THE Climate + Clean Energy EQUITY FUND

Policy Brief: Energy Transition Concerns

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01. Hydrogen Gas: A False Promise

1. What is hydrogen gas and why is it harmful?
2. What are some limited uses for green hydrogen gas?
3. What should hydrogen gas not be used for?
4. How does hydrogen gas perpetuate environmental inequities?
5. What are the clean energy solutions?

Hydrogen is being increasingly promoted as a potential "clean" energy source. While there may be some specific potential uses for green hydrogen, the overall narrative of hydrogen as a clean energy solution is misleading. This brief addresses why hydrogen is not so clean after all, points out the flaws in arguments made by the fossil fuel industries, and offers some alternative policy paths.

Key Facts

- **Limited Feasibility of Producing Clean Hydrogen:** The only carbon-free way to produce hydrogen is through electrolysis with clean, zero-emission energy, and there's not enough production capacity to go around. This "green hydrogen" makes up less than 1 percent of today's hydrogen production in the United States. Widely deployed green hydrogen is still at least a decade away and will always be less efficient than directly using renewable electricity wherever feasible.[1]
- **Safety Concerns and High Infrastructure Costs:** In order to burn hydrogen as a fuel, massive and expensive infrastructure upgrades will need to be made to transport and store hydrogen. Current infrastructure cannot be used to produce green hydrogen—let alone transport or store hydrogen—without expensive major upgrades and continued safety concerns.[2]
- **Current Hydrogen Production Emits Air and Climate Pollution:** The remaining 99 percent of hydrogen is currently made from fossil fuels responsible for health-damaging air and water pollution in frontline communities that are primarily Black, Indigenous, and People of Color (BIPOC).[3]
- **Unproven Technologies:** While the technology already exists to produce green hydrogen from renewable electricity, other methods of making hydrogen "cleaner" (such as carbon capture) are unproven.[4] Hydrogen production relying on carbon capture and storage, nuclear energy, fossil gas, biomethane, and/or biomass is not compatible with a zero-emission future. All of these methods maintain, and may even worsen, environmental pollution and long-standing injustices.[5]
- **Burning Hydrogen Generates Pollution:** Regardless of how it is produced, hydrogen combustion emits significant air pollution.[6] Hydrogen used in fuel cells emits less pollution than burning hydrogen, but fuel cells should only be deployed in specific cases.
- **High Costs:** Producing and using green hydrogen is less efficient and more costly than directly using renewable energy and other types of energy storage.[7]
- **Limited Use in Hard-to-Electrify Industries:** Studies show that green hydrogen could be used for hard-to-electrify sectors, like maritime shipping, aviation, and long-haul trucking. Otherwise, renewable-energy-powered electricity is more cost effective, more energy efficient, less water intensive, and safer.[8]

1 https://earthjustice.org/sites/default/files/files/hydrogen_earthjustice_2021.pdf; https://irena.org/-/media/Files/IRENA/Agency/Publication/2020/Dec/IRENA_Green_hydrogen_cost_2020.pdf
2 https://www.nrel.gov/docs/fy13osti/51995.pdf; https://earthjustice.org/sites/default/files/files/hydrogen_earthjustice_2021.pdf
3 https://onlinelibrary.wiley.com/doi/full/10.1002/ese3.956; https://earthjustice.org/sites/default/files/files/hydrogen_earthjustice_2021.pdf
4 Relying on the availability of carbon capture is an "optimistic and unproven assumption." https://onlinelibrary.wiley.com/doi/full/10.1002/ese3.956
5 "Toxic compounds might be produced through the hydrothermal gasification of real biomass. Some chlorinated organic compounds are very toxic and can cause serious damage to the human body even with exposures of trace amounts." https://www.intechopen.com/chapters/40411; see generally https://earthjustice.org/sites/default/files/files/hydrogen_earthjustice_2021.pdf
6 "The NOx emissions are significantly increasing especially due to thermal NO." https://doi.org/10.1016/j.ijhydene.2017.05.107; see also https://etn.global/wp-content/uploads/2020/01/ETN-Hydrogen-Gas-Turbines-report.pdf, p. 9
7 https://phys.org/news/2006-12-hydrogen-economy-doesnt.html; https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/hydrogen-technology-faces-efficiency-disadvantage-in-power-storage-race-65162028
8 https://www.transportenvironment.org/press/e-fuel-would-be-wasted-cars-while-it%E2%80%99s-badly-needed-decarbonise-planes-and-ships-%E2%80%93-study

