On climate change, “false solutions” and communication

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1 Introduction

For a while now, I have been musing over what exactly activists mean by “false solutions” in the context of climate change and decarbonisation. This was triggered while listening to a podcast on the recent congressional hearings with big oil, in which one person, Carroll Muffet, lamented these companies promoting false solutions:

> I think that what is really striking in these documents is the incredibly compelling evidence that the reliance on carbon capture and storage, the reliance on on blue hydrogen, is just a new form of industry denial and greenwashing and that denial has not gone away it has simply evolved... if you look at the economics of these false solutions, whether it’s CCS or or blue hydrogen, ... it’s clear there is no serious case to be made for them from the perspective of responding to the climate crisis.

My immediate reaction was to interpret this as meaning they had no part to play in of climate mitigation efforts. However, excluding these technologies essentially means foregoing all the lovely staff industrial organic chemistry has given us, which struck me as a surprisingly radical though not undefensable position.

That’s not the only interpretation that “false solution” could have however. I propose the following possible alternative meanings of this phrase which I will discuss in this text (my opinion is indicated in brackets):

- These are literally not solutions in the sense that they won’t help us decarbonise. (Mostly disagree)
- They may technically be solutions, however they are too immature or inefficient to be really viable. (Partially disagree)

- They have the potential to be solutions, however they are used by industry as a greenwashing or delaying tactic. (Agree)
- They are unnecessary if we practice a more sobre lifestyle. (On the fence)

I have taken as a starting point that these really could be considered "false". I don't think this is biased, since I believe you could approach all decarbonisation technologies with a similarly critical viewpoint, even wind and solar power (as we'll find out when we start dumping solar panels by the shedload).

In addition, the technologies that I will be treating as potentially "false" solutions are Carbon Capture and Storage (CCS)[1], hydrogen in all its forms and biomass. I chose these specifically because they are all potential solutions for continuing industrial organic chemistry processes, such as producing plastics and ammonia fertilisers. By organic chemistry, I don't mean "cute and cuddly green chemistry", I mean the production of materials which contain carbon. I will explain these technologies in more detail throughout the text.

So with that in mind, let's get started.

2 Literally not solutions

The most literal interpretation of "false solution"technology is that it simply will not help us decarbonise, that is reduce our greenhouse gas emissions. I would deem that such a bold statement as this can only ever be partially correct and I will begin by explaining why it's wrong. The angle that I will take is that of how to decarbonise industrial, organic chemistry processes to keep matters simple(ish) and since that is what I'm most familiar with.

2.1 A brief introduction to industrial organic chemistry

Let's begin by outlining what we would be missing out on if we didn't have these processes. To begin with, no plastics. Fair enough, no one likes plastic these days. Practically speaking however, we are extremely reliant on plastics. I'm not just thinking of single use takeaway boxes, I'm thinking of my computer monitors case, my mouse, the handlebars of my bike, my polyester clothes, my (waterproof!) bag and coat, ... We wouldn't have organic solvents, so no more paints, glues, dyes or the ability to make other materials e.g. plastics. No detergents, no fertilisers, no pharmaceuticals. A quick Google search will doubtless unveil more.

We can replace all of the above items with other materials of course but often the alternatives would be worse than using plastic. This is a silly example, but I'm quite glad that we don't produce all our rubber from trees anymore, and

[1] I am only talking about CCS employed at the point of emitting. Direct air CCS is and will probably remain a last ditch solution at best.

anyway I would be unsurprised if this would be impossible even if we decided not to give a toss about the Living[2]. Another silly example, but single use paper bags are generally worse than plastic ones. Of course, we could reduce our consumption of these materials, a point which I will get back to later.

The common thread of all the materials and products I listed before is that they are (apology for repeating myself) organic - they contain carbon and mostly hydrogen and oxygen. This is a gross oversimplification, but many of them can be produced starting from syngas ("synthesis gas") which is predominantly carbon monoxide and hydrogen. With syngas you can then make ammonia or methanol and with methanol you can start making more and more complex compounds. In fact, the collection of reactions you can get from syngas have their own name, the Fischer-Tropsch process. In addition, hydrogen has a variety of applications in organic chemistry.

