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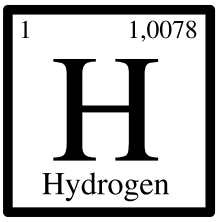
Hydrogen

What Communities Need to Know

Hydrogen is a highly debated climate solution. It can be used as power in many different ways, but serves as an energy carrier (like a battery) rather than as a primary source of energy (like the wind and sun). Without strong safeguards, hydrogen technology risks raising emissions, locking in fossil fuel infrastructure, straining the grid, and harming environmental justice communities. However, one type of hydrogen (green hydrogen) can strengthen energy independence and help decarbonize hard-to-electrify sectors if implemented responsibly.

What is Hydrogen?

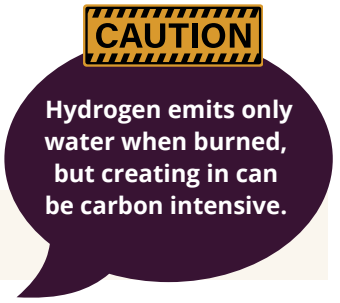


Hydrogen is a colorless and odorless gas and the world's most abundant chemical element, but it is not typically found in its pure form in nature. Thus, **to be used as power, hydrogen has to be extracted from other substances.** This is called hydrogen production.

Hydrogen is an **energy carrier** in the same way that electricity or a battery stores and delivers energy. It is **not a primary energy source on its own**, like the wind and the sun are.

What are the potential benefits of using Hydrogen?

- Hydrogen's versatility allows it to power almost any application, with water vapor being its sole byproduct.
- It can be stored and transported, to be used as energy at a later time.
- When burned, it gives a consistent and reliable power output regardless of weather conditions.
- It has the potential to bring cleaner energy to hard-to-electrify industries, such as making steel.



Hydrogen Production and Types of Hydrogen

There are many different ways hydrogen can be produced. The environmental impact varies significantly depending on the production method, leading to different color classifications in the industry:

Gray Hydrogen

Gray hydrogen is **produced through steam methane reforming of natural gas. This process involves breaking down natural gas (methane - CH_4) into carbon dioxide (CO_2) and hydrogen (H_2)**.

This method is currently the cheapest and most common. **It is highly polluting to produce.**

Currently, the most common type of hydrogen being produced is also the one that is most polluting.

Blue Hydrogen

Blue hydrogen is also **produced from fossil fuels or natural gas, but incorporates carbon capture and storage** (CCS) at the end of the process.

Despite the use of CCS, **blue hydrogen still has a huge carbon footprint**. Additional issues involve **methane leakage** along the supply chain, as methane is a very strong greenhouse gas.

There are strong lobbying efforts from the oil and gas industry promoting blue hydrogen as a cleaner solution. This strategy allows them to continue selling fossil fuels while presenting the technology as an improvement, despite its significant environmental drawbacks.

Green Hydrogen

Green hydrogen is produced through **electrolysis**, which is a process that uses electricity to split water (H_2O) into hydrogen (H_2) and oxygen (O_2). If the power source for the electricity in this process comes from renewable energy such as solar or wind power, the hydrogen produced is considered "green." Unlike gray and blue hydrogen, **green hydrogen doesn't emit greenhouse gases during its production**.

While it is the only truly clean choice, **producing green hydrogen is challenging**. Electrolysis is currently inefficient and expensive, limiting green hydrogen's role in the global energy mix to a tiny fraction.

There are other hydrogen "colors," too. The color assigned depends on the technique used to make the hydrogen. So, pink/red/purple typically refers to hydrogen produced using nuclear energy. Brown/black means the hydrogen was produced using coal. You might hear about other colors (ie techniques), too!

