Can new technologies save us?

Owen McCormack

Last year, the Government's Chief Scientific Advisor, Professor Mark Ferguson, addressed the Dáil's Climate Committee. He had a reassuring message that doesn't seem to have filtered through to the global climate movement or the school strikers yet but is still worth remembering. He told the Committee:

> "Please don't demonise oil and gas… you concentrate and pump back down carbon dioxide and you are going to need those fossil fuels in any transition to a low carbon economy. There's a big business there in terms of reusing that vast amount of empty space that we take gas out of…and the last comment I would say is as a scientist, I am optimistic. Climate change is a big problem and a big issue, but I remind you that no crisis that was ever predicted in human history has come to pass. Many times, we have predicted that we were going to run out of food and we've never run out of food, and why is that? It's because science and innovation has moved faster than the crisis. I believe the opportunity in climate change will be for the science and innovation to move faster than the problem."

Professor Ferguson was not only articulating a rather touching faith in technology to solve climate breakdown, but also an equal faith in free markets and capitalism. It's understandable he would have a faith in capitalism; his biotech firm Renovo netted him a return of around 18 million euro while it was around. His faith in technical solutions to problems is less understandable given that the same firm never made a single marketable product despite receiving over 170 million euro of funding over its time, before going bust.

Such expressions of confidence in technical solutions to climate change are not rare, but they are just as misinformed as Ferguson's. Outright climate change deniers are increasingly hard to find in mainstream economic and social elites. They may continue to obfuscate and avoid taking the kind of actions needed, but most of the elite accept that it is real, it is happening, and that we need to do something about it.

It's what exactly that "something" *is* that is at the core of this article.

To most of us, the obvious solution to climate change driven by CO2 emissions is to move rapidly to cut and eliminate energy systems based on CO2 emissions. In this sense a strictly technical solution is available. Various engineering and academic studies[1] have pointed out just how possible it is for us to move rapidly away from fossil fuel use and what such a move might look like it. This does require huge change and the use of all of society's available resources, investment and wealth. A global switch to renewable energy is only a part of those changes, and the deployment of technologies already available is a part of the solution. Electrifying public transport, building and retrofitting homes to be carbon neutral, as well as many other such endeavours, are all part of the moves needed. In this sense, there is a technical solution available now, notwithstanding difficulties such as those around battery storage, intermittency of renewables, etc.

The reason this isn't happening on the scale or pace needed has nothing to do with a lack of technical or engineering know-how; we aren't waiting for new technologies to be invented by inspiring entrepreneurs. The solutions do exist but implementing them comes up against two insurmountable obstacles.

Firstly, moving away from fossil fuels poses an existential threat to some of the most powerful among current capitalist elites. The largest, richest and most influential sections of capitalism are embedded in

fossil fuel and related industries. Allied to them are the financial and banking interests tied by a thousand strings to the oil, gas and coal on the books of the major companies and to the future use of their proven reserves of fossil fuels. The second problem is of course the very nature of capitalism; driven by competition and a need to expand and increase new markets for goods. This is such a central feature that it makes talk of green capitalism or sustainable growth in the current system a chimera.

Tech fix to the rescue?

What is extraordinary now is how the issue of new technology is being used to avoid doing the very things that are essential to stopping the worst climate catastrophe scenario. I am going to look at some of the 'solutions' proffered in a moment, but what they all have in common is not the question of whether they are feasible or not as solutions - they are not - but that they are in fact premised on keeping things essentially as they are. Far from being disruptive or revolutionary, the technical solutions we are offered are about maintaining the status quo, in terms of the economic system and the social structures we currently live under. Ironically, many are driven not by any desire to reduce the use of fossil fuel, but to make possible the continued use of oil, coal and gas. This is not to say that elements of each of the technologies we are looking at can't form a part of tackling climate change, but that in the current economic system they are not a magic bullet and won't make any real difference in the long term to the aim of stopping CO2 emissions.

Crucially, their advocates all start from the premise that climate change is, in reality, a technical problem. One which can be fixed with enough innovation and a continued belief in free market capitalism; the underlying conviction seems to be that if there is enough profit in it, someone will surely build it.

So, what's on offer as a technical solution under capitalism to climate chaos?

Carbon Capture and Storage

Carbon Capture and Storage (CCS) is now most widely touted as the one innovation that can save the day. It's not a fantasy, it already exists in some form, and indeed so optimistic are many in climate research about this technology that it has become a central feature of IPCC reports. Essential to all the models in IPCC predictions of future levels of CO2 and greenhouse gasses(GHGs), is the assumption that we will be able to remove large volumes of carbon via CCS in the future.