1 What is hydrogen gas and why is it harmful?

To evaluate hydrogen, it is important to examine how the hydrogen is *produced* and how it is *used* because both stages can generate pollution.

Production

There are several different ways to produce hydrogen. Most commonly, hydrogen is produced from fossil gas—also known as "natural" gas or methane—using a process called "steam methane reforming," which emits both air pollutants and greenhouse gases.[9] Other methods of producing hydrogen ideally create less pollution (some more successfully than others). These methods use:

1. Clean renewable resources, such as solar and wind;

2. Nuclear energy, biomass, biofuels; or

3. Fossil fuel with carbon capture (although this alternative still hasn't been proven as effective).

For green hydrogen to be *truly* clean, meaning pollution-free, it must be produced with a completely different method than those used today. Hydrogen production must use electricity generated entirely from zero-emission, renewable sources with adequate and safe storage and transport. Less than 1 percent of hydrogen is produced today using clean, renewable energy. This process is *so* energy intensive that the only way to scale green hydrogen is to pair it with aggressive renewable energy build-outs.

Table 1 describes the different methods of hydrogen production. Colors (grey, blue, green, etc.) are often used to identify the types of hydrogen by their production process. With the exception of green hydrogen, none of these production methods are clean: they generate greenhouse gases, health-damaging air pollutants, and/or toxic waste.

The only way to scale green hydrogen is to pair it with aggressive renewable energy build-outs.

Table 1. Main Methods of Hydrogen Production

	Production Process	Concerns
Grey hydrogen	Produced from fossil gas through steam methane reformation	▪ Releases greenhouse gas emissions and health-damaging air pollution ▪ Water intensive and produces significant amounts of wastewater
Blue hydrogen	Produced from fossil gas through steam methane reformation Carbon capture and storage technology used to reduce total greenhouse gas emissions	▪ Releases greenhouse gas emissions and health-damaging air pollution ▪ Requires more upstream gas production than grey hydrogen if gas is relied on to power the carbon-capture equipment ▪ Water intensive and produces significant amounts of wastewater
Hydrogen using biomass, biofuels, and nuclear energy	Produced from biomass and biofuels through steam methane reformation Produced using electrolysis (splitting water into hydrogen and oxygen) powered by nuclear energy	▪ Biofuel and biomass usage releases health-damaging air pollution ▪ Nuclear energy creates safety risks and harmful toxic wastes
Green hydrogen	Produced using electrolysis (splitting water into hydrogen and oxygen) powered by renewable energy resources (like wind and solar)[10]	▪ Green hydrogen production should not generate air pollution, but the combustion of green hydrogen does release health-damaging air pollution

9 Hydrogen Production: Natural Gas Reforming, https://www.energy.gov/eere/fuelcells/hydrogen-production-natural-gas-reforming

10 International Energy Agency (2019), "The Clean Hydrogen Future Has Already Begun," https://www.iea.org/commentaries/the-clean-hydrogen-future-has-already-begun

The federal government is backing harmful types of hydrogen gases. The 2021 federal Infrastructure Deal would authorize approximately $9.5 billion for hydrogen research, development, and demonstration programs. Under this agreement, the current definition of hydrogen would allow for production of hydrogen using methods that increase greenhouse gases, air pollutants, and/or toxic contaminants.

Producing and relying on blue hydrogen is worse than just burning fossil fuels.