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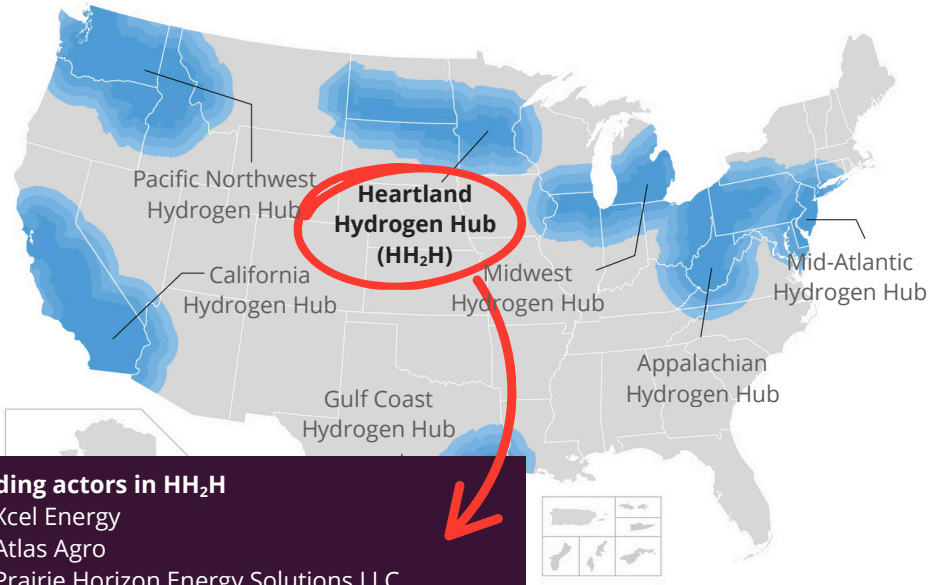
Because the infrastructure needed to produce hydrogen is costly to build, **hydrogen hubs** have been promoted as a way to join forces regionally in advancing hydrogen technology. Instead of focusing on developing individual sites across the country, each hydrogen hub represents a network of hydrogen producers, transporters, and consumers. **Minnesota is part of the Heartland Hydrogen Hub (HH_2H), which also includes Montana, Colorado, North Dakota, South Dakota, and Wisconsin.**

The Department of Energy and the Hubs have shared limited information with the public so far. Additionally, the Trump administration has directed the Hubs to stop activities associated with Community Benefits Plans. These plans were intended to ensure local communities benefited from hydrogen development. With these changes, it is difficult to ensure hydrogen hubs will have positive environmental and developmental impacts for rural Minnesota.

The **HH_2H plans to produce commercial-scale quantities of hydrogen to be used for fertilizer**. They plan to produce both green hydrogen and blue hydrogen. HH_2H is still in the "concept development" phase (ie. first stage) of its development.



Leading actors in HH_2H

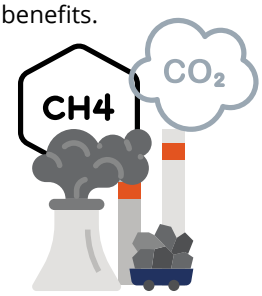
- Xcel Energy
- Atlas Agro
- Prairie Horizon Energy Solutions LLC
- EERC Foundation (University of North Dakota)

Environmental Justice Considerations

Gray and blue hydrogen can (and do) increase pollution

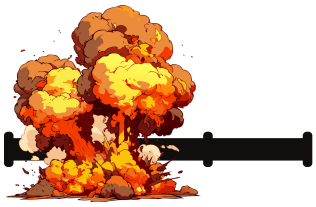
Gray hydrogen is highly polluting to make. So, even though it only releases water vapor when burned, the process to make it negates its intended environmental benefits.

Blue hydrogen can also increase emissions. When hydrogen hubs are allowed to produce blue hydrogen, they risk propping up the fossil fuel industry, generating emissions with the constructions of pipelines, making traffic worse, and increasing demand for fracking in surrounding regions.

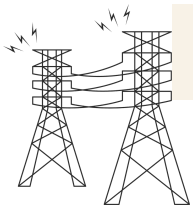


Construction of pipelines often harms local communities

Hydrogen hubs will require a massive buildout of pipelines to transport hydrogen from a hub to its end use. Hydrogen burns at a very hot temperature, and is combustible and corrosive. This means the slightest rupture in a pipeline or other storage device containing hydrogen can cause explosions.



The history of pipeline construction in the U.S. has often been fraught, with disproportionate siting in rural areas and negative impacts for low-income and marginalized communities.



Green hydrogen production could still pollute waterways and put pressure on the electric grid

The water used in electrolyzers (used to make green hydrogen) needs to be filtered. If the waste produced by these electrolyzers is not discarded correctly, it can pollute waterways.

Green hydrogen production requires a lot of electricity and can divert renewable energy from the grid, causing other customers to rely more on fossil fuels. If a green hydrogen production facility is built, additional renewable energy (such as solar and wind) must be added nearby to avoid increased reliance on fossil fuels for other electricity needs.

This fact sheet was developed as part of the Emerging Climate Technologies in Greater Minnesota Pilot Project. For more information, visit waxwingllc.com/ruralejproject

For a list of resources that contributed to this brief, scan this QR code: