Responses to: The Trouble with Negative Emissions

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Last month we reported on **Kevin Anderson and Glen Peters' piece in Science** describing how a reliance on negative emissions to draw carbon out of the atmosphere – rather than making necessary and drastic emissions cuts now – will only lock in carbon addiction and make reaching the 2 degree target set out in the Paris Agreement impossible. Below is further exchange on this topic, with a letter in response to the article, and a response to the letter.

Authors of the pro-negative emissions letter use the analogy of throwing a life-preserver to a drowning victim, where negative emissions technologies are the life-saver, and the drowning victim the planet. The life-saver may not ultimately result in a successful rescue, but offering the life-preserver is better than not doing so. The implication being that if negative emissions technologies could help, they should be tried. Anderson and Peters counter by saying that, to use the same analogy, relying on negative emissions is the equivalent of knowingly letting someone jump into a raging torrent, and telling them that we may be able to save them with a technology that we have not yet developed.

The promise of negative emissions

Edited by Jennifer Sills (Science)

In their Perspective "The trouble with negative emissions" (14 October, p. 182), K. Anderson and G. Peters assert that negative-emissions technologies are an "unjust and high-stakes gamble." This characterization would sideline negative-emissions technologies and remove potentially important options from the portfolio for mitigating and

ameliorating climate change.

As Anderson and Peters acknowledge, the remaining carbon budget is pitifully small; at the current rate, the world will blow through 600 Gt of CO2 in 15 years. Dumping this much CO2 in the atmosphere will almost certainly result in more than 1.5°C warming. Indeed, as advocates of a 350-ppm target point out, the remaining CO2 budget could be negative.

Anderson and Peters provide no evidence that faith in negative-emissions technologies is to blame for a delay in implementing other mitigation plans or for the failure of countries to cut emissions. This failure is easily explained by the free-riding behavior of some countries (1), and taking negative-emissions technologies off the table would not make collective action any easier. Indeed, given that negative-emission technologies require financial contributions, not changes in behavior, their development and deployment may well be less vulnerable to free riding. Furthermore, we need a lot of arrows in the quiver to stand a chance of meeting the Paris targets. This was a key finding from the integrated assessment modelers (2).

Rather than dividing mitigation into competing strategies, an inclusive approach would focus on stopping climate change as fast as possible while minimizing risk to vulnerable populations and to societal stability. Negative-emission technologies are not unique in facing challenges, risks, and uncertainties. It is true that negative emissions may fall short of closing the gap, but to characterize them as a high-stakes gamble is not consistent with the facts and the plausibility of meeting the Paris goals without them.

Throwing a life-preserver to a drowning victim may not assure a successful rescue, but it is not a high-stakes gamble. Offering the life-preserver is preferable.

Response

by Kevin Anderson and Glen Peters

As we wrote in our Perspective, we agree with Lackner *et al*. that negative-emissions technologies should “be the subject of research, development, and potentially deployment.” We support research on the technical, environmental, social, and economic viability of negative-emissions technologies. However, we stand by our conclusion that given the breadth and depth of fundamental uncertainties associated with negative-emissions technologies (1–6), a program of timely and deep mitigation in line with 2°C budgets should assume that they will not be deployed at a large scale.

A mitigation agenda that does not rely on future large-scale application of negative-emissions technologies will require a legislative environment that delivers profound social and behavioral change by high-emitters, rapid deployment of existing low-carbon energy technologies, and urgent research and development of new promising energy technologies, including negative-emissions technologies. If negative-emissions technologies do indeed prove to be successful, then a lower temperature rise can be subsequently pursued.

Lackner et al. claim that including negative-emissions technologies in assessments does not delay other mitigation tactics. On the contrary, evidence indicates that an assumption of negative-emissions success does delay conventional mitigation. Without negative-emissions technologies, much more ambitious and far reaching mitigation is required (2).

The 2°C scenarios assessed by the IPCC that do not include negative emissions but do allow afforestation have considerably lower fossil-fuel consumption than scenarios that include negative emissions [e.g., Fig. S4 in (7)]. The “emissions gap” (8, 9) between the necessary level of mitigation to deliver on the Paris goals and the collective proposition of governments (i.e., the sum of the Intended Nationally Determined Contributions) would be much larger if negative emissions were excluded.

We stand by our claim that postulating large-scale negative emissions in the future leads to much less mitigation today. Negative emissions facilitate the appealing option (10) of exceeding tight carbon budgets and assuming that the debt will be paid back later. If we cannot pay back our carbon debt because the negative-emissions technologies do not deliver as planned, then we have saddled the vulnerable and future generations with the temperatures we seek to avoid in the Paris Agreement. To use the analogy of Lackner *et al*., we knowingly let someone jump into a raging torrent, telling them we may

be able to save them with a technology we have yet to develop.

References

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