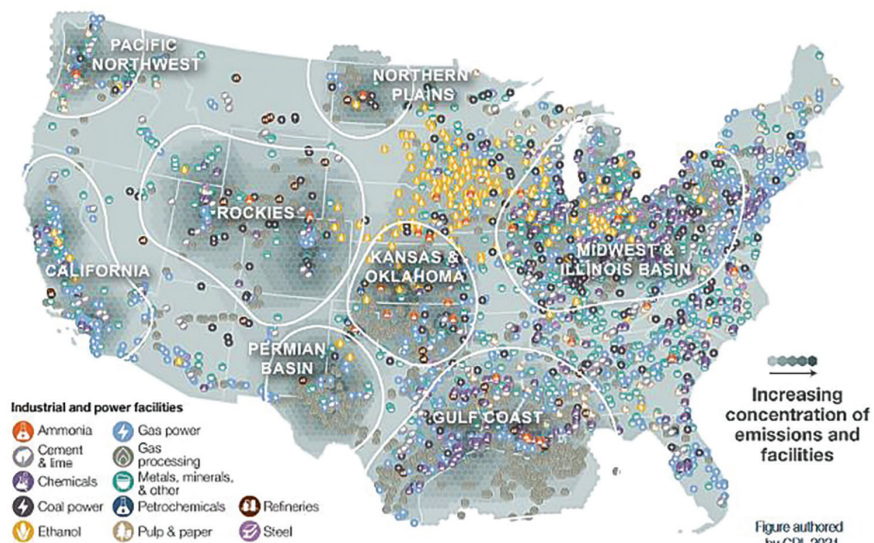


States are vying for money to start ‘hydrogen hubs’—what are they?

Regional Opportunities for Hub Development

Figure 1. The Great Plains Institute created an atlas identifying eight regions where concentrated industrial activity coincides with opportunities for permanent geologic carbon storage.¹ The identified regions emit a collective total of 1.7 billion metric tons of carbon dioxide emissions per year. On-site fuel combustion and process emissions account for 402 metric tons and 302 metric tons of carbon dioxide emissions, respectively. The Gulf Coast and Midwest and Illinois Basin regions currently lead in total stationary fuel consumption and in total emissions.



By Robert Zullo

Across the United States, states are vying for federal funding to set up hydrogen infrastructure. However, how broad a role hydrogen will play in decarbonizing the U.S. economy is a matter of debate.

Across the country, states are inking agreements with neighbors or striking out on their own to pursue billions in federal funding to set up “hydrogen hubs” (Figure 1),¹ clustered centers for production, storage, and use of the gas that many see as a crucial piece of the puzzle for decarbonizing the U.S. economy.

How broad a role it should play, however, is a matter of debate.

The U.S. Department of Energy is looking to dole out \$7 billion from last year’s bipartisan infrastructure law that could fund up to 10 regional clean hydrogen hubs (Figure 2),¹ defined as “a network of clean hydrogen producers, potential clean hydrogen consumers and connective infrastructure located in close proximity” to be sited across the country.²

“The H2Hubs will be a central driver in helping communities across the country benefit from clean energy investments, good-paying jobs and improved energy security—all while supporting President Biden’s goal of a net-zero carbon economy by 2050,” the department said in a news release in September 2022, calling the federal cash infusion one of the largest in the DOE’s history.³

That pool of money joins provisions in the Inflation Reduction Act—which created a clean hydrogen production tax

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credit⁴ and enacted big changes in carbon capture tax credits⁵—that could also boost hydrogen.

“Some states are going to be motivated by climate goals. Hydrogen is an important tool for achieving those climate goals,” says Bryan Willson, a professor of mechanical engineering and executive director of the Energy Institute at Colorado State University. “Others are really motivated by economic development and hydrogen represents a tremendous new business opportunity.”

Willson is also the director of the Rocky Mountain Alliance for Next Generation Energy,⁶ which is made up of universities and national labs from four western states that are providing technical support to the effort to create the Western Interstate Hydrogen Hub,⁷ a collaboration between Colorado, New Mexico, Utah, and Wyoming, two red states and two blue ones.

Matt Fry, a senior policy manager focusing on carbon management at the nonprofit Great Plains Institute⁸ and a former adviser to Republican Wyoming Gov. Matt Mead, says even conservative states have come around on the need to capture carbon and the obvious effects of a changing climate.

“We know that this is what we’re going to have to do,” he says. “We’ll utilize hydrogen as we bridge from a more fossil-fuel-based economy to a more electrified economy.”

