EARTHJUSTICE

RECLAIMING HYDROGEN FOR A RENEWABLE FUTURE

Distinguishing Fossil Fuel Industry Spin from Zero-Emission Solutions: *Summary for Policymakers*

Top Line Items:

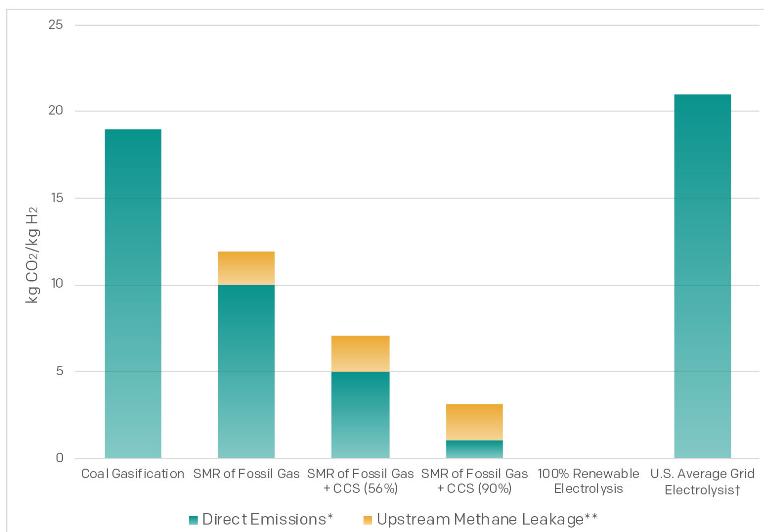
- **Only hydrogen produced from renewable electricity is a true climate solution**, but even green hydrogen has serious limitations, warranting caution.
- **Green hydrogen can play some role in a decarbonized economy, but that role should be limited to hard-to-electrify applications**, like maritime shipping, aviation, and high-heat industrial processes.
- **Direct electrification of transportation and buildings is usually a better solution than hydrogen.** Policymakers should reject proposals to use hydrogen to decarbonize sectors in which zero-emission solutions are already available.

A recent study found that the greenhouse gas footprint of "blue" hydrogen, or hydrogen produced using natural gas with carbon capture, was over 20% more than burning natural gas or coal for heat.[7]

Most hydrogen production is far from clean.

The predominant method for producing hydrogen today is a process called steam methane reformation (SMR) of natural gas, also called fossil gas, which emits massive amounts of health-harming pollution into neighboring communities.[1] Globally, hydrogen production accounts for more greenhouse gas emissions than the entire nation of Germany.[2]

Using hydrogen will not break our dependence on fossil fuels unless we quit relying on fossil fuels to produce hydrogen. The only "clean" hydrogen fuel is green hydrogen: hydrogen made using 100% renewable electricity to split hydrogen from water molecules. This process, called electrolysis, is so energy-intensive, hydrogen made with grid-average electricity is even more carbon intensive than hydrogen made from SMR of natural gas.[3]



Carbon Intensities of Hydrogen Production.
*Source: Bartlett and Krupnick 2020, IEA 2019; ** Source: NRDC, 2021
†2017 Data, does not include upstream emissions

Even green hydrogen has serious limitations.

Green hydrogen cannot deliver near-term emissions reductions at scale because of several constraints: energy conversion loss, air pollution, difficulty of storage and transport, resource constraints, and high production costs.

VIEW THE FULL REPORT HERE
Visit www.earthjustice.org for more information

CONTACT:
Gavriella Keyles
Senior Research & Policy Analyst
gkeyles@earthjustice.org

Athena Motavvef
Legislative Representative
amotavvef@earthjustice.org

- **It will always be more efficient, and less expensive, to rely first on the direct use of renewable electricity wherever it is possible to do so.** This is because using electricity to power electrolysis results in substantial energy losses–anywhere between 20 and 40%.[4] Many applications already have affordable, viable, and efficient decarbonization solutions, like renewable energy power generation, battery-electric vehicles, and heat pumps.

