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Comment on acp-2022-91

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Community comment on "Climate consequences of hydrogen emissions" by Ilissa B. Ocko and Steven P. Hamburg, Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2022-91-CC1, 2022

There are significant flaws in this analysis that coupled with misleading statements and opinions that undermine the credibility of the paper. For example:

1) Hydrogen is a gas, as is methane and carbon dioxide. The paper concerns hydrogen 'escape' and 'leaks' into the atmosphere. When those escapes happen, a volume of hydrogen will be released, and the mass of the hydrogen released will depend on the volume, and pressure, of the release. If a similar leak of methane were to happen, for example, the volume of methane released would be similar but the mass of methane would be about 8X higher (because a mol of methane is about 8X heavier than a mol of molecular hydrogen). The problem with using comparative leaks using Global Warming Potential (GWP) values is that GWP is based on the mass of the climate pollutant, not the volume. So, while hydrogen has a higher GWP on a mass basis, the same volumetric leak of hydrogen relative to a leak of methane or carbon dioxide will have ~8 or ~22 times less mass (respectively), and the volume-adjusted GWP of the hydrogen from a leak is actually lower than that of both methane and carbon dioxide from the same volume of leak. An honest assessment of the impact of leakage of hydrogen vs methane or carbon dioxide, for example from a gas pipeline, should take this volume adjustment into account.

2) The GWP of climate pollutants is measured in terms of the GWP over 100 years, i.e. GWP-100, which was established as the standard in 1990. The authors write: "reporting hydrogen's potency in GWP-100 has limited value." Yes, hydrogen has a short atmospheric half-life (~5 years) and the authors correctly point out that the GWP of hydrogen in the first years is higher than that in the out years – but that's the same with virtually every climate pollutant. The authors must use GWP-100 as the standard because it is the standard. If they choose to use GWP-10 as a comparative, that's fine and can help bring out more near-term effects, but GWP-100 is the broadly accepted standard and to say it has "limited value" is wrong.

3) Clean hydrogen, including green hydrogen, will be a purpose-manufactured, with a real continuous (i.e., variable) expense of producing the product, meaning that the green hydrogen will be produced for economic value. This is very different from fugitive Scope 1 emissions of methane or the release of carbon dioxide from combustion, cement manufacturing, or from industrial processes (e.g., steel production), where there is no economic incentive in recovering those released gasses. But with clean hydrogen there are strong economic and practical motivations to limit hydrogen leakage. The authors instead seem to wrongly equate the potential of hydrogen leakage with the leakages from

uneconomical and unwanted methane and carbon dioxide and ignore this important nuance.

4) Because of these flaws, the conclusions greatly exaggerate the impact of hydrogen as a GHG and argue against using green hydrogen as a climate solution, in stark contrast to the well accepted role that green hydrogen must play in achieving decarbonization of hard to abate sectors. The problem is hydrogen leaks, but as stated in point #1 above that a leak of hydrogen will have a lower GWP than a similar leak of methane or CO2 (based on the same volume of a leak) and as stated in point #3 that there is a strong economic incentive to limit such leaks.