Similar hub agreements have been made between Louisiana, Oklahoma, and Arkansas⁹; Minnesota, Montana, North Dakota, and Wisconsin¹⁰; and Connecticut, Massachusetts, New Jersey, and New York.¹¹ Minnesota and Wisconsin also have a separate memorandum of understanding with Illinois, Indiana, Kentucky, Michigan, and Ohio aimed at “accelerating and improving” clean hydrogen production.¹² And Oregon and Washington are also collaborating to create a Pacific Northwest hub.¹³

Other states, like Pennsylvania¹⁴ and Georgia,¹⁵ have launched efforts to create hubs on their own.

“The hubs are trying to focus on areas where you have resources to produce it, resources to use it and resources to balance that supply and demand,” says Jeffery Preece, director of research and development at the Electric Power Research Institute.

“We’re still working on where and how to deploy hydrogen in a decarbon-

ized future. It’s important to bring stakeholders together ... to figure this out. Getting it focused in hubs helps to really find those ways where we’re challenged with limitations on infrastructure today.”

Why hydrogen?

There is a consensus that hydrogen, which releases no carbon emissions when burned,¹⁶ could be a major part of addressing hard-to-decarbonize portions of the economy in which electrification is not feasible (Figure 3),¹⁷ including shipping;¹⁸ aviation;¹⁹ heavy ground transportation, such as rail;²⁰ and industry, such as steelmaking²¹ and cement. Hydrogen fuel cells can power heavy vehicles such as long-haul tractor-trailers,²² which need greater range than batteries can currently provide, or hydrogen can be used to produce fuels compatible with existing internal combustion engines.²³

It can also be blended—up to a certain point currently²⁴—with natural gas to burn in gas turbines for electric generation. In what it called the largest test of its kind, Georgia Power reported in June that it was able to burn a 20% hydrogen blend in one of the turbines at its Plant McDonough-Atkinson natural gas power

GPI’s Carbon and Hydrogen Hubs

Identified potential carbon and hydrogen hubs

Figure 2. The Great Plains Institute identified 14 potential hubs across eight regions of the United States in its atlas. These suggestions are by no means exclusive, as industrial emissions occur throughout the country, and carbon removal or direct air capture will need to be deployed wherever beneficial.

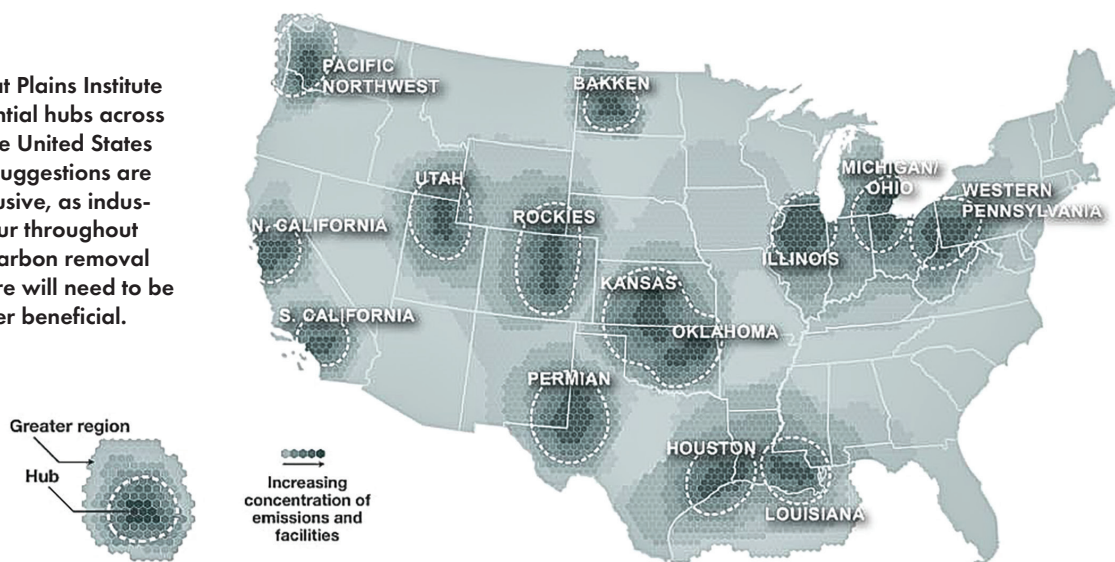


Figure authored by GPI, 2021.

