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COMMENT

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Target methane

Joshua F. Dean [1]✉

Methane is a potent greenhouse gas emitted by both human activity and the natural environment. Due to its relatively short atmospheric lifetime, controlling methane emissions is increasingly recognised as a powerful climate mitigation strategy.

Methane (CH_4) is a greenhouse gas that has contributed roughly half as much global climate warming since 1750 relative to carbon dioxide (CO_2). Methane is much less abundant in the atmosphere than CO_2—but per molecule in the atmosphere, it is a much more potent greenhouse gas. The potential benefits of tackling methane emissions have been discussed in scientific circles for some time and are now entering the political sphere: 112 countries have pledged "…to reduce global methane emissions by at least 30% from 2020 levels by 2030" since the 26th Conference of the Parties (COP26) meeting in 2021.

The combination of methane's strong warming effect and relatively short lifetime in the atmosphere, due to natural oxidation by hydroxyl radicals, makes it a prime target for global efforts to reduce greenhouse gas emissions. Indeed, warming could be reduced by as much as 0.2 °C by 2050 if the pledge to reduce methane emissions by 30% is met. However, global methane emissions come from both natural and anthropogenic sources, split roughly 50:50 (ref. [1]), and so an holistic understanding of how these emissions may change in response to both human activity and climate change is needed to guide strategies designed to reduce overall emissions (Fig. 1).

Natural methane emissions are dominated by wetlands and freshwater ecosystems[2]. As global temperatures rise, these ecosystems are at risk of emitting more methane, which forms a climate feedback loop driving further warming[3]. Better understanding of how methane is formed and released across different environments is crucial to understanding the future of this climate feedback.

The fossil fuel industry is one of the dominant anthropogenic sources of methane[4]. Cutting emissions from this sector is an important component of global efforts to mitigate climate change. Methane is the main component of natural gas and so the sooner we reduce our dependence on fossil natural gas as an energy source, the sooner we can reduce methane emissions resulting from leaks during its mining, distribution and combustion. As such, despite the concerns over energy security arising from the war in Ukraine, we must avoid turning to exploitation of unconventional fossil natural gas. Similarly, using fossil natural gas to produce hydrogen as an alternative energy pathway should also be a nonstarter[5]. It is increasingly difficult to justify our reliance on fossil natural gas, and it would be far more constructive to focus on transitioning to renewable energy generation.

Many industrial applications, including some atmospheric carbon dioxide removal technologies, use natural gas due to its high energy efficiency. For example, natural gas is used to produce the heating required during direct air capture of CO_2 in negative emissions technologies. Biogas (or renewable natural gas) produced from the organic breakdown of industrial waste products could replace fossil natural gas in these technologies. Although again, limiting leaks from renewable natural gas production and distribution must be a priority if this energy source is to become a carbon-neutral energy pathway[6].

Agriculture is the other main anthropogenic source of methane, but tackling emissions from agriculture is a considerable challenge. Changing consumer diets and waste reduction offer great potential to lower agricultural methane emissions[7]. However, putting the onus on consumers to

[1] School of Geographical Sciences, University of Bristol, Bristol, UK. ✉email: josh.dean@bristol.ac.uk

Fig. 1 Gas manhole cover. The fossil fuel industry is a major anthropogenic source of methane. Credit: Andrew Martin, Pixabay.

reduce methane emissions will likely not be as effective as directly engaging and incentivising the industry players themselves. Harnessing biogas from the decomposition of agricultural waste that would otherwise emit greenhouse gases is one potential solution. Other solutions include improving water management in rice production and reducing emissions from livestock through diet and breeding. Support and incentives could help implement the kind of long-term changes in agricultural practices required to reduce methane emissions from this sector by 2030 and beyond.

Ambitious targets to cut global methane emissions today will buy much needed time for efforts to reduce other greenhouse gas emissions tomorrow; though targeting methane alone will not be enough to avoid a dangerous climate future. Leadership from central governments is needed to put policy into action to target methane emissions now and set a precedent for future reductions of greenhouse emissions.

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Additional information

Correspondence and requests for materials should be addressed to Joshua F. Dean.

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