The point I'm trying to make is that syngas, and in particular hydrogen, is a good starting point for making organic materials. Once you have hydrogen, your good to go as it were. This is a gross oversimplification, but I think it's correct enough description for my purposes. Syngas is also not the only or necessarily the most effective starting point. For example, I thought you could make polyesters from syngas via ethane and then ethylene (ethene) by steam cracking. While I'm sure I could find some research papers or patents where this is the case, according to Wikipedia (shoot me) it seems that ethane is mostly obtained by separating it from methane in fossil gas. Still, I believe that my argument, that once you have hydrogen you can start building up your cosmos of organic chemicals, still stands.

2.2 Why is organic chemistry bad for the climate?

Syngas is currently produced by steam reformation of methane which you probably know better under the name of fossil or natural gas[3]. The steam reformation only produces carbon monoxide (nasty, but not a significant greenhouse gas). If only the hydrogen is desired (e.g. for producing ammonia fertiliser or for "hydrocracking"), the water gas shift reaction is used which does produce carbon dioxide[4]. The production of methanol doesn't actually produce carbon dioxide either, though it does when it is burned (which it probably will be eventually). Aside from the carbon dioxide which may occur when producing derivatives of hydrogen, there is also the carbon dioxide produced by burning fuel to get the required reaction temperatures[5]. In short, the current way of

[2] I am trying to use "the Living" (often used in French as "le Vivant") instead of environment to firmly place humanity back within the "natural" world we think we managed to leave behind.

[3] To be exact, fossil gas is the gas you extract which will be mostly methane plus some impurities

[4] The Haber-Bosch process for producing ammonia is responsible for 1.2% of global emissions and roughly half of all chemical sector emissions. Those numbers don't account for the fact that ammonia used as fertiliser will also partially escape to the atmosphere as nitrous oxide which is a potent greenhouse gas.

[5] This is generally an issue for decarbonising heavy industry sector. While for heating homes we can use heat pumps, you won't be able to heat a reactor to 900 Celsius using one. That leaves

obtaining organic compounds produces greenhouse gases which we need to get rid of[6].

2.3 Why we need "false solutions"...

And it is impossible to get rid of these greenhouse gases without CCS, "renewable" hydrogen production or biomass[7]. In fact, it's mostly impossible without CCS, which is the only solution for reactions which produces carbon dioxide as a byproduct (e.g. water gas shift reaction or cement production). Most importantly, hydrogen is critical for organic chemistry uses and you can't make it sustainably without CCS (blue hydrogen), electrolysing water using wind and solar power (green hydrogen) or biomass gasification (also green hydrogen). In fact, there's a(n extremely irritating) rainbow of colors for hydrogen to specify where it comes from.

A large part of the policy debate in Europe around hydrogen concerns this, pardon my French, fucking[8] rainbow. For example, the European Commission is still trying to figure out how and when it should classify hydrogen as "green", a process derailed by Germany. In the meantime, pretty much the entirety of the hydrogen we produce globally currently comes from fossil gas. This leads to true but I would argue somewhat misleading statements such as this one from We Smell Gas. Misleading in that while they're true, pretty much everyone agrees (on camera at least) that we shouldn't produce hydrogen this way. For example, the European Commission's Hydrogen strategy specifically states:

> Renewable hydrogen can be obtained via electrolysis using renewable electricity to split water into hydrogen and oxygen. It will play a key role in decarbonising sectors where other alternatives might be unfeasible or more expensive. It can be used to replace fossil-based hydrogen for transport and industrial processes, and to start new industrial products, such as green fertilisers and steel.[9]

2.4 ... and why they might be a terrible idea

I will single out blue hydrogen, that is hydrogen produced from fossil gas with the carbon dioxide captured and stored somewhere, to discuss how it may ac-

you with the option of heating directly with electricity or producing a "sustainable fuel" and burning that (capturing the carbon dioxide it emits if needs be).

[6]Besides the environmental issues you could equally question how much longer we'll have access to cheap natural gas.