Credit: Great Plains Institute

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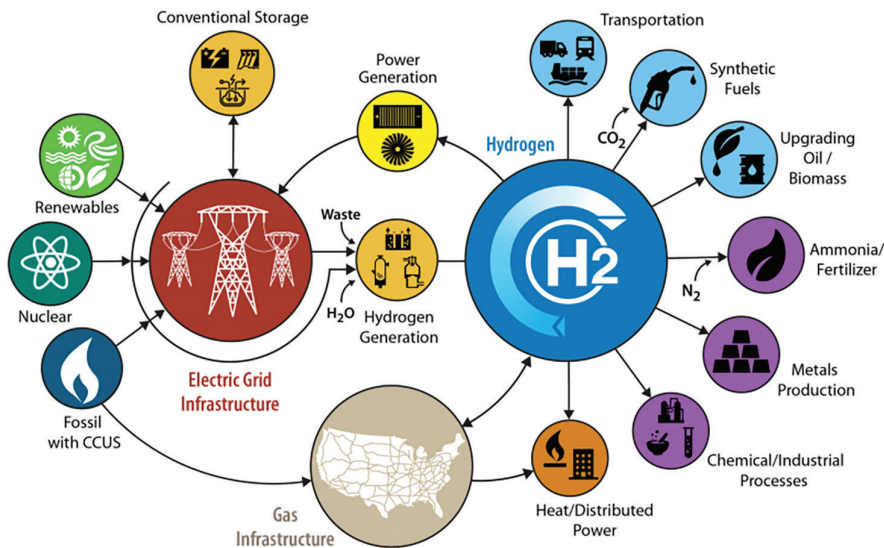


Figure 3. Illustration showing how clean hydrogen could help decarbonize the U.S. economy.¹⁷

plant outside Atlanta, achieving a 7% reduction in CO₂ emissions.²⁵

“We are probably the most aggressive state in terms of decarbonization. Along with that we have increasing needs for storage and hydrogen basically gives the ability to fill in the gaps when the wind doesn’t blow and the sun doesn’t shine,” Willson of Colorado State University says.

But how clean hydrogen is depends on how it is produced. Right now, most hydrogen in the U.S. is produced using steam-methane reforming via natural gas,²⁶ so-called “grey” hydrogen.²⁷ “Green” hydrogen is produced by an electrolysis process with clean energy. “Blue” hydrogen is fossil-fuel derived but coupled with carbon capture,²⁸ in which CO₂ that would normally go up a smokestack or flue is filtered out of emissions and stored underground,²⁹ though there are increasingly more efforts to find beneficial uses for that carbon.³⁰

There is precious little green or blue hydrogen being produced at the moment, but Willson says the money for hydrogen hubs, production tax credits, and the Department of Energy’s Hydrogen Shot,³¹ an initiative to reduce the cost of hydrogen produced from renewable energy from the current cost of about \$5 per kilogram to \$1 per kilogram over the next decade, could change that.

“Right now there’s no question that hydrogen from fossil resources is cheaper,” he says. “But as the cost of renewables continues to drop and the cost of hydrogen continues to come down, the case for green hydrogen becomes pretty compelling.”

Given that dynamic, though, environmental groups worry that pushing to use hydrogen in scenarios in which renewable power and electrification (such as for home heating³² and appliances like stoves) make more sense could wind up prolonging the life of fossil fuels, particularly natural gas.

“In general when it comes to hydrogen we feel that there are some good opportunities there and there are also some very bad possibilities depending on how this is implemented,” says Patrick Drupp, the Sierra Club’s deputy legislative director for climate and clean air.

Drupp notes that the political wrangling over the infrastructure bill produced some constraints for the Department of Energy as it evaluates hydrogen hub proposals.

“Certain things were mandated in the legislation that we don’t agree with,” he says. “The DOE should focus on things where hydrogen has the best possible outcomes.”

For example, at least one hub must demonstrate the production of hydrogen from fossil fuels (with carbon capture),

one must be from nuclear, and one must be from renewable energy. They must also be located in different regions of the U.S. “and shall use energy resources that are abundant in that region, including at least two H2Hubs in regions with abundant natural gas resources,” DOE documents state.³³

Building out a large hydrogen economy, with its unique storage and transportation requirements, Drupp notes, will require expensive infrastructure such as new pipelines to handle high concentrations of hydrogen being blended into the natural gas system.

As of March 2022, natural gas and electric utilities had proposed more than two dozen pilot projects related to producing and distributing hydrogen for electric generation, heating buildings, or other uses, according to a report by Energy Innovation, Policy & Technology,³⁴ a nonpartisan energy and climate policy think tank. Blending hydrogen with natural gas for those purposes would do little to curb greenhouse gas emissions and might “thwart more viable decarbonization pathways while increasing consumer costs, exacerbating air pollution and imposing safety risks,” the report warns.

“There’s a lot of money out there,” Drupp says. “The gas industry sees the writing on the wall and sees this as an opportunity to prolong their industry.”

About the author

Robert Zullo is a national energy reporter based in southern Illinois focusing on renewable power and the electric grid. He joined States Newsroom in 2018 as the founding editor of the Virginia Mercury. Contact Zullo at rzullo@statesnewsroom.com.

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