# Making hydrogen work for the energy transition

*How can we direct hydrogen production and use to serve the energy transition without increasing emissions or pushing up utility rates?*

According to the US DOE, by 2050, hydrogen has the potential to account for 10% of economy-wide emissions reductions.[1]

**Successfully reducing emissions with hydrogen requires three things:**

1) Using only green hydrogen, defined as hydrogen produced through water electrolysis in line with the three pillars of additional, time-matched, and deliverable carbon-free electricity.[2] This requires a focus on increasing clean electricity capacity and transmission.

2) Avoiding the deployment of hydrogen where direct electrification is possible. Direct electrification is 3 to 7 times more efficient than hydrogen for many purposes including road transportation and home heating.[3]

3) Prioritizing essential uses of hydrogen[4] such as fertilizer as needed for food production. Phase in hydrogen for promising but non-essential uses <u>only</u> when there is sufficient additional, deliverable, and time-matched clean electricity for grid needs and additional green hydrogen.

**Why?**

Hydrogen is a secondary energy source.[5]

Significant energy is lost in the production, compression, and transport of hydrogen. Though electrolytic hydrogen has the potential for greater efficiency than hydrogen made from fossil fuels,[6] even green hydrogen pathways can ultimately deliver less than half the energy used to make it.[7]

With a constrained grid and 95 - 99% of current hydrogen produced from fossil fuels,[8] non-essential uses of hydrogen are likely to increase pollution, emissions, and utility prices.[9]

**Other considerations:**

1) Residential pipelines: The effect on emissions is negligible to detrimental because of continued methane usage. Blending of hydrogen into the natural gas system is extremely limited due to pipeline and home appliance risks,[10] and the maximum 20% blend by volume contributes only 7% by energy.[11]

2) Use of RNG (e.g. factory farm gas, biomethane) for hydrogen production is ill-advised because its limited quantities[12] are better used directly, and if supplies are insufficient, facilities will revert to fossil methane.[13]

3) Careful attention should be paid to new data on hydrogen leakage, the GHG effects of which are now estimated at 12 times that of CO2 over a 100 year period.[14]

4) In the future, steel, long-haul trucking, maritime shipping and aviation, and seasonal energy storage may be good uses for Green hydrogen.[15] Deployment via fuel cells is preferred to combustion because fuel cells are much more efficient and don't emit NOx pollution.[16]

Hydrogen will be part of our decarbonized future, but we must deploy it wisely and put most of our effort into other pathways to decarbonization.

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# End Notes


1. www.hydrogen.energy.gov/docs/hydrogenprogramlibraries/pdfs/us-national-clean-hydrogen-strategy-roadmap.pdf accessed 12/15/24

2. https://www.nrdc.org/bio/rachel-fakhry/new-analysis-3-pillars-will-support-large-hydrogen-deployment accessed 12/15/24

3. https://blogs.edf.org/energyexchange/2023/01/30/rule-1-of-deploying-hydrogen-electrify-first/ accessed 12/15/24

4. Essential uses– uses for which hydrogen is a necessary input. These uses are currently met by hydrogen from steam methane reformation.

5. In the future, geologic hydrogen may give the potential for hydrogen as a primary energy source: https://www.usgs.gov/media/files/geologic-hydrogen-potential-conterminous-united-states accessed 12/15/24

6. https://www.netl.doe.gov/projects/files/HydrogenShotTechnologyAssessmentThermalConversionApproachesRevised_120523.pdf accessed 12/15/24; https://www.energy.gov/sites/default/files/2024-12/hydrogen-shot-water-electrolysis-technology-assessment.pdf accessed 12/15/24

7. https://theclimatecenter.org/wp-content/uploads/2023/06/Hydrogen-Policy-Guidance-August-2023-The-Climate-Center.pdf accessed 12/15/24

8. https://psr.org/wp-content/uploads/2022/07/hydrogen-pipe-dreams.pdf accessed 12/15/24; https://www.energy.gov/eere/fuelcells/hydrogen-fuel-basics accessed 12/15/24

9. https://energyinnovation.org/publication/evidence-shows-three-pillars-remain-crucial-for-45v-hydrogen-tax-credit-to-protect-climate-consumers-industry/ accessed 12/15/24

10. https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M496/K285/496285890.PDF accessed 12/15/24

11. https://www.cngc.com/wp-content/uploads/PDFs/IRP/2023/washington/TAG-6-Meeting-Minutes.pdf accessed 12/15/24; https://earthjustice.org/feature/green-hydrogen-renewable-zero-emission accessed 12/15/24

12. RNG only has the potential to replace a small portion of current natural gas use. Oregon DOE estimated "4.6 to 17.5% of current natural gas use **was the maximum potential** for RNG" (https://www.oregon.gov/energy/Data-and-Reports/Documents/2018-RNG-Inventory-Report.pdf accessed 12/15/24)

13. https://blog.ucsusa.org/julie-mcnamara/ucs-expert-testifies-on-the-new-clean-electricity-tax-credits/ accessed 12/15/24; https://blog.ucsusa.org/julie-mcnamara/the-serious-risks-around-treatment-of-biomethane-in-45v/ accessed 12/15/24

14. https://pubs.acs.org/doi/10.1021/acs.est.3c09030 accessed 12/15/24

15. https://energyinnovation.org/wp-content/uploads/2024/08/Hydrogen-Policys-Narrow-Path-Delusions-and-Solutions.pdf accessed 12/15/24

16. https://www.energy.gov/sites/default/files/2015/11/f27/fcto_fuel_cells_fact_sheet.pdf accessed 12/15/24

# Additional References

https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-29935.pdf accessed 12/15/24

https://blog.ucsusa.org/julie-mcnamara/whats-the-role-of-hydrogen-in-the-clean-energy-transition/ accessed 12/15/24

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