[7]I have a suspicion that you could probably make a lot of the organic chemicals you would want using biochemical reactions, i.e. without going through hydrogen. However, as I suspect the environmental impacts would be equally problematic than if we continued to use grey hydrogen.

[8]I have taken an irrational disliking to this coloring hydrogen.

[9]It then goes on to make some very optimistic statements about hydrogen's role in the power sector. The role of hydrogen in the transport sector should also be severely limited in mine and pretty much every other sensible person's opinion. While I'm at it, it should never be used to heat up a house, since that is an absolutely stupid waste of energy.

tually be a terrible idea. This is based on this paper by Howarth and Jacobson, and the reasoning goes something like this:

- Fossil gas is mostly methane, which is a potent greenhouse gas.
- If just a little bit of it leaks (roughly more than 3%), the warming impact of the leak can be greater than if you had just burnt the gas or an equivalent (in energy terms) of coal.
- So if you leak some methane and use the rest to produce hydrogen while capturing the carbon dioxide, you're not carbon neutral at all due to the leak.

This paper was followed by a response from quite a long list of authors and then another reply from Jacobson [10]. I will admit I have not read further than the abstract of any of these papers, but both seem to have some reasonable points[11] and my takeaway is "blue hydrogen may well not be anywhere close to carbon neutral"[12].

2.5 A digression on communication

I brought this last point up because it illustrates how the devil is in the details which is often the case for such matters[13]. Whether a technology truly is helping decarbonisation efforts depends on a number of factors, not just whether it's a solution on paper. A classic example of this would be burning biomass i.e. trees or crops, which in the long term may be carbon neutral but in practice is rarely the case (see here and here for example).

This, for me, is annoying, since there is a very serious problem (that a technology may not actually decarbonise a particular activity) which is potentially being exploited by vested interests but you can't satisfyingly turn it into a slogan and shout it at someone with confidence because they will reply "but it does decarbonise" and they would technically be correct. There are many arguments you need to make before you can reduce your message to the kind of clean and simple message so loved in the age of the internet. Or you end up making what I would consider to be misleading statements such as that of We

[10] Jacobson has form with this sort of back and forth, which I rather enjoy. People disagreeing is the best way to learn in my opinion.

[11] Up to a point. Howarth and Jacobson make the good point that Romano et al. base their leakage values on an illustrative figure from the Oil & Gas Climate Initiative, which is laughably shoddy research. Perhaps Howarth and Jacobson are misrepresenting Romano et al though, who knows.

[12] The leakage issue also applies to arguments that fossil gas is better than coal. Depending on the leakage rate, it is not.

[13] Possibly due to the sheer scale of human activity which means that anything we do is bound to have unexpected or unintended consequences.

Smell Gas[14] which misinterpret the public debate and are easily brushed off by "serious" policy makers.

Of course, the world is complicated, and I should accept this, grow up and stop polarising public opinion. This is the stance that I think most academics would take. It is, in my opinion, rather naive. It leaves the door open for companies and governments to exploit the nuances of the debate to ignore heavy criticism or brush it off by saying what should be done in practice[15]. In the meantime business as usual continues, at least for a while longer until it is clear that something doesn't add up. I will come back to this point in Section 4.

3 May be solutions if they weren't so immature or inefficient

The criticism that CCS is an unproven or immature technology is common, as is the criticism that electrolysis of hydrogen is inefficient. There are surely other technical limitations which could be addressed to these and similar technologies, but for the sake of brevity I will only remark on these two.

3.1 CCS has not been proven at scale, but that's not the whole picture

CCS has indeed still not been deployed at scale and is still as far as I can tell in the pilot project stage (see e.g. this project in Rotterdam). This may leave a perhaps misleading impression of the maturity of CCS, which is not in any way new and has been deployed in the past, ironically, by the oil and gas industry to increase the production of wells. For example, the first instance of CCS use was in 1972 in Texas.

From my limited understanding of the situation the main issue is that CCS is capital, labour and generally resource intensive. This is not like setting up a solar panel on your roof, you need not only the separation columns to scrub your flue gases but also a network to carry the carbion dioxide and somewhere to store it. It only really starts to make sense if you already have or are sure you will have the latter two components. Without sufficient financial and organisational incentives for industry, the push has to come from governments for these projects, governments that can be very fickle (e.g. George Osborne scrapping the Teeside project back in 2016).