- **Burning hydrogen creates health-harming pollution, and many industry proposals for hydrogen involve combustion rather than fuel cells.** Hydrogen combustion emits a significant amount of nitrogen oxides (NOx), a pollutant that damages heart and respiratory function, impairs lung growth in children, leads to higher rates of emergency room visits and even premature death, and is a precursor to both ambient ozone and fine particulate matter pollution. Hydrogen combustion would perpetuate the disproportionate negative impacts that power generation from fossil fuels has had on frontline communities.[5]

- **Transporting and storing hydrogen is costly and potentially dangerous**. Hydrogen requires significant investments in new storage and transportation infrastructure like dedicated pipelines. Hydrogen behaves differently than methane in existing fossil gas infrastructure: it is extremely flammable and more difficult to contain than other gases, leaks are hard to detect, and it can cause embrittlement, making pipes more susceptible to cracking. Its low energy density requires more infrastructure to carry and store less energy.

- **Dramatic reductions in climate pollution cannot wait until the 2030s, when we expect to see significant cost declines and increased availability for green hydrogen**. Globally today, less than 1% of hydrogen is produced through electrolysis and less than 0.02% is truly green hydrogen produced from renewable electricity.[6]

Green hydrogen can play a role in decarbonizing our economy.

But its use should be targeted to hard-to-decarbonize industries where battery-electric and direct electrification technology is infeasible.

LEAST-REGRETS USE FOR GREEN HYDROGEN	EXPLORE WITH CAUTION	REJECT THE HYDROGEN HYPE
Displace fossil hydrogen currently used as an industrial feedstock	Maritime shipping	Power plants
	Aviation	Low-heat industrial processes
	High-heat industrial processes	Building appliances
	Long-term electricity storage	Cars, buses, and short-haul trucks
	Long-haul trucks and trains	

Policymakers should reject proposals to decarbonize the power sector by eventually switching from gas-fired power plants to those run on green hydrogen. Deploying solar and wind are zero-emission solutions available now.

The best use for green hydrogen is to displace the fossil fuel-derived hydrogen already in use today at industrial facilities. Policymakers may also find that green hydrogen is an appropriate tool for decarbonizing maritime shipping, aviation, high-heat industrial processes, and long-distance trucking, though these applications should be explored with caution.

Endnotes

1 U.S. Environmental Information Administration, *Hydrogen for refineries is increasingly provided by industrial suppliers* (Jan 20, 2016), https://www.eia.gov/todayinenergy/detail.php?id=24612#.
2 International Energy Agency, *The Future of Hydrogen*, at 17, 37–38 (June 2019), https://www.iea.org/reports/the-future-of-hydrogen/.
3 California Air Resources Board, *LCFS Life Cycle Analysis Models and Documentation*, https://ww2.arb.ca.gov/resources/documents/lcfs-life-cycle-analysis-models-and-documentation (last visited July 26, 2021).
4 Energy Transitions Commission, *Making the Hydrogen Economy Possible: Accelerating Clean Hydrogen in an Electrified Economy*, at 22 (Apr. 2021), https://energy-transitions.org/wp-content/uploads/2021/04/ETC-Global-Hydrogen-Report.pdf.
5 California Air Resources Board, *Nitrogen Dioxide & Health*, https://ww2.arb.ca.gov/resources/nitrogen-dioxide-and-health/ (last visited July 22, 2021).
6 Emanuele Taibi *et al.*, *Green Hydrogen Cost Reduction*, International Renewable Energy Agency, at 18 (2020), https://irena.org/-/media/Files/IRENA/Agency/Publication/2020/Dec/IRENA_Green_hydrogen_cost_2020.pdf.
7 Robert W. Howarth & Mark Z. Jacobson, "How green is blue hydrogen?", *Energy Science & Engineering* (Aug. 12, 2021), https://onlinelibrary.wiley.com/doi/10.1002/ese3.956.

VIEW THE FULL REPORT HERE
Visit www.earthjustice.org for more information

CONTACT:
Gavriella Keyles
Senior Research & Policy Analyst
gkeyles@earthjustice.org

Athena Motavvef
Legislative Representative
amotavvef@earthjustice.org