With a vested interest in preserving existing fossil fuel infrastructure, hydrogen industry advocates have been promoting false claims of "clean alternatives" to green hydrogen—namely, that blue hydrogen and hydrogen using biomass, biofuels, and nuclear are "clean." A common argument is that an "all-of-the-above" approach that includes many types of hydrogen is necessary to achieve zero emissions. There are several reasons why this approach is problematic:

- **Hydrogen produced with biofuels is not clean.** Hydrogen producers attempt to count biomethane or biomass as "renewable," "clean," or "green," when in reality these methods have harmful health and climate impacts.[11] For example, hydrogen could be produced using gas trapped from landfills and dairy farms (biomethane) or by burning timber or crops (biomass), but these methods rely on facilities known to pollute the air, water, and/or land in ways that last for generations.

- **Blue hydrogen is unproven, not cost-effective, and still a source of pollution.** Blue hydrogen derived from "natural" gas relies on carbon capture and storage techniques to eliminate up to 95 percent of carbon dioxide (CO_2) emissions, but it does not address methane leakages associated with handling fossil gas. Methane leakage increases the climate impact of fossil gas by 92 percent, as compared to CO_2 alone. Studies show that methane leakages from how fossil gas is produced, stored, and transported—known as "upstream emissions"—can essentially negate the benefits of carbon capture. In fact, a recent lifecycle analysis of blue hydrogen found that generating blue hydrogen would result in more climate emissions than directly burning gas for heat.[12] In other words, producing and relying on blue hydrogen is worse than just burning fossil fuels. Moreover, carbon-capture techniques do not avoid the health-damaging air pollutants released during hydrogen usage.

- **Hydrogen production impacts the local environment.** The majority of hydrogen production today is through steam methane reformation, which relies on a steady stream of fossil gas production. Gas production has numerous upstream environmental impacts, including but not limited to high water use and large volumes of contaminated wastewater.[13] Without proper handling, storage, and treatment, such contaminated wastewater will pollute nearby land and water bodies.

Usage

Hydrogen can be used in primarily three different ways (see **Table 2**). Only green hydrogen used in fuel cells is truly green and pollution-free. A fuel cell uses hydrogen fuel to produce electricity and heat without any additional harmful emissions.[14] A fuel cell works like a battery but does not need recharging. However, hydrogen fuel cells are more inefficient, costly, and highly flammable compared to battery-powered electrification and other alternatives.[15] Hydrogen fuel cells also require the mining of expensive materials, such as platinum, which are associated with negative environmental impacts.

Only green hydrogen used in fuel cells is truly green and pollution-free.

11 Classifying biomethane and biomass as "renewable" is happening in California, see https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0145_summary.pdf

12 https://onlinelibrary.wiley.com/doi/full/10.1002/ese3.956

13 https://www.eia.gov/energyexplained/natural-gas/natural-gas-and-the-environment.php

14 This assumes that there is no leakage from the fuel cell. https://www.energy.gov/eere/fuelcells/fuel-cells

15 For a comparison of hydrogen fuel cell vs. battery-powered vehicles, see: https://www.volkswagenag.com/en/news/stories/2019/08/hydrogen-or-battery--that-is-the-question.html#; https://www.osha.gov/green-jobs/hydrogen/fire-explosion

Table 2. Main Uses of Hydrogen

Use	Examples of Current or Proposed Use	Concerns
Combustion of hydrogen in fossil fuel infrastructure	Blending with fossil gas in fossil fuel infrastructure to generate electricity	▪ Emits greenhouse gases due to fossil fuel still being used and leakages ▪ Emits more health-damaging air pollution than just burning fossil gas alone[16] ▪ Requires costly upgrades that may not be feasible in certain parts of the country
Fuel cells in vehicles	Can be used in long-haul trucks and trains	▪ Lower efficiency than batteries due to high energy losses ▪ Highly flammable; explosion risks ▪ Emission free only if 100% green hydrogen is used and there are no leaks ▪ Limited availability of green hydrogen
Larger stationary fuel cells	Can provide backup energy for buildings or the grid and provide energy for difficult-to-electrify sectors	▪ More expensive than other forms of energy storage ▪ Less efficient than other forms of energy storage ▪ Emission free only if 100% green hydrogen is used and there are no leaks ▪ May require costly infrastructure to supply hydrogen

One group of researchers predicted that burning pure hydrogen would emit more than six times as much nitrous oxides as burning fossil gas.

