week, and remember to Just Have a Think.**

**See you next week.**