

CLIMATE & ENVIRONMENT AT IMPERIAL

Insights from staff and students across Imperial working in climate and environment related areas

Reducing carbon emissions: don't wait until tomorrow

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[Neil Grant](#), Research Postgraduate on the [Science and Solutions for a Changing Planet DTP](#), blogs on why avoiding a tonne of carbon dioxide today is not the same as removing a tonne of carbon dioxide tomorrow.

In 2019, public concern about climate change [increased dramatically](#), and pressure is growing on world leaders to take decisive action in reducing greenhouse gas emissions. Experts are warning that, with the world [significantly off-track](#) to meeting the goals of the Paris Agreement, rapid action is essential if we want to limit global warming to well below 2°C and aim for 1.5°C.

And we know what governments should do because, in one sense, the answer is simple: they should reduce emissions to zero as quickly and as fairly as possible. But in another sense, it's very complex. There are a wide range of different strategies and technologies that could be used to reduce emissions. One such potential solution is the use of 'negative emissions technologies' (NETs) – technologies that actively remove carbon dioxide (CO₂) from the atmosphere.

In the Intergovernmental Panel on Climate Change (IPCC)'s [Special Report on Global Warming of 1.5°C](#), scenarios that limit warming to 1.5°C rely on NETs to suck an average of 590 billion tonnes of CO₂ out of the atmosphere between 2020 and 2100. That's 18 years' worth of current emissions over the next eighty years – no mean feat!

A controversial solution

There are real concerns that relying on NETs could lead policymakers [to take less action reducing emissions now](#), in the hope that the mess can be cleared up later by negative emissions – a particularly risky strategy given these technologies don't yet exist at the scale required in the models. This has led to [controversy](#) around their use in low-carbon pathways.

A key question in the debate is as follows: ***Is avoiding a tonne of CO₂ today equivalent to removing a tonne of CO₂ tomorrow?*** That is – does it matter if we take action on climate change by cutting emissions today, or by sucking back emissions tomorrow? This matters, because in the economic frameworks that much climate policy is based on, these two tonnes of CO₂ *are* treated as identical. In economics jargon: CO₂ is a [fungible good](#). That means each tonne of CO₂ is indistinguishable from another, and so emissions reduction and CO₂ removal are given equal

weight in mitigation strategies. However, avoiding a tonne of CO₂ today is not equivalent to removing a tonne of CO₂ tomorrow – and here's why:

1. There must be inter-generational justice

Every tonne of CO₂ emitted today (rather than avoided altogether), becomes the burden of a future society – our children's or grandchildren's society. They will have to finance a future negative emissions industry to remove the emissions produced today. A [recent study](#) shows that placing more value on the welfare of future generations leads to a much lower reliance on negative emissions. This suggests that negative emissions enter modelling pathways partly for the wrong reasons – as a means of shifting the burden of reducing emissions onto future generations.

In a [recent paper](#), the Grantham Institute's [Dr Joeri Rogelj](#) presented a new framework to model low-carbon futures. This framework could be a good way to ensure that NETs are used in models in a way that is compatible with intergenerational justice, avoiding '[unfair and risky](#)' scenarios.

2. Betting on negative emissions technologies is a risky business

If the world avoids emitting a tonne of CO₂ today, that tonne will never enter the atmosphere. If instead that tonne of CO₂ is emitted, we have to rely on NETs to remove a tonne in the future. Put simply, the more we emit now, the greater our reliance on negative emissions in the future. For [a variety of reasons](#), there is no certainty that negative emissions technologies will deliver at the scale required in climate models. If countries delay reducing emissions now, they trade the certainty of avoiding a tonne of CO₂ today, with the uncertain prospects of removing a tonne of CO₂ in the future.

3. We should be sharing the burden

In the future, there will most likely be a [finite supply of negative emissions technologies](#). If a country is unwilling to reduce emissions in the short-term, preferring to rely on future NETs, they are inherently claiming a larger share of this negative emissions pie. Given that countries have very [different responsibilities](#) for climate change and different capacities to reduce emissions, it's important to ensure that the distribution of a (potentially very

limited) negative emissions pie is as fair as possible. This means we should prioritise the use of NETs to compensate for countries or sectors that will really struggle to reach net-zero emissions in time, such as emissions that occur from economic development in the Global South. Using NETs to offset sluggish near-term action on reducing emissions, particularly in the West, is not a way to share the burden of emissions reductions fairly.

Removing a tonne of CO₂ today doesn't eat into our limited potential for negative emissions in the future. Emitting this tonne of CO₂ and relying on NETs to compensate for it does. Distributing the effort required to tackle climate change fairly requires that we think of these two tonnes of CO₂ differently.

4. We need systemic change now

Finally, avoiding a tonne of CO₂ today requires that action is taken today, such as closing a coal-fired power station or switching away from a petrol/diesel car. These actions drive systemic change away from a world that is dependent on fossil fuels, towards one based on renewable energy. The issue with fossil fuels goes beyond just carbon emissions. The [local ecological devastation](#) and [injustice](#) associated with fossil fuel extraction, alongside the massive health issues associated with [air pollution from fossil fuels](#), means there are many incentives to move beyond them. Avoiding a tonne of CO₂ today helps drive that change. Removing a tonne of CO₂ tomorrow doesn't – and so we shouldn't consider the two actions as equivalent.

If we fail to reduce emissions fast enough, we will have to rely on NETs to compensate for any excess emissions. And, even in a world which is on track to meet the Paris Agreement targets, NETs may have a place: allowing us to hedge against climate uncertainties (e.g. removing additional CO₂ if it transpires that the atmosphere is more sensitive to greenhouse gas emissions than previously thought), and compensating for residual emissions in certain sectors.

However, we must understand the difference between avoiding emissions today, and removing them in the future. Having [separate targets](#) for emissions reductions and negative emissions would be a good start. If we

don't manage this, we risk burning up our carbon budget today while dreaming about the solutions of tomorrow.

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