[14] I'm sorry to pick on We Smell Gas. I have other examples though they're not directly related to hydrogen. For the sake of fairness, another example: the group Tegengas claims that Engie will be getting so many millions for their new gas power plants in Belgium, ignoring the fact that the way these subsidies are set up (their reliability options) Engie may end up repaying this amount entirely (in theory).

[15] I give a particularly egregious example of this attitude in Section 4.

A whole lot more could be said about this and if you have an afternoon to waste this paper may be interesting[16]. The bottom line is that CCS has not been proven at scale but that doesn't mean it should be put in the same category as nuclear fusion.

3.2 Hydrogen is an inefficient solution if you're an idiot and apply it to the wrong problems

Regarding hydrogen, for many purposes it indeed does not make sense to use it becvause it is so inefficient compared to other technologies. The classic example is hydrogen for heating, which makes absolutely no sense when compared to heat pumps (see e.g. the calculations done here). You would have to be a special breed of idiot to think this was a good idea or a very desparate salesman.

This and other uses are so obviously stupid ideas that very few "serious" people would consider them, and indeed they don't. Most would agree that hydrogen is the "champagne" of energy vectors, meaning it should only be used where necessary. Really it should be the Carapils, since you would only drink it if you really needed to get drunk (e.g. for a family dinner) and there was nothing else that would do the trick. If you look at the European Commission's page on hydrogen, they say (emphasis is my own):

> Renewable hydrogen can be obtained via electrolysis using renewable electricity to split water into hydrogen and oxygen. It will play a key role in decarbonising sectors where other alternatives might be unfeasible or more expensive. It can be used to **replace fossil-based hydrogen** for **transport** and **industrial processes**, and to start new industrial products, such as **green fertilisers and steel**.
>
> When produced at times when solar and wind energy resources are abundantly available, renewable hydrogen can also support the EU's electricity sector, providing long-term and large-scale storage. **The storage potential of hydrogen is particularly beneficial for power grids** as it allows for renewable energy to be kept not only in large quantities, but also for long periods of time. This means that hydrogen can help improve the flexibility of energy systems by balancing out supply and demand when there is either too much or not enough power being generated, helping to boost energy efficiency throughout the EU.

You can see that they don't mention heating. Transport is a bit of a grey area, as it only really makes sense for e.g. trucks and ships. I left the part in about "support[ing] the EU's electricity sector" since that is also a bit of a grey area. Power

[16] This paper also looks informative, though keep in mind that both are written by proponents of CCS.

to gas generally seems like a bad idea given the alternatives, but generally the idea of having "increased demand flexibility / elasticity"{} (i.e. consuming electricity when it's abundant) strikes me as reasonable[17].

3.3 Putting technical hurdles into context

I think a reasonable standpoint for technologies which are not yet being deployed at scale for whatever reason, especially ones which will be necessary for decarbonising some industries (see 2), is something like:

> Sure, these seem like options we should pursue or at the very least not dismiss outright. However, I want to know what you're doing to decarbonise now - not tomorrow, not in 2030 or 2050, right now.

This strikes me as a clearer, more honest stance than to simply label these technologies as "false solutions". However, it's not quite as effective as riling people up by saying that fossil fuel companies are peddling "false solutions", which once again is annoying because it's just as serious a problem.

4 Are solutions but used to greenwash or delay real climate action

This interpretation can be very grossly summarised as follows:

> Fossil fuel companies are proposing these solutions. The cuntery[18] they've displayed in the past[19] and their current business plans indicate they have no real desire to decarbonise and just want to continue business as usual. When they propose these solutions they are therefore greenwashing their activities (since these solutions make up only a small percentage of their business) or delaying real climate action (by talking about what they plan to do instead of are doing).

I'm quite sympathetic to this line of reasoning. It is simplistic and would doubtless raise cries of "Grow up!" from policy makers and industry. It is however, rather realistic and in my opinion anything but a healthy shedload of skepticism of industry narratives would be naive. This is the opinion of Jacobson, who described blue hydrogen as a "way for the fossil fuel industry to stay alive".

