

Accounting for short-lived forcers in carbon budgets

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Limiting warming to any level requires CO₂ emissions to be kept to within a certain limit known as a carbon budget. Can reducing shorter-lived climate forcers influence the size of this budget? A new IIASA study published in the journal *Environmental Research Letters* analyzes the impact of short-lived air pollutant and greenhouse gas reductions on carbon budgets compatible with the 2°C climate target.

Short-lived [greenhouse gases](#) and atmospheric pollutants—including methane, hydrofluorocarbons (HFCs), black carbon or soot, and sulfates—are emitted by human activities and also contribute to climate change, but remain in the atmosphere for a much shorter time than carbon dioxide (CO₂).

Some of these emissions, such as methane have a strong warming effect, while others act to cool the atmosphere, making their role in [climate change mitigation](#) complicated to nail down.

"To limit [global warming](#) to any level, the total amount of carbon-dioxide emissions needs to be limited to a certain budget," says Rogelj. "We knew that warming from non-CO₂ gases like methane or some air pollutants, can influence the size of this carbon budget. The question was, how much?"

The study examines how stringently reducing each climate forcer separately would affect the size of the carbon budget. The researchers found that reducing [methane emissions](#) stringently in the second half of

the century could increase the size of the carbon budget for meeting the 2°C target by 2100 by about 20%. In the long term, CO₂ emissions thus still need to reach net zero. Strict controls on pollutants such as black carbon, by contrast, had only a small impact on the [carbon budget](#) of around 5%.

The new study is the first to quantify the influence of non-CO₂ emissions reductions for future global carbon budgets.

"Our findings are important from a policy perspective. The pressure on the 2°C compatible CO₂ budget will be extremely high if we are not successful in mitigating non-CO₂ emissions for example from meat and rice production," says IIASA Energy Program Director Keywan Riahi, a co-author on the study. "Hedging against these risks requires us to not put all of our eggs into one basket, and instead to pursue stringent reductions of CO₂ in combination with efforts to limit non-CO₂ emissions."

IIASA research has shown that climate and air pollution are closely linked from an economic and policy standpoint, and addressing both together could bring joint benefits for health and environment at a fraction of the cost. For example, a recent study led by Rogelj quantified how actions to reduce CO₂ emissions would also lead to reduced SLCP emissions, because CO₂ and some SLCPs are emitted by the same sources, for example diesel engines which emit both CO₂ and black carbon. Yet, the other way around, air pollution measures alone would not reduce carbon dioxide [emissions](#).

The new study takes that research a step further and applies it to carbon budgets. It provides a quantitative scenario analysis of how reductions of [black carbon](#), methane, HFCs, sulfur dioxide and nitrogen dioxide can complement and help the transition to a zero-carbon future.

More information: Joeri Rogelj, Malte Meinshausen, Michiel Schaeffer, Reto Knutti, and Keywan Riahi, 2015. Impact of short-lived non-CO₂ mitigation on carbon budgets for stabilizing global warming, *Environ. Res. Lett.* 10 075001 [DOI: 10.1088/1748-9326/10/7/075001](https://doi.org/10.1088/1748-9326/10/7/075001)

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