New study estimates global warming potential of hydrogen

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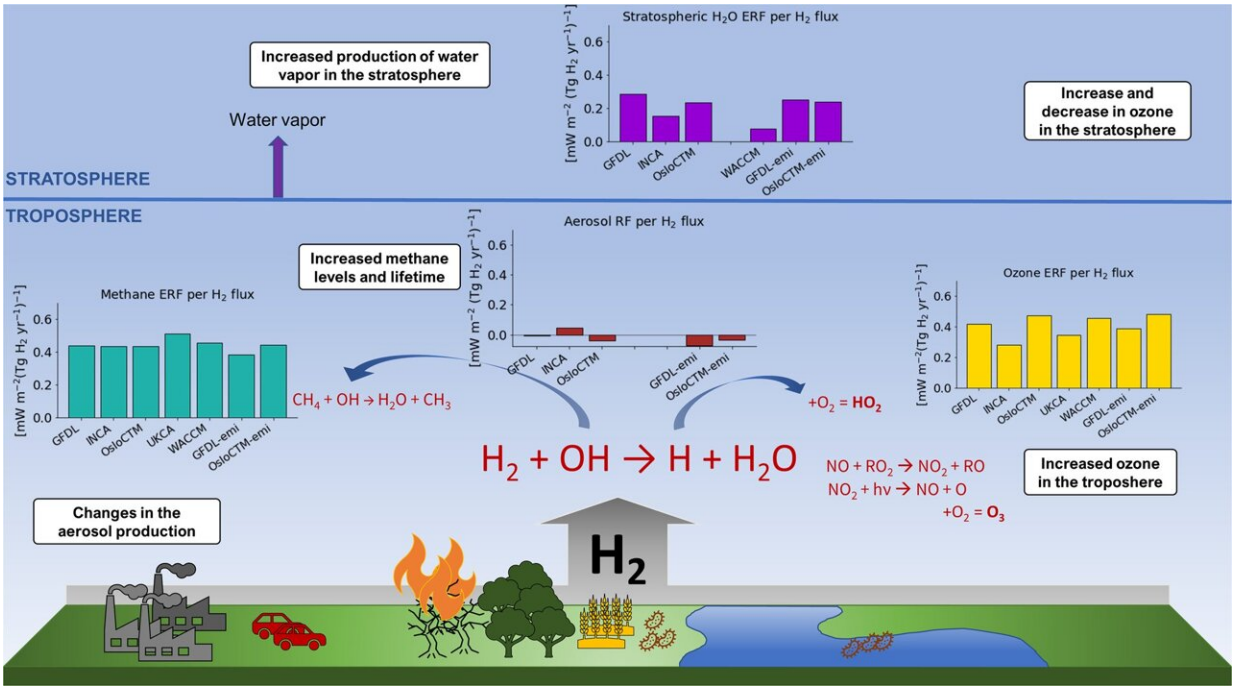

Changes in the radiative forcing due to 1 Tg flux of hydrogen. The main changes in the radiative forcing due to 1 Tg flux of hydrogen; methane (green bars), ozone (yellow), stratospheric water vapor (purple), and aerosols (red). Credit: *Communications Earth & Environment* (2023). DOI: 10.1038/s43247-023-00857-8

The global warming effect of leaked hydrogen is almost 12 times stronger than CO_2, shows a new study by CICERO, a climate research

center, published in *Communications Earth & Environment.*

The study fills a gap in our knowledge about the climate effects of hydrogen, a central technology in the energy transition.

Unlike exhaust from burning coal and gas that contains CO_2, burning hydrogen emits only water vapor and oxygen. Rather, it is the leaking of hydrogen from production, transportation and usage that adds to global warming.

Hydrogen is not a greenhouse gas, but its chemical reactions in the atmosphere affect greenhouse gases like methane, ozone, and stratospheric water vapor. In this way, emissions of hydrogen can cause global warming, despite its lack of direct radiative properties.

The study was led by Dr. Maria Sand, a senior scientist at CICERO, and her colleagues with collaborators from the U.K., France and the U.S.

"The climate effects of hydrogen have been an under-researched topic. However, a few papers based on single model studies confirm our estimated global warming potential (GWP100) of 11.6," said Sand.

"We used five different atmospheric chemistry models and investigated changes in atmospheric methane, ozone and stratospheric water vapor," said Sand.

"Hydrogen interacts with various biogeochemical processes. In our estimates, we have included soil uptake, photochemical production of hydrogen, the lifetimes of hydrogen and methane, and the interactions between hydrogen and methane," said Sand.

The study is the most comprehensive assessment of the climate effect of hydrogen to date, thanks to the advanced and novel use of existing

climate models.

"We have assessed the uncertainties, and our study forms a robust foundation for political decision-making on hydrogen," said Sand.

"A global warming potential of 11.6 is significant, and our study clearly shows the importance of reducing hydrogen leaks. We lack the technology to monitor and detect hydrogen leaks at the scale needed, but new technology is being developed as the industry adapts," said Sand.

The potential benefit of switching to a hydrogen economy will depend on the magnitude of hydrogen leakages and to what extent hydrogen replaces fossil fuels.

"There are still many open questions, and our group will continue to expand our knowledge to ensure timely and accurate decision-making on a key mitigation technology," said Sand.

More information: Maria Sand et al, A multi-model assessment of the Global Warming Potential of hydrogen, *Communications Earth & Environment* (2023). DOI: 10.1038/s43247-023-00857-8

Provided by CICERO