[17] I should add that the economic viability of electrolysers (like other technologies) depend on their "full load hours" which is the number of hours per year in which they run at full capacity. The higher this number, the more they make economic sense but this number depends on the availability of renewable electricity. I have no reference for this right now, but it's not a controversial statement.

[18] If you're offended by use of the word "cunt" feel free to read "knobheadedness" instead.

[19] For a history of climate denial from the fossil fuel industry, see season 1 of the podcast "Drilled".

A conversation with a professor at my former university, Imperial, brilliantly illustrated this point regarding CCS. When I brought up the fact that fossil fuel companies are planning on expanding their operations and that this wasn't in line with the Paris Agreement, he (Paul Fennel) replied "But it [gas] will be burnt using CCS." Fossil fuel companies are then let off the hook. They are not responsible for what everyone else does with their fossil fuels, it is up to everyone else to make sure that they don't somehow contribute to global warming[20].

That is not to say that they are for the reasons outlined in 2: if we want certain materials and products, we will need one or a combination of CCS, hydrogen from electrolysers and biomass. Focusing on these technologies may be a distraction from all that we can do right now (e.g. off the top of my head, reducing meat consumption), but ultimately they will be necessary if we still want, say, WD-40.

4.1 Another digression on communication

I generally agree with the above, even if I haven't argumented it very well. However, it's a stance which I think is difficult to communicate simply and clearly and ultimately to get angry about. Eventually if we find memos of company executives explicitly stating that they're promoting these solutions to postpone changing business as usual then I would feel justified being angry and taking drastic action. As it stands, I don't.

Let me illustrate with a case in point, XR Ghent's disruption of an ArcelorMittal event in which they unveiled their "Steelanol" bio-fuel project in Ghent[21]. Quoting the website, this project takes waste gases from the steel making process (presumably carbon dioxide produced from burning coal or gas in the blast furnace?) and uses microbes to produce bio-ethanol which is then burnt. The website displays a closed loop process i.e. no carbon dioxide leaks to the atmosphere but I highly doubt this is the case.

XR Ghent's communication on their disruption (from what I understood) largely consists of calling out greenwashing (ArcelorMittal still consumes vast quantities of coal and produces 8% of Belgium's emissions) and labelling CCS as unavailable and unsafe.

[20] My conversation with Paul led to another irreproachable (!) line of defense. Paul is of the opinion that we need fossil fuel companies because they have large amounts of capital which will be necessary to make the required investments for the energy transition. This makes sense to some degree, but by this logic simply having money means your opinion should be valued over everyone elses. Paul described his approach as utilitarian and pragmatic. I agree that it's utilitarian but not pragmatic. If anything it's naive, ineffective and unjust. Naive because if fossil fuel companies were a person, you would not trust anything they say or propose you do for your own benefit. Ineffective precisely because the continued existence of fossil fuel companies (who have had decades to become energy companies) cannot be called into question and unjust because no punishment for bad behaviour can be meted out.

[21] I have jumped from talking about hydrogen to taking the broader scope of decarbonising industry. Apologies for this, but I think the example is nonetheless useful.

I largely agree with the above criticisms. However, I have a number of unanswered questions: how exactly does XR Gent[22] think should we go about decarbonising industry? Should we criticise every attempt decarbonising industry as greenwashing? Or perhaps the idea is to rid ourselves of heavy industry entirely? Which leads me to my final point.

5 They are unnecessary if we have more sobre lifestyles

I have written extensively at this point so I will do my best to be brief.

I began this piece by remarking that a combination of CCS, hydrogen electrolysers or biomass are essential for decarbonising certain processes which make things that we generally find useful. However, useful is not the same as essential. I do not need a phone, bike, laptop case, paint, single use cup ... in order to live comfortably and flourish as a human being. In short: do we really need to decarbonise these processes or can we just get rid of them?

I'm sure many people would disagree that we can do away with these processes and the things they produce and still flourish as humans[23]. Still, the degrowth movement is large enough that I feel confident in saying that many others would agree. The question really is about how much we are willing to concede.

This stance makes me think of a time I was at a climate conference style event and there was a debate between what I would now call (disdainfully) an eco-pragmatist and someone arguing for "deep ecology", in which the protection of the natural world which is considered sacred trumps all other considerations[24]. I remember at the time feeling genuinely frightened at the prospect of a society which embraced deep ecology - how much would I have to give up? Raves? My phone? My computer? Soap? While most deep ecologists or radical environmentalists would dismiss the criticism that "you want us all to live in caves again", I don't think we should be naive about how much we would have to give up if we don't want industrial processes any more.

I mention this because if this is truly what is meant when labelling CCS et al as "false solutions" (I doubt it is, but humour me) then again it is a difficult rallying cry and I would completely understand someone who said that they weren't prepared to go along with this. There is a whole spectrum of possibilities when it comes to degrowth and sobriety and I feel that either end, increased industrial activity to satisfy insatiable human desires one the one hand and "living in caves" on the other, is purely ideological.

[22] I say XR Gent to continue the example, read "environmental activist" if you will.

[23] I also was a bit cheeky and didn't mention fertilisers, which some people would maintain is the reason we're able to sustain 8 billion people on this planet. Living, I will happily admit, is a prerequisite for human flourish.

[24] As with all of this piece, I'm surely caricaturising.

6 Why this bothers me

The world, if you haven't noticed, is pretty fucked up (pick whichever angle of fucked you want). It is infuriating, disheartening, desperately upsetting and something desperately needs to be done.

One thing that can be done is non-violent direct action, as I have been dabbling with for the past year. The radicality of such actions ranges from postering or replacing adverts to hunger strikes in front of government buildings or disruption of a companies activities.

I don't for a second judge people who take more radical actions. I envy them to a large degree. As I said, the world is fucked and I often feel that my actions should reflect that, and I believe that the actions of those in groups such as Just Stop Oil or Last Generation achieve that whereas I fall short.

If it's not obvious by now, I am however too conflicted on many topics to feel justified taking such radical action. I desparately want a cause where I feel justified gluing myself for innumerable hours or shouting at in indignation. A cause where I feel that I am clearly, unambiguously fighting injustices.

Such causes obviously exist. I was in Lutzerath recently, and it is absolutely insane that Germany is still mining coal. There was an action not so long ago against private jets, which can only be justified if you're an out and out bastard.

Many others I feel much less justified. I see the slogans and I think "Yeah but...". I read the arguments and I spot obvious omissions, errors or questionable lines of attack. This is my issue with Tegengas and Ineos Will Fall[25] while StopAlibaba I can fully get behind. I could quibble about how many gas power plants or plastic production facilities we "need", but an extension to an airport for entirely useless shit we don't need? I can't see any logical argument for it.

I should probably finish with a flourish, but I have reached the limits of my ability to give a toss.

7 Remarks

I'm not particularly happy with the way this turned out, even though I think there's definitely something here. Here are some brief reflections:

- I think there are at least 2 interlinked ideas here, which I didn't realise until I was writing. One is on "false solutions" and the other is communicating injustices. Writing with that in mind may make the text clearer.
- I decided not to give an explanation of the technology of CCS and electrolysers, thinking I could work it into the text. I think I was only marginally succesful.

[25] I won't go into my specific lines of reasoning because it would require an entirely separate article.

- I'm not one for details, and this proved an obstacle when translating my gut feeling regarding hydrogen and decarbonising industry (e.g. I thought syngas production produced CO2 but it doesn't). I need to read up more about this (and while I think about it, exactly which metals are required for batteries and EVs).
- My initial angle was hydrogen and organic chemistry, thinking this would be specific enough. I think I need to be even more specific regarding the processes we would have to forego if we don't have ways of producing hydrogen however. I'm also doubting whether inclusion of biomass was a good idea.
- There was a lot going on here and a lot of disparate thoughts. I think that this was necessary, however if I ever re-write this I should pay extra attention to clarity and avoid giving too many examples or going off on too many tangents.
  - Then again, a lot of the tangents were caveats which proved my main point: reality is not so clear cut and this is annoying if you want to send clear and simple messages.