The IPCC report used by the Irish Government to try to justify continued fossil fuel exploration has an interesting conundrum at its heart. According to most scientific studies, the world has a fixed *carbon budget* of about 800 billion tonnes of carbon that it can release and still have any hope of staying under a 2-degree temperature rise.[2] However, in most of the scenarios used by the IPCC, as well as those used by Governments and businesses, the carbon budget is almost double that, around 1500+ billion tonnes. This allows the targets and dates for implementing cuts to be pushed out to 2030 or 2050. This doubling of the carbon budget is not a mistake - it is however based largely on a pure fantasy. Embedded in these figures is the hope that future use of CCS will allow us to remove vast quantities of carbon.

Essentially, it allows us to continue emitting CO2 in the hope that at some stage, someone will invent or scale up a version of CCS that will take it out of the atmosphere. As Kevin Anderson has pointed out, this trickery allows Governments and the elites to pretend we have 20 years to reduce our CO2 levels at current use, when in fact we have much less time.

So, what is CCS, and could it work? In basic terms, it involves capturing the carbon emitted in the industrial process of, say, using gas or oil, and then pumping it back into the well head or the ground. In theory, it is also possible to extract carbon from the air and, again, pump it back into the ground or another geological formation, where it should then remain. Other versions of the technology involve treating the CO2 before trying to store it away from the atmosphere.

The chief thing to know about CCS technology is that it was developed by oil and gas exploration companies as a mechanism to enable the extraction of *more* oil and gas. Companies use CCS to pump carbon back into the wells and geological formations from which they were extracting oil or gas. By doing so they are able to economically extract more of the oil or gas since before CSS, large volumes of oil or gas would be unreachable or unextractable without huge costs. CCS makes it commercially viable and can lengthen the life span of a

well or mine, thereby increasing the amount of oil or gas being extracted.

CCS is part of a bunch of technologies called Negative Emission Technologies. To quote Anderson,from listening to many commentators "it sounds like you can buy this technology off the shelf, but these things don't exist". [3] He goes on to say:

> This has never worked at scale. There are no examples of this working anywhere at the scale of a power station. There are massive technical and economic unknowns. We don't even know how carbon capture and storage works. We've not got one power station that reliably works with carbon capture and storage. The only one we have is in Canada. It's 110 MW, about 1/40th size of *Drax power station* and it's *proved* really *problematic* over the last two years. It's only captured 40% of the CO_2 they thought it would capture.

According to the latest report from the CCS institute,[4] (a business-focused research group with a vested interest in exaggerating CCS potential) there are roughly 17 large CCS plants in operation globally. Thirteen of those use the captured carbon for enhanced oil recovery – that is, to extract *more* oil. Four of the five plants under construction are also for enhanced oil recovery. Only four of the existing plants and only one of the new plants inject the captured CO2 into a geological formation for storage. Two in Norway inject the captured carbon into rock formations, but it is worth noting that this is part of an industrial process which is geared towards extracting gas in the first place.

CCS could form a part of a response to climate chaos, as it may be that we will have to extract CO2 from the atmosphere. But the talk of it as a fix-all solution is, at present, simply a mechanism to allow for continued exploration and use of oil and gas. It can't be unrolled at the scale needed because it simply isn't commercially viable, and no capitalist enterprise is going to invest the massive resources needed in the time scale available. Therefore, the few plants operating are connected to existing fossil fuel use that is the only profitable use of CCS at present.

Other variations of CCS face the same issues. BECCS (Biomass Energy and CCS) begins by planting huge volumes of plants and trees, before cutting them down to be burnt in order to generate power, with the CO2 released then captured and stored. Again, the scale needed to make any significant impact is a physical impossibility. Land masses the size of India would have to be used to supply the needed volume of biomass, and no account ever considers the massive use of energy in shipping, transporting and building the infrastructure at scale for such scenarios.

Electric Vehicles

The recent Government climate action plan has a target of bringing just under 1 million electric cars onto Irish roads by 2030. At present, there are roughly 5000, out of a total of around 2.5 million vehicles in Ireland. Climate Minister Richard Bruton has also announced plans to ban the sale of petrol and diesel engines by 2030 and promised more incentives, such as grants and lower taxes, for purchasing and using electric vehicles (EVs). On one level this seems like an obvious and good idea. Recent reports show the dangerous levels of pollution stemming from the huge increase in traffic volumes.[5] Nitrous Oxide and various particulate matter (PMs) are estimated to kill over 1500 a year in premature deaths in Ireland alone. The pollution levels in some towns and areas of Dublin pose a real danger to people (and the worst levels recorded are often in working class areas).

