Hydrogen's Global Warming Impacts

The hype around clean hydrogen as a decarbonization tool overlooks the fact that all hydrogen significantly increases global warming if it leaks into the atmosphere, and its use with natural gas does not substantively reduce greenhouse gas emissions. There are many reasons to be concerned about the increased use of hydrogen.

Hydrogen is an Indirect Greenhouse Gas that will Indirectly Warm the Climate

- As more hydrogen gets used, the amount of hydrogen leaking into the atmosphere will increase. Hydrogen is extremely prone to leakage due to its small molecular size (source).
- More hydrogen in the atmosphere slows the rate that methane is removed from the atmosphere, extending its lifetime and subsequent global warming impact (source). Methane is a powerful greenhouse gas that traps more heat in the atmosphere than carbon dioxide (CO_2).
- Due to this effect, in the first 20 years of its atmospheric lifetime, hydrogen gas produces 35 times the climate warming impacts of CO_2 (source).
- Since hydrogen extends the lifetime harm of methane in the atmosphere, its global warming impact is even worse if hydrogen is produced using natural gas, such as with grey or blue hydrogen, as this increases upstream methane emissions as well.

Combusting Hydrogen Does Not Significantly Reduce CO_2

- One of the biggest drivers of interest in hydrogen is its potential use in the power sector. Because hydrogen gas does not produce CO_2 when combusted in power plants, several utilities are blending hydrogen into their fuel mix to purportedly reduce CO_2 emissions (source).
- Blending hydrogen with natural gas for combustion does not significantly reduce CO_2 emissions. Due to hydrogen's lower energy density and heating value compared to natural gas, a blend of hydrogen to natural gas does not lead to a one-to-one reduction in CO_2 emissions (source).
- Most existing natural gas infrastructure can only handle a maximum blend of 30 percent hydrogen to natural gas. Due to increases in upstream methane emissions as well as hydrogen's lower energy density, injecting a 30 percent blend of hydrogen to natural gas only results in a 6 percent decrease in lifecycle greenhouse gas emissions (source).
- Combusting hydrogen at high temperatures contributes to local air pollution, due to the resulting formation of nitrogen oxide (NOx), as well as other safety concerns. (source).

So, Should Clean Hydrogen Be Part of the Clean Energy Transition?

Any role hydrogen gas plays in the clean energy transition must factor in the fuel's potential global warming impacts, both through production and use. (See accompanying fact sheet for "Blue and Green Hydrogen: Potential Harms and Global Warming Impacts.") While there may be some limited uses for zero-carbon hydrogen that electrification alone can't address, these uses are much narrower than the hydrogen hype would have us believe. Any potential hydrogen project must set strict regulations to ensure that hydrogen doesn't contribute more greenhouse gas emissions than it offsets. Hydrogen should not be used as a climate solution if it causes more harm than good.

Concerns about Hydrogen in the Power Sector

Despite the increasing hype surrounding hydrogen in the power sector, there are many reasons to be concerned about its use, including harmful emissions, poor efficiency, storage and transport issues, high water usage, and the potential for explosions.

NOx EMISSIONS

Burning hydrogen in a power plant can lead to nitrogen oxide (NOx) emissions at six times the rate of methane. Effective pollution controls for high hydrogen blends and pure H2 in gas turbines do not yet exist.

DIVERSION OF RENEWABLE ENERGY

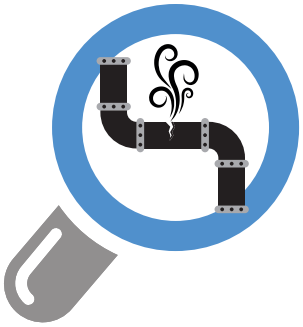
When green hydrogen is burned in a power plant, 70% of the initial renewable energy is wasted due to inefficiencies. This diversion of renewables reduces the amount of fossil fuels that could be directly replaced, along with corresponding reductions in CO_2 emissions.

PUBLIC HEALTH

Burning H2 would create new sources of local NOx emissions, harming the health of families in frontline communities for decades to come.

HIGH WATER USAGE

Electrolysis to create green hydrogen requires up to 9 tons of water per ton of H2 produced. If the water needs to be purified, the amount of water needed could double to 18 tons of water per one ton of hydrogen.



STORAGE AND TRANSPORT

When steel pipelines are exposed to H2 at high temperatures or high pressure, it can crack the pipes, which could lead to leakage or explosions.

DANGERS OF EXPLOSION

Using H2 in homes for heating and cooking would lead to four times as many domestic explosions, resulting in increased injuries and loss.

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To learn more about the many pitfalls with hydrogen's production and use, visit www.cleanegroup.org/initiatives/hydrogen.