# Could new technology solve climate change?

***Elizabeth Robinson** and **Esin Serin** consider how far we should be relying on technological fixes in the mission to reach net zero.*

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**This article is part of a series by LSE's Grantham Research Institute on Climate Change & the Environment (visit website).**

It is already clear that significant progress on mitigating climate change can be achieved through a move to zero-carbon energy, reducing deforestation and adjusting how we grow food and what we eat. Renewable energy is increasingly becoming cheaper to produce than fossil fuels – one recent Oxford University study suggests that replacing fossil fuels with clean energy could bring global savings of up to $12 trillion by 2050. And the International Energy Agency has found that there is now more employment in 'clean energy' – including renewables, electric vehicles, energy efficiency and nuclear power – than in the fossil fuel industry, so the economic argument alone should provide sufficient incentive for rapid decarbonisation of the energy system.

We also know that a transition away from fossil fuels would bring significant benefits for health and wellbeing through reduced air pollution and shifts towards more active lifestyles and balanced diets. And a commitment to net zero can also reduce social inequality, particularly in already highly unequal societies, if investments are made in, for example, affordable and reliable low-carbon public transport, urban green spaces, and homes with more efficient cooling and warming.

Yet the fact is, global emissions are still increasing, and countries are seemingly resistant to implementing the necessary pricing and regulatory policies to speed up the energy transition that is so central to reaching net zero. In part, this is because of vested interests, in part because not enough attention is being paid to a just transition, for example with respect to workers whose livelihoods are closely linked to fossil fuels.

At this stage, it will be hard to avoid the need for further technological solutions if the world is to have any hope of meeting the Paris Agreement temperature goals. Indeed, by 2050 almost half of the emission reductions required to reach global net zero may need to come from technologies that are currently at the demonstration or prototype stage, according to the International Energy Agency.

**What more can technologies achieve?**

Certainly, we need to continue to develop technologies that increase energy efficiency and reduce demand, to expand low-carbon methods of generating energy to replace fossil fuels, and to remove existing carbon from the atmosphere. On the latter front, **carbon capture** – used either to address the industrial emissions that are most challenging to reduce, or to remove carbon directly from the atmosphere – is often seen as an essential element of pathways to net zero. The world's current largest facility for capturing carbon directly from the atmosphere, in Iceland, can permanently remove only 4,000 tonnes of $CO_2$ per year, but several million-tonne-scale projects are due to come online by 2030. Costs are currently high, though, and there is currently no market for removals for operators to easily recover these costs. For example, the business case of the Icelandic project may require a carbon offset purchase price per tonne of $CO_2$ of $200–300 by 2030 and $100–$200 by 2035, which represents a significant increase on the current carbon prices under the European Emissions Trading Scheme of around $70–80 per tonne.

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**Hydrogen** is another area where there is large innovation potential for a move towards clean energy. This versatile fuel is only low-carbon to the extent that it is produced in a low-carbon way. The most common method of producing low-carbon hydrogen requires ample supply of renewable energy and water. To address the latter, some scientists are working to pull this fuel "from thin air". These methods come at a high cost, with estimates that green hydrogen might not be competitive even if carbon prices were around €200 ($237) per tonne.

**Nuclear fusion**, which could provide an effectively unlimited source of low-carbon power, has been considered to be 'a few decades away' for many decades already. The cost of ITER – the international megaproject aiming to bring fusion to life – could now run to €22 billion, up from an initial estimate of €6 billion. But confidence that fusion will eventually be commercialised is perhaps stronger now than ever, with private sector investment growing rapidly in recent years and a historical record on sustained fusion energy broken earlier this year.

At the more controversial end of the spectrum are **geoengineering** techniques such as solar geoengineering, which reflects sunlight away from the Earth's surface, or 'seeding' clouds and oceans to modify rainfall and increase carbon absorption from the seas. (Some scientists have even suggested a plan to refreeze the North and South Poles.) Such techniques offer the potential to reduce global temperatures while they are being applied but do not reduce carbon dioxide concentrations in the atmosphere, which means they do not address the root cause of climate change and risk temperatures going back up straight away if they are discontinued. Nor do they reduce ocean acidification, whereas reducing or removing carbon dioxide can achieve this. There is also considerable uncertainty around the impacts these technologies might have across space and time: if they altered tropical monsoon rains, for instance, the negative implications for food security could be significant, particularly in lower-income countries.

**Whatever the promises, we should not over-rely on a technological fix**

Even if enabling *new* technology is the world's best (and perhaps only) chance to limit global emissions to net zero, we must not delay in embedding solutions readily available today in the hope that some future technological fix will save us. If we do, we will be at significant risk of overshooting the Paris temperature goals and threatening intergenerational equity as we imperil the futures of younger generations and those not yet born. By the time new technologies are available in a form that works, at an affordable price, it could be too late. Experience with some of the carbon capture and storage projects to date illustrates that technology may not work perfectly at first go and learning-by-doing (which takes time) is an essential part of the innovation process.

The rapid fall in the cost of solar photovoltaics (PV) and wind power might suggest the same could happen for newer technologies. However, the over-allocation of public resources to new innovations (with the possibility of socially regressive consequences, depending on how costs are recovered) could undermine the public legitimacy of the transition as a whole. This threat may be higher with regard to investment into the more controversial technologies, which currently have low levels of public support, such as solar geoengineering.

Many of today's early-stage technologies may increasingly become part of a more comprehensive (or desperate?) plan to address climate change, especially with the world set to miss many of its Paris Agreement and Glasgow Climate Pact targets and aspirations, if current trends continue. But we already have a very good idea of the immediate steps that can deliver urgently needed emissions reductions, net zero-compatible growth, and health and well-being co-benefits. This leaves no reason to delay sensible climate mitigation action that can and must happen now.

*Hear the latest perspectives on these issues from expert speakers at 'Whatever It Takes – Is There A Plan B For Climate Change?', chaired by Elizabeth Robinson and hosted by the LSE Environment Week on 20 September 2022 at 6:30pm. The event is taking place in the Old Building on campus with no ticket or pre-registration required – for more details see here.*

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*Notes:*

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- *Featured image by James Rathmell on Unsplash*

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