Unsurprisingly, industry and hydrogen advocates are most interested in combusting hydrogen in fossil fuel infrastructure, which is the easiest way for gas utilities and companies to maintain their current structures and systems. Again, this approach is problematic for several reasons:

- **Hydrogen blends will do little for the climate.** Gas companies are beginning to recommend gases with a 20-percent hydrogen blend as a "clean" energy solution,[17] and again, this claim is wrong. Not only will it have a minimal effect on reducing carbon emissions, but blending too much hydrogen can create major safety hazards, such as explosions, because the existing pipelines were not designed to handle hydrogen.[18]
- **Combusting hydrogen has negative health impacts.** Burning hydrogen gas is not clean. It releases high amounts of nitrous oxides (NOx), which are health-damaging air pollutants. One group of researchers predicted that burning pure hydrogen would emit more than six times as much NOx as burning fossil gas, a fossil fuel already incompatible with a just transition.[19]

In sum, be wary of statements in the news that claim "clean" hydrogen is part of a net-zero carbon future or that "clean" hydrogen can be produced by renewable energy and fossil fuels. The bottom line is that hydrogen production relying on carbon capture and storage, nuclear energy, fossil or "natural" gas, biomethane, and/or biomass is not compatible with a zero-emission future. While truly green hydrogen, produced by clean renewable energy, has potential in select cases, it is typically a more expensive and inefficient alternative, emits air pollution when burned, and can risk hydrogen leakage.

16 https://www.sciencedirect.com/science/article/abs/pii/S0360319917319791
17 https://www.prnewswire.com/news-releases/socalgas-and-sdge-announce-groundbreaking-hydrogen-blending-demonstration-program-to-help-reduce-carbon-emissions-301178982.html
18 https://earthjustice.org/features/green-hydrogen-renewable-zero-emission
19 https://www.sciencedirect.com/science/article/abs/pii/S0360319917319791

2 What are some limited uses for green hydrogen gas?

There are a few sectors where green hydrogen could be a cost-effective option. These are areas that are difficult to electrify or that already use hydrogen gas produced by fossil fuels:

- **With more research, green hydrogen could be an option for difficult-to-electrify sectors.** These sectors include maritime shipping, aviation, high-heat industrial processes (such as steel production), and long-haul trucks and trains, which have few lower-cost decarbonization strategies available today. More research on deployment is necessary, which would likely not be ready until the 2030s. More research is also needed on how to reduce the environmental impacts of green hydrogen if it is burned and not used in fuel cells.
- **Green hydrogen could replace current uses of grey hydrogen.** Industries that already have the means to use hydrogen are well positioned to transition to green hydrogen. For example, zero-emission green hydrogen could replace the hydrogen gas used in producing chemical agriculture inputs, such as fertilizer, without too many high upfront costs.[20] However, this switch should be considered alongside efforts to make agricultural practices more sustainable and safer in general, and work needs to be done to reduce any environmental impacts of green hydrogen production. Likewise, using green hydrogen in fuel cells could be an effective way to decarbonize certain sectors of the economy.

3 What should hydrogen gas not be used for?

For the following areas, lower-cost, safer, more efficient, and equitable energy solutions already exist, rendering hydrogen gas a poor alternative:

- **Hydrogen gas should not replace "natural" gas In homes and buildings:** Electric appliances are more energy efficient, improve air quality, and avoid the risks of leaking gas. One study estimates that modern electric space heaters and water heaters need 1/6th the renewable energy that would be required for hydrogen-gas-powered appliances, which means substantial cost savings for households.[21]

  Efforts to keep gas infrastructure and use green hydrogen in existing pipes are strong. There are some problems with this strategy:

  - *Safety risks:* Putting significant amounts of hydrogen in today's homes and buildings entails major risk of explosions. Our current gas infrastructure is not built for hydrogen, which is odorless and colorless and has a much smaller molecule. It is also known to damage steel pipes and rubber sealing. Hydrogen is much more likely to leak and difficult to store.
  - *Not feasible in existing appliances*: Our current gas appliances are built for methane. As previously mentioned, gas companies may try to overcome this problem by recommending hydrogen blends, but this method offers few pros and many cons (see page 4).
  - *Indoor air pollution*: Hydrogen gas appliances release health-damaging air and climate pollutants, unlike electric appliances.
- **Hydrogen gas should not replace gas-powered cars, buses, and short-haul trucks:** Battery-powered electric vehicles are more than three times more efficient than hydrogen-powered vehicles, in terms of how much renewable energy they need to operate. Many major automobile makers that originally invested in hydrogen fuel cell vehicles have now pivoted to electric vehicles.[22] The shift away from hydrogen applies to buses, as well![23]
- **Power plants should not replace fossil gas with hydrogen gas or expand their production to include hydrogen:** Today's gas plants can only handle a blend of hydrogen, which would barely make a dent in the current levels of climate and air pollution from these facilities. In addition, these facilities are not set up to store and transport hydrogen, implying major safety concerns and upfront costs.

20 https://earthjustice.org/features/green-hydrogen-renewable-zero-emission
21 https://earthjustice.org/features/green-hydrogen-renewable-zero-emission
22 https://cleantechnica.com/2021/01/30/scania-ditches-fuel-celltrucks-to-focus-on-full-electric/; https://thedriven.io/2021/03/16/vw-joins-ranks-of-car-makers-rejectinghydrogen-fuel-cells/
23 https://cleantechnica.com/2022/01/11/french-city-cancels-hydrogen-bus-contract-opts-for-electric-buses/

4 How does hydrogen gas perpetuate environmental inequities?

The hydrogen industry, in large part, wants to build or retrofit infrastructure at the current locations of fossil fuel infrastructure. This strategy means very little will change for frontline communities already bearing the brunt of climate and air pollution.

In fact, the impacts these communities face may even grow worse. **If gas-powered plants were to be retrofitted to run on hydrogen, the air pollution impacts in frontline communities might be more devastating.** The facilities might release higher amounts of health-damaging pollutants, such as NOx, which generally lead to premature death and illnesses, respiratory issues, and other serious health problems, particularly for children and the elderly. Studies show that this pattern affects Black and Latinx communities at alarmingly higher rates than white communities.[24] Pollution might also become worse in gas-producing regions as higher demand for blue hydrogen increases production of fossil gas.

The Phillips 66 oil refinery in St. James Parish, Louisiana, is planning to build the largest hydrogen production unit in the United States.[25] The parish is part of "Cancer Alley," an area between Baton Rouge and New Orleans that contains more than 150 polluting petrochemical plants and refineries and is also predominantly made up of BIPOC communities. The shift to hydrogen does little to course correct the area's deep history of environmental injustices.

Retrofits of power plants and gas facilities are largely overpromised and unproven.[26] There are still major questions about how to store and transport hydrogen, how to capture carbon, and more. These many unknowns mean that construction of facilities to safely produce and burn blue hydrogen and hydrogen using biomass, biofuels, and/or nuclear energy is likely not feasible in most parts of the United States.

Lastly, it is important to ask who will be burdened with the high costs of potential retrofits. This brief has mentioned the high costs of hydrogen—namely, the need for new infrastructure and retrofits, the energy-intensive process, and hydrogen's energy inefficiency (compared to renewable energy). Green hydrogen is also expected to cost more than fossil gas.[27] And when compared to renewable electricity, green hydrogen will always be more expensive because it is inherently less efficient and can lose up to 20-40 percent of its energy throughout the production process.[28] So who will pay?