Electric vehicles would make an impact on this pollution, and indeed EVs could make a difference in terms of CO2 emissions. However, the eulogising of plans for 1 million EVs is a stark example of how bereft of ideas many mainstream commentators are when dealing with climate change. Obviously EVs will be a part of the solution. A mass switch to public transport that uses EV technology, where the electricity itself is generated by renewable energy, could significantly reduce our use of fossil fuels and CO2 emissions. However, that is not what is envisioned in most of the discussion around EVs. The emphasis is still on private car usage and ownership. Instead of 2.7 million diesel and petrol engines clogging the roads, we will have the same number of electric engines clogging the roads. While this may help in Ireland with pollution emitted by Internal Combustion Engines (ICE) its impact globally on reducing CO2 emissions is much more doubtful.

If there is a mass switch to EVs across much of the advanced world it would mean the use and extraction of vast quantities of copper, cobalt, lithium and rare

earth elements. By one estimate "electrifying all of U.S. motor vehicles would require roughly 18 times the world's current cobalt production, about nine times global neodymium output, nearly seven times global lithium production, and about four times world copper production".[6] Aside from the question of whether they exist in the volumes required to convert the private fleets of ICE vehicles to EVs, there is the question of the energy and CO2 emissions used in producing EVs for this new market.

Another study suggests producing an EVs requires twice the amount of energy needed to produce an ICE vehicle.[7] Its actual contribution to reducing GHGs is dependent on how the electricity used to power it is itself generated, how long it lasts on the road, and how much it is driven. In summary, there is, at least, a question mark over whether there is any actual reduction during the entire lifespan of an EV compared to an ICE vehicle if they are simply used to try to replace the world's entire private car fleets.

The problem here is not the technology, but how the technology is used under a capitalist economic system. Using EV technology to produce new forms of mass transit and to electrify the bus fleet could achieve a dramatic reduction in CO2 and other greenhouse gasses. However, its net effect will be negligible on our climate crisis if the technology is just used for another round of profit accumulation by simply creating a new market in private cars led by the Elon Musks of this world instead of the Henry Fords.

Nuclear Energy

Proposals for the widespread adoption of nuclear energy are perhaps one of the most controversial among socialist and environmentalists. Some respected commentators have fully embraced nuclear energy as the only realistic option for cutting the use of fossil fuels in energy systems globally.[8] It is important to understand that for many this doesn't come from any ignorance of the potential disasters that could happen with a mass building program of nuclear power plants. In fact, the adoption of nuclear energy as a solution often comes from a profound pessimism about climate change and the speed with which we need to cut emissions of greenhouse gasses. In the absence of any radical shift or overthrow of capitalist rule, nuclear energy begins to seem like the most reasonable and realistic technological fix available. The argument is something approaching the following: our system used X amount of energy last year, in ten years' time it's going to need significantly more than X; hence, the only way to feed that and hope to reduce GHGs is to adopt nuclear power.

We are not talking about challenging the fossil fuel industry here so much as offering a way to leave intact the main structures of the current economic system. The problem here is that again some activists are adapting the technical solution to the current requirements of the capitalist system and accepting that challenging or changing that system is effectively off the table. Using less energy doesn't have to mean a drop in the livelihoods of ordinary people, but it would certainly threaten the very heart and logic of capitalism and its need to constantly expand.

So, within that framework is nuclear power an option? Aside from the issue (and it remains a huge one) of the potential disasters that await a world dependent on the kind of nuclear building programme required, or indeed the thorny question of what the world would do with the vast quantities of waste produced, there are concrete reasons activists should not buy into this narrative. Kevin Anderson points out that there are currently about 450 nuclear power plants globally supplying about 2.5% of global electricity demand. To increase that to 25% would require about another 3000 nuclear plants of the same capacity as the Sizewell B station in England. You would need roughly 100 new plants per year till 2040, by which stage it is likely that they wouldn't even be able to cover that original 25% of demand given the insatiable growth in energy requirements consistently seen under capitalism. It is not that this is technically impossible, but such an endeavour is not carbon neutral and relies on mining and transporting vast quantities of rare earth elements and minerals.

If Europe was to aim for 70% of its electricity needs to be supplied via nuclear power, it would mean a six-fold increase in current plant numbers:

> Estimates for the International Panel on Climate Change suggest that within the European continent, 1000 reactors would need to be operational in 2100, six times the current level. The average construction time of a nuclear power reactor is now ten years.

> Building 115 power stations per year would only reduce our CO2 use by 16%.

We can't simply build our way out of climate change using nuclear options. The logistical obstacles alone suggest that it is far from the realistic option it's often portrayed as. It would be a tragedy if the climate movement succumbed to the same deep pessimism that motivates some commentators to look to nuclear power. As one report put it:

> There are now more than 450 nuclear reactors throughout the world. If nuclear power is embraced as a rescue technology, there would be many times that number, creating a worldwide chain of nuclear danger zones—a planetary system of potential self-annihilation. To be fearful of such a development is rational. [9]

Zero Carbon Britain have shown in their study that reaching 100% renewable energy is feasible with no imput from the nuclear industry[10] and within existing technologies.

Geoengineering

The term refers to large scale interventions in the Earth's natural systems to stave off the effects of climate change and should not to be confused with the chemtrail conspiracy theories often found on the internet. There is a host of proposed 'solutions' to various problems, all based around technical interventions and engineering. While they come under different names, such as weather modification or solar radiation management, they contain the same basic proposal.

The more fanciful, from erecting giant sun screens in space to deflect the suns heat to building walls to buttress the collapsing Antarctic ice sheets, can pretty much be dismissed as lunacy. These proposals keep some researchers and scientists busy but are on the more extreme end of proposed geoengineering solutions.

One quick fix which is being touted is particularly dangerous. This is because as the effects of climate change kick in, it becomes more likely ruling elites may gamble with such options rather than deal with the actual cause of climate change. This fix involves spraying the skies with forms of sulphates that could act pretty much like the emissions from a large volcanic eruption.

What is known as the Little Ice Age during the Middle Ages is widely attributed to increased volcanic activity during that time. Volcanic activity that produces sulphate aerosols and reaches the stratosphere can lead to significant temperature drops It has been suggested that volcanic *forcings* (the influence of volcanic activity on climate) can account for a significant amount of hemispheric temperature changes over the last 1000 years. The period leading to the Little Ice Age is known for having witnessed very large eruptions.

Based on this, an increasing volume of research and testing is proposing to spray huge quantities of sulphuric acid or sulphur dioxide into the stratosphere to reduce the levels of warming. The only (!) drawback is the potential to trigger mass deaths via increased weather extremes with stronger storms and hurricanes, prolonged droughts in some regions or even destroying the ozone layer. For some, this still looks like a better option than challenging capitalism or the fossil fuel industry.

Of course, while the projects involved are often touted as a way of "buying us time", they are actually about buying time for fossil fuel usage while the underlying cause of climate change is not dealt with. CO2 and other GHGs would continue to accumulate in the atmosphere, and if the spraying of sulphates does stop the warming that it was meant to, it would simply be stored up and rapidly unleashed on the Earth.

That such far flung, almost sci-fi scenarios now consume pages upon pages of academic journals, not to mention attracting increasing funds for testing, is a sign of the extent to which some elements in the ruling class are willing to go rather than deal with the actual cause of climate change.

To paraphrase the famous quote from Mark Fisher that it seems easier to imagine the end of the world than the end of capitalism, for many it seems easy to imagine a future of giant sun screens in space or spraying sulphuric acid in the skies than keeping fossil fuels in the ground.

Conclusion

The demand of the climate movement has been "keep it in the ground". This is recognition that stopping the use of fossil fuels is the only real solution to climate change. Allied to that, a part of how we need to respond will be looking to natural "climate fixes" such as planting appropriate trees in appropriate places and

safeguarding the natural systems and sinks we have, all while changing the industrial forms of capitalist agriculture we rely on.

Even with this, it may well be that elements of the technologies available will be needed. The key thing is not to find or search for some magic bullet that will allow capitalism to continue. It is to understand that the crisis is caused by the need of capitalism to expand and use ever greater levels of the earth's finite resources to expand infinitely. This is not done as a service to humanity but in the service of a ruling and tiny ruling elite. It is time to again imagine the end of capitalism as the more realistic option than a world of dimmed, sulphuric skies with a billion EVs beneath them scurrying over a ravaged land.

Endnotes

1 For example see *http://dconnolly.net/greenplanireland/ or https://www.cat.org.uk/info-resources/zero-carbon-britain/*

2 *https://www.carbontracker.org/carbon-budgets-explained/*

3 A good synopsis of Anderson's case is here at Redd; *https://redd-monitor.org/2019/09/05/nature-cannot-be-fooled-kevin-anderson-on-mitigation-as-if-climate-mattered/*

4 *https://www.globalccsinstitute.com/resources/publications-reports-research/*

5 *http://www.epa.ie/pubs/reports/air/quality/epaairqualityreport2017.html*

6 *https://thehill.com/opinion/energy-environment/460496-electric-vehicles-wont-save-us-from-climate-change*

7 *https://www.weforum.org/agenda/2017/11/battery-batteries-electric-cars-carbon-sustainable-power-energy/*

8 See; *https://www.monbiot.com/category/nuclear/*

9 *https://thebulletin.org/2019/08/the-false-promise-of-nuclear-power-in-an-age-of-climate-change/#*

10 *https://www.cat.org.uk/info-resources/zero-carbon-britain/research-reports/zero-carbon-rethinking-the-future/*