History tells us that costs will ultimately become the burden of the consumer. If gas companies use hydrogen as a way to maintain and expand their fossil fuel infrastructure when fossil fuel usage is declining, they will also work to continue passing on these costs in rates reflected in utility bills. Without adequate protections that guarantee energy affordability, low-income households of color will face the highest burden of energy costs from the high cost of trying to transform fossil fuel infrastructure to burn hydrogen. This inequity is also true for the energy transition overall, as low-income communities of color face the biggest barriers to renewable energy and technologies. As more households (usually high income) switch to clean energy, utilities shift the costs to remaining households (usually low income) to pay for upkeep and maintenance. Low-income households are often last to gain access to clean energy solutions and first to suffer the consequences of poor policy design.[29]

The Intermountain Power Project in Utah is one of the few projects in the United States well positioned for the challenges of green hydrogen production and storage. Local underground salt caverns, which do not exist in most parts of the country, can be used for storing hydrogen, and the state also has abundant renewable generating capacity. Existing transmission lines can be used to get this energy on the grid. This set of conditions (low-cost storage, easy delivery, and renewable energy capacity) is likely to be extremely limited across the United States.

24 https://www.lung.org/getmedia/17c6cb6c-8a38-42a7-a3b0-6744011da370/sota-2021.pdf; https://www.lung.org/research/sota
25 https://www.phillips66.com/sustainability/programs-stories/hydrogen
26 https://earthjustice.org/sites/default/files/files/hydrogen_earthjustice_2021.pdf, p. 19, 24
27 https://ww2.energy.ca.gov/2019publications/CEC-500-2019-055/CEC-500-2019- 055-F.pdf
28 https://energy-transitions.org/wpcontent/uploads/2021/04/ETC-Global-Hydrogen-Report.pdf; https://www.agora-energiewende.de/fileadmin2/Projekte/2017/SynKost_2050/Agora_SynKost_Study_EN_WEB.pdf
29 https://grist.org/energy/green-incentives-usually-help-the-rich-heres-how-the-build-back-better-act-could-change-that/

5 What are the clean energy solutions?

1. **Double down on clean renewable energy, such as wind and solar.** Wind and solar must be increased exponentially to meet rising demand and decarbonize the electricity, energy, and transportation sectors. Increasing the geographical diversity of solar and wind increases its reliability.

2. **Fight for clean and green electricity alternatives.** Hydrogen is often promoted as a way to generate electricity whenever it is needed, but there are other clean alternatives that are available to meet this need, including:

   a. *Demand-side management:* A variety of methods can be used to reduce and change energy demand, including increasing energy efficiency of homes and buildings and paying households to reduce their energy usage at the highest peak times. These methods can be examined to reduce the need for a substitute fuel like hydrogen.

   b. *Energy storage:* Energy storage is a resource or device that captures energy produced at one time for use at a later time. Different types of energy storage can be used, such as batteries. Batteries are being increasingly used throughout the country to provide energy storage; they are more economical, safer, and produce less pollution than hydrogen.[30]

   c. *Other types of renewables*: Other types of renewables, such as geothermal energy and hydropower, can also provide renewable energy and meet needs even after the sun goes down.

   d. *Electric alternatives*: From appliances to buses to cars, there are increasingly efficient and cost-effective electric alternatives available. These alternatives are safe, do not emit localized pollution when used, and should be considered instead of vehicles or appliances that use hydrogen.

3. **Require hydrogen production to be pollution-free and green.** To ensure that the production of green hydrogen does not increase climate and air pollution burdens, "green hydrogen" must be clearly defined. It should specify that production must not increase pollution burdens and should be derived from the electrolysis of water.

   The 2021 Federal Infrastructure Act defines hydrogen as "hydrogen produced with a carbon intensity equal to or less than two kilograms of CO_2-equivalent produced at the site of production per hydrogen produced."[31] This definition would allow hydrogen production through sources such as biofuels, which emit harmful pollution, and the definition fails to consider upstream emissions and downstream leakage from pipelines and sequestration facilities.

   Fortunately, some states are adopting stronger definitions of hydrogen. For example, Illinois defines green hydrogen in electricity generation as:

   > A power plant technology in which an [electric generating unit] creates electric power exclusively from electrolytic hydrogen, in a manner that produces zero carbon and copollutant emissions, using hydrogen fuel that is electrolyzed using a 100% renewable zero carbon emission energy source.[32]

   Washington, Colorado, and Oregon have also defined renewable hydrogen to include hydrogen made from energy resources that are consistent with those states' climate policies.[33]

4. **Require green hydrogen to be used in fuel cells only in sectors that are hard to electrify.** Utilizing green hydrogen in fuel cells eliminates the pollution created from burning hydrogen and is a cheaper option than modifying current fossil fuel infrastructure to safely burn green hydrogen fuel. With careful decision-making and design, hydrogen fuel cell technology could be utilized in limited situations to help transition hard-to-electrify industries.[34]

30 There are still concerns about how batteries for energy storage are made because they generally utilize a rare metal, lithium, and its mining has impacted environmental justice communities.

31 See Investment and Infrastructure Act, Section 822(b)(1)(B), https://www.congress.gov/bill/117th-congress/house-bill/3684/text/enr

32 Illinois Public Act 102-0662, SB 2408 Enrolled, available at https://ilga.gov/legislation/publicacts/102/PDF/102-0662.pdf, p. 921

33 Washington SB 5588 (authorizing public utilities to produce "renewable hydrogen" that must be produced from "renewable resources"); Oregon SB 333 (limiting hydrogen to energy sources that do not emit greenhouse gas); Colorado SB 21-264 (requiring that hydrogen be derived from a clean energy resource).

34 https://www.eia.gov/energyexplained/hydrogen/use-of-hydrogen.php

Conclusion

In summary, producing and using hydrogen wastes water and energy and is likely to cost consumers money. Hydrogen is difficult to store and transport. When burned to provide energy, it emits health-damaging air pollutants and offers marginal climate benefits, at best. Production currently relies on environmentally unjust practices that continue to pollute the most marginalized communities and have major safety concerns and limitations.

When deployed as a "clean energy solution" by the fossil fuel industry, hydrogen can hinder necessary climate action, like the transition to electrified homes, expanded and electrified public transportation, and the realization of an energy democracy. Green hydrogen has been praised as a zero-emission solution, but advocates tend to overlook what is truly "green" and call for an "all-of-the-above" hydrogen production approach reliant on dirty and polluting methods. This approach is not compatible with a zero-emission and climate-just future. Even the most optimistic predictions state that any large-scale hydrogen infrastructure wouldn't be ready until the 2030s.

We cannot wait another decade or two for investments in hydrogen hubs to tell us what we know already: the future of hydrogen is overpromised, at best. The hype around hydrogen cannot and should not delay imperative climate and environmental action that prioritizes our most vulnerable communities.

Additional Resources

Reports and Articles

- A great choice if you'd like to dive deeper into the world of hydrogen, this brief draws heavily from this resource: Earthjustice (2021), Reclaiming Hydrogen for a Renewable Future: Distinguishing Fossil Fuel Industry Spin from Zero-Emission Solutions
- A short, slightly more technical summary: CleanEnergyGroup (2021), The Hydrogen Hype Bubble May Have Finally Popped

Government Resources

- Hydrogen Storage Challenges
- Hydrogen Explained: Production of Hydrogen
- Blending Hydrogen into Natural Gas Pipeline Networks: A Review of Key Issues

Science Articles

- How Green is Blue Hydrogen?
- Hydrogen as a Universal Climate Solution Might Be a Bit of False Promise
- Hydrogen Instead of Electrification? Potential Risks for Climate Targets

Examples of Letters From Advocates Opposing Dirty Hydrogen

- 2020 Letter to the New York State Department of Environmental Conservation opposing the permit for the Astoria Replacement Project and New York's denial of the permit
- 2021 Letter to U.S. Senators Nancy Pelosi and Chuck Schumer, Hydrogen: Don't Believe the Hype
- 2021 press release from a group of allied